DESIGN THINKING AND THE 3-D MODEL: APPROPRIATE METHODS FOR GUIDING CHANGE?

A description and assessment of two methods as methods which support episodic interventions within organizational infrastructures

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Preface

This is the master thesis “Design Thinking and the 3-D model: Appropriate methods for guiding change?”. The research for this thesis about the appropriateness of design intervention methods is conducted through a theoretical study about the Design Thinking and 3-D model literature. This master thesis has been written from January to July 2019 for the purpose of finishing the Business Administration master programme “Organizational Design and Development” at the Radboud Universiteit Nijmegen.

The idea for the subject of this thesis was conceived during one of several interesting meetings with my supervisor, dr. Jan Achterbergh. The combination of dr. Achterbergh’s new book about the 3-D model, which had not been assessed yet, and my own curiosity of learning more about Design Thinking and extending my knowledge about the 3-D model, made for a relevant new research topic. Creating a metamodel to describe and assess design intervention methods, and analysing these methods was challenging, but with the help of my supervisor I was able to formulate an extensive answer for this study’s research question.

I would like to thank my supervisor Jan Achterbergh for his outstanding support throughout the whole research process. Not only were his ideas and feedback very valuable for me, the meetings we had were mind-challenging and provided exactly what I like about research – contributing to both knowledge and practice through zooming out on a certain phenomenon in innovative ways. I also wish to thank my second supervisor Marc Wijngaarde, who provided me with useful feedback to make my thesis even better.

Lastly, I would like to thank my friends and family for listening to my countless complaints about writer’s blocks, helping me with tough methodological decisions, and supporting and motivating me through my whole research process.

I hope you will enjoy reading this thesis.

Denise Drost

Nijmegen, July 23, 2019
Chapter 1: Introduction

Organizations can be described as social systems which deliver a societal contribution (Achterbergh & Vriens, 2009). This means that an organization consists of interlocking interactions, and tries to contribute to the society it operates in by experimenting with interaction premises. Most if not all organizations cope with problems someday, which could seriously threaten their viability as a system (Beer, 1979). These problems could for example relate to the structure, HR, strategy and technology of the organization. To deal with organizational problems, organizational members can either undertake operational regulation activities or design regulation activities. Whereas operational regulation is focused on dealing with disturbances in the primary processes of an organization, design regulation focuses on changing the infrastructure in such a way that the goals of the organizations can be adapted and realized (De Sitter, 1994). This “infrastructure” is an entity consisting of the structure, human resources and technology in an organization (Croteau, Solomon, Raymond, & Bergeron, 2001; Albadvi, Keramati, & Razmi, 2007; McEwan, 2015). In this thesis, the focus is only on design regulation, which relates to the organization’s infrastructure. Design regulation consists of either continuous or episodic interventions. Whereas continuous interventions happen gradually with small steps, episodic interventions have a clear beginning and end, and affect a big part of the organization (Weick & Quinn, 1999). Although these interventions are supposed to counter organizational problems, few of them are successful: no less than 66% to 70% of the interventions in organizations fail (Smith, 2002; Burnes & Jackson, 2011). As episodic design interventions are necessary for the survival of organizations, but are hard to effectuate successfully, this issue creates an interesting research topic for both science and practice.

Given the fact that episodic design interventions are important yet problematic for organizations, methods to deal with these interventions are created by academics as well as practitioners in the field. There are several episodic intervention design methods to be found in both science and practice. Examples of these intervention methods are Lean, Design Thinking, Agile, and the 3-D model. However, it is not completely known to what extent these design intervention methods are actually appropriate to support episodic interventions in the infrastructures of organizations. Moreover, it is not fully known which theories and concepts these methods contribute when looking at them as methods for episodic interventions in infrastructures. For example, it is still hard to give a definition of the method of Design Thinking, since there are few
overviews of the complete content of this method (Zheng, 2008). We need to know this information to be able to select the right design intervention method in specific practical situations, and to form a judgment about certain intervention methods. It is for example important to judge to which extent a design intervention method has blind spots, and how intervention methods are similar or different on certain variables. Therefore, it would be helpful for both practitioners as well as scientists to describe all the design intervention methods in terms of methods which support episodic interventions in organizational infrastructures, and assess to what extent all design intervention methods are suitable as such a method. However, in the scope of this research, it is only possible to describe and assess two of all the design intervention methods.

For this description and assessment, two relatively new episodic design intervention methods are chosen as the subjects for inquiry.

The first method which will be described and assessed is Design Thinking, which can be seen as a mindset, process, and toolbox which contains prescriptions for innovating and solving complex problems in a multiple areas, including a business setting (Buchanan, 1992; Brown, 2008; Dorst, 2011; Brenner & Uebernickel, 2016). Design Thinking is known for its human-centered approach to solving problems, and iterative cycles in which it tests ideas in practice by creating prototypes (Brown, 2008; Brenner & Uebernickel, 2016). The method of Design Thinking is largely based on design ideas from Herbert Simon (1969) in his book *The Sciences of the Artificial*. New attention was paid to the method when the CEO of consulting firm IDEO wrote an article about it in the Harvard Business Review (Brown, 2008). Nowadays, the method is growing in popularity amongst both practitioners and scientists (Kimbell, 2011).

The second relatively new episodic design intervention method is the 3-D model (Achterbergh & Vriens, 2019). This model consists of three different dimensions, and can be used for the purpose of designing episodic interventions in organizational structures. Its functional, social and infrastructural dimension make it a versatile method that both practitioners and scientists can use to assess and undertake interventions (Achterbergh & Vriens, 2019). The 3-D model is based on the cybernetic insights from Ashby (1958), the social systems theory of Luhmann (1984), the interpretation and elaboration of these theories by De Sitter (1994), and earlier work from the authors of the book, Achterbergh and Vriens (2009).

Design Thinking and the 3-D model both form a currently important way of thinking about interventions in organizations. Concepts of design and change appear to be the central topics in these two methods. Nowadays, Design Thinking is emerging as a popular approach to use in organization design, and recently it is getting more foundation in the field of academic
science (Kimbell, 2011). The 3-D model is another recent method which has its roots in organizational design theory. The 3-D model is especially a relevant second method, because it identifies itself explicitly as a method which is specifically created for episodic design interventions in organizations, in contrast to Design Thinking (Achterbergh & Vriens, 2019). Another reason to choose for these two methods is that the 3-D model is taught by the Radboud University as an appropriate way to intervene in organizations. It is therefore interesting as a researcher to describe both methods and assess whether and how both methods are appropriate as episodic design intervention methods. In this way, it becomes possible to see how the university-taught 3-D model relates to the more practice-oriented Design Thinking with regard to this aspect.

To examine the two methods described above, they will be systematically described and assessed. This description and assessment will be done by means of a new metamodel that is to be created in this thesis, and this metamodel – to the best knowledge of the researcher – uses key variables which have not been used before to describe and assess this type of methods. The term “metamodell” is used in this thesis to indicate a model consisting of relevant variables and norms of these variables which are extracted from the academic literature about episodic design intervention methods. This model can be used to give a description and assessment of a method with regard to its appropriateness for designing episodic organizational interventions. After describing the methods along the chosen key variables, an assessment is performed which is based upon the established norms of the metamodel’s variables. Against the background of this assessment, the appropriateness of the 3-D model and Design Thinking as a method for episodic interventions in infrastructures is compared with each other.

For the sake of selection and judgment with regard to design intervention methods, it could be useful to describe and assess both methods. This description and assessment also creates the possibility to indicate with regard to which variables the methods could be improved. For example, an outcome of the assessment could be that the 3-D model should incorporate the human-centered aspect of Design Thinking into its method, or that both methods do not score good when assessing their theoretical and conceptual substantiation with regard to statements about interventions. Finally, this description and assessment are also able to fill a gap in the literature, since no such description and assessment has been done before for these two methods. The 3-D model itself has not been described and assessed before, since it is a very recent intervention method which is published in 2019. Moreover, to the best knowledge of the researcher, Design Thinking has not been described and evaluated before as a method which specifically supports episodic interventions within organizational infrastructures.
Other episodic design intervention methods, such as Lean and the Viable System Model, have been described and assessed before (Galankashi & Helmi, 2017; Wynn & Clarkson, 2018), but this has not happened yet for Design Thinking and the 3-D model. Furthermore, no academic paper was found in which the methods were assessed specifically as a method which supports episodic interventions in organizational infrastructures. The research of Wynn and Clarkson (2018) about models of the design and development process comes the closest to the type of research in this paper, but still does not mention that is only geared to episodic instead of continuous change methods, and does not state anything about using it for designing infrastructures. Moreover, the research does neither assess Design Thinking nor the 3-D model. This makes it relevant to conduct the research which was explained above.

The objective that can be derived from the described problem situation is as follows:

“Contributing to the knowledge about the design of episodic interventions in organizational infrastructures, by systematically describing and assessing the methods of Design Thinking and the 3-D model as methods which support episodic interventions in organizational infrastructures.”

Based on the previous objective, the following research question can be determined:

“What can be learned about the appropriateness of Design Thinking and the 3-D model as methods which support episodic interventions in infrastructures, by describing and assessing the two methods as methods for episodic interventions in organizational infrastructures?”

When this research question is answered, it becomes possible to meet the stated objective. To answer this research question, this thesis has to answer the following sub-questions:
This theoretical research is both scientifically and practically relevant.

The yet to be created metamodel is relevant for science, since it (1) contributes to the literature about metamodels for the purpose of describing and assessing design intervention methods, (2) can be used in further scientific research which shows overlap with the subject of this thesis, and (3) gives insight into the way in which a metamodel could be created for an academic method description and assessment. Moreover, the outcomes of this thesis are relevant for science, because (1) insight is given in a systematic description of two organizational intervention methods (3-D model and Design Thinking) to design episodic interventions, and (2) the two methods are assessed along the lines of the chosen sub-variables from the metamodel, which also contributes to the literature about designing episodic interventions. These two contributions have – to the best knowledge of the researcher – not been made before in the current literature about Design Thinking and the 3-D model.

This research is also relevant for practice, since (1) the systematic description and assessment of Design Thinking and the 3-D model makes it possible to select and judge these two intervention methods on their appropriateness for designing episodic interventions in organizational infrastructures, and (2) the variables of the created metamodel could be used by practitioners in the field to describe and assess other methods which show overlap with Design Thinking and/or the 3-D model, which facilitates the selection and judgment of other design intervention methods.
The further outline of this thesis is as follows. The thesis is divided into two parts that each consist of two chapters, and ends with a conclusion and discussion. Part I consists of chapter 2 and 3. In chapter 2, the metamodel which will be used for the assessment is created. Thereafter, in chapter 3, the methodology which is used in this thesis for the literature research will be discussed, and the scientific appropriateness of this thesis will be argued. The outcome of part I is a methodological framework which will be used to gather, describe, and assess literature about Design Thinking and the 3-D model. Subsequently, the two methods will be described and assessed in part II, which consists of chapter 4 and 5. In chapter 4, Design Thinking is described and assessed as a method for episodic interventions in organizational infrastructures, according to the variables which are formulated in chapter 2. In chapter 5, the same is done for the 3-D model. The chapters of part II together deliver a description of Design Thinking and the 3-D model in line with the described metamodel, and an assessment of the two methods. Finally, the conclusions of this thesis are presented in chapter 6. Besides conclusions, an academic reflection and the implications for practice as well as for theory are explained. This chapter gives the ultimate answer on the research question which was presented in chapter 1.
Part I: Metamodel and methodology

The goal of part I of this thesis is to (1) create a metamodel which can be used to systematically describe and assess the two methods of Design Thinking and the 3-D model, (2) describe the method which is used to apply the metamodel and check the results with peers, and (3) argue why this master thesis meets the methodological requirements of academic literature research. In order to achieve these three goals, this part is divided into two chapters. In chapter 2, the metamodel of this thesis will be explained. In chapter 3, the used methodology and the methodological requirements will be discussed.

Chapter 2: Metamodel

2.1 Introduction

This chapter’s goal is to develop the metamodel which will be used to describe and assess the two methods in this thesis. Thereby, the first sub-question of this thesis will be answered: “Which variables and norms have to be included into the metamodel in order to be able to describe and assess methods for the purpose of episodic interventions in organizational infrastructures?” To reach this goal, this chapter describes the key variables and sub-variables that form this thesis’s metamodel. In section 2.2, four steps are explained with which the variables for the metamodel are chosen. Then in section 2.3 to section 2.5, all sub-variables of the three key variables in the metamodel are defined and explained. Finally, in section 2.6, an overview is given of all key variables and sub-variables in the metamodel, including the meaning of each sub-variable.

2.2 Constructing the metamodel | General

In the following sections, a metamodel is constructed which will be used to develop the answer to the research question of this thesis. The goal of the metamodel is to enable the description and assessment of methods for the purpose of episodic interventions in organizational infrastructures. This metamodel will consist of multiple key variables, where each key variable again consists of several sub-variables.

To arrive at an appropriate metamodel, the construction of this metamodel has to be done in four steps.
First, the goal of the metamodel should be taken as a starting point when constructing its key variables and sub-variables. If this goal is not taken as a starting point, there is a risk that the final metamodel is unsuitable for describing and assessing the methods for episodic interventions in organizational infrastructures.

Second, the academic literature must be consulted in order to form scientifically substantiated key variables and sub-variables.

Third, logical thinking should be used to determine whether the variables from the academic literature are in line with the goal of the metamodel for this thesis.

Fourth, the metamodel should be constructed by means of an iterative process, where the researcher learns from both literature as well as the application of the metamodel to the methods. As a part of this iterative process, the literature about Design Thinking and the 3-D model is first read “blank”, without any variables in mind. Then, the key variables and its sub-variables are step-by-step created, after which the literature about the two methods is read with these variables in mind. Based on this iterative process, the whole metamodel is constantly being adjusted by the researcher.

The former four steps are not specifically based on a theory about creating metamodels for assessing intervention methods, since little literature was found surrounding this subject. Therefore, these four steps are thought of by the researcher by means of logical thinking.

Step 1: Goal of the metamodel as starting point
So first, the goal of the metamodel is taken as a basis for constructing the metamodel. As stated earlier, the metamodel’s goal is to enable the description as well as the assessment of methods for the purpose of supporting episodic interventions in organizational infrastructures. This goal will be kept in mind during the complete process of developing the key variables and sub-variables. For all variables, it should be checked whether they really contribute to the description and assessment of methods with regard to episodic interventions in infrastructures.

Step 2: Consideration of the academic literature
The second point of attention during the construction of the metamodel is the consideration of the academic literature. The academic book by Jonker (1990) about exploring the diagnosis of organizations in practice seems like a good basis for the metamodel of this thesis. Jonker’s explorative book shows similarities with this research, since he analyses different intervention methods which deal with design in organizations – namely, the diagnosis phase of design. Therefore, the book is more usable to extract key and/or sub-variables for the metamodel than
for example the literature about research methods, since the latter does not specifically creates metamodels for describing and assessing intervention methods. What makes Jonker’s book quite unique in comparison with other academic books and articles, is that Jonker tries not to zoom in on the different available intervention methods, such as for example Feld (2000) and Shah and Ward (2003) did with Lean, but tries to take a step back and look how the different methods could be structured on a general level. To do this, he creates several key criteria with which you could describe and assess methods. Authors such as for example Wynn and Clarkson (2018) have also created a sort of metamodel for intervention methods, but this was only meant to describe and distinguish the methods. Jonker’s metamodel (1990) is unique since it not only creates criteria to describe and distinguish between intervention methods, but also assess them. He speaks in terms of key criteria which every intervention method with regard to designing organizations should meet.

Another reason for choosing Jonker’s book (1990) is that he is a professor who is active on the Radboud University, just like the writer of this thesis. It is interesting to critically look at a researcher who created a book with so many similarities to this thesis, and who adheres to the same theories as those taught to the researcher of this thesis.

To bring order into the multitude of terms, views, theories, perspectives and aspects, Jonker (1990) distinguishes four key criteria with which he is able to assess methods: a procedural, instrumental, conceptual and theoretical criterion.

The first, procedural criterion consists of interactions, procedures and content (Jonker, 1990). Since interaction is seen as the basis of the diagnosis process, the designer should have certain characteristics, such as sufficient analytical capacity (Jonker, 1990). The procedure includes planning the different tasks for diagnosing an organization, adapting and anticipating on the available time, and handling feedback from the client. Jonker (1990) sees content as knowledge about both the field and about the instruments which are able to diagnose an organization. Together, these three elements should be included in a method on designing organizations.

The second, instrumental criterion consists of the tools with which the concepts are put into practice (Jonker, 1990). These instruments could be (1) scientific methods to gather data, such as quantitative and qualitative research method, (2) historical or actual data sources, or (3) ready-made tools to diagnose an organization (Jonker, 1990).

According to Jonker (1990), the third, conceptual criterion consists of conceptual models and metaphors. Conceptual models are the more visible simplifications of reality. Each
model consists of a set of elements, and interrelationships between these elements, which forms a structure. A conceptual model focuses on things that are crucial for a functioning organization. Metaphors, on the other hand, are according to Jonker (1990) the mental, invisible and implicit concepts inside of people who are involved with organizations.

Lastly, the theoretical criterion by Jonker (1990) is based on the idea that people in practice diagnose organizations by means of their often unconscious view on organizing. The theory on which an author bases his/her own ideas, gives an indication of this perspective on organizing. According to Jonker (1990), a theory about organizations could be described as the whole of knowledge that people have about how organizations function and why. Jonker (1990) states that organizational theories may involve thinking about organizations and organizing, or thinking about diagnosis.

The four criteria of Jonker for organizational design methods are variables from a book with a peer reviewed publisher, and are created by an academic researcher from the field Organization Change and Organization Design. Therefore, these criteria could be used for constructing the metamodel of this thesis.

**Step 3: Logical thinking**

The idea is to base the key variables of the metamodel on the four criteria by Jonker (1990). However, as stated earlier, the variables from the academic literature should be viewed against the background of the metamodel’s goal. Therefore, logical thinking is used to critically analyse the key criteria by Jonker. During the second step these four criteria appeared relevant for assessing methods for episodic interventions in organizational infrastructures. Nonetheless, the criteria are not entirely appropriate for the metamodel on five points. These five criticisms are pointed out in this step.

To be able to critically analyse Jonker’s criteria, it is necessary to make the purpose of the metamodel more specific, by looking at the research objective of this thesis. The goal of the metamodel, which is based on the research objective, is to enable the description and assessment of methods like Design Thinking and the 3-D model as methods supporting episodic interventions in organizational infrastructures. To find out which key variables need to be included in the metamodel, this metamodel goal has to be rewritten into several key variables. Therefore, by dissecting this metamodel goal, the metamodel should enable looking at these kinds of methods (1) as a method for episodic interventions in organizations, (2) as a method for episodic...
interventions in organizational infrastructures, and (3) as a method in itself. These are considered to be the three layers of the metamodel. When the four criteria of Jonker (1990) are coupled to this layered goal of the metamodel, the following matrix appears:

<table>
<thead>
<tr>
<th></th>
<th>Procedural</th>
<th>Instrumental</th>
<th>Conceptual</th>
<th>Theoretical</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1) Method for episodic</td>
<td>Procedures that help with intervening in organisations</td>
<td>Instruments that help with intervening in organisations</td>
<td>Concepts that help to think about relevant aspects of interventions</td>
<td>Theories about the approach to episodic interventions and their contribution to the change in organisations</td>
</tr>
<tr>
<td>interventions in</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>organizations</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(2) Method for episodic</td>
<td>Procedures to design infrastructures</td>
<td>Instruments to design infrastructures</td>
<td>Concepts that help to think about relevant aspects of infrastructures</td>
<td>Theories about the contribution of infrastructures to the functioning of organisations</td>
</tr>
<tr>
<td>interventions in</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>organizational infra-</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>structures</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(3) Method in itself</td>
<td>See “procedural – interventions” and “procedural – infrastructures”</td>
<td>See “instrumental – interventions” and “instrumental – infrastructures”</td>
<td>Concepts about methods as methods</td>
<td>Theories about methods as methods (methodology)</td>
</tr>
</tbody>
</table>

Table 1: Coupling the metamodel’s goal to Jonker’s (1990) criteria

The table above exists of combinations between the four criteria of Jonker (1990) and the three layers of the metamodel of this thesis. For example, when combining the instrumental criteria of Jonker with the infrastructural layer of the metamodel’s goal, “instruments to design infrastructures” are the result. The table shows a first reason why the four criteria of Jonker (1990) cannot be used without adjustments for the key variables metamodel in this thesis. Due to the fact that the research objective of this thesis, in contrast to that of Jonker, is layered, the metamodel of this thesis needs to exist of a different categorization of key variables than Jonker’s criteria. So, although the criteria of Jonker will be included into the metamodel because of their relevance, they will not form its key variables in their current form, but have to be adjusted. When creating key variables, we want these variables to be distinctive from each other. From the table, it appears that not the criteria of Jonker, but the layers of the metamodel’s goal are the most distinctive variables which guide the content. The key variables of this thesis should reflect three layers of the metamodel of this thesis – therefore, the key variables of this metamodel are intervention, infrastructure, and method.

The second point on which Jonker’s criteria (1990) do not fit with the metamodel’s goal, is the scope of every criterion. Since the research issue of Jonker revolves around the diagnosis phase
of design, every criterion is geared towards this diagnosis phase. For example, Jonker (1990) states that a theory could be about either organizations or diagnosis. To fit with the goal of this thesis’s metamodel, the theoretical criterion as well as the other criteria should not only be focused on diagnosis, but on the whole process of design. This also includes other phases such as a design, implementation and evaluation phase.

The third criticism is about a missing variable in Jonker’s model. Because of their discontinuous, intentional and revolutionary character, episodic interventions generally need a distinct organization which intents and implements the change (Weick & Quinn, 1999). Weick and Quinn (1999), who introduced the concepts of episodic and continuous change, state that episodic interventions require an outsider intervention, or at least an intervention which is deliberately initiated and executed by so-called “change agents”. This could be a team of external consultants, or a project team which is formed from in the organization. This project team could be seen as a distinct and temporary organization besides the focal organization, which has as goal to successfully implement the episodic intervention. This organization has for example its own HR and structure (Nadler, 1995). In this thesis, the distinct organization which is responsible for the episodic intervention will be called the “intervention organization”.

The procedures and instruments from Jonker (1990) belong to the intervention organization, since they represent the steps that are undertaken by the intervention organization (such as planning and dealing with client’s feedback), and the toolbox with which these procedures are realized. Thus, both procedures and instruments are relatively small and related elements of the distinct organization which is responsible for bringing the intervention to a good end – the intervention organization. However, this intervention organization is broader than these two variables. For instance, who are participating in the intervention, and the roles in which these people are participating is equally important for the organization of the intervention. Therefore, it seems more logical to replace the procedural and instrumental criteria of Jonker (1990) by one new criterion which is broader – the intervention organization, which is shortened to the term "organization". This criterion includes all elements of which the organization of an intervention exist. It comprises but is not limited to the procedure and instruments in interventions.

A fourth point of criticism points towards the fact that Jonker (1990) does not include a separate variable which captures the pre-theoretical assumptions of the authors. A theory does not happen to emerge, but is based on the more implicit views with which an author of a model looks at reality. And to change an organization fundamentally, it is necessary to also change the pre-
theoretical views which prevail in the organization (Weick & Quinn, 1999). Therefore, it is necessary to include a criterion which captures these pre-theoretical assumptions, including the metaphors and paradigms which are used. Other influential authors who conducted research about change in organizations, such as Weick and Quinn (1999), also used a pre-theoretical variable like “the metaphor of the organization”, to distinguish between different ways in which change in organizations could be captured.

The inclusion of metaphors under the pre-theoretical criterion can cause confusion, since it already forms a part of Jonker’s conceptual criterion (1990). This conceptual criterion was broken down into models and metaphors. However, metaphors should not be a part of the conceptual criterion, but of the pre-theoretical criterion. Whereas a model is a simplification which represent a reality itself, a metaphor is a simplification that represents reality with an image that is not meant to exactly correspond to that reality. Therefore, while a model is seen in this thesis as a concept of a theory, a metaphor is seen as a more pre-theoretical image. As stated earlier, besides metaphors, the pre-theoretical criterion also includes paradigms. A paradigm is also a pre-theoretical variable, which comprises the more scientifically articulated view someone has on the world around him/her, and will be explained in more detail in sections 2.2.2 to 2.2.4.

Fifth, the conceptual and theoretical criteria are completely separated from each other in Jonker’s book (1990). However, there is some form of overlap between a concept and a theory, which makes it difficult to completely separate them. A theory is a justified belief which explains a relationship between several concepts (Vennix, 2011). For example, a theory could explain how and why certain intervention techniques lead to a better acceptation of the change by organization members. In this example, the intervention technique and the acceptation of change are the two separate concepts. Concepts are “the building blocks of theory and are the points around which […] research is conducted” (Bryman, 2016, p. 151). Theories and concepts are related to each other – a theory always is built from several concepts, but a concept does not necessarily have to be a theory. Because of this relationship between concepts and theory, the two terms will be grouped under the same criterion, which is consisting of both theoretical and conceptual variables. This is in line with choices of authors in the field of scientific research, such as Alan Bryman (2016).

The critical analysis of Jonker’s metamodel has made it possible to take lessons from this metamodel, and refine the metamodel which will be used in this thesis.
The first lesson learned is that several key variables should be created, which make it able to describe and assess design intervention methods on several important criteria. The second lesson learned is the fact that theoretical, conceptual, instrumental and organization variables which were included in Jonker’s metamodel, should also be included in some way in this thesis’s metamodel, since it matches the goal of the metamodel from this thesis. The third lesson which was learned from the analysis, is that pre-theoretical assumptions are important to include in a metamodel which should enable describing and assessing methods on their intervening capacity (Weick & Quinn, 1999).

As a result of the criticism about Jonker’s metamodel which was formed with logical thinking, the criteria of Jonker (1990) are adapted to fit the goal of the metamodel. First, the procedural and instrumental variables of Jonker’s metamodel are replaced for the broader term “organization”. Second, the pre-theoretical variable is added to the criteria. Third, the conceptual and theoretical variable, which showed some sort of overlap, will be both covered in one category.

**Step 4: Iterativity**
The fourth step for constructing the metamodel is the iterativity during this construction process. The researcher will constantly check the developed key variables and sub-variables in the light of the metamodel’s goal, and adapt the variables if necessary. This iterative process will start from section 2.2.2 onwards, when all sub-variables are explained. During this process, it is possible that certain key variables or sub-variables are changed, due to misfit with the goal of the metamodel. In chapter 3 and 4, where Design Thinking and the 3-D model will be described and assessed, this iterativity could also occur. When certain variables are not suitable for the description and/or assessment of the methods, they will be changed or removed from the metamodel.
The metamodel of this thesis, including all key variables and second order sub-variables, is made visual in table 2 below. In section 2.2.2 to section 2.2.4, all sub-variables in this table are explained more specifically. An overview of the final list of variables is given in section 2.2.5.

For the second order sub-variables 1.2, 1.3, and 2.1, which are too broad to describe and assess as a whole, several third order sub-variables will be distinguished, such as sub-variable 1.3.1. A visualization of the hierarchy of sub-variables is given in Figure 1.

The structure of section 2.2.2 to 2.2.4 will be as follows. The key variable about interventions will be explained first, since all criteria of Jonker (1990) are covered in this key variable. Subsequently, the key variable about infrastructures is clarified, because it covers two of the three criteria. Lastly, the key variable concerning methods is described, because it only encompasses one criterion. For each sub-variable, a definition is given.

![Figure 1: Hierarchy of metamodel variables](image)

Next, the sub-variable is as much as possible substantiated with academic literature, and examples of the variable are given. Finally, the way this variable is used in this thesis is made clear.

<table>
<thead>
<tr>
<th>Key variables</th>
<th>Criteria</th>
<th>Second order sub-variables</th>
</tr>
</thead>
<tbody>
<tr>
<td>KV 1 Intervention</td>
<td>Pre-theoretical</td>
<td>KV 1.1 Intervention metaphor &amp; paradigm</td>
</tr>
<tr>
<td></td>
<td>Theoretical and conceptual</td>
<td>KV 1.2 Organizational interventions theory</td>
</tr>
<tr>
<td></td>
<td>Organization</td>
<td>KV 1.3 Intervention organization</td>
</tr>
<tr>
<td>KV 2 Infrastructure</td>
<td>Theoretical and conceptual</td>
<td>KV 2.1 Infrastructure theory</td>
</tr>
<tr>
<td>KV 3 Method</td>
<td>Pre-theoretical</td>
<td>KV 3.1 Methodological metaphor &amp; paradigm</td>
</tr>
</tbody>
</table>

Table 2: Scheme of the metamodel and the represented criteria per sub-variable

The table above shows that all criteria of Jonker are in one way or another included in the metamodel. However, not all criteria of Jonker are reflected in all of the key variables. The organization criteria is not included in the key variables about the infrastructure and method, since this criterion is already completely covered in the key variable about interventions. Moreover, the theoretical and conceptual criterion is not included in the methodological key variable.
During the iterative process of writing down the results in chapter 4 and 5, it appeared that the literature about Design Thinking and 3-D model does not explicitly or implicitly discuss methodological concepts and theories. This makes the theoretical and conceptual criterion inapplicable for this key variable, since there is little to describe and/or assess about methodological theories and concepts. However, in line with Jonker (1990), theories and concepts are applicable to both interventions and infrastructures, so the criterion was included in these two key variables. Since a method does not only have pre-theoretical assumptions about its methodology, but can also have these about infrastructures and interventions, this sub-variable was included in all three key variables.

2.3 Constructing the metamodel | KV 1: Intervention

The first key variable of the metamodel comprises of sub-variables for methods with the purpose of guiding interventions. According to Argyris (1970, p. 15), intervening is “to enter into an ongoing system of relationships, to come between or among persons, groups, or objects for the purpose of helping them”. According to Van den Wittenboer (1992), an intervention consists of four important elements: the intervener (the person who intervenes), the intervention (or the interference), the object of the intervention (that at which the intervention is aimed), and the objective of the intervention (what is intended with the intervention). Below, the choice of the sub-variables for methods aimed at intervening in organizations are explained.

This key variable regarding episodic interventions consists of pre-theoretical, conceptual and theoretical, and organizational criteria, as explained in section 2.2.1.

The pre-theoretical criterion consists of second order sub-variable 1.1, which is called “metaphor & paradigm”. Since a metaphor is a (simplified) way to make a complex paradigm explicit, and can be seen as a pre-paradigmatic image, the metaphor is grouped together with the paradigm.

The theoretical and conceptual criterion is represented by second order sub-variable 1.2 about organizational interventions theory, which is further divided into third order sub-variables about the intervention’s goal, theoretical and conceptual substantiation, social aspect, and types of change. This second order sub-variable about interventions theory addresses the more specific and detailed theoretical framework on which the methods regarding interventions are based. This sub-variable is seen as substantially different from the metaphor and paradigm, since it does not represent the world view underlying the theory and concepts, but the more
explicit theory and concepts of the method in itself. Theories emerge from different subsequent studies that confirm each other, and even have a sort of predictive value. Authors of methods could base their views on these existent theories and concepts, or create their own new substantiated and argued theories and concepts.

The third criterion, organization, is represented by second order sub-variable 1.3 which is called “intervention organization”. The fact that this sub-variable only focuses on the way in which the intervention is actually realized, instead of a focus on general theories and concepts about interventions, distinguishes it from the sub-variable 1.2. The third order sub-variables of sub-variable 1.3 explain how the goal of the intervention actually could be achieved. This sub-variable involves the process, organization and instruments which are used in the interventions.

In table 3, the framework of the first key variable is visualized.

<table>
<thead>
<tr>
<th>Key variable</th>
<th>Criteria</th>
<th>Sub-variables</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>KV 1 Intervention</td>
<td>Pre-theoretical</td>
<td>KV 1.1 Intervention metaphor &amp; paradigm</td>
<td>…</td>
</tr>
<tr>
<td></td>
<td>Theoretical and conceptual</td>
<td>KV 1.2 Organizational interventions theory</td>
<td>…</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1.2.1 Goal</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>1.2.2 Theoretical and conceptual substantiation of interventions</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>1.2.3 Social aspect</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>1.2.4 Type of change</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Organization</td>
<td>KV 1.3 Intervention organization</td>
<td>…</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1.3.1 Process</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>1.3.2 Configuration</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>1.3.3 Instrument</td>
<td></td>
</tr>
</tbody>
</table>

Table 3: Framework Key Variable 1

KV 1.1: Intervention metaphor & paradigm

The first sub-variable of this key variable comprises of the metaphors and paradigms used by authors of methods with the purpose of guiding interventions. This sub-variable is important to give an indication of the world view that forms the background against which the design intervention methods are constructed. In other words, before the sub-variables about theories, concepts and organization with regard to interventions are explained, a step back must be taken in order to understand these theories, concepts and organization ideas. To take this step back, the world view of the design intervention method’s authors is looked at from a paradigmatic and
metaphorical perspective. So, variable 1.1 will dive deeper into the metaphors and paradigms of the authors of Design Thinking and the 3-D model. Methodologically, it is not completely correct to put two different terms in one sub-variable. However, for this sub-variable it was decided to do this anyway, since the two terms both represent someone’s world view, and therefore have a lot in common (Wake, 2000). Whereas a metaphor is a limited and less scientifically articulated way of expressing a world view, a paradigm is more scientifically substantiated. Despite being grouped together in one sub-variable, it will be made clear in the results whether the result is seen as a metaphor or a paradigm, when this is possible.

Jonker (1990) introduces metaphors as the mental, invisible and implicit concepts inside of people who are involved with organizational interventions. However, in the eyes of the researcher, this does not represent a proper definition of metaphors. First, as explained earlier, a “concept” represents a label that is given to several significant elements of the world which we want to understand (Bryman, 2016). It could be a part of a theory, and is more substantiated than a metaphor. Second, the terms “invisible” and “explicit” do not fit with metaphors, since metaphors can also be made very explicit and visible by someone, such as in poems, and when someone uses metaphors to explain a phenomenon in the world.

In this thesis, a metaphor is seen as a pre-paradigmatic image that is used to describe reality. Metaphors are a limited form to express your views, because you describe reality with an image that does not exactly and literally correspond to that reality. Each metaphor highlights interesting phenomena and focuses on new relationships, but obscures other phenomena and relationships (Van Amelsvoort, Kuipers, & Kramer, 2010). However, while a metaphor is scientifically less articulated, it serves an important purpose in explaining organizational phenomena. There are several categorizations of metaphors with regard to organizations, but one of the most popular ones (with more than 21,000 citations on Google Scholar) is the categorization of Morgan (1999). Morgan states that there are eight different images of organizations with which you are able to make different aspects or sides of organizations visible. These eight metaphors are: seeing organizations as machines, organisms, brains, cultures, political systems, physical prisons, flux and transformation, and as instruments of domination. Depending on someone’s metaphor of organizations or interventions, this person will believe in a certain way of intervening in the organization. For instance, someone with a machine metaphor will believe in a more formal and planned way of intervening, whereas someone with an organism metaphor will believe in more continuous change. For this thesis, the metaphor the authors of the methods use for the organization or the intervention will be described and assessed. It should be noted
that there are two ways in which these methods could use metaphors. The first way is the metaphor which the authors of the method themselves adhere to, and the second way are the metaphors which other people could adhere to, in the eyes of the method’s authors. For this sub-variable, the focus will be on the first type of metaphor, but it will be made explicit when the second type of metaphor use is also present in the method.

The norm of the intervention metaphor is that the authors should make explicit in which way they look at organizational interventions and organizations as such. Moreover, it is important that multiple metaphors are used and highlighted by the authors, since a method should be able to look from multiple perspectives at the world. When only one metaphor is dominant, this means that many other views of interventions and organizations are left in the dark (Van Amelsvoort et al., 2010).

*Intervention metaphor: a simplified image used to describe (an aspect of) organizational interventions or the author’s view on these interventions.*

Methods concerning organizational infrastructures are not just created, but are based on an explicit or implicit underlying view about the world, called a paradigm (Kuhn, 1962). A paradigm is seen in this thesis as an underlying view with which someone looks at the world, and includes the whole of models and theories that form the framework from which reality is analysed and described. In comparison with metaphors, paradigms are more articulated and scientifically substantiated.

With regard to the field of organizational interventions, there are several classifications of paradigms which are used during intervention processes. The classification of Morgan (1980) will be used for this thesis, since it is a highly classic and influential article about intervention paradigms, with more than 2,000 citations on Google Scholar. In his classification, Morgan (1980) distinguishes between a subjective versus objective approach, and between radical change versus a regulating approach. Along these dimensions, Morgan (1980) identifies four paradigms with regard to organizing: a radical humanist (subjective), radical structuralist (objective), social interpretative (regulating-subjective) and functionalist paradigm (regulating-objective).

Starting with the functionalist paradigm, Morgan (1980) describes this paradigm as based on objective and positivist assumptions in a predictable and orderly world. Organizations are seen as having a clear task structure and responsibilities. Interventions are efficiently organized and effectively planned and regulated.
The radical structuralist paradigm also has objectivist assumptions, but focuses more on conflict, domination and exploitation of humans and resources. This paradigm entails the view that organizations are only able to survive when they are adapted to changed circumstances. Topics such as collaborations and structural changes in organizational structures play an important role.

The third paradigm, the radical humanistic one, provides a vision on the societal behaviour of organizations, and gives insight into patterns of dominance and emancipation. Interventions in this approach focus on bringing people with different perspectives together to transform the work situation and social relationships in the organization.

The last paradigm, the social interpretative paradigm, has a subjective vision on science and states that people are capable of changing their own reality. Interventions are based on methods which gather systematized experiences in case studies and action research. The core of the intervention process is dialogues between actors, broad participation, feedback and self-organization.

With regard to this thesis, the different methods will be categorized according these four paradigms concerning organizational interventions. The norm of the paradigm is the same as that of the metaphor; the authors should make explicit in which way they look at organizational interventions and organizations, and use multiple paradigms to look at the world. 

*Intervention paradigm: the underlying view with which someone looks at organizational interventions.*

**KV 1.2: Organizational interventions theory**

There are different theoretical foundations for organizational interventions, and it would be beyond the scope of this thesis to discuss and use all theories about this subject. Instead, several sub-variables are chosen to represent important criteria on which methods which support episodic interventions in organization can be described and assessed.

Sub-variable 1.2.1 is about the goal of the intervention. An intervention is not just being created; the urge for an intervention emerges when an organization is not fully able (anymore) to fulfil its goals. And since this thesis is about episodic interventions, which have an explicit a priori goal, the intervention’s goal should be included as a criterion for methods which support episodic interventions in organizations (Weick & Quinn, 1999).

Sub-variable 1.2.2 comprises the theoretical and conceptual substantiation of the intervention method. The statements which the authors make about interventions in organizations should at least to some extent be theoretically and conceptually substantiated, by for example
mentioning the theory that the authors adhere to, or explaining their own new theories and concepts. The reader should be sure that the information about interventions which is provided by the authors is scientifically grounded, or sufficiently substantiated in the articles or books about the method.

Sub-variable 1.2.3 is about the social aspect which should be taken into account by the methods. Since organizations are social systems which comprise of interactions between actors, intervention methods should include the social aspects of these interventions (Luhmann, 1984). Without taking into account that the intervention should be accepted by organization members and become part of daily behaviour, chances are big that the intervention will not be successful (Schein, 1969).

Sub-variable 1.2.4 comprises the type of change under which the intervention can be classified. This sub-variable is chosen, since the methods will be described and assessed as methods which support specifically episodic interventions, which is one type of change. It is therefore important to know whether the method is explicitly geared towards this type of change, or another type of change.

**KV 1.2.1: Goal**

Sub-variable 1.2.1 about the goal of the intervention consists of three parts: the “reason why” the intervention is being executed, the “object” of the intervention, and the “application area” of the intervention. These three parts will be explained in this section.

Each intervention is executed with a specific reason in mind, i.e. each intervention has a certain purpose. For example, this “reason why” could be to contribute to the proper functioning of the organization, or maintain a specific capacity which gives the organization a competitive advantage. Other “reasons why” of an intervention method could be to solve problems which are related to organizational communication, or to create more product innovation. According to Vennix (2011), an intervention aims in general to change some state of affairs or to change a development. Often, there is a gap in the organization between a desired state and the current state, and the intervention attempts to (partly) close this gap, thereby solving a particular problem (Vennix, 2011). Because each intervention has its own reason why it is being executed, the methods of Design Thinking and the 3-D model should explicitly dictate what the reason and purpose of their interventions is.

For interventions, it is also possible to identify an object which “undergoes” the steps of this method. The intervention interacts with a tangible or intangible object in the real world. Ashby (1958) also speaks of an object – or “thing”- which is handled in daily life. Each object
has coherence and is seen as a collection of interdependent parts, such as a chair. Objects introduce certain constraints to our world, according to Ashby (1958). Examples of an object of the intervention could be an organization, a system, a product or service, etc. This object answers the question: what does the intervention method try to change? For each intervention method in this thesis, the object which it tries to design and/or change will be identified. In this thesis the object could also introduce certain constraints; when we take the organizational structure as an example of an object, this structure could inhibit the proper execution of an intervention, and thereby obstruct the goals of the organization.

Besides the object described above, an intervention could be directed towards a specific application area. This application area is – unlike the object – not a thing, but a field such as a sector or a type of organization. The intervention method could for example be aimed at governmental organizations or organizations in the healthcare sector. The object in this example is an organization, whereas the application area is the governmental and healthcare sector. It is possible to have an intervention method which is aimed at multiple objects (f.e. systems and services) within one application area (f.e. business). It is also possible to have an intervention method which is aimed at one object (f.e. organizations) within multiple application areas (f.e. law, healthcare). With regard to Design Thinking and the 3-D model, the application area of both methods will be described and assessed.

The norm value of this sub-variable is that the authors have to be explicit about the reason why, object and application areas of the method. It has to be clear for the reader on which situations he/she can apply the method, and which goals could be reached by using the methods. Moreover, the goal of the method should fit with a method which supports episodic interventions in organizational infrastructures.

**Goal:** the purpose with which the intervention method is executed, the object of the intervention (the collection of interdependent parts undergoing the intervention), and the application area of the intervention (the field towards which the intervention is directed).

**KV 1.2.2: Theoretical and conceptual substantiation of interventions**

Besides the metaphors and paradigms, which guide the author’s view on organizations and interventions, there are also various theories and/or concepts present in intervention methods. These are more actively used by the author to represent and explain the content of their method. The statements which the authors make about interventions in organizations should at least to some extent be theoretically and conceptually substantiated. To explain this sentence, a definition will be given of both theories and concepts.
In this thesis, a theory is defined as a set of methodologically justified beliefs that together describe and explain a phenomenon, and explain why there are relations between certain elements of this phenomenon (Vennix, 2011). Whereas a paradigm refers to a broad worldview regarding a subject, a theory is a more specific justified belief which can result from a paradigm. Authors of methods about interventions in organizations presumably also follow a theory with regard to this topic. As explained above, it would be beyond the scope of this thesis to examine all kinds of theories about intervening in organizations. Therefore, this theoretical variable makes sure that the researcher is able to capture any interventional theory on which the authors of Design Thinking and the 3-D model base their views.

Concepts are defined in this thesis as “the building blocks of theory” and “the points around which […] research is conducted” (Bryman, 2016, p. 151). A concept represents a label that is given to several significant elements of the world which we want to understand, and they could take the form of an independent or dependent variable (Bryman, 2016).

Concepts and theories together form ideas that drive a certain method and shed light on how this method should be interpreted (Bryman, 2016).

The norm of this sub-variable is that both methods should make explicit on which scientific theories and concepts their views with regard to interventions are based, and/or define the own theories and concepts they have. The methods should be sufficiently based on at least one scientific theory or concept, or come with an extensive description of a new theory they have created. When there is no theoretical or conceptual foundation for the statements about interventions, the danger is that the method just comprises of thoughts and ideas, instead of justified beliefs. This gives the reader less security about the scientific soundness of the statements.

**Theoretical and conceptual substantiation of interventions: the extent to which an author makes explicit the theories and concepts from other authors on which his/her intervention method is based, or the extent to which an author explains a new theory or concept about interventions which is brought forward by the method.**

**KV 1.2.3: Social aspect**

An aspect which can be found in many theories regarding interventions in organizations is the social aspect of these interventions (see f.e. Kotter, 1996; Beer & Nohria, 2000; Ford, Ford & D’Amelio, 2008; Feldman & Orlikowski, 2011). The underlying foundation for many of these theories is that since organizations are regarded as social systems where interactions between
actors take place, methods with regard to organizational interventions should take into account
the social aspect of organizations (Luhmann, 1984). According to these theories, interventions
do not just take place by imposing them the people involved in the organization. Interventions
should be supported by those involved in order to make an intervention successful (Lewin,
1947; Schein, 1969). It is therefore important to let organizational members and other stake-
holders participate during the intervention and ensure the acceptance of this intervention, as
shown by numerous older and newer empirical studies (Coch & French, 1948; Pasmore & Fa-
gans, 1992; Oreg, Vakola, & Armenakis, 2001; Nielsen & Randall, 2012). The former state-
ments of these classical works about organizational change have been reiterated by numerous
recent works of scientific researchers, such as those of Young (2009) and Cummings, Bridg-
man, and Brown (2016). Based on all these theoretical and empirical studies, it can be con-
cluded that an intervention method should pay attention to the former explained social aspect
of interventions, by including concepts like integration, adoption, and participation of a variety
of stakeholders. For example, methods could stress the importance of communication about the
intervention, or show how to make stakeholders accept the change more. For the methods of
Design Thinking and the 3-D model, it will be assessed to what extent these methods take the
social aspect of organizational interventions into account.

The norm of this sub-variable is reached when the method takes the integration, adop-
tion and interests of stakeholders of the intervention into account sufficiently. This is done by
at least mentioning the importance of one of these social aspects, and/or explaining how to
reach one of these things with the method.

Social aspect: the extent to which an intervention method takes the integration, participation
and adoption of the intervention, and the interests of stakeholders of the intervention into ac-
count.

KV 1.2.4: Type of change

Another group of theories about organizational interventions states that organizational change
is a concept that can occur in different ways. These theories identify different types of change
in organizations. Examples of these theories are Theory E and Theory O from Beer and Nohria
(2000), which differentiates organizational change as being centered around creating economic
value (Theory E) or change as being based in organisational capabilities (Theory O). Another
example of such a theory is that of Gersick (1991) and Tushman and Romanelli (1985), where
evolutionary change is distinguished from revolutionary change. These typifications make it
easy to distinguish for what kind of change interventions methods are created.
For this thesis, the theory of Weick and Quinn (1999) is chosen as the classification of change. Their theory a classical classification of change, with more than 3,600 citations on Google Scholar. Moreover, the theory also fits the best with the goal of the metamodel, which is to enable the description and assessment of methods for the purpose of episodic interventions in organizational infrastructures. Weick and Quinn (1999) distinguish two types of change in organizations: episodic change and continuous change. Whereas episodic change is marked by distinct periods in time where the sudden dramatically change is driven by an external and/or internal events, continuous change is characterized by emergent and small shifts without explicit intentions prior to the change. In this thesis, each article and book will be categorized as focused on episodic change, continuous change or even both.

The norm value for this sub-variable is that the authors should at least make explicit what type of change the method is focusing on. Moreover, the method should focus specifically on episodic change, since the methods are assessed on their potential as being a method which supports episodic interventions in organizational infrastructures.

Type of change: whether an intervention method focuses on episodic change, continuous change or on both.

KV 1.3: Intervention organization

The goal of the intervention was explained in the previous section. However, without a proper intervention organization, it is not possible to reach the intended goal of the object. The intervention – that is, the interference – itself should be coordinated and maybe even regulated, to guide it effectively and efficiently towards the intervention goals. This sub-variable about the intervention organization deals with these issues. The term “intervention organization”, which was defined earlier as being all elements of the distinct organization which is responsible for the episodic intervention, is central in this whole second order sub-variable.

First, sub-variable 1.3.1 describes the process which is proposed by the method. The reader should know specifically which things should be done and in what order, to be able to live up to propositions of the intervention method. Including the process steps will make the intervention method more practically useful for its readers.

Second, sub-variable 1.3.2 is about the configuration which is used to give shape to the process steps which were supposed. The reader what division of tasks, strategy, personnel policy, technology and culture is needed to be able to realize the specific steps of the intervention process. For example, the process steps to create a positive learning climate in an organization
could be followed very precisely, but when the organization keeps its defensive culture, the intervention is deemed to be unsuccessful.

Third, sub-variable 1.3.3 comprises the instruments which are presented by the intervention method. Since there are many instruments which claim to guide episodic intervention processes, the method should at least say something about this variety of instruments, to help the reader in choosing which ones are fitting the goal of the intervention, and supporting the process steps and configuration of the intervention organization. The method could even come up with its own new instruments, which guide the realization of one or more goals of the method.

**KV 1.3.1: Process**

Given the goal of the intervention, an intervention method should provide a process that must be followed to reach that goal. An intervention process is a specified order of performing actions in the intervention. For example, an intervention process could be described as a cycle which entails a diagnosis, design, change and evaluation phase (Vennix, 2011). It is also possible that the described intervention process is more detailed, containing the exact things that should be done in order to reach the goal of an intervention. An example of a more detailed intervention process are the activities of a pre-diagnostic phase of an intervention, provided by Jonker (1990). He creates a scheme consisting of the request for help, the appointments and/or quotation for pre-diagnosis, the report, and the bid proposal/contract. In this thesis, the intervention processes given by the two focal methods will be described and assessed.

The norm of this sub-variable is that the intervention process should be made explicit by the authors of the method, and it must be made plausible that the activities in this intervention process match the purpose of the intervention. This can be done explicitly, when the author clarifies why a process (step) leads to a desired outcome, or it can follow from logical thinking by the reader.

*Process: a specific sequence of steps that must be taken to reach the goal of an intervention.*

**KV 1.3.2: Configuration**

The intervention process described above is situated in practice, which means that it is executed in time, by people who interact with each other. Therefore, an intervention method should not only describe an intervention process, but also explain the way in which this intervention process is configured. An example of an author who also used configurations to describe and assess organizations, is Mintzberg (1980). Mintzberg identified five configurations which all rely on
their own coordinating mechanism, favour a specific part of the organization, and have their own specific design parameters and coordinating mechanisms. Jonker (1990) also talks about a sort of configuration of interventions, since his procedural dimension shows similarities with this variable. According to Jonker (1990), the intervention procedure consists of interactions (f.e. characteristics of the consultant), procedures (f.e. planning diagnosis tasks) and content (f.e. knowledge about the field and instruments). However, for the variable about the configuration of the intervention organization, a broader definition is chosen. In this thesis, the configuration of the intervention organization is on the one hand seen as both a process of configuring the intervention, which includes but is not limited to the task division, strategy, policy for personnel, technology, and culture of the intervention organization. On the other hand, the configuration is seen as a result which emerges when doing this configuring activity. The view of Design Thinking and the 3-D model on the configuration of the intervention organization will be described and assessed.

The norm of this sub-variable is that the authors should at least say something about the activity and/or the result of the configuration of the intervention organization. Besides this, the configuration should be logically following from the mentioned process steps which the authors have presented.

Configuration: the way in which the intervention process is organized. The configuration of the intervention organization could be an activity (including the division of tasks, strategy, personnel policy, technology and culture), and a result of this configuring activity.

KV 1.3.3: Instrument

Another variable for methods concerning organizational interventions is the instrumental variable. An intervention method may provide a toolbox which can be used for the benefit of the process and configuration of the intervention organization. Just like a carpenter has its hammer and screwdriver, methods have their own toolboxes filled with tools like brainstorming and observation. There is a hierarchy here to be distinguished: an intervention method can be seen as an instrument to achieve a specific intervention goal (which is covered in sub-variable 1.2.1), but within these intervention methods, multiple instruments could exist to help realizing the process and configuration of the intervention method itself. Jonker (1990) states for example that there are scientific methods to gather data from organizations, such as quantitative and qualitative research method and historical or actual data sources. Moreover, he states that there are ready-made instruments to intervene in an organization (Jonker, 1990). Examples of these
readymade instruments could be techniques with which organizational problems can be identified, or instruments which help to create readiness for change within an organization. Given the information above, the two methods in this thesis should provide information about instruments which could guide interventions in organizations, and this information is described and assessed.

The norm for this sub-variable is that the method should at least take into account the possibility of using instruments, and be explicit about this possibility. A method could for example present some instruments, or explain in what situation certain instruments could be used. Moreover, the instruments which are mentioned should fit with the process steps and configuration of the intervention organization, and help to reach the goal of the intervention.

Instrument: a toolbox which consists of a set of techniques, rules, and/or procedures, and which is put forward by an intervention method for the purpose of guiding the process in the proposed configuration of the intervention organization, in such a way that the goal of the intervention can be reached.

Below, the final metamodel of the first key variable is shown, including the meaning of all sub-variables.

<table>
<thead>
<tr>
<th>Key variable</th>
<th>Sub-variables</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>KV 1 Intervention</td>
<td>KV 1.1 Intervention metaphor &amp; paradigm</td>
<td>Intervention metaphor: a simplified image used to describe (an aspect of) organizational interventions or the author’s view on these interventions. Intervention paradigm: the underlying view with which someone looks at organizational interventions.</td>
</tr>
</tbody>
</table>
| KV 1.2 Organizational interventions theory | 1.2.1 Goal | Goal: the purpose with which the intervention method is executed, the object of the intervention (the collection of interdependent parts undergoing the intervention), and the application area of the intervention (the field towards which the intervention is directed).
Theoretical and conceptual substantiation of interventions: the extent to which an author makes explicit the theories and concepts from other authors on which his/her intervention method is based, or the extent to which an author explains a new theory or concept about interventions which is brought forward by the method.
Social aspect: the extent to which an intervention method takes the integration, participation and adoption of the intervention, and the interests of stakeholders of the intervention into account.
Type of change: whether an intervention method focuses on episodic change, continuous change or on both. |
KV 1.3 Intervention organization

1.3.1 Process
Process: a specific sequence of steps that must be taken to reach the goal of an intervention.

1.3.2 Configuration
Configuration: the way in which the intervention process is organized. The configuration of the intervention organization could be an activity (including the division of tasks, strategy, personnel policy, technology and culture), and a result of this configuring activity.

1.3.3 Instrument
Instrument: a toolbox which consists of a set of techniques, rules, and/or procedures, and which is put forward by an intervention method for the purpose of guiding the process in the proposed configuration of the intervention organization, in such a way that the goal of the intervention can be reached.

Table 4: Metamodel Key Variable 1

2.4 Constructing the metamodel | KV 2: Infrastructure

As explained earlier, this thesis will conduct research about the appropriateness of Design Thinking and the 3-D model as methods for intervening in infrastructures. In other words, the object of the intervention is the infrastructure. With this in mind, the author of this type of method should properly approach infrastructures, by making statement about this kind of object of the intervention. Methods should provide information about their knowledge or other author’s knowledge concerning infrastructures. Therefore, the second key variable to be distinguished is “infrastructure”, which relates to the academic literature about Organization Design. In the academic literature about organizations, the infrastructure often refers to managing human resources, such as in articles by McEwan (2015) and Albadvi et al. (2007). The term infrastructure is also used for the technology in an organization (Croteau et al., 2001). In other articles, the term indicates the structure of an organization (Albadvi et al., 2007; Croteau et al., 2001). In this thesis, the organizational infrastructure is defined as consisting of the organizational structure, the technology, as well as the management of human resources. Together, these three elements enable an organization to achieve its goals and function appropriately. When the infrastructure is not functioning optimally, it could hinder the organization to achieve its goals (Ashby, 1958). Therefore, the infrastructure could form the object of an organizational intervention.

Methods which support interventions in organizational infrastructures should provide theories that focus on what this infrastructural object is. Moreover, these types of methods should provide theories that are able to support the act of designing an infrastructure which is able to realize a certain goal.
The first type of theories is represented in third order sub-variable 2.1.1, which is about the theoretical and conceptual substantiation of the infrastructural object. Both methods should present theories which scientifically validate the statements which are made about the infrastructure, so the reader is sure that these statements are grounded in the academic literature, or that the statements at least are justified and explained by the authors.

The second type of theories can be found in third order sub-variables 2.1.2, 2.1.3, and 2.1.4 about respectively the essential variables, parameters and relationship between the parameters and essential variables. These sub-variables are based on the design regulation theory of academic Ashby (1958). If one wants to make an infrastructural design which makes it possible to realize certain goals, one has to be able to talk about these goals in term of essential variables (Ashby, 1958). Moreover, one has to identify the parameters which are of influence on the behaviour of these essential variables, since it is important to know which needs to be changed in order to come to an appropriate design. Lastly, one needs to know what the relation is between the parameters and the essential variables, so it becomes clear in which way certain parameters should be adapted to influence the essential variables in a positive way.

To conclude, the framework for key variable 2 is as follows:

<table>
<thead>
<tr>
<th>Key variable</th>
<th>Criterion</th>
<th>Sub-variables</th>
<th>Meaning</th>
</tr>
</thead>
</table>
| KV 2 Infrastructure | Theoretical and conceptual | KV 2.1 Infrastructure theory  
2.1.1 Theoretical and conceptual substantiation of the infrastructural object  
2.1.2 Essential variables  
2.1.3 Parameters  
2.1.4 Relation between parameters and essential variables | … |

Table 5: Framework Key Variable 2

KV 2.1: Infrastructure theory

This sub-variable starts with a variable about theories regarding infrastructures. For identifying the other variables, the design regulation theory of Ashby (1958) and the interpretation of this theory by De Sitter (1994) is used. Design regulation is defined as the adjustment of the organizational infrastructure in such a way that the organization stays able to survive (Ashby, 1958). Ashby is seen as a pioneer in the area of cybernetics and systems thinking, and contributed to an academic basis which was used widely for developing Organization Design theories. De Sitter is the founder of the sociotechnical theory in the Netherlands, that is derived from systems
thinking. Since both authors were influential in the whole of theories about designing infrastructures, their concepts are used to identify the last three variables in this sub-variable.

KV 2.1.1: Theoretical and conceptual substantiation of the infrastructural object

There is a wide range of theories and concepts about organizational infrastructures as an object for interventions, on which methods who deal with infrastructures can be based. With regard to the organizational structure, theories such as Sociotechnics (De Sitter, 1994), Lean manufacturing (Womack & Jones, 1997), Cybernetics and Systems Thinking (Ashby, 1958), the Configurational approach (Mintzberg, 1980), and the ideas of Thompson (2007) exist. Examples of theories about managing human resources are the hierarchy pyramid of needs (Maslow, 1943) and the reinforcement theory (Skinner, 2014). Regarding technology, examples are adaptation theories such as the window of opportunity (Tyre & Orlikowski, 1994) and the media richness theory of Daft and Lengel (1986). For the two focal methods in this thesis, the theories about infrastructures on which they explicitly or implicitly base their method are described and assessed. The theories mentioned above are just examples of theories about infrastructures. In other words, the researcher in this thesis remains open to new theories.

The norm of this sub-variable is that both methods should make explicit on which scientific theories or concepts their views with regard to infrastructures are based, and/or define the own theories they have. The methods should be sufficiently based on at least one scientific theory or concept, or come with an extensive description of a new theory or concept they have created. There should be substantiated theories and concepts about all three aspects of the infrastructure – HR, technology, and structure. When there is no theoretical or conceptual foundation for the statements about infrastructures, the danger is that the method just comprises of thoughts and ideas, instead of justified beliefs. This gives the reader less security about the scientific soundness of the statements.

Theoretical and conceptual substantiation of the infrastructural object: the extent to which an author makes explicit the theories and concepts from other authors on which his/her views about the infrastructure are based, or the extent to which an author explains a new theory or concept about the infrastructure as an object which is brought forward by the method.

KV 2.1.2: Essential variables

Each method which deals with infrastructures in organizations should have essential variables which it tries to improve. These essential variables can be seen as goal variables that indicate if the object is in a good or bad state. In scientific terms, this is the dependent variable when
looking at the appropriateness of infrastructures. Since a method tries to achieve something for the focal object, it can be derived that each method should introduce one or more essential variables. Ashby (1958) introduced this concept in his book, and stated that these essential variables should be kept between certain limits to keep the object in a good state. The organization has to keep these essential variables in certain norms to survive. As an example, Ashby (1958) sees the blood volume and the liver of a body as the essential variables of a human. When looking at De Sitter (1994), he speaks in his book of three essential variables in an organization, which he calls functional requirements – the quality of the organization, the quality of work, and the quality of working relations. In this thesis, the essential variables of the methods for designing episodic interventions in organizations will be described and assessed.

The norm of this variable is that when talking about infrastructures, the essential variables of these infrastructures should be identified and explained. Moreover, norm values of these essential variables should be clear. There is no content specific norm, other than that the essential variables should be about all three aspects of the infrastructure – HR, technology, and structure – and should fit reasonably with the rest of the method, such as with the goal of the intervention.

*Essential variables: variables which should be kept between certain norms to reach the goal(s) of the organization.*

**KV 2.1.3: Parameters**

Another variable with regard to the infrastructure of organizations is the use of parameters. A parameter has a value which varies, and the combination of different values of parameters influences the state and behaviour of the essential variables of a system (Ashby, 1958). Therefore, the value of a parameter is seen as the input which determines the organization’s behaviour, and can be adapted to change this behaviour (Ashby, 1958). In more scientific terms, the parameter is the independent variable which influences the essential variables (the dependent variable), which distinguishes it from a “normal” variable which is not necessarily independent. Designers in organizations can change the values of parameters in order to design the infrastructure, thereby influencing the behaviour of the whole organization. An example of parameters is given by Mintzberg (1980), who says that organizations can use parameters such as training and liaison devices to design their organizational structure. De Sitter (1994) distinguishes between seven different parameters which can be used to describe a structure in an organization, and are also usable for guiding the (re)design of organizational structures. When
looking at the methods of Design Thinking and the 3-D model in this thesis, the parameters that the designer can use to properly design and change the organization will be identified.

The norm of variable 2.1.3 is that when talking about infrastructures, the parameters of these infrastructures should be identified and clarified. There is again no content specific norm, other than that the parameters should be about all three aspects of the infrastructure – HR, technology, and structure – and should fit reasonably with the rest of the method, such as with the goal of the intervention.

Parameters: characteristics of the infrastructure which can have a varying value, and with which an organization can design its infrastructure. The role of parameters is to give the essential variables their norm values.

KV 2.1.4: Relation between parameters and essential variables

From the previous sections, it can be concluded that both essential variables and parameters should be identified in a method about intervening in infrastructures. However, the designer of an infrastructure does not know how to design an infrastructure when there is no indication of the relation between the parameters and essential variables. This relation is introduced by Ashby (1958), who stated that for each value of a parameter (the input), there is a value of an essential variable (output). An example of the relation between parameters and essential variables in an organization is given by De Sitter (1994). He states that the seven parameters he introduced should have a low value to contribute positively to the essential variables, and thereby realize a good state of the object (the organization). When applying this to Design Thinking and the 3-D model, these two methods should make this relationship explicit. When the authors do not provide an explicit relation, the relationship between the parameters and essential variables should at least be logically following from the method’s literature.

The norm of variable 2.1.4 is that when talking about infrastructures, the relationship between the parameters and essential variables of these infrastructures should be taken into account. Since the parameters are seen as the independent variable, and the essential variables are seen as the dependent variable, there has to be a (specified or logical) relationship between them. The relation between parameters and essential variables should be about all three aspects of the infrastructure – HR, technology, and structure.

Relation between parameters and essential variables: the way in which a certain value of a parameter influences an essential variable, or the value a parameters should have in order to maintain an essential variable in its norm value.
All sub-variables of key variable 2 are described in the table below.

<table>
<thead>
<tr>
<th>Key variable</th>
<th>Sub-variables</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>KV 2 Infrastructure</td>
<td>KV 2.1 Infrastructure theory</td>
<td>Theoretical and conceptual substantiation of the infrastructural object: the extent to which an author makes explicit the theories and concepts from other authors on which his/her views about the infrastructure are based, or the extent to which an author explains a new theory or concept about the infrastructure as an object which is brought forward by the method. Essential variables: variables which should be kept between certain norms to reach the goal(s) of the organization. Parameters: characteristics of the infrastructure which can have a varying value, and with which an organization can design its infrastructure. The role of parameters is to give the essential variables their norm values. Relation between parameters and essential variables: the way in which a certain value of a parameter influences an essential variable, or the value a parameters should have in order to maintain an essential variable in its norm value.</td>
</tr>
<tr>
<td></td>
<td>2.1.1 Theoretical and conceptual substantiation of the infrastructural object</td>
<td>直接关系</td>
</tr>
<tr>
<td></td>
<td>2.1.2 Essential variables</td>
<td>直接关系</td>
</tr>
<tr>
<td></td>
<td>2.1.3 Parameters</td>
<td>直接关系</td>
</tr>
<tr>
<td></td>
<td>2.1.4 Relation between parameters and essential variables</td>
<td>直接关系</td>
</tr>
</tbody>
</table>

Table 6: Metamodel Key Variable 2

2.5 Constructing the metamodel | KV 3: Method

For the organizational interventions described above, methods such as Design Thinking and the 3-D model may be created. These methods are the specific techniques and procedures which are used for the intervention (Saunders, Lewis & Thornhill, 2016). In the former sections, methods focused on infrastructures and organizational interventions were discussed. However, each method should also be viewed from a methodological perspective. The methodology refers to the science about “how research should be undertaken, including the theoretical and philosophical assumptions upon which research is based and the implications of these for the method or methods adopted” (Saunders et al., 2016, p. 720). In other words, methodology is about how a researcher handles the different aspects of their method. In this third key variable, the variables with regard to methods in general will be explained.

The third key variable of the metamodel about methods in general consists of one pre-theoretical sub-variable, the metaphor and paradigm which are used in the model. Since the conceptual and theoretical aspect is not applicable enough on the methods of Design Thinking and the 3-D model, this aspect is not included here. Moreover, the intervention organization was already covered in the first key variable, so this aspect is also not covered in this third key variable. Table 7 represents the framework of the third key variable.
With regard to doing scientific research, authors of methods have an explicit or implicit paradigm, based on which they form the views underlying their method. A research paradigm is an underlying view with which someone looks at research and how this research should be conducted. Kuhn is seen as an important science philosopher and has researched the shift of paradigms in science (Kuhn, 1962). According to Kuhn (1962), paradigms represent a certain way of thinking that is shared by a community of scientists, which guides how the problems in their field should be solved. According to Bryman (2016, p. 694), a paradigm affects “what should be studied, how research should be done, and how results should be interpreted”. Given their paradigm, researchers know which research is scientifically correct, and even more importantly, which research is not (Kuhn, 1962). A popular paradigm categorization in the social sciences is the perspective a researcher has with regard to epistemology (Symon & Cassell, 2012). Epistemologically, a researcher can be an objectivist, when he believes people can neutrally observe and test the social world, or a subjectivist, when he believes that observing the social world influences how we see it (Symon & Cassell, 2012). In this thesis, the epistemology of the method’s authors will be examined.

For this methodological paradigm, there is no content-specific norm. The authors should speak about the way in which they look at science, so their methodological paradigm can be discovered by reading their literature. The objectivist and subjectivist epistemologies represent this way in which authors look at science, by representing for example whether the authors think that reality is measurable apart from the researcher.

Methodological paradigm: the underlying view with which someone looks at scientific research.

To express the former examples of paradigms about methodology, it is possible that an author uses metaphors. Moreover, the author may create a metaphor for its own method, or use a metaphor to express methodological parts of its method. For instance, Christis (2019) uses a map
as a metaphor for theories in general, since a map shows relations while it reduces the complexity of its object, and highlights specific characteristics while obscuring others. With regard to Design Thinking and the 3-D model, the used metaphors for the methodologic parts of these methods will be described and assessed.

Just as with the methodological paradigm, the methodological metaphor has no norms about the content of the metaphors. It is important, however, that the authors make clear what their view is on science.

Methodology metaphor: a simplified image used by authors to describe their own method, their used methodology or their view on methodology.

Table 8 below shows the sub-variable of key variable 3, including its meaning.

<table>
<thead>
<tr>
<th>Key variable</th>
<th>Sub-variable</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>KV 3 Method</td>
<td>KV 3.1 Methodological metaphor &amp; paradigm</td>
<td>Methodological metaphor: a simplified image used by authors to describe their own method, their used methodology or their view on methodology. Methodological paradigm: the underlying view with which someone looks at scientific research.</td>
</tr>
</tbody>
</table>

Table 8: Metamodel Key Variable 3

2.6 Constructing the metamodel | Overview of variables

Section 2.2 is ended by giving an overview of all variables which were explained above. But first, it should be stated that this set is by no means a complete list of variables or the only variables which can be used. The created metamodel is only one way in which methods can be described and assessed. Another important remark is that all of the selected variables can occur on different scales. For example, the background theory an author uses in his/her literature could be made fully explicit, only appear as a reference in the text, or not be mentioned in the text. The presence of these different gradations demands a research process which takes this into account. This process is described in section 2.3.3. Lastly, no iterative adaptations where made during the process of defining the sub-variables. However, any iterations which possibly are made during the method assessment will be indicated and explained in chapter 4 and 5.

For each sub-variable, the way in which it will be assessed is described. However, to be able to visualize the assessment of both methods, there is a general way in which all sub-variables will be assessed. Each sub-variable will receive a score of “green”, “orange”, or “red” when it is
assessed. The green score is given when the sub-variable is made explicit by the authors, or when it is present in an appropriate way. The orange score is given when the sub-variable is not made explicit by the authors, or when it is not present in an appropriate way, but when this is not crucial for the method when we assess it as a method for supporting episodic interventions in organizations. This could be the case when a method gives space to the reader to get a certain sub-variable by using other methods, or when the method provides an alternative. The red score is given when an (appropriate) sub-variable is missing, and when this is crucial in a negative way when assessing the method.

An overview of the final metamodel is shown in the table below.

<table>
<thead>
<tr>
<th>Key variables</th>
<th>Sub-variables</th>
<th>Meaning</th>
</tr>
</thead>
<tbody>
<tr>
<td>KV 1 Intervention</td>
<td><strong>KV 1.1 Intervention metaphor &amp; paradigm</strong></td>
<td>Intervention metaphor: a simplified image used to describe (an aspect of) organizational interventions or the author’s view on these interventions. Intervention paradigm: the underlying view with which someone looks at organizational interventions.</td>
</tr>
<tr>
<td>KV 1.2 Organizational interventions theory</td>
<td>1.2.1 Goal</td>
<td>Goal: the purpose with which the intervention method is executed, the object of the intervention (the collection of interdependent parts undergoing the intervention), and the application area of the intervention (the field towards which the intervention is directed).</td>
</tr>
<tr>
<td></td>
<td>1.2.2 Theoretical and conceptual substantiation of interventions</td>
<td>Theoretical and conceptual substantiation of interventions: the extent to which an author makes explicit the theories and concepts from other authors on which his/her intervention method is based, or the extent to which an author explains a new theory or concept about interventions which is brought forward by the method.</td>
</tr>
<tr>
<td></td>
<td>1.2.3 Social aspect</td>
<td>Social aspect: the extent to which an intervention method takes the integration, participation and adoption of the intervention, and the interests of stakeholders of the intervention into account.</td>
</tr>
<tr>
<td></td>
<td>1.2.4 Type of change</td>
<td>Type of change: whether an intervention method focuses on episodic change, continuous change or on both.</td>
</tr>
<tr>
<td>KV 1.3 Intervention organization</td>
<td>1.3.1 Process</td>
<td>Process: a specific sequence of steps that must be taken to reach the goal of an intervention.</td>
</tr>
<tr>
<td></td>
<td>1.3.2 Configuration</td>
<td>Configuration: the way in which the intervention process is organized. The configuration of the intervention organization could be an activity (including the division of tasks, strategy, personnel policy, technology and culture), and a result of this configuring activity.</td>
</tr>
<tr>
<td></td>
<td>1.3.3 Instrument</td>
<td></td>
</tr>
<tr>
<td>KV 2 Infrastructure</td>
<td></td>
<td></td>
</tr>
<tr>
<td>---------------------</td>
<td></td>
<td></td>
</tr>
<tr>
<td>KV 2.1 Infrastructure theory</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.1.1 Theoretical and conceptual substantiation of the infrastructural object</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.1.2 Essential variables</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.1.3 Parameters</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.1.4 Relation between parameters and essential variables</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Table 9: Overview of the metamodel**

<table>
<thead>
<tr>
<th>KV 3 Method</th>
</tr>
</thead>
<tbody>
<tr>
<td>KV 3.1 Methodological metaphor &amp; paradigm</td>
</tr>
</tbody>
</table>

Instrument: a toolbox which consists of a set of techniques, rules, and/or procedures, and which is put forward by an intervention method for the purpose of guiding the process in the proposed configuration of the intervention organization, in such a way that the goal of the intervention can be reached.

Theoretical and conceptual substantiation of the infrastructural object: the extent to which an author makes explicit the theories and concepts from other authors on which his/her views about the infrastructure are based, or the extent to which an author explains a new theory or concept about the infrastructure as an object which is brought forward by the method.

Essential variables: variables which should be kept between certain norms to reach the goal(s) of the organization.

Parameters: characteristics of the infrastructure which can have a varying value, and with which an organization can design its infrastructure. The role of parameters is to give the essential variables their norm values. Relation between parameters and essential variables: the way in which a certain value of a parameter influences an essential variable, or the value a parameters should have in order to maintain an essential variable in its norm value.

Methodological metaphor: a simplified image used by authors to describe their own method, their used methodology or their view on methodology.

Methodological paradigm: the underlying view with which someone looks at scientific research.
Chapter 3: Methodology

3.1 Introduction
The goal of this chapter is to (1) explain the methodology that will be used in this thesis, and to (2) discuss to what extent this thesis meets the methodological requirements of an scientific assessment of methods. To be able to reach the first goal, section 3.2 consists of several subsections which give an overview of the methodology. Section 3.2.1 explains how the literature research about design intervention methods can be classified. Section 3.2.2 discusses the selection criteria for the literature, and substantiates why the chosen literature meets these criteria. Moreover, the process by which literature is searched and methods will be described and assessed is made clear in section 3.2.3. Finally, the second goal is reached in section 3.3, where the reliability and validity of this research is substantiated.

3.2 Methodology: how to describe and assess?

To be able to conduct an scientifically proper assessment of design intervention methods, the methodology of this assessment should be specified. This section gives insight into a classification of the literature research, the selection criteria for the literature, and the process of describing and assessing the design intervention methods.

3.2.1 Methodology | A classification of the literature research

To deliver a contribution to science as well as practice, in this thesis a literature research about two design intervention methods is conducted. However, literature research is a broad concept which can include a variety of things. To specify how this literature research can be classified, the taxonomy of Cooper (1988) according to six characteristics is used. Cooper’s taxonomy is chosen since it is a fairly influential theory (with almost 800 citations on Google Scholar) amongst the scarce amount of theories about classifying literature reviews. Moreover, Cooper’s theory is issued by a peer-reviewed publisher. Furthermore, the theory fits better with this thesis than theories which only give tips and guidelines on writing a literature review (such as in Torraco, 2005), and fits better than other classifications which are focused on literature reviews as only being a part of a whole dissertation (such as in Boell & Cecez-Kecmanovic, 2014). The specification of how this literature review thesis can be classified, is described below.
Classification 1: focus
First, literature research can be classified according to its focus. The focus can lie on the outcomes, methods, theories or practices/applications. In this thesis, the focus will be on the theories of Design Thinking and the 3-D model. According to Cooper (1988), this could help to establish the theories that are already devised by other authors. Besides, it could help to create and/or improve a whole new theory. This focus fits with the aim of this thesis, which will assess existing theoretical concepts of DT and the 3-D model, but also possibly gives suggestions to improve the two methods.

Classification 2: goal
Second, the goal of literature research can differ. This goal can be to integrate findings, critically analyse research, or identify central issues, and multiple goals are possible. The research objective of this thesis, as specified in chapter 1, is “contributing to the knowledge about the design of episodic interventions in organizational infrastructures, by systematically describing and assessing the methods of Design Thinking and the 3-D model as methods which support episodic interventions in organizational infrastructures”. All three goals as described by Cooper can be found in this research objective.

The first goal of literature research which can be found in the research objective of this thesis, is to identify what the central issues of Design Thinking and the 3-D model are, by describing the method according to the metamodel’s sub-variables. In this way, scientists as well as practitioners better understand the core of each method. The second goal which can be found is to execute a critical assessment of both Design Thinking and the 3-D model by using the metamodel, so possible downsides and blind spots get discovered. In this way, the applicability of each method as a method for supporting episodic interventions in organizational infrastructures is investigated. The third goal which can be identified within this research’s objective is to integrate the views of multiple authors on Design thinking into one view of the Design Thinking method, which is needed in order to describe the design intervention method. This does not apply to the 3-D model, since there is currently only one book available about this model (Achterbergh & Vriens, 2019). In other words, this literature research has all the three goals identified by Cooper (1988).

Classification 3: perspective
Third, the perspective of literature research creates a distinction between various types of literature research. A researcher can try to be as neutral as possible, or openly discuss its biases and
According to Cooper (1988), review methods which are qualitatively executed should explain the researcher’s position. In line with this argument, the biases which possibly influence this literature research will be discussed, and an ethics reflection is conducted.

Classification 4: coverage
Fourth, there are different degrees of coverage to be found in literature research. The scope of the amount of research that is analysed can be exhaustive, exhaustive with selective citation, representative, or central/pivotal. In the scope of this thesis, it is only possible to examine the central or pivotal articles and books in the field of Design Thinking. It will be justified why certain articles and books are chosen whilst others are left out of the analysis. A further explanation of the selection criteria for the literature can be found in section 3.2.2. With regard to the 3-D model, an exhaustive examination is possible, since at the moment of this research there is only one academic book available which discusses this model (Achterbergh & Vriens, 2019).

Classification 5: organization
Fifth, literature research can be classified according to its organization. A historical format, conceptual format and methodological format is possible. This literature research thesis is organized in line with a methodological format, which means that it has an introduction, method section, results section and discussion. However, the results are organized along a conceptual format, since it is organized according to the two methods and the variables against which these methods will be assessed.

Classification 6: audience
Sixth, there are different types of audiences to be distinguished for literature research. The audience can consist of specialized scholars, general scholars, practitioners/policymakers or the general public. For this thesis, the primary audience is the supervisor and the 2nd supervisor. The secondary audience consists of the scholars which are specialized in organizational design and/or organizational change. The tertiary audience of the thesis is a broader public of business administration scholars and practitioners who have to deal with organizational change or are interested in this phenomena.

3.2.2 Methodology | Selection criteria for the literature
According to Albinski (1981), when qualitatively analysing the content of literature, it is – just as in other types of academic research – necessary to make the selection criteria explicit that decide which books and articles are included or excluded for the research. It is earlier stated that this thesis has a scope of central or pivotal articles and books in the field of Design Thinking, and provides an exhaustive examination of the 3-D model. The selection criteria to decide which literature about Design Thinking is used is presented below. These selection criteria apply only to the literature of Design Thinking, since there is only one book yet about the 3-D model. Six academic articles and books are chosen for the analysis of Design Thinking: Simon (1969), Buchanan (1992), Brown (2008), Martin (2009), Dorst (2011) and Brenner and Uebernickel (2016). After each criterion is explained, the reason why the chosen books and articles meet the criterion is given. In table 10 below, the information with regard to these books and articles is given. This information will be used to substantiate the reasons for the chosen literature.

<table>
<thead>
<tr>
<th>Academic article/book</th>
<th>Amount of citations (source: Google Scholar)</th>
<th>Peer review journal</th>
<th>Academic journal/publisher</th>
</tr>
</thead>
<tbody>
<tr>
<td>Buchanan (1992)</td>
<td>2,748</td>
<td>Yes</td>
<td>Design Issues</td>
</tr>
<tr>
<td>Martin (2009)</td>
<td>1,573</td>
<td>No (book), although summarizing article (Martin, 2010) is peer reviewed</td>
<td>Harvard Business Press. Summarizing article: Strategy &amp; Leadership</td>
</tr>
<tr>
<td>Dorst (2011)</td>
<td>813</td>
<td>Yes</td>
<td>Elsevier</td>
</tr>
<tr>
<td>Brenner and Uebernickel (2016)</td>
<td>31</td>
<td>No (book), although based on peer reviewed articles)</td>
<td>Springer</td>
</tr>
</tbody>
</table>

Table 10: Information about the chosen Design Thinking books and articles.

Criterion 1: amount of citations

The first requirement for including literature is that it must have a sufficient amount of citations by other researchers. However, the amount of citations should always be assessed while taking into account the characteristics of the research, such as the amount of time that the literature is published. If an article or book is published in recent years, it is logical that the amount of citations is lower. As an indication, according to the Thomson Reuter’s Web of Science’s database only 14,499 of all articles in their database had more than 1,000 citations, which corre-
sponds to 0.026% (Van Noorden, Maher & Nuzzo, 2014). In other words, when scientific research has more than 1,000 citations, this can be seen as influential research. The source used to identify the amount of citations is Google Scholar.

As shown in table 10, all articles or books for Design Thinking have been cited significantly in the academic literature, except for the article of Dorst (2011) and the book of Brenner and Uebernickel (2016). However, since this article and this book have only been published in recent years, the criterion of 1,000 citations is considered of less importance.

**Criterion 2: peer-reviewed**

A second requirement of the chosen literature is that the articles are published in a peer reviewed academic journal. This requirement is chosen since selection decisions should be driven by the quality of the journals in which the used papers are published (Tranfield et al., 2003). A journal being peer-reviewed means that the scientific quality of the articles inside such journals are checked by other academics. Since scientific books most of the times are not published in an academic journal, the chosen books do not have to be peer reviewed. However, the publisher of the book should be in line with faculty standards of the Radboud University, to ensure that the books are peer-reviewed in a proper way. Examples of publishers which fit these norms are Routledge and Springer.

With regard to the chosen literature for Design Thinking, the table above shows that all articles are peer-reviewed. For the three books, which are not published in a peer-reviewed journal, the publisher is checked. The publishers of these books are MIT Press, Harvard Business Press, and Springer, which are all approved as peer-reviewed publishers by the Radboud University.

**Criterion 3: impact**

The third requirement for the to be chosen literature is that all articles and books should have a substantial impact on the history of the method, or describes this history. This substantial impact is partly proven by the amount of citations, which is already covered by criterion 1. According to Landsoght (2018), there are no shortcuts to discover the most important literature. However, Landsoght also states that when a paper is mentioned several times in other academic articles or books regarding the subject, this means it can be regarded as influential. Moreover, when literature is named in multiple papers about the history of Design Thinking, or captures an overview of Design Thinking itself, it can also be seen as influential. To conclude, literature
meets this third criterion when the authors are mentioned multiple times in other (historical) articles and books about Design Thinking, when the literature itself gives an overview of Design Thinking, and/or when the literature has played a significant role in the history of the method of Design Thinking.

When looking at the chosen literature about Design Thinking, all articles or books have had a substantial impact on the history of DT, or give an overview of its history. This reason will be substantiated in section 4.1, where an overview of the history of Design Thinking is given.

**Criterion 4: saturation**

A fourth requirement to take into account for the academic books and articles is the saturation rate. When reviewing articles, it is important that each new book or article adds enough new information to the knowledge that the researcher already has got about the subject. When including more books or articles would not deliver more new significant information, the search for new literature will be stopped.

During the selection of books and articles with regard to Design Thinking, a certain saturation occurred when analysing more articles and/or books than the chosen six. More articles and/or books would sketch a roughly similar picture of the DT approach. This is partly due to the fact that all articles and books have had a substantial impact on Design Thinking, and thereby really contributed something new to the method.

**Criterion 5: language**

The fifth requirement of the literature is that the researcher should be able to understand the content of the paper sufficiently to analyse it. This criterion is already used by other authors (Randolph, 2009). In this case, this means that the research papers should be in English or Dutch. However, when an important article or book is only available in another language, the researcher will do everything in her power to include it whatsoever.

With regard to the articles and books about Design Thinking, all literature is written in English, and therefore meets this final criterion.
Searching the literature

The search for relevant literature will happen via the online academic literature database of the Radboud University (RUQuest), EBSCO and Google Scholar, in line with the recommendations of Lantsoght (2018). Key words like “Design Thinking”, “Design Thinking theory/method”, “Design theory/method”, “Overview/summary Design Thinking”, and “History Design Thinking” were used. After gathering several articles and books via these search machines, the snowball method is used to gather more articles which were used as references in the already chosen articles (Lantsoght, 2018). Another search method that is recommended by Lantsoght (2018) is to use a review paper which is written by an authority in the field of research, such as a professor who describes the history of academic research in the focal topic. This method will also be used in this thesis, to discover which academic books and articles form important work about Design Thinking.

Storing and reading the literature

To store the digital literature, several folders and subfolders will be created to organize the digital archive of articles and books. This is in line with the tips of successful data storage of Lantsoght (2018). To engage early with the literature, documents will be created to summarize certain articles and books with regard to the chosen variables (Lantsoght, 2018). In these documents, important quotes of the articles are stored, which can be used later to substantiate certain statements. Moreover, similarities and differences between Design Thinking articles are tracked in another document.

Unit of research

As stated earlier, Design Thinking and the 3-D model will be systematically described and assessed, along the variables of the metamodels described above. Albinski (1981) states that when conducting analysis about the content of literature, the researcher should make explicit what the unit of research is. In other words, it should be clear from which units of the material something is captured. In this thesis, the unit of research is the whole academic article or book. Moreover, sometimes other articles from the same author will be used, since these also reflect the view of the author on a certain variable.
Describing and assessing the methods

The system that will be used to analyse both methods is as follows.

Step 1: overview
First, a historical overview is given of the Design Thinking and the 3-D model, to give the reader a short summary about each method. This overview contains the history of each method, such as how the method emerged and which authors delivered a significant contribution to it. Moreover, the core idea behind each method is described.

Step 2: description
Second, Design Thinking and the 3-D model will be described by means of the variables from the metamodel that are explained in this chapter. This metamodel consists of variables of a method in general, variables of a method dealing with organizational interventions, and variables of a method dealing with organizational interventions in infrastructures. The different variables are shown in Table 11. Because there is a gradation in the explicitness of each variable, the amount of explicitness will be indicated. If a variable does not appear explicitly in the article or book, a substantiated hypothesis will be given for this variable, to the extent that this is possible. For each variable of Design Thinking, similarities and differences with regard to this variable among authors of the selection of academic articles and books will be discussed. The views of these authors will be integrated into one view of the method Design Thinking. This integration process is continuously made clear, by stating which views of authors are included or excluded, and why.

Step 3: assessment
Third, for each sub-variable of the metamodel an assessment is performed on the two methods. For example, it is assessed to what extent the methods could be defined as a proper method for designing episodic interventions in infrastructures, when looking specifically at their theoretical and conceptual substantiation of the method’s statements about infrastructures. This is done using the norms which were described for each sub-variable in chapter 2. This assessment also transcends the variable level by taking place on a more general level. For example, possible relationships between the outcomes on different variables are discussed.

Step 4: conclusion
Fourth, the researcher concludes – by means of the description and assessment – to which extent Design Thinking and the 3-D model as a method are appropriate for supporting episodic interventions in organizational infrastructures. Moreover, the researcher describes how the two methods could learn from each other and complement each other, and on what sub-variables this could be the case.

When the described methodology is combined with the metamodel which was presented in chapter 2, the following table emerges:

<table>
<thead>
<tr>
<th>Key variables</th>
<th>Sub-variables</th>
<th>DT description</th>
<th>3-D model description</th>
<th>Assessment</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>KV 1 Intervention</strong></td>
<td>KV 1.1 Intervention metaphor &amp; paradigm</td>
<td>…</td>
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<tr>
<td></td>
<td>KV 1.2 Organizational interventions theory</td>
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<tr>
<td></td>
<td>1.2.1 Goal</td>
<td>…</td>
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</tr>
<tr>
<td></td>
<td>1.2.2 Theoretical and conceptual substantiation of interventions</td>
<td>…</td>
<td>…</td>
<td>…</td>
</tr>
<tr>
<td></td>
<td>1.2.3 Social aspect</td>
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<td></td>
<td>1.2.4 Type of change</td>
<td>…</td>
<td>…</td>
<td>…</td>
</tr>
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<td></td>
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<td>…</td>
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<td>1.3.2 Configuration</td>
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<td></td>
<td>1.3.3 Instrument</td>
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<tr>
<td><strong>KV 2 Infrastructure</strong></td>
<td>KV 2.1 Infrastructure theory</td>
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<td>…</td>
</tr>
<tr>
<td></td>
<td>2.1.1 Theoretical and conceptual substantiation of the infrastructural object</td>
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</tr>
<tr>
<td></td>
<td>2.1.2 Essential variables</td>
<td>…</td>
<td>…</td>
<td>…</td>
</tr>
<tr>
<td></td>
<td>2.1.3 Parameters</td>
<td>…</td>
<td>…</td>
<td>…</td>
</tr>
<tr>
<td></td>
<td>2.1.4 Relation between parameters and essential variables</td>
<td>…</td>
<td>…</td>
<td>…</td>
</tr>
<tr>
<td><strong>KV 3 Method</strong></td>
<td>KV 3.1 Methodological metaphor &amp; paradigm</td>
<td>…</td>
<td>…</td>
<td>…</td>
</tr>
</tbody>
</table>

*Table 11: Scheme of the metamodel and methodology combined*

As can be concluded from the table above, for each sub-variable a description will be given for both the Design Thinking method and the 3-D model. Moreover, for each sub-variable in the table, an assessment with regard to the norm of this sub-variable will be executed.
3.3 Reliability and validity

In line with the Dutch Code of Conduct on Scientific Practice (*Nederlandse Gedragscode Wetenschapsbeoefening*), each academic research should make clear why the research is scientifically sound. For substantiating this scientific soundness, the concepts of validity and reliability are chosen. According to Randolph (2009), these concepts of reliability and validity are also applicable to a literature research, and can be used to measure the scientific soundness of research. Below, arguments will be given why this thesis meets the criteria of a reliable and valid research.

With regard to the validity, the following arguments substantiate the sufficient amount of reliability of this research.

In this thesis, a self-created metamodel is used with variables which are specifically made for answering the main research question. In other words, the metamodel is specifically made for describing and assessing methods as methods which support episodic interventions in organizational infrastructures. Using a measurement instrument which is created specifically for measuring the answers to the main research questions, increases the internal validity (Verhoeven, 2007). Moreover, all aspects of the research question are represented in the metamodel which is used to answer this research question. Both the infrastructural aspect, interventions aspect and methodology aspect are included in the key variables of the metamodel. The sub-variables of these key variables are as much as possible substantiated through academic literature. This contributes to the content validity as well as to the construct validity of the research (Verhoeven, 2007).

By using several data sources – a total of six books and articles – to represent the literature about Design Thinking, the validity is being increased, since multiple data sources give a better picture of the phenomena than only one data source (Baarda et al., 2013).

For the selection of the key variables and sub-variables, criteria from academic authors such as Jonker (1990) and Weick and Quinn (1999) are used. This contributes to the content validity and construct validity, and increases the internal consistency (Verhoeven, 2007).

By using substantiated selection criteria for the literature of Design Thinking, the selected books and articles are representative for the whole Design Thinking literature. This en-
sures that the so-called observation units (the articles and books) are representative for the population of this research (all literature about Design Thinking). This increases the external validity of this research (Baarda et al., 2013).

In line with Ogawa and Malen’s (1991) method for conducting qualitative literature research, a peer review will be conducted with an expert about one of the methods. Jan Achterbergh, one of the authors of the 3-D model, will check the results to see if they really represent the content of his academic book. To appropriately conduct such a peer review, the draft version of this thesis will be presented to Jan Achterbergh, who will analyse the literature research in a critical way (Ogawa & Malen, 1991). Consulting a fellow researcher by organizing a peer review increases the validity of the research (Verhoeven, 2007; Baarda et al., 2013).

During reading the articles and books, a sort of log is kept with all relevant quotes of the different authors on a certain sub-variable, as can be seen in appendix 1 and 3. After reading an article or book, it was noted down in key words what the impression of the researcher was about this sub-variable. Keeping these logs ensures a higher validity (Verhoeven, 2007; Baarda et al., 2013).

With regard to the reliability, the following arguments substantiate the sufficient amount of reliability of this research.

A first argument for the reliability of this research is its transparency. By giving a detailed description of the process by which literature is gathered and analysed, it becomes easier for other researchers to reconduct this research, thereby increasing reliability (Cooper, 1984; Verhoeven, 2007; Pati & Lorusso, 2018). In the appendixes, all quotes on which the description and assessment of the methods are based are written down per sub-variable and per author. So, not only the methodology is made explicit, it is also possible for others to check on which information certain conclusions are drawn, thereby increasing reliability (Baarda et al, 2013). Moreover, the criteria for inclusion and exclusion of articles are made explicit and justified, which increases reliability (Boote & Beile, 2005).

A second argument for the reliability of this research are the used selection criteria. Through the use of these substantiated selection criteria for the literature of Design Thinking, the selected books and articles are representative for the whole Design Thinking literature. This increases the reliability as well (Verhoeven, 2007).

To conclude, it can be stated that this thesis presents a sufficiently reliable and valid research, which meets the criteria of a scientifically sound study.
Part II: Results

The goal of part II is to describe and assess the methods of Design Thinking and the 3-D model according to the sub-variables of the metamodel which were identified in chapter 2. This part is divided into two chapters. In chapter 4, the results for the method of Design Thinking are given. In chapter 5, the results for the method of the 3-D model are discussed. Both chapters are structured according to the different key variables and sub-variables from the metamodel. For each sub-variable, a description of the method on this variable is given, followed by an assessment. Moreover, a summarizing table for each key variable is shown in appendixes 1 and 2.

Chapter 4: Results for Design Thinking

The goal of chapter 4 is to discuss the results for the method Design Thinking, according to the metamodel which was created for this thesis. Thereby, it gives an answer to the second sub-question of this thesis: “What is the description of Design Thinking along the chosen sub-variables?” It also answer the Design Thinking part of sub-question four: “What is the assessment of Design Thinking and the 3-D model, with regard to the used sub-variables of the metamodel and their norms?” To reach the goal of this chapter, section 4.1 starts with a general overview of the history and content of Design Thinking. Then, in section 4.2 to 4.4, all sub-variables of respectively key variable 1 (intervention), key variable 2 (infrastructure) and key variable 3 (method) are described. Since there are six authors who are chosen as the key authors of Design Thinking, the description of each author with regard to a certain sub-variable is given. These descriptions are summarized into one general description for Design Thinking as a method. After this, an assessment is given for Design Thinking on each sub-variable. Moreover, each section about a key variable ends with a table in which the results of Design Thinking are summarized. Finally, in section 4.5, a conclusion of the results for Design Thinking is given.

4.1 Overview of Design Thinking

Before the results of Design Thinking are given for each sub-variable, a quick overview of the method’s core and history will be described in this section. Although it is hard to arrive at a general definition of Design Thinking (Zheng, 2018), its central concepts provide a comprehensive picture of what the method entails.
Design Thinking is a method which aims to create innovation and solve complex to even wicked problems (Buchanan, 1992; Brenner & Uebernickel, 2016). As the name suggests, the method is especially driven by a design philosophy (Brown, 2008), although it is also used in other application areas, such as healthcare and business (Dorst, 2011). What makes the method special, is that it can be applied to a broad variety of problem situations. For example, it is possible to use the method of Design Thinking when designing a product, a service, or even a system (Simon, 1969; Buchanan, 1992). The method is also known for its human-centeredness, because it puts the end customer and other stakeholders central in the whole design process (Brown, 2008). Design Thinking is also recognized as a method which focuses on analysing and reframing the problem at hand, which is also done by emphasizing the stakeholders of the problem. It uses several prototypes which are created to visualize and test ideas of the designer. An iterative way of working in cycles with small steps is used to analyse the problem, create multiple prototypes, and get to an optimal solution.

Design Thinking (DT) started around the 1960’s, when a stream of research appeared that was focused on how designers actually perform design activities (Kimbell, 2011). Although there are multiple authors in that decade who executed research about the processes and nature of design, Herbert Simon’s book *Sciences of the Artificial* (1969) is frequently mentioned as the origin of Design Thinking (Kimbell, 2011; Brenner & Uebernickel, 2016; Rodgers & Winton, 2010; Buchanan, 1992; Dunne & Martin, 2006). With his book, Simon (1969) was one of the first authors to propose design as a way of thinking, or even as science. The book shows the process of designing as a means to respond to organizational problems (Dunne & Martin, 2006; Kimbell, 2011). In the following years, several authors (such as Rowe in 1987) wrote about DT as a way of working in the sectors of craft and industrial production (Kimbell, 2011). A more general perspective on Design Thinking was proposed by Buchanan (1992), as he did not look into the specific design process of individual designers, but rather into the broader role of DT in all sectors and jobs.

A few years later, Dorst (1997, 2006) added to the approach of Design Thinking by emphasizing the role of abductive thinking as a means for designers to solve problems and deal with paradoxes. Moreover, he introduced the concept of reframing a problem in order to understand a problem and react to it properly (Dorst, 2006; Dorst, 2011).
A more recent contribution to the approach of DT was made by Tim Brown, the CEO of design and consulting firm IDEO. Brown (2005, 2008) focused more on design thinking as a resource for organizations, based on earlier work of IDEO’s working processes with regard to design and innovation, together with earlier work from his colleague Kelley (2001), formed the basis for Brown’s conceptualization of the term Design Thinking (Johansson-Sköldberg, Woodilla, & Çetinkaya, 2013; Kimbell, 2011). The concepts and tools presented in the article by Brown (2008) are used widely in the business field, and this causes more recent authors to see Brown as the (re)inventor of Design Thinking (Koomans & Hilders, 2016; Zheng, 2018).

As stated earlier, six academic articles and books are chosen for the analysis of Design Thinking: Simon (1969), Buchanan (1992), Brown (2008), Martin (2009), Dorst (2011) and Brenner and Uebernickel (2016). The reasons for choosing these six articles were given in section 3.2.2. It is important to note that it is possible to look at Design Thinking in a broad or narrow sense. When looking at Design Thinking in a narrow sense, only the authors who saw themselves as Design Thinkers, and talked specifically about Design Thinking would be included. However, in this thesis the broad way of looking at Design Thinking is chosen. This means that all authors who fit the selection criteria of section 3.2.2 and contributed to the method of Design Thinking are included in this research. Therefore, Simon (1969), who did not call himself a Design Thinker or spoke directly about Design Thinking, is included in the authors who represent the method of Design Thinking.

4.2 Key variable 1: Intervention

4.2.1 Sub-variable 1.1: Intervention metaphor & paradigm

The first sub-variable is about the metaphor and paradigm which the authors from Design Thinking use to express their view on interventions and the organization which undergoes these interventions. The intervention metaphor was defined in chapter 2 as “a simplified image used to describe (an aspect of) organizational interventions or the author’s view on these interventions”. The intervention paradigm was defined as “the underlying view with which someone looks at organizational interventions”. The norm of this sub-variable is that the authors should make explicit in which way they look at organizational interventions and organizations as such. Moreover, it is important that multiple metaphors and/or paradigms are used and highlighted by the authors, since a method should be able to look from multiple perspectives at the world.
Description

In appendix 2.1, a summary is shown of all the views from the six authors of Design Thinking on sub-variable 1.1. The extensive substantiation of the content on which the description of Design Thinking is based, is shown in Appendix 1 per sub-variable and per author. In Appendix 2, these quotes from the literature about Design Thinking are summarized for each-sub-variable.

The authors which were chosen to represent Design Thinking do not refer to the metaphors which were proposed by Morgan (1999). However, the authors present a variety of metaphors with which they look at organizations. A maximum of two authors have chosen for the same metaphors from Morgan. The brain, theatre and organism metaphor even only appears in the work of one author. The metaphors which were chosen by two authors will be shortly explained.

The flux and transformation metaphor is chosen by authors who see the organization as something which has to adapt and change for a constantly changing environment (Morgan, 1999). This can be found in the book of Simon (1969), where he talks about finding a pattern in the environmental chaos, and where he states that systems should be adaptive.

The culture metaphor states that organisations have their own beliefs, rules and rituals which shape the organization (Morgan, 1999). When changing an organization, its culture must therefore be changed too. Buchanan (1992) for instance says that organizations consist of a unifying idea or thought, and Brenner and Uebernickel (2016) think that when changing an organization, company culture should be addressed.

Next, the machine metaphor describes an organisation as a place where people work effectively with procedures and rules, and where planning and controlling is an important task for managers. This view is typical for bureaucracies. Dorst (2011) states that in the beginning of Design Thinking, this metaphor of organizations was prevailing, when design was seen as a rational search process.

Lastly, the sensemaking metaphor of Morgan (1999) is based upon the ideas from Weick (1977). Weick emphasizes with this metaphor how reality is enacted by individuals, and states that organizational realities are social constructions. Brenner and Uebernickel (2016) are one of the authors who adhere to this metaphor, by stating that organizations have their own language which impacts this sensemaking process.
With regard to the metaphor of the intervention, most of the authors do not really present a classical metaphor. They especially describe some synonyms for an intervention. An exception to this is Simon (1996), who gives an extensive metaphor about making and implementing designs:

*Making complex designs that are implemented over a long period of time and continually modified in the course of implementation has much in common with painting in oil. In oil painting every new spot of pigment laid on the canvas creates some kind of pattern that provides a continuing source of new ideas to the painter. The painting process is a process of cyclical interaction between painter and canvas in which current goals lead to new applications of paint, while the gradually changing pattern suggests new goals.* (Simon, 1996, p. 163)

The intervention paradigm of the Design Thinking authors lies between the functionalist and social interpretivist paradigm, since four authors reflect a functionalist paradigm, and four authors reflect the social interpretivist paradigm. This is due to the fact that Design Thinking authors have a regulating view on the hegemonic order, but stress epistemological pluralism, which is both objectivist and subjectivist. The argumentation for this epistemology will be covered in more detail in section 4.4.1. The regulating view on the hegemonic order appears from the fact that little attention is given to power relations and domination in organizations, except form possible conflicting interests of stakeholders. The authors of Design Thinking believe that a hegemonic world order is possible, and conflicting interests could be solved by applying their method and coming to a solution for the present problems.

Since both an objectivist and subjectivist epistemology is existing in Design Thinking, the method also has two paradigms. On the one hand, the combination of a regulating view and an objectivist epistemology leads to a functionalist paradigm. For instance, Simon (1969) emphasizes planning, efficiency and order in his view on interventions in organizations, which is typical for this paradigm.

On the other hand, the combination of the regulating view and the more subjectivist epistemology results into the social interpretivist paradigm. Dorst (2011) talks the reflection-in-action approach, where persons who construct their own reality. This approach works best in a situation where the problem and strategies are not that clear. Brown (2008) thinks that feedback and collaborating is important. Both authors show thereby their adherence to the social interpretivist paradigm.
Assessment

Design Thinking scores an “orange” on the sub-variable about the intervention metaphor and paradigm. Although it was possible to extract a variety of intervention metaphors from the text, few authors actually paid attention to the concept of metaphors, and none of the authors talked explicitly about their metaphor of the organization or intervention. However, there was a variety of identified metaphors of the organization. Each author had its own set of metaphors, which allows the reader to see organizations and interventions from multiple perspectives.

With regard to the intervention paradigm, there were again no authors who talked explicitly about this subject. This means that the authors of Design Thinking have not made their world view about interventions explicit, although this was one norm with regard to this sub-variable. However, there is a variety of paradigms present in Design Thinking.

A danger of the intervention metaphor and paradigm of Design Thinking, is that there is not that much attention given to views which acknowledge the presence of power in the organization. In this way, this view on organizing and intervening is left into the dark. The former facts led to this score for Design Thinking.

A summary of the results of Design Thinking on sub-variable 1.1 is given in the table below.

<table>
<thead>
<tr>
<th>1.1</th>
<th>Design Thinking</th>
</tr>
</thead>
</table>
| **Description** | M: few metaphors for intervention (only painting in oil)  
Metaphor for organization: flux and transformation, culture, sensemaking, machine  
P: Functionalist and social-interpretivist |
| **Assessment** | No explicit information about the intervention metaphor and paradigm. Variety of metaphors and paradigms, which allows to see organizations and interventions from multiple perspectives. Power views are not explicitly acknowledged. |

*Table 12: Results of Design Thinking and the 3-D model on sub-variable 1.1*

4.2.2 Sub-variable 1.2.1: Goal

In chapter 2, sub-variable 1.2.1 was defined as “the purpose with which the intervention method is executed, the object of the intervention (the collection of interdependent parts undergoing the intervention), and the application area of the intervention (the field towards which the intervention is directed)”. The norm value of this sub-variable is that the authors have to be explicit about the reason why, object and application areas of the method. The goal of the method should also fit with a method which supports episodic interventions in organizational infrastructures.
Description

In this sub-variable, the reason for the interventions which are proposed by Design Thinking is specified. All authors directly or indirectly said something about the reason why the interventions are undertaken.

When comparing the view of the different authors on this reason, it becomes clear that Simon (1969), Buchanan (1992), Martin (2009) and Dorst (2011) view the solution of problems as one of the purposes of Design Thinking. However, Simon (1969), who laid the foundations for Design Thinking, states that the purpose of design is creating a desired state for each type of problem, whereas Buchanan (1992) and Brenner and Uebernickel (2016) emphasize that the to be solved problems by Design Thinking should be “wicked” or “indeterminate”. Buchanan (1992, p.15) defines wicked problems as “a class of social system problems which are ill-formulated, where the information is confusing, where there are many clients and decision makers with conflicting values, and where the ramifications in the whole system are thoroughly confusing”. Dorst (2011) also frames the reason for the intervention somewhat differently, by emphasizing that designers’ problems can be perceived as paradoxes. In other words, whereas Simon focuses on problems in its broadest sense, Buchanan, Brenner and Uebernickel, and Dorst focus on a more complex class – that of wicked, paradoxical problems – in the broad concept of problems.

A second broader reason for the intervention that is named by several authors (Brown, 2008; Brenner & Uebernickel, 2016; Martin, 2009) is creating innovation in the object of the intervention. Both Brown (2008) and Brenner and Uebernickel (2016) state that innovations are needed to create value for the customer. Martin underlines ambidexterity as the purpose of Design Thinking, which means that the approaches enables organization to perform explorative innovations as well as exploitational innovations.

For the final Design Thinking description of this thesis, the two broader reasons of “innovation” and “solving complex (wicked, paradoxical) problems” will be perceived as the ultimate reason for the intervention of Design Thinking. These two purposes are mentioned by multiple core authors, and reiterated in the conceptual overview of Kimbell (2011). The purpose of ambidexterity from Martin (2009) will not be a separate reason for the intervention of DT,

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1 A summary of the perspectives of six different authors on the goal the intervention of Design Thinking is shown in the table in Appendix 2.2.
since the exploration variable of ambidexterity overlaps with the reason of innovation. Moreover, the exploitation variable is not identified by the other authors, and therefore this variable will not be included in the final assessment.

The six chosen authors all explicitly state at which object the Design Thinking interventions are aimed, though they do not call this specifically an “object”. Although there are some differences to be found, the authors seem to fairly agree with each other on these objects. The objects which are named by at least three of the authors are explained here.

First, all of the authors state that interventions in Design Thinking could be geared towards organizations. There is no specific type of organizations at which the interventions should be aimed; both public as well as business organizations are included (which will be specified further later in this section).

Second, five of the authors on Design Thinking say that interventions of their method could be aimed at physical objects or products. For example, Simon (1969) states that design is able to solve problems which are related to physical objects. Again, there is little further specification about what type of physical objects is included or excluded.

Third, four out of the six authors mention services as a possible object for the interventions of Design Thinking. Buchanan (1992) for instance gives activities and organized services as an example of something which could be possibly designed. There is no further elaboration about which kind of services are targeted, and no definition of services is given.

Fourth, a system is seen by four authors as a potential object for the interventions which are suggested by the Design Thinking method. Simon (1969), who formed a huge inspiration for the DT method, states that the object is only social systems, whereas Buchanan specifies systems as “complex (intangible) systems or environments for living, working, playing, and learning –information and communication systems, electrical power grids, transportation systems to managerial organizations, public and private institutions, and national constitutions” (Buchanan, 2001a, p. 12). So, the amount of explicitness by the authors about this object varies.

Lastly, three out of the six authors on Design Thinking think that the method’s interventions are aimed at processes. Brenner and Uebernickel (2016) give innovation processes, development processes and problem-solving processes as an example of processes which could be the focal object of an intervention. Dorst (2011) emphasizes that design processes are applicable across projects.
With regard to the application areas, all authors except for Martin (2009) state that DT is applicable in a broad context with multiple sectors or professions (Simon, 1969; Buchanan, 1992; Brown, 2008; Brenner & Uebernickel, 2016). Multiple examples of the application of Design Thinking in certain application areas are given, for example in the book of Brenner and Uebernickel (2016).

In the overview of DT given by Brenner and Uebernickel (2016), it becomes clear that the approach was first especially applied in traditional design disciplines like engineering, industrial design and architecture. These areas are also mentioned by Simon (1969), who is the founding father of the Design Thinking way of operating, and Buchanan (1992). Thereafter, the framework spread itself quickly to a broad variety of other areas. Business, education, IT and medicine are the most frequently mentioned when speaking of these “newer” DT application areas.

Although Martin (2009) does not apply Design Thinking to a diversity of sectors or professions, he does not state that the approach only applies to management and business either. Moreover, since Roger Martin has worked together with Tim Brown (Brown & Martin, 2016), it is supposed that he also recognizes the value of Design Thinking in areas outside the scope of business.

**Assessment**

Design Thinking scores a “green” for the goal of the intervention. The authors of this method all explicitly tell what the reason why, object and application area of interventions is. Moreover, authors like Buchanan (1992) specify exactly what they mean by this reason for the intervention, giving definitions and characteristics. Furthermore, Brenner and Uebernickel (2016) even give an historical overview of the different application areas in which Design Thinking was and is being used over the past decade. The authors also give multiple examples of the different ways in which Design Thinking is applied in different fields.

The authors agree with each other what the two important reasons of the intervention are, which confirms that the views of authors really capture the core of Design Thinking. However, the content of the reason for the intervention is not fully in line with the purpose of a method which supports episodic interventions in organizational infrastructures – although it is not fully contradictory either. A variety of objects is included by the authors. However, not all authors specify what they view under a certain object, and which types of objects are included or excluded. Moreover, none of the authors mentions the infrastructure (or a synonym of this term) as a
potential object for Design Thinking interventions. Thus, when assessing Design Thinking as a method for supporting episodic interventions in organizational infrastructures, it should be concluded that Design Thinking is not explicitly created to support interventions which are aimed at the infrastructure. However, because Design Thinking is a very open method, it also does not explicitly exclude this goal, so it remains possible to use the method with this goal in mind. The explicitness and consistency of the authors from Design Thinking, in combination with the less appropriate content, result in a “green”.

A summary of the results of Design Thinking on sub-variable 1.2.1 is given in the table below.

<table>
<thead>
<tr>
<th>1.2.1</th>
<th>Design Thinking</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Description</strong></td>
<td>Explicitly mentioned</td>
</tr>
<tr>
<td>Reason why: Solving complex (wicked, paradoxical) problems, innovation</td>
<td></td>
</tr>
<tr>
<td>Object: Organizations, Physical objects/products, services, systems, processes</td>
<td></td>
</tr>
<tr>
<td>Broad application area:</td>
<td></td>
</tr>
<tr>
<td>First engineering, industrial design and architecture. Later business, education, IT and medicine</td>
<td></td>
</tr>
<tr>
<td><strong>Assessment</strong></td>
<td>The reason why, object and application area is explicitly mentioned by the authors, and the content is fairly consistent among the authors. The reason why, object and application area is left open and broad enough to fit with a method supporting episodic interventions in organizational infrastructures, although it not explicitly fits this kind of methods.</td>
</tr>
</tbody>
</table>

*Table 13: Results of Design Thinking and the 3-D model on sub-variable 1.2.1*

### 4.2.3 Sub-variable 1.2.2: Theoretical and conceptual substantiation of interventions

In chapter 2, the sub-variable about the theoretical and conceptual substantiation of interventions was defined as: “the extent to which an author makes explicit the theories and concepts from other authors on which his/her intervention method is based, or the extent to which an author explains a new theory or concept about interventions which is brought forward by the method”. The norm of this sub-variable is that both methods should make explicit on which academic theories and concepts their views with regard to interventions are based, and/or define the own theories and concepts they have. The methods should be sufficiently based on at least one scientific theory or concept, or come with an extensive description of a new theory or concept they have created.
Five out of the six authors which were chosen to represent Design Thinking do use a theory on which they base their views surrounding organizational interventions. For example, Simon (1969) pointed in his book towards utility theory and statistical decision theory which he used as a framework for making rational choices among several alternatives. However, it should be noted that these theories sometimes remain rather vague, and are not always explained thoroughly. For instance, Dorst (2011) states that the interventions in Design Thinking are based on theories and models from design methodology, psychology, and education. No specific theory is mentioned, and the content of these theories and models is neither explained.

Moreover, there is little consensus among the authors which theories are important to substantiate their perspectives on interventions. The only theory which is named by multiple authors is that of Simon (1969), which does not fully count, since his work is seen as one of the earliest works surrounding Design Thinking. In the rest of the cases, each authors comes with its own theories and concepts, which are not mentioned again by the other authors.

Five out of the six authors provide their own theory or concept about intervening in organizations. An example of this is the article of Brown (2008), in which he explains how Design Thinking leads to more innovation in line with the needs of customers, and that this innovation creates a sustainable competitive advantage for the firm. He also tells about how the intervention should be filled in, by for example proposing iterativity and cycles of prototyping, testing, and refinement. In section 4.2.6 to 4.2.8, a more detailed take on the intervention and its process, configuration, and instruments is given. However, when looking critically at the proposed theories and concepts, it appears that many of the statements of the Design Thinking authors are not much substantiated. For instance, by looking again at the article of Brown (2008), a threefold process of inspiration, ideation, and implementation is mentioned which leads to an appropriate intervention, according to the author. However, it is not explained why especially these three steps are needed to come to a good intervention, and how each step specifically contributes to the goal of the intervention. These situations appear in the work of multiple authors. Another example is from Brenner and Uebernickel (2016), who state that Design Thinking intervention teams should be heterogeneous. It is however not substantiated why it is important to have heterogeneous teams, the statement is just made without a proper context.

The former could be a result of the fact that Design Thinking is especially grounded in practice, and only in recent years has gotten more attention in academic fields (Kimbell, 2011).

\[2\] The results of sub-variable 1.2.2 are summarized in the table in Appendix 2.3.
As such, most of the statements made by the authors are following from practical experience in the field, instead of substantiated scientific works.

**Assessment**

Design Thinking receives a score of “orange” for sub-variable 1.2.2 about the theoretical and conceptual substantiation of statements about interventions. Almost all authors explicitly state one or more theories or concepts on which their views concerning interventions are based. However, these theories and concepts are in some cases rather vague, and there exists little consensus among the authors, except for the fact that Simon’s theory (1969) on interventions has been influential for Design Thinking. Almost all of the authors also come with new theories or concepts about interventions, but it should be noted that there is little theoretical explanation given by the authors about the how’s and why’s with regard to these theories and concepts. When weighing all pro’s and con’s, Design Thinking arrives at a score of “orange”.

A summary of the results of Design Thinking on sub-variable 1.2.2 is given in the table below.

<table>
<thead>
<tr>
<th>1.2.2</th>
<th>Design Thinking</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Description</strong></td>
<td>Explicitly mentioned theories and concepts of other authors, such as utility theory, although rather vague and inconsistent among authors. Simon’s theory (1969) seen as influential. Own theories and concepts about interventions are introduced, but not fully explained.</td>
</tr>
<tr>
<td><strong>Assessment</strong></td>
<td>Explicit substantiation of theories and concepts surrounding interventions is there, but it is vague, inconsistent, and not always fully explained.</td>
</tr>
</tbody>
</table>

*Table 14: Results of Design Thinking and the 3-D model on sub-variable 1.2.2*

4.2.4 Sub-variable 1.2.3: Social aspect

In the second chapter, the social aspect of the intervention was defined as “the extent to which an intervention method takes the integration, participation and adoption of the intervention, and the interests of stakeholders of the intervention into account”. To reach the norm of this sub-variable, the method has to take the integration, adoption and interests of stakeholders of the intervention into account sufficiently.
The six different authors which represent the literature of Design Thinking, are showing a fairly similar opinion about the social aspect of Design Thinking.

First, all six authors agree that understanding the end-user is of great importance for the method. The end-user could be the person, group of persons or even a society who is going to use the innovation which is created by the Design Thinking team, or who is influenced by this innovation. Some authors, like Brown (2008), focus more on the end-user as a sort of customer or client, while others, like Dorst (2011), state that all relevant stakeholders should be incorporated when designing. All authors acknowledge that it is important that a Design Thinker is able to understand the perspective of this end-user. For example, Martin (2009) states that the needs and perspectives of this end-user should be understood by the Design Thinker. This is done by making the end-user participate in various parts of the design process, such as the creation and adaptation of prototypes, and implementation of these prototypes. This makes Design Thinking a “human-centered approach” to innovation and problem solving (Brown, 2008; Brenner & Uebernickel, 2016).

Second, four authors pay attention to the social aspect in the design team itself (Simon, 1969; Brown, 2008; Martin, 2009; Brenner & Uebernickel, 2016). Brenner and Uebernickel (2016) state for instance that there should be open feedback in the design team, and Martin (2009) stresses the importance of having collaborative skills. However, little advice is given with regard to this subject. Most of the authors state that collaborating is important, but they do not explain what good collaboration is to them, or how to achieve this collaboration.

It should also be noted that in Design Thinking, little attention is paid to the integration of change in an organization, and the inclusion of different participants. While it is important for an proposed intervention to be accepted by the people who are affected by the intervention, and integrated into the behaviour of these people, the authors of Design Thinking do not give much advice on this implementation process. However, they do state that it is important to include the end-user in the whole process of creating and implementing prototypes (Brown, 2008; Brenner & Uebernickel, 2016).

With regard to the broad participation in the intervention, Design Thinking does not make explicit how important this concept is. While Dorst (2011) suggests to look at a broad variety of stakeholders, he and the other authors do not stress the importance of letting a variety of stakeholders participate in the intervention. The participation of the end consumer is a central

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3 The views of the six authors of Design Thinking on the social aspect of the intervention are summarized in the table in appendix 2.4.
theme in Design Thinking, but none of the authors says something about who this end consumer is, and if for example lower level employees could and should also participate in the intervention process.

**Assessment**

Design Thinking score a “orange” on the sub-variable about the social aspect of the intervention. All authors of Design Thinking emphasize the importance of understanding the end-user for a successful intervention, and give advice on how this understanding could be reached. Four of the six authors also recognize the importance of collaboration in the design teams. However, since there is limited attention for the way in which a successful collaboration is achieved, and since the authors pay too little attention to the implementation of change and a broad participation of stakeholders, Design Thinking does not get a maximum score on this sub-variable.

The results of Design Thinking on sub-variable 1.2.3 are summarized in the table below.

<table>
<thead>
<tr>
<th>1.2.3</th>
<th>Design Thinking</th>
</tr>
</thead>
</table>
| **Description** | Human-centered method, centrality of the end-user  
Collaboration in design team  
Less attention for integrating and adopting change and broad participation of stakeholders |
| **Assessment** | Pays attention to social aspect by putting end-user central, and focusing of collaboration in team. End-user should be included in whole process, from problem definition to implementation. However, not enough attention is paid to integration, adoption, and including broad variety of stakeholders. |

*Table 15: Results of Design Thinking and the 3-D model on sub-variable 1.2.3*

4.2.5 Sub-variable 1.2.4: Type of change

In chapter 2, the sub-variable about the type of change was defined as “whether an intervention method focuses on episodic change, continuous change or on both”. The norm value for this sub-variable is that it should at least be explicit what type of change the method is focusing on. Moreover, it is ideal when the method focuses specifically on episodic change, since the methods are assessed on their potential as being a method which supports episodic interventions in organizational infrastructures.
With regard to the type of change in the innovation, none of the authors which were chosen to represent the literature about Design Thinking mention the explicit distinction between episodic and continuous change by Weick and Quinn (1999). However, Simon (1969), Brown (2008), and Brenner and Uebernickel (2016) explicitly talk about a type of change which resembles these types of change, such as incremental versus radical innovations. The other three authors do not explicitly talk about a type of change, though their type of change could be identified from their articles or books.

Five out of the six authors share the same view on the type of change. Almost all authors state that Design Thinking is created as a method for both episodic and continuous change (Buchanan, 1992; Brown, 2008; Martin, 2009; Dorst, 2011; Brenner and Uebernickel, 2016). For instance, Brown (2008) says that a combination of incremental innovation and revolutionary innovation is needed. Brenner and Uebernickel (2016) confirm this, and on the one hand, they emphasize that radical innovation is needed to solve wicked problems. On the other hand though, they state that a linear sequence is rarely followed, and that the briefing process is a continuous process.

Episodic and continuous change are not only needed in separation from each other, they also complement each other. Episodic innovation could be seen as a start-up for continuous innovation, whereas the latter causes the episodic innovation to become sustainable (Brenner & Uebernickel, 2016).

Simon (1969) is the only author who does not endorse episodic change. He stresses cyclical interactions, continual and adaptive change, and compares the intervention with evolution, which all points at a more continuous type of change. Since Simon is not a Design Thinker in the narrow sense of the word, and does not explicitly suggest that Design Thinking should not be geared towards episodic change, and since all other authors stress the combination of episodic and continuous change, this combination of two types of change is seen as the final view of the Design Thinking method.

Assessment

Design Thinking receives the score “orange” for this sub-variable about the intervention’s type of change. From the description of this sub-variable, it became clear that none of the authors

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4 The table within appendix 2.5 presents a summary of the views of the six authors of Design Thinking on the type of change of the intervention. Within this table, “C” stands for continuous change, whereas “E” stands for episodic change.
mentioned the distinction between episodic and continuous change, and only half of the authors mentioned any type of change explicitly. The authors of Design Thinking do not exclude that the method can be used for episodic change and for continuous change. And, since there are multiple indications that the method could fit with both episodic and continuous change, it is concluded that Design Thinking could be an intervention method for episodic as well as continuous change. This means that the method is not specifically geared towards episodic interventions. This, and the fact that the type of change is not completely explicitly indicated by all authors, result in the former stated score.

A summary of the results of Design Thinking on sub-variable 1.2.4 is given in the table below.

<table>
<thead>
<tr>
<th>1.2.4</th>
<th>Design Thinking</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Description</strong></td>
<td>No authors mention episodic-continuous change explicitly, three authors mention any type of change explicitly. DT created specifically for neither episodic change nor continuous change.</td>
</tr>
<tr>
<td><strong>Assessment</strong></td>
<td>The type of change is not very explicitly mentioned, and the method is not specifically geared towards episodic interventions.</td>
</tr>
</tbody>
</table>

*Table 16: Results of Design Thinking and the 3-D model on sub-variable 1.2.4*

4.2.6 Sub-variable 1.3.1: Process

In chapter 2, a process was defined as a specific sequence of steps that must be taken to reach the goal of the intervention. In other words, the intervention process describes how the goal of this intervention could be reached. The norm of this sub-variable is that the intervention process should be made explicit by the authors of the method, and it must be made plausible that the activities in the process match the purpose of the intervention.

**Description**

When looking at the table in the appendix, it becomes clear that each author of Design Thinking gives an extensive and clear overview of the intervention process in this method. The process varies to a great extent per author, but there are a number of key process steps that are mentioned by multiple authors.

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5 Appendix 2.6 presents the overview of the intervention processes which are mentioned by the six chosen authors of Design Thinking.
First, all six authors state that the Design Thinking process consists of iterative cycles. Buchanan (1992) for instance says that this method does not consist of a simple linear process, and Brown (2008) stresses that Design Thinking is not a predefined series of orderly steps. Brenner and Uebernickel (2016) show in their book that the intervention process should be seen as iterative cycles, where the outcome of the first cycle delivers the starting situation of the second cycle.

Second, four authors mention explicitly that the problem definition is an important step at the beginning of an intervention. According to Dorst (2011), this problem definition consists of analysing the history of the problem owner, and looking at the initial problem formulation. Thereafter, the problem situation itself has to be analysed, and the stakeholders of the problem should be identified (Dorst, 2011; Brenner & Uebernickel, 2016). The problem definition step is crucial, since a problem should be fully understood before it can be solved.

Third, prototyping is a step which is mentioned by three of the six authors. A prototype is the creation of an early solution to a problem, which has not yet been worked out on a full scale. According to Martin (2009), it is possible to create prototypes for products, services, experiences and interactions. The prototypes enable Design Thinkers to test their solutions with stakeholders, and get clues why the prototype is or is not fulfilling needs of these stakeholders (Martin, 2009; Brenner & Uebernickel, 2016).

Fourth, the visualization and representation of the Design Thinker’s final ideas to the stakeholders is seen as important by five of the authors. Simon (1969), who influenced the Design Thinking method, states that this step is crucial to make a solution transparent to the end customer, for instance. Design Thinkers are making sketches, telling stories, creating videos and giving presentations to make their ideas visual (Brown, 2008). This visualization process also helps them to look critically at their ideas and improve them further (Dorst, 2011).

It is plausible that these steps fit the goal of the intervention, which is creating innovation and solving complex problems. The iterativity of the intervention process fits these purposes, since these iterative cycles allow a creative and adaptive process, which enables the Design Thinker to arrive at (innovative) solutions for problems (Brown, 2008). Having a clear problem definition is also a logical step which helps to reach the goals of the intervention; understanding the issue at hand and the involved stakeholders, helps to reach an optimal problem solution, and makes for a better innovation that is more tailor-made for the stakeholders. The step of prototyping gives Design Thinkers a chance to improve their solution or innovation, which increases the chance of a good outcome (Martin, 2009; Brenner & Uebernickel, 2016). And as stated earlier, visualization and representation help to make solutions transparent and
improve these ideas, which matches the goal to arrive at optimal solutions and innovations (Simon, 1969; Dorst, 2011).

**Assessment**

Design Thinking receives a score of “green” for this sub-variable. As mentioned above, the process steps for interventions are explicitly mentioned by all authors of Design Thinking. Moreover, it is plausible that the proposed activities contribute to reaching the goals of the intervention. Partly, this is made plausible by the authors themselves, and partly, logical thinking leads to this conclusion. As a consequence, it is possible as a reader of the Design Thinking literature to follow the prescribed steps, and in this way achieve innovation and the solution of complex problems.

The results of Design Thinking on sub-variable 1.3.1 are summarized in table 17 below.

<table>
<thead>
<tr>
<th>1.3.1</th>
<th>Design Thinking</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Description</strong></td>
<td>Extensive and explicit intervention processes Iterative cycles Problem definition Prototyping Representation and visualization</td>
</tr>
<tr>
<td><strong>Assessment</strong></td>
<td>Intervention process is explicitly mentioned by the authors, and it is plausible through logical thinking that these steps actually lead to achieving the intervention goals.</td>
</tr>
</tbody>
</table>

*Table 17: Results of Design Thinking and the 3-D model on sub-variable 1.3.1*

4.2.7 Sub-variable 1.3.2: Configuration

In chapter 2, the configuration of the intervention organization was defined as “the way in which the intervention process is organized”. The configuration of the intervention organization could be an activity (including the division of tasks, strategy, personnel policy, technology and culture), and a result of this configuring activity”. The norm of this sub-variable is that the authors should say something about the activity and/or the result of the configuration of the intervention organization.

**Description**

*Within the table in Appendix 2.7, an overview is given of the configurations which are proposed by the six chosen authors of Design Thinking.*
Generally, the authors of Design Thinking do not have a specific section where they talk about the configuration of the intervention organization. This configuration is woven into the processes, instruments and other subjects where the authors make statements about. Remarkably, the authors do not have a high amount of similar ways of configuring the intervention; each author highlights another aspect. The aspects which were at least named two times by the chosen authors will be explained below.

First, four of the Design Thinking authors mention that the configuration of the intervention organization should be human-centered, since the method itself sees stakeholders (and especially the customer) as the focal point of intervening (Buchanan, 1992; Brown, 2008; Martin, 2009; Brenner & Uebernickel, 2016). This means that the design team should be built in such a way that it can fulfil the needs of the end customer in the best possible way.

Second, three authors mention that the work of a Design Thinking team is done on a (ad hoc) project basis (Brown, 2008; Martin, 2009; Dorst, 2011; Brenner & Uebernickel, 2016). This means that work is carried out in projects, with a specific deadline, which disappear when the work of the project is completed (Martin, 2009).

Third, two out of the six authors state that it is important to have a design team which consists of a diversity of people, from multiple disciplines. This stimulates divergent thinking, which makes it easier to come up with new innovative ideas (Brown, 2008; Brenner & Uebernickel, 2016).

The principles for the configuration of the intervention organization are especially geared towards the activity of configuring itself; it does not say much about the result of this configuration process. For example, the authors of Design Thinking state that there should be a diverse and interdisciplinary team, but talks especially about forming such a team, instead of the final result of this formation process.

**Assessment**

The method of Design Thinking gets a “green” score for sub-variable 1.3.2 about the configuration of the intervention organization. The authors are explicit about how the intervention should be configured. In the results, it came forward that Design Thinking is especially explicit about configuring as an activity, so they are not that explicit about the configuration as a result that emerges because of the configuring activity. The method only provides readers with configuration heuristics. Nevertheless, the explicitness of the authors makes sure that readers know
how they should configure the intervention, and yet they receive enough freedom to arrive at multiple configuration results.

The results of Design Thinking on sub-variable 1.3.2 are summarized in table 18 below.

<table>
<thead>
<tr>
<th>1.3.2 Description</th>
<th>Design Thinking</th>
</tr>
</thead>
<tbody>
<tr>
<td>Description</td>
<td>Human-centered approach</td>
</tr>
<tr>
<td></td>
<td>(Ad hoc) project basis</td>
</tr>
<tr>
<td></td>
<td>Diverse and interdisciplinary teams</td>
</tr>
<tr>
<td>Assessment</td>
<td>Explicitly mentioned by authors. More explicit about configuring as activity than as result, because of the openness of the method.</td>
</tr>
</tbody>
</table>

Table 18: Results of Design Thinking and the 3-D model on sub-variable 1.3.2

4.2.8 Sub-variable 1.3.3: Instrument

In chapter 2, the instrument of the intervention was defined as “a toolbox which consists of a set of techniques, rules, and/or procedures, and which is put forward by an intervention method for the purpose of guiding the process in the proposed configuration of the intervention organization, in such a way that the goal of the intervention can be reached”. The norm for this sub-variable is that the method should at least take into account the possibility of using instruments, and be explicit about this possibility. A method could for example present some tools, or explain in what situation certain tools could be used.

**Description**

When looking at the table mentioned above, it appears that although each author explicitly mentions a variety of instruments, there is little consensus amongst the authors about which instruments are serving the central concepts of Design Thinking. Martin (2009) even states that Design Thinking has no specific material practices to be distinguished. However, it is possible to make a categorization of instrument types, based on the purposes of the instruments.

The first category of instruments serves the goal of visualization and representation. Examples of these instruments are sketches, videos, role-plays, post-its (Brown, 2008), storytelling (Brenner & Uebernickel, 2016), and flow charts (Simon, 1969).

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7 A summary of the perspectives of the different authors on sub-variable 1.3.3 is shown in the table in appendix 2.8.
The second category consists of instruments with the goal of identifying what the stakeholders want and need, such as the stakeholder map, the persona-method (Brenner & Uebernickel, 2016), observations (Buchanan, 1992; Brown, 2008; Martin, 2009; Dorst, 2011; Brenner & Uebernickel, 2016), and interviews (Buchanan, 1992; Brenner & Uebernickel, 2016).

The third category entails the instruments with the purpose of understanding the problem at hand, such as the 5-Whys (Brenner & Uebernickel, 2016), simulation (Simon, 1969), and placements (Buchanan, 1992).

The fourth category of instruments serves the goal of coming up with new ideas to solve problems and/or innovate, such as brainstorming and ambiguous media (Brown, 2008).

The fifth and last category consists of the instruments with the goal of choosing between alternative ideas and design options, or improving them. Examples of these instruments are means/ends analysis, cost/benefit analysis, utility theory (Simon, 1969), prototyping, and testing (Buchanan, 1992; Brown, 2008; Martin, 2009).

Although each author explains multiple instruments which can be used for Design Thinking, and sometimes mentions the goal of an instrument, there is not that much explanation about where in the intervention process certain instruments should be used. In some cases, such as in the book of Brenner and Uebernickel (2016), a list of instruments is given without extensively explaining how and when these instruments should be used.

Assessment
The method of Design Thinking receives a “green” for this sub-variable. All authors take into account that there is a variety of instruments which can be used for the intervention. The authors show a lot of instruments with different purposes, and explain explicitly what these instruments are. As a consequence, the reader of the Design Thinking literature receives a toolbox which is filled with different instruments (Brenner & Uebernickel, 2016), which can be used to episodically intervene in organizational infrastructures. One point of improvement could be to specify when and how the instruments exactly can be used, so the reader knows more about the using the different instruments correctly.

The results of Design Thinking on sub-variable 1.3.3 are summarized in table 19 below.
Visualization and representation
Identifying what the stakeholders want and need
Understanding the problem at hand
Coming up with new ideas
Choosing between alternative ideas and design options, or improving them

**Assessment**
A variety of instruments with different purposes is provided and explicitly explained. However, there are little instructions about how and when to use these instruments.

| Table 19: Results of Design Thinking and the 3-D model on sub-variable 1.3.3 |

**4.3 Key variable 2: Infrastructure**

4.3.1 Sub-variable 2.1.1: Theoretical and conceptual substantiation of the infrastructural object
The definition which was given to sub-variable 2.1.1 in chapter 2 was: “the extent to which an author makes explicit the theories and concepts from other authors on which his/her views about the infrastructure are based, or the extent to which an author explains a new theory or concept about the infrastructure as an object which is brought forward by the method”. The norm of this sub-variable is that both methods should make explicit on which theories or concepts their views with regard to the three aspects of infrastructures – HR, technology, and structure – are based, and/or define the own theories they have. The methods should be sufficiently based on at least one theory, or come with an extensive description of a new theory or concept they have created.

**Description**
During the research with regard to this whole key variable about infrastructures, something remarkable was discovered. As was specified in section 4.2.2 in sub-variable 1.2.1 about the goal of the intervention, Design Thinking does not have the explicit purpose to support interventions in organizational infrastructures. Instead, Design Thinking is openly aimed at solving all kinds of complex problems, and doing all kinds of innovations. Because of the openness of this method, no specific literature of Design Thinking is about intervening specifically in infrastructures. As such, there is no substantiation to be found about the infrastructural object, since the infrastructure is no explicit object of Design Thinking.

**Assessment**
Design Thinking receives an “orange” score with regard to the theoretical and conceptual substantiation of the infrastructural object. The method does not explicitly mention any theoretical
or conceptual substantiation which about the infrastructure, as this infrastructure is not an explicit object of this method. The reader should therefore search for additional specific design theories and methods which provide this substantiation, depending on the intervention’s object. Nevertheless, an advantage of the method is its openness, which gives the reader the space to find methods and theories that provide this substantiation. In addition, the method does not state that the infrastructure could not be the object of Design Thinking, and there are also no statements made about the infrastructure which are not substantiated, which is positive. The negative and positive points above resulted in the score “orange”.

The results of Design Thinking on sub-variable 2.1.1 are summarized in table 20 below.

<table>
<thead>
<tr>
<th>2.1.1</th>
<th>Design Thinking</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Description</strong></td>
<td>Not applicable</td>
</tr>
<tr>
<td><strong>Assessment</strong></td>
<td>Disadvantage: no explicitly mentioned theoretical and conceptual substantiation of the infrastructural object. So, reader should obtain specific design theories and methods, depending on the intervention’s object. Advantage: the openness of the method allows using other methods and theories which provide this substantiation.</td>
</tr>
</tbody>
</table>

*Table 20: Results of Design Thinking on sub-variable 2.1.1*

4.3.2 Sub-variable 2.1.2: Essential variables

In chapter 2, the sub-variable about essential variables was defined as “variables which should be kept between certain norms to reach the goal(s) of the organization”. The norm of this variable is that when talking about infrastructures, the essential variables of all three aspects of these infrastructures should be identified and explained. Moreover, norm values of these essential variables should be clear.

**Description**

As such, there are no infrastructural essential variables identified in this method.

**Assessment**

Design Thinking receives an “orange” score with regard to essential variables. The method does not explicitly mention infrastructural essential variables, and also does not give norm values for these variables. The reader should therefore search for additional specific design theories and
methods which provide these essential variables, depending on the intervention’s object. However, the method’s openness gives the reader the space to find connecting methods and theories that provide these essential variables. In addition, the method does not state that there are no essential infrastructural variables to be identified.

The results of Design Thinking on sub-variable 2.1.2 are summarized in table 21 below.

<table>
<thead>
<tr>
<th>2.1.2 Design Thinking</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Description</strong></td>
</tr>
<tr>
<td><strong>Assessment</strong></td>
</tr>
</tbody>
</table>

*Table 21: Results of Design Thinking on sub-variable 2.1.2*

4.3.3 Sub-variable 2.1.3: Parameters

The sub-variable about parameters was defined in chapter 2 as “characteristics of the infrastructure which can have a varying value, and with which an organization can design its infrastructure. The role of parameters is to give the essential variables their norm values”. The norm of variable 2.1.3 is that when talking about infrastructures, the parameters of all three aspects of these infrastructures should be identified and clarified.

**Description**

Just as with sub-variable 2.1.2, no description is to be found about infrastructural parameters of Design Thinking, since the method is not specifically focused on infrastructures.

**Assessment**

Again, Design Thinking receives an “orange” score with regard to the sub-variable 2.1.3 about parameters. The method does not explicitly mention parameters which are geared towards infrastructures. The reader should therefore search for additional specific design theories and methods which provide these parameters, depending on the intervention’s object. However, the openness of the method gives the reader the space to find connecting methods and theories that
provide these parameters. Moreover, the method does not state that there are no infrastructural parameters to be identified.

The results of Design Thinking on sub-variable 2.1.3 are summarized in table 22 below.

<table>
<thead>
<tr>
<th>2.1.3</th>
<th>Design Thinking</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Description</strong></td>
<td>Not applicable</td>
</tr>
<tr>
<td><strong>Assessment</strong></td>
<td>Disadvantage: no explicitly mentioned infrastructural parameters. So, reader should obtain specific design theories and methods which provide these parameters, depending on the intervention’s object. Advantage: the openness of the method allows using other methods and theories which provide these parameters.</td>
</tr>
</tbody>
</table>

*Table 22: Results of Design Thinking on sub-variable 2.1.3*

4.3.4 Sub-variable 2.1.4: Relation between parameters and essential variables

In chapter 2, the relation between parameters and essential variables was defined as “the way in which a certain value of a parameter influences an essential variable, or the value a parameters should have in order to maintain an essential variable in its norm value”. The norm of variable 2.1.4 is that when talking about infrastructures, the relationship between the parameters and essential variables of all three aspects of these infrastructures should be identified and explained.

**Description**

Since there are no infrastructural parameters and essential variables to be found in the literature about Design Thinking, there are also no relationships between these parameters and essential variables.

**Assessment**

Just as with the other sub-variables, Design Thinking gets an “orange” score for sub-variable 2.1.4. The method does not explicitly mention the relationship between parameters and essential variables which are geared towards infrastructures. The reader should therefore search for additional specific design theories and methods which provide these relationships, depending on the intervention’s object. However, the method’s openness gives the reader the space to find other methods and theories that provide these relationships. Moreover, the method does not
state that there are no relationships between infrastructural parameters and essential variables to be identified.

The results of Design Thinking on sub-variable 2.1.4 are summarized in table 23 below.

<table>
<thead>
<tr>
<th>2.1.4</th>
<th>Design Thinking</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Description</strong></td>
<td>Not applicable</td>
</tr>
</tbody>
</table>
| **Assessment** | Disadvantage: no explicitly mentioned relationship between infrastructural parameters and essential variables. So, reader should obtain specific design theories and methods which provide these relationships, depending on the intervention's object.
Advantage: the openness of the method allows using other methods and theories which provide these relationships. |

*Table 23: Results of Design Thinking on sub-variable 2.1.4*

### 4.4 Key variable 3: Method

#### 4.4.1 Sub-variable 3.1: Methodological metaphor & paradigm

This last sub-variable is about the methodological metaphor and paradigm of the method’s authors. The methodological metaphor was defined in chapter 2 as “a simplified image used by authors to describe their own method, their used methodology or their view on methodology”. The methodological paradigm was defined in this chapter as “the underlying view with which someone looks at scientific research”. The norm value for this sub-variable is that the methodological metaphor and paradigm should be made explicit by the authors. Moreover, ideally the method gives space to multiple paradigms, since this creates a more open view towards science.

**Description**

The six chosen authors of Design Thinking use a variety of metaphors for their method. The authors agree with each other that Design Thinking should be seen as a tool or instrument, but all authors state different goals for which Design Thinking could be a tool. For example, while Buchanan (1992) sees design as an instrument for cultural life, Dorst and Dijkhuis (1995) also emphasize that design can be seen as a rational search process. According to

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8 A summary of the perspectives of the different Design Thinking authors on the methodological metaphor and paradigm is shown in the table in appendix 2.9.
Dorst and Dijkhuis (1995), this broad variety of metaphors has to do with the two methodo-
logical paradigms that are present in the Design Thinking community. The first paradigm is
the “problem solving approach”, in which designing is seen as a rational search process. The
second paradigm is the “reflection-in-action approach”, which emphasizes that each design
problem is “an universe of one”. Dependent on someone’s paradigm with regard to design as
a method, different metaphors can be chosen, which explains the great variety of metaphors of
Design Thinking.

When looking at the epistemological paradigm which is present in Design Thinking,
these two methodological paradigms both seem to represent their own epistemology. The
problem solving approach has a background in positivism, and stresses for example the rigour
of analysis, objective observations and generalizability (Dorst & Dijkhuis, 1995). All of this
points to an objectivist epistemology. The reflection-in-action approach, however, has a back-
ground in constructionism, and states that design problems are actively framed by the design-
ers themselves, which points towards a subjectivist epistemology. This dichotomy in episte-
ological perspectives shows when looking at the different authors of Design Thinking. Five
out of the six authors show both subjectivist and objectivist views, or stress that Design
Thinkers should look at the world with multiple epistemological perspectives. Only Simon
(1969) uses one objectivist epistemology, but this mainly positivist and empiricist view is
heavily criticized by later Design Thinkers (Buchanan, 1992). Simon (1969) also is not a De-
sign Thinker in the narrowest sense of the word, although he influenced the method a lot.
Therefore, Simon’s epistemological view will not be included into the description of Design
Thinking.

Assessment

The assessment score of Design Thinking on this sub-variable is “green”. Overall, it is possible
to discover the metaphor and paradigm of all the six authors with regard to methodology, but
their explicitness on this sub-variable varies per author. On the one hand, authors like Dorst
(2011) and Martin (2009) express very explicitly what their methodological metaphor and par-
adigm is, and even reflect on the epistemological features of a true Design Thinker. This plu-
ralism helps the reader to look from different perspectives on science in general, and more
specifically on methods such as Design Thinking. On the other hand, it is relatively difficult
(though possible) to determine the content on this sub-variable of authors like Brenner and
Uebernickel (2016). When summing up this explicitness and pluralism, the final assessment
score of Design Thinking on the methodological metaphor and paradigm is “green”.

84
A summary of the results of Design Thinking on sub-variable 3.1 is given in the table below.

### 3.1 Design Thinking

<table>
<thead>
<tr>
<th>Description</th>
<th>Assessment</th>
</tr>
</thead>
<tbody>
<tr>
<td>M: Tool with various purposes</td>
<td>Authors are quite explicit on their methodological metaphor and paradigm, and stress epistemological pluralism, which promotes looking at science from various perspectives.</td>
</tr>
<tr>
<td>P: Epistemological pluralism; both subjectivist and objectivist</td>
<td></td>
</tr>
</tbody>
</table>

Table 24: Results of Design Thinking and the 3-D model on sub-variable 3.1

### 4.5 Conclusion Design Thinking

In this section, a conclusion is given about the description and assessment of the Design Thinking method as a method which supports episodic interventions in organizational infrastructures.

The summarized results of this method for all sub-variables of the metamodel are shown below in table 25.

<table>
<thead>
<tr>
<th>Description</th>
<th>Assessment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.1 M: few metaphors for intervention (only painting in oil)</td>
<td>No explicit information about the intervention metaphor and paradigm. Variety of metaphors and paradigms, which allows to see organizations and interventions from multiple perspectives. Power views are not explicitly acknowledged.</td>
</tr>
<tr>
<td>Metaphor for organization: flux and transformation, culture, sensemaking, machine</td>
<td></td>
</tr>
<tr>
<td>P: Functionalist and social-interpretivist</td>
<td></td>
</tr>
<tr>
<td>1.2.1 Explicitly mentioned</td>
<td>The reason why, object and application area is explicitly mentioned by the authors, and the content is fairly consistent among the authors. The reason why, object and application area is left open and broad enough to fit with a method supporting episodic interventions in organizational infrastructures, although it not explicitly fits this kind of methods.</td>
</tr>
<tr>
<td>Reason why: Solving complex (wicked, paradoxical) problems, innovation</td>
<td></td>
</tr>
<tr>
<td>Object: Organizations, Physical objects/products, services, systems, processes</td>
<td></td>
</tr>
<tr>
<td>Broad application area: First engineering, industrial design and architecture. Later business, education, IT and medicine</td>
<td></td>
</tr>
<tr>
<td>1.2.2 Explicitly mentioned theories and concepts of other authors, such as utility theory, although rather vague and inconsistent among authors. Simon’s theory (1969) seen as influential. Own theories and concepts about interventions are introduced, but not fully explained.</td>
<td>Explicit substantiation of theories and concepts surrounding interventions is there, but it is vague, inconsistent, and not always fully explained.</td>
</tr>
</tbody>
</table>
| 1.2.3 | Human-centered method, centrality of the end-user  
Collaboration in design team  
Less attention for integrating and adopting change and broad participation of stakeholders | Pays attention to social aspect by putting end-user central, and focusing of collaboration in team. End-user should be included in whole process, from problem definition to implementation. However, not enough attention is paid to integration, adoption, and including broad variety of stakeholders. |
| 1.2.4 | No authors mention episodic-continuous change explicitly, three authors mention any type of change explicitly  
DT created specifically for neither episodic change nor continuous change | The type of change is not very explicitly mentioned, and the method is not specifically geared towards episodic interventions. |
| 1.3.1 | Extensive and explicit intervention processes  
Iterative cycles  
Problem definition  
Prototyping  
Representation and visualization | Intervention process is explicitly mentioned by the authors, and it is plausible through logical thinking that these steps actually lead to achieving the intervention goals. |
| 1.3.2 | Human-centered approach  
(Ad hoc) project basis  
Diverse and interdisciplinary teams | Explicitly mentioned by authors. More explicit about configuring as activity than as result, because of the openness of the method. |
| 1.3.3 | Instrument categories:  
Visualization and representation  
Identifying what the stakeholders want and need  
Understanding the problem at hand  
Coming up with new ideas  
Choosing between alternative ideas and design options, or improving them | A variety of instruments with different purposes is provided and explicitly explained. However, there are little instructions about how and when to use these instruments. |
| 2.1.1 | Not applicable | Disadvantage: no explicitly mentioned theoretical and conceptual substantiation of the infrastructural object. So, reader should obtain specific design theories and methods, depending on the intervention’s object.  
Advantage: the openness of the method allows using other methods and theories which provide this substantiation. |
| 2.1.2 | Not applicable | Disadvantage: no explicitly mentioned infrastructural essential variables. So, reader should obtain specific design theories and methods which provide these essential variables, depending on the intervention’s object.  
Advantage: the openness of the method allows using other methods and theories which provide these essential variables. |
| 2.1.3 | Not applicable | Disadvantage: no explicitly mentioned infrastructural parameters. So, reader should obtain specific design theories and methods which provide these parameters, depending on the intervention’s object. |
Table 25: Results of Design Thinking

By looking at the table above, the conclusion is that Design Thinking scores “orange” on eight third order sub-variables, and “green” on five third order sub-variables. This means that for the largest part of the sub-variables, the norm of the sub-variable is not fully reached, but that this does not form a massive problem for Design Thinking as a method which supports episodic interventions in organizational infrastructures. The specific description and assessment results will be discussed per second order sub-variable.

With regard to sub-variable 1.1, which is about the intervention metaphor and paradigm, it appears that there are few intervention metaphors given. The metaphor for the organization is flux and transformation, culture, sensemaking, and machine. The both objectivist and subjectivist epistemology of Design Thinking, in combination with a regulating view on the hegemonic order, leads to a functionalist and social-interpretivist paradigm. Design Thinking receives an orange score, since the intervention metaphor and paradigm are not explicitly mentioned by the authors, and – although a variety of intervention metaphors is present – no perspectives on power relations in organizations are found.

The results of sub-variable 1.2, about the organizational interventions theory, are as follows. Design Thinking is a method which has the goal to (1) solve complex problems and (2) stimulate innovation. It is geared towards a variety of objects, such as organizations, physical objects, services, systems, and processes. The method was at first especially used in areas like engineering, industrial design and architecture, but later its application area broadened to fields of business, IT, medicine and education. Its theoretical and conceptual background with regard to interventions was not clear, the only theoretical work which was mentioned as important for
the background of Design Thinking’s intervention views was Simon (1969). Although the method pays sufficient attention to the interests of the end user and the collaboration in the intervention organization, less attention is paid in the method to making sure the proposed intervention gets accepted, and a variety of stakeholders can participate in the intervention. With regard to the type of change, it appears that Design Thinking is not specifically geared towards episodic or continuous change, since both types of change can be found in the literature. When looking at the assessment, only the third order sub-variable 1.2.1 about the goal of the intervention receives a green score, because the elements of this sub-variable are made clear by the authors of Design Thinking. The rest of the third order sub-variables got an orange score. This is partly due to the lack of explicitness on some important areas of organizational interventions theory, and partly due to the content not fitting a method which supports episodic interventions in organizational infrastructures, as is the case with the type of change which is not geared towards episodic interventions.

With regard to sub-variable 1.3, about the intervention organization, the results are that Design Thinking’s intervention process exists of iterative cycles in which steps like problem definition, prototyping, and visualization are prevalent. The configuration of the intervention organization is characterized by an approach in which humans are central, and (sometimes ad hoc) projects are executed by diverse teams. Design Thinking present a lot of different tools, for which five categories are distinguished: tools with the purpose of (1) visualization and representation, (2) identifying stakeholders’ needs, (3) understanding the problem, (4) coming up with new ideas, and (5) choosing among a variety of ideas and design options, or improving these. Design Thinking scored maximum for this whole second order sub-variable, due to its explicitness, and the coherence between the content of the different third order sub-variables.

Sub-variable 2.1, which is about infrastructure theory, appears to be not applicable for the Design Thinking method. Since the infrastructure of the organization is not a specific object of Design Thinking interventions, nothing was said by its authors about the infrastructure. Therefore, the method receives an orange score. Despite of its inexplicitness regarding this sub-variable, Design Thinking does not receive a red score, since the method’s openness leaves enough room for the reader to search for other methods which provide theories about the infrastructure.

The results of sub-variable 3.1, about the methodological metaphor and paradigm, are as follows. The method of Design Thinking is being compared by its authors with a tool which has various purposes. Based on the literature, it is concluded that the authors of Design Thinking stress epistemological pluralism, which entails that they want Design Thinkers to look with
both objectivist and subjectivist methodological perspectives to the world. The method gets a green score with regard to this sub-variable, since it is sufficiently explicit about the methodological metaphor and paradigm, and promotes an objectivist as well as subjectivist epistemology.

To give a final conclusion, Design Thinking is a quite appropriate method which support episodic interventions in organizational infrastructures, despite the fact that it is not explicitly intended to be such a method. Its openness and explicitness with regard to the intervention organization and methodological metaphor and paradigm are its positive points, whereas its lack of content about the organizational infrastructure, its lack of explicitness theoretical and conceptual substantiation concerning the organizational interventions theory, and its lack of explicitness regarding the intervention metaphor and paradigm are its negative points.

Chapter 5: Results for the 3-D model

The goal of chapter 5 is to discuss the results for the 3-D model, the second focal method in this thesis. Thereby, the chapter gives an answer to sub-question 3: “What is the description of the 3-D model along the chosen sub-variables?” It also gives an answer to the 3-D model part of sub-question 4: “What is the assessment of Design Thinking and the 3-D model, with regard to the used sub-variables of the metamodel and their norms?” Moreover, it answer sub-question 5: “What are the differences and similarities between Design Thinking and the 3-D model, with regard to their assessment on the used sub-variables of the metamodel and their norms?” The structure of this chapter is the same as in chapter 4. The chapter will start with section 5.1, in which an overview of the 3-D model is given, In section 5.2 to 5.4, the description and assessment of the 3-D model on each sub-variable is discussed. After each assessment, a comparison between the assessment results of the 3-D model and Design Thinking is given. Finally, in section 5.5, a conclusion of the results for Design Thinking is given.

5.1 Overview of the 3-D model

 Whereas the method of Design Thinking has a history of several decades, the 3-D model (Achterbergh & Vriens, 2019) is published in the current year. Nevertheless, the method is grounded in social systems theory, cybernetics and organizational theory and design. These
theories are respectively based on the work of – among others – Beer (1979), Luhmann (1984), Ashby (1958) and De Sitter (1994).

In their first book, *Organizations: Social systems conducting experiments*, Achterbergh and Vriens (2010) described how an organization and its infrastructure should be designed, to enable the organization to realize and adapt goals to be able to meaningfully survive. Rich meaningful survival is seen by Achterbergh and Vriens (2010) as maintaining a separate and meaningful existence as an organization, separate from the organization’s environment. This existence is meaningful when the organization delivers a positive contribution to the society. To achieve meaningful survival, the organization should formulate goals which reflect this meaningful contribution to its environment, and realize this contribution in an adequate way. Achterbergh and Vriens (2010) explain in their book how the infrastructure should be designed in order to facilitate this meaningful survival. In this sense, this first book was about the capability to design in organizations, based on the design perspectives from the above named four authors.

The second book of Achterbergh and Vriens (2019), *Organization Development: Designing episodic interventions in organizations*, could be seen as a complementary book to the first one. In this book, the two authors explain how someone can create episodic interventions in organizational structures, to arrive at a state of the organization in which it can fulfil the realization and adaptation which is needed to meaningfully survive. Their book is based on the view that many organizational infrastructures are limiting itself in realizing and adapting its goals, which is called a self-inhibiting infrastructure. Because of this self-inhibiting infrastructure, the organization is not capable of changing itself appropriately when needed. To do this, such an organization needs an episodic intervention. Achterbergh and Vriens (2019) describe in their book how these episodic interventions should be designed.

They do this by introducing three dimensions which are needed to do an episodic intervention: a functional, social, and infrastructural dimension. Shortly, the functional dimension is about making sure that an appropriate structure is created, the social dimension is about changing and retaining behaviour of the organization members in such a way that the episodic intervention is integrated and adopted, and the infrastructural dimension is about creating an appropriate intervention organization, which is responsible for successfully implementing the episodic intervention.

Since the second book is about episodically intervening in organizations, this book is not specifically about design, like the first book, but about change. However, designing organizations is still explained as a part of the intervention.
The method of the 3-D model will be analysed using the same metamodel as the method of Design Thinking. However, since the 3-D model until now is only discussed by Achterbergh and Vriens (2019), there is no need to provide tables with perspectives of the different authors.

5.2 Key variable 1: Intervention

5.2.1 Sub-variable 1.1: Intervention metaphor & paradigm
The sub-variable is about the intervention metaphor and paradigm which the authors from Design Thinking use to express their view on interventions and the organization which undergoes these interventions. The intervention metaphor was defined in chapter 2 as “a simplified image used to describe (an aspect of) organizational interventions or the author’s view on these interventions”. The intervention paradigm was defined as “the underlying view with which someone looks at organizational interventions”. The norm of this sub-variable is that the authors should make explicit in which way they look at organizational interventions and organizations as such. It is also important that multiple metaphors and/or paradigms are used and highlighted by the authors, since a method should be able to look from multiple perspectives at the world.

Description
The authors of the 3-D model, just like Design Thinking, show various metaphors and paradigms with regard to intervening in organizations. Achterbergh and Vriens (2019) compare the setting of goals in interventions with sailing on an unruly sea:

Setting social (and functional) goals in the case of episodic interventions is like sailing on an unruly sea, full of unpredictable currents, vortices, and winds that, in combination, continuously drive the ship off course. In order to know at all whether the ship is on or off course, navigational coordinates that constitute this course are needed (coordinates that may be reset as the situation requires this). Moreover, in order to steer the ship, even without exactly knowing the complex, intransparent, and unpredictable forces that drive the ship off course, once again, these navigational coordinates are needed. Social (and functional) goals in the 3-D model have exactly this role and status. (p. 243-244)

9 The substantiation of this sub-variable concerning the intervention metaphor and paradigm can be found in appendix 3.1.
For organizations in general, Achterbergh and Vriens (2019) make use of various metaphors. First, they see an organization as continuously in flux and transformation: “Both the continuous production of new interactions and the change of interaction premises can, metaphorically, be described as a continuous process of ‘birth’, as a ‘flow’, or as a ‘flux’” (Achterbergh & Vriens, 2019, p. 12). This means that based on interaction premises, amongst which are metaphors about organizations, interactions are influenced, and that these interactions again influence the interaction premises, forming a cycle or flux.

Second, they use the metaphor of organisms for organizations: “Other metaphors, however, may be more suitable for LPVSs. Morgan (1999), for instance, discusses thinking of an organization as an organism as an alternative. […] It pictures organizations as learning and adaptive systems” (Achterbergh & Vriens, 2019, p. 97).

The last metaphor Achterbergh and Vriens (2019) use is that of brains, which is also based on the learning and adaptation that the two authors propose.

For the combination of these three metaphors from Morgan (1999), the authors of the 3-D model use their own metaphor of viable systems, “which carries with it a more commonsense idea of organizations as systems that strive for survival and therefore need the capacity to learn, change, and adapt, and refer to this general idea as ‘organizations as organisms’” (Achterbergh & Vriens, 2019, p. 101).

With regard to intervention metaphors, it should be noted that Achterbergh and Vriens (2019) use these metaphors in two ways. The first way in which they use metaphors, is to explain their own view on organizations. The metaphor of the unruly sea, and the metaphor of the organization as flux and transformation are two examples of this first way. The second way in which the authors use metaphors, is to explain how other people in organization could possibly look at organizations in general. Here, Achterbergh and Vriens use all metaphors of Morgan (1999), and state for example that some people have interaction premises about the organization as fluid or a machine, although the two authors themselves do not adhere to this view.

Moreover, there is another different way in which intervention metaphors are used in the 3-D model. In the literature about Design Thinking, the metaphors were used without a theoretical and conceptual substantiation. The metaphors therefore had the function to express a view on organizations which the Design Thinkers could not put into words with scientific theories and concepts. In the literature about the 3-D model, however, the metaphor is substantiated with own theories and concepts, and those from other academic authors. The authors talk
about metaphors against the background of their own theory, and stress that they want to look at organizations using scientific theories like cybernetics and social systems theory, instead of metaphors (Achterbergh & Vriens, 2019).

Another remarkable thing is that Achterbergh and Vriens (2019) acknowledge the consequences of the metaphor with which people look at organizations for the way in which they will look at interventions, and even for the way in which they will actually intervene. This is in line with the explanation of this sub-variable in the metamodel of chapter 2, where it was concluded that the intervention metaphor influences how people think about interventions.

With regard to the paradigm on interventions, the authors of the 3-D model do not make explicit statements about whether they adhere to a functionalist, social interpretivist, radical structuralist or radical humanistic paradigm. However, Achterbergh and Vriens (2019) seem to tend more towards a regulating than a radical perspective on the hegemonic order in the world. The reasoning behind this regulating perspective is given below.

There seems to be two ways of looking at power in an organization, if we want to describe how Achterbergh and Vriens (2019) deal with power in their book.

The first way of looking at power in organizations is as a constellation of interests, where there is a conflict of interests between different groups, such as between employees and managers, men and women, handicapped personnel and non-handicapped personnel, etc (Morgan, 1986). One of these groups could dominate the other group, and the subsumed group could undertake revolutions. Achterbergh and Vriens (2019) do not discuss Morgan’s type of looking at power. The only way in which they pay little attention to this way of looking at power, is by stating that in hierarchical organizations, little regulation is given to the lower levels in the organization, which could reinforce the power positions of already dominant groups (Achterbergh & Vriens, 2019).

The second way of looking at power in organizations, is as a reason why an organization is not functioning well. According to Achterbergh and Vriens (2019), the organization should achieve both functional and social goals in each intervention. When an organization does not achieve these goals, it is possible to analyse why this is the case. The conclusion of this analysis could be that one of the reasons for not achieving the functional and social goals is a power situation where different interests play a role (Achterbergh & Vriens, 2019). So, the effects of power on the intervention are included and explained by the authors of the 3-D model.
So, although the authors of the 3-D model do think about the role of power in interventions, they do not view power in the way which Morgan (1999) described in his theory about metaphor and paradigms. Since this sub-variable is based on Morgan’s theory (1979), it is concluded that Achterbergh and Vriens (2019) have a regulating view on the hegemonic order in the world. Since Achterbergh and Vriens have both subjectivist and objectivist epistemological assumptions (although it tends more towards objectivist, as will be explained in section 5.4.1), they also have two paradigms with which they view the world around them.

This first paradigm which is present by the 3-D model’s authors is the functionalist paradigm. This paradigm fits with the brain, organism and flux and transformation metaphors which are used by the authors of the 3-D model (Morgan, 1979), and suits their epistemology which tends more towards objectivism.

The second present paradigm is the social interpretative paradigm. This paradigm fits with the metaphor of the organization as sense making (Morgan, 1979). This paradigm is also evident in the statements that Achterbergh and Vriens (2019, p. 332) make about feedback: “To begin with, the intervention structure can be designed in such a way that human resources can help each other. […] structural conditions should enable both inter- and intra-group learning, discussing intervention tasks, and peer assessment and feedback”. Moreover, the 3-D model is all about letting people in the organization participate in the intervention: “Participation […] means that organization members actually participate in and thereby influence the design of their own work. […] Together, participation, understanding, and evidence can support a feeling of ‘ownership’ of the intervention which, in turn, can increase motivation” (Achterbergh & Vriens, 2019, p. 334-335).

Assessment
Achterbergh and Vriens (2019) score a “green” for this sub-variable. They talk explicitly about their metaphor for both interventions and organizations, and even reference to Morgan (1999). They show multiple intervention metaphors, which highlight a variety of views about the organization and the intervention. However, the authors of the 3-D model do no talk explicitly about the intervention paradigm, though it is fairly easy to know their intervention paradigms, based on their intervention metaphors. One danger of the intervention metaphor and paradigm of the 3-D model, is that there is not that much attention given by Achterbergh and Vriens (2019) to views which acknowledge the organization as a constellation of interests. In this way,
this view on organizing and intervening is left into the dark. However, the authors do pay attention to power as having a potential effect on interventions. Based on the above, the score for the 3-D model is calculated.

In the table below, a summary is given of the final results of both Design Thinking and the 3-D model on sub-variable 1.1.

<table>
<thead>
<tr>
<th>Sub-variable 1.1</th>
<th>Design Thinking</th>
<th>3-D model</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Description</strong></td>
<td>M: few metaphors for intervention (only painting in oil)</td>
<td>M: intervening is like sailing an unruly sea</td>
</tr>
<tr>
<td></td>
<td>Metaphor for organization: flux and transformation, culture, sensemaking, machine</td>
<td>Organization as flux and transformation, organism, brain (together the viable systems metaphor)</td>
</tr>
<tr>
<td></td>
<td>P: Functionalist and social-interpretivist</td>
<td>P: functionalist paradigm and social interpretivist</td>
</tr>
<tr>
<td><strong>Assessment</strong></td>
<td>No explicit information about the intervention metaphor and paradigm. Variety of metaphors and paradigms, which allows to see organizations and interventions from multiple perspectives. Power views are not explicitly acknowledged.</td>
<td>Explicit information about intervention metaphor, not about intervention paradigm. Variety of metaphors and paradigms, which allows to see organizations and interventions from multiple perspectives. Power views are acknowledged as having a potential effect on interventions, but organization is not seen as constellation of interests.</td>
</tr>
</tbody>
</table>

Table 26: Results of Design Thinking and the 3-D model on sub-variable 1.1

When comparing the 3-D model with Design Thinking, it becomes clear that the 3-D model scores higher on this sub-variable. This is due to the fact that the 3-D model refers explicitly to the metaphors of Morgan (1999), and thereby implicitly also substantiate what their intervention paradigm is. Remarkably, both methods do not pay a lot of attention to the power relations in organizations. This should be kept in mind when using the methods for supporting episodic interventions in organizational infrastructures.

5.2.2 Sub-variable 1.2.1: Goal

In chapter 2, sub-variable 1.2.1 was defined as “the purpose with which the intervention method is executed, the object of the intervention (the collection of interdependent parts undergoing the intervention), and the application area of the intervention (the field towards which the intervention is directed)”. The norm value of this sub-variable is that the authors have to be explicit
about the reason why, object and application areas of the method. The goal of the method should also fit with a method which supports episodic interventions in organizational infrastructures.

Description

The goal of the 3-D model is explained in the first chapter of the book *Organization Development: Designing episodic interventions in organizations* (Achterbergh & Vriens, 2019). The 3-D model’s goal is to “help understand and flexibly design episodic interventions in organizational structures” (Achterbergh & Vriens, 2019, p. 10).

To correctly understand this purpose, an explanation of episodic interventions is needed. The authors define episodic interventions as follows: “intentional, deliberate, comprehensive changes to the organization’s structure that have their own separate temporary intervention organization” (Achterbergh & Vriens, 2019, p. 6). The words “intentional” and “deliberate” mean that the intervention’s objective and process are explicit rather than implicit. “Comprehensive” means that the intervention covers a significantly big part of the organization. The “intervention organization” means that the intervention itself has an organization containing people who work together on the intervention. This intervention organization is usually established at the beginning of the intervention, and stops existing as soon as the intervention is completed.

According to Achterbergh and Vriens (2019), episodic interventions in organizational structures are designed successfully when they are designed in such a way that both the goal of the intervention and the goal in the intervention are realized. The goal of the intervention is to solve organizational problems by changing the infrastructure. Achterbergh and Vriens (2019) state that a general and a specific goal of the intervention can be distinguished. The general goal of an intervention is to contribute to the meaningful survival of the organization, as explained earlier in section 5.1, and this goal applies to all interventions. The specific goal is only applicable to a specific intervention. Examples of the specific goal are increasing the quality of work, or increasing the performance of the focal organization. The goal in the intervention is also two-fold: it consists of a functional goal and a social goal. The functional goal entails optimizing the quality of the design and the implementation of this design. However, only realizing the functional goal would result in a plan which is not realized in the organization. Therefore, the social goal should also be realized. This social goal entails the acceptance and integration of the intervention in the behaviour of the organization, which expresses itself in social practices.

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10 In appendix 3.2, the substantiation of this sub-variable about the goal of the intervention can be found.
According to Achterbergh and Vriens (2019, p. 11), the 3-D model is applicable to “episodic interventions (kind) in organizational structures (object) of organizations that currently have complex and hierarchical structures (context)”. Although the 3-D model in this book is especially applicable to the object “structures”, Achterbergh and Vriens (2019) denote that the model is also of use for objects like the organization’s technology, culture or human resources. These objects sometimes overlap with each other.

To understand this object of the intervention, the interpretation of the terms which are used by Achterbergh and Vriens (2019) must be explained. The first term, episodic interventions, is already defined in this section.

The second term, organizational structures, is seen as “the way tasks are defined and related into a network of tasks” (Achterbergh & Vriens, 2019, p. 46). Organizations are seen as social systems which conduct experiments. First, organizations are described as social systems, since a) they deliver a contribution to the well-being of societal members and b) they are a system where organizational members have interlocking interactions with each other (Giddens, 1979; Luhmann, 1984). Second, organizations consist of experimental activities, because there is a continuous process of formulating, testing, and reformulating of functional and social goals, which are merely hypotheses. These activities make sure that the organization can participate in meaningful survival.

The last term, complex and hierarchical structures, is explained in chapter 3 from the book of Achterbergh and Vriens (2019). In this chapter, the authors suggest that complex and hierarchical structures are those structures which have high parameter values. This means that these structures have a high value on the seven parameters of De Sitter (1994), which causes an increased likelihood of the occurrence of disturbances, and a decreased regulatory capacity.

The application area of the 3-D model is not limited to a certain industry or profession. Although certain application areas such as healthcare, a butcher’s business, and construction work are used as an example, Achterbergh and Vriens (2019) do not talk about a specific area in which the 3-D model should be applied. Therefore, the application area of the 3-D model includes all professions and industries where episodic interventions in organizational structures exist, of organizations that have a hierarchical and complex structure.

Assessment
The 3-D model scores “green” on this sub-variable. Achterbergh and Vriens (2019) explicitly tell what the reason why, object and application area of the 3-D model are, and explain the words they use to describe this reason why, object and application area.

With regard to the content of the goal, this fits the goal which someone would expect from a method which supports episodic interventions in organizational infrastructures.

Moreover, they state that the 3-D model’s interventions at least are geared towards organizational structures, which is one part of the infrastructure. However, they do not state that the 3-D model is aimed at the whole infrastructure of an organization, including HR and technology.

Achterbergh and Vriens (2019) explicitly state that the method is not created for a specific field, and thereby keep the application area of the method open. Moreover, they give some concrete examples of the fields in which the 3-D model could be applied. Perhaps more information about the application area becomes clear when the method is longer known amongst scientists and practitioners.

This explicitness and appropriateness of the content results in the score which was given.

A summary of the final results of both Design Thinking and the 3-D model on sub-variable 1.2.1 is given in the table below.

<table>
<thead>
<tr>
<th>1.2.1</th>
<th><strong>Design Thinking</strong></th>
<th><strong>3-D model</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Description</strong></td>
<td>Explicitly mentioned</td>
<td>Explicitly mentioned</td>
</tr>
<tr>
<td>Reason why: Solving complex (wicked, paradoxical) problems, innovation</td>
<td>Reason why: Help understand and flexibly design episodic interventions in organizational structures</td>
<td></td>
</tr>
<tr>
<td>Object: Organizations, Physical objects/products, services, systems, processes</td>
<td>Object: Episodic interventions (kind) in organizational structures (object) of organizations that currently have complex and hierarchical structures (context)</td>
<td></td>
</tr>
<tr>
<td>Broad application area: First engineering, industrial design and architecture. Later business, education, IT and medicine</td>
<td>Application area: Not limited to certain industry or profession</td>
<td></td>
</tr>
<tr>
<td>Examples: healthcare, butcher’s business, construction work</td>
<td>Examples: healthcare, butcher’s business, construction work</td>
<td></td>
</tr>
<tr>
<td><strong>Assessment</strong></td>
<td>The reason why, object and application area is explicitly mentioned by the authors, and the content is fairly consistent among the authors. The reason why, object and application area is left open and broad enough to fit with a method supporting episodic interventions in organizational infrastructures, although it not explicitly fits this kind of methods.</td>
<td>Explicitly mentioned and explained. The content of the goal and object fits with a method supporting episodic interventions in organizational infrastructures, and the application area is broad enough to fit to this.</td>
</tr>
</tbody>
</table>

*Table 27: Results of Design Thinking and the 3-D model on sub-variable 1.2.1*
When looking at the table above, the conclusion is that the 3-D model and Design Thinking both score high on this sub-variable. Both methods are very explicit about the goal, but the goal of the 3-D model is slightly more suitable for a method which supports episodic interventions in organizational infrastructures. However, since Design Thinking has an open goal, it is not the case that its content explicitly not fits with these kinds of methods. Therefore, both Design Thinking and the 3-D model receive a green score, although the 3-D model fits better, content wise.

5.2.3 Sub-variable 1.2.2: Theoretical and conceptual substantiation of interventions

In chapter 2, sub-variable 1.2.2 was defined as: “the extent to which an author makes explicit the theories and concepts from other authors on which his/her intervention method is based, or the extent to which an author explains a new theory or concept about interventions which is brought forward by the method”. The norm of this sub-variable concerning the theoretical and conceptual substantiation of interventions is that both methods should sufficiently base their views on academic theories and concepts of other authors, or come with an extensive description of a new theory or concept concerning interventions they have created.

Description

Achterbergh and Vriens (2019) base their statements about interventions on three academic authors who are known for their contributions to the scientific field of Organizational Change: Weick and Quinn (1999), Schein (1969), and Luhmann (1984). Schein and Luhmann could be seen as authors who adhere the social systems theory, which has a large influence on the intervention theory of the 3-D model.

The first authors on which Achterbergh and Vriens (2019) base their method are Weick and Quinn (1999). The article of these authors is mainly used for explaining the distinction between episodic and continuous interventions, which will be explained further in section 5.2.5. Since the 3-D model is geared towards episodic interventions, the article of Weick and Quinn (1999) forms important literature on which the core ideas of the 3-D model are based.

Schein (1969) is the second important author to which Achterbergh and Vriens (2019) refer when talking about interventions. In fact, the whole social dimension of the 3-D model is

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11 The substantiation of this sub-variable about the theoretical and conceptual substantiation of interventions can be found in appendix 3.3.
based on the three-stage model of planned change which was developed by Edgar Schein. The social dimension consists of three goals, which will be explained in section 5.2.6 about the intervention process. The motivation goal of the social dimension relates to the unfreeze stage of Schein, the adoption goal relates to the change phase, and the integration goal relates to the freeze stage (Achterbergh & Vriens, 2019). Because Schein (1969) is the source of inspiration of one of the dimensions of the 3-D model, his theory is considered to be an important influence on the method.

The third academic author who helps to substantiate the statements of Achterbergh and Vriens (2019) about interventions is Luhmann (1984). Just like Luhmann, Achterbergh and Vriens (2019) see organizations as social systems, who produce interactions against the background of interaction premises. As such, Luhmann’s theory is used to explain why a social dimension which changes basic assumptions of organization members is needed in an intervention method like the 3-D model. Since Luhmann’s theory (1984) forms the foundation on which the social dimension is built, this theory is deemed influential for the 3-D model.

Besides the theories and concepts mentioned above, Achterbergh and Vriens (2019) also come with their own theories and concepts concerning interventions in organizations. The functional, social and infrastructural dimension which they propose in their 3-D model are partly based on insights from academic authors, but are partly new insights from the authors themselves. An example of this are the specific goals of the social dimension, and the process steps which are needed to get to these goals (see also section 5.2.6 about the process of the intervention). Achterbergh and Vriens (2019) not only explain how these steps should be executed, but also tell why each step is important to reach the social goals, and in the end, the goal of the intervention. Moreover, the relationship between the process steps of the different dimensions – which forms a new theory that is created by the authors themselves – is made explicit and is clarified. So, the authors of the 3-D model do not only use scientific works to substantiate their statements about interventions, but also explain their own concepts and theories in detail.

Assessment

For sub-variable 1.2.2 about the theoretical and conceptual substantiation of intervention, the 3-D model receives a score of “green”. Achterbergh and Vriens (2019) mention explicitly on which scientific theories and concepts their statements about interventions are based. Moreover, the authors of the 3-D model also create their own theories and concepts concerning interven-
tions. These theories and concepts, and the relationships between them, are thoroughly explained by Achterbergh and Vriens (2019). As such, the 3-D model receives a “green” score on this sub-variable.

In the table below, a summary is given of the final results of both Design Thinking and the 3-D model on sub-variable 1.2.2.

<table>
<thead>
<tr>
<th>1.2.2</th>
<th>Design Thinking</th>
<th>3-D model</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Description</strong></td>
<td>Explicitly mentioned theories and concepts of other authors, such as utility theory, although rather vague and inconsistent among authors. Simon’s theory (1969) seen as influential. Own theories and concepts about interventions are introduced, but not fully explained.</td>
<td>Weick and Quinn (1999): episodic versus continuous interventions. Schein (1969): goals of the social dimension. Luhmann (1984): organizations as social systems, background foundation for social dimension. Own theories and concepts about interventions and relationships between them are fully explained.</td>
</tr>
<tr>
<td><strong>Assessment</strong></td>
<td>Explicit substantiation of theories and concepts surrounding interventions is there, but it is vague, inconsistent, and not always fully explained.</td>
<td>Explicit substantiation of theories and concepts surrounding interventions is there, both for theories and concepts of other authors, and for own theories and concepts.</td>
</tr>
</tbody>
</table>

*Table 28: Results of Design Thinking and the 3-D model on sub-variable 1.2.2*

When looking at the table above, it appears that the 3-D model scores higher than Design Thinking on sub-variable 1.2.2. This is due to the fact that in the literature about the 3-D model, the concepts and theories from other academic authors are explained extensively. Moreover, in contrast to Design Thinking, the 3-D model has its own new theories and concepts which are substantiated sufficiently, by telling why certain elements of these theories and concepts are important, and explaining how they relate to each other.

5.2.4 Sub-variable 1.2.3: Social aspect

In the chapter 2, the social aspect of the intervention was defined as “the extent to which an intervention method takes the integration, participation and adoption of the intervention, and the interests of stakeholders of the intervention into account”. The norm of this sub-variable is reached when the method takes the integration, adoption and interests of stakeholders of the intervention into account sufficiently.
The social aspect is largely represented in the method of the 3-D model. The fact that Achterbergh and Vriens (2019) chose to name one of the three dimensions the “social dimension” already gives away that the social aspect of intervention is of great importance for them. Moreover, the organization itself is seen by the authors as a social system, consisting of interactions and interaction premises between people.

The social dimension’s purpose is to motivate the people who are affected by the intervention to adopt and integrate behaviour that will help to make the intervention a success. In other words, the social dimension secures that those affected by the intervention accept and integrate the proposed change. Achterbergh and Vriens (2019) emphasize that the goals of the functional dimension are not enough to successfully implement an intervention. When the affected people in the organization are not aware that their current behaviour is problematic, and are not able to change this problematic behaviour, the intervention will never be implemented in the organization. To successfully implement the intervention, a variety goals and activities to reach these goals is specified by Achterbergh and Vriens (2019), consisting of creating motivation, creating adoption, and creation integration. These goals and activities are explained in more detail in section 5.2.6, in the sub-variable about the process of the intervention.

 Whereas the social dimension is geared towards the people who are affected by the intervention, the infrastructural dimension is (amongst other things) about the people who are part of the intervention organization. Since the intervention organization is seen by Achterbergh and Vriens (2019) as a distinct organization, they also do suggestions for the HR in this intervention organization. For instance, the authors state that human resources should be selected, trained and motivated. Moreover, human resources support measures must be selected that facilitate the people in the intervention organization.

 Besides emphasizing the social aspect of an intervention in the social dimension and infrastructural dimension, Achterbergh and Vriens (2019) also stress the importance of broad participation in the intervention. No one is excluded from participation: “In ‘our’ intervention organization, in principle, all organization members and other relevant parties can participate” (Achterbergh & Vriens, 2019, p. 15).

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12 The extensive substantiation of this sub-variable about the social aspect of the intervention can be found in appendix 3.4.
Assessment

The 3-D model scores no less than “green” on the sub-variable regarding the social aspect of the intervention. The 3-D model consists of a social dimension, which pays attention to all stakeholders which are affected by the intervention. The infrastructural dimension consists of suggestions about the HR of the team who is responsible for the intervention. Moreover, Achterbergh and Vriens (2019) stress the importance of including all organization members and other parties in the intervention organization. Because the authors of the 3-D model do not only emphasize the importance of the social aspect of intervention, but also suggest how this social aspect is successfully reached, the method receives the maximum score.

In table 29, a summary is given of the final results of both Design Thinking and the 3-D model on sub-variable 1.2.3.

<table>
<thead>
<tr>
<th>1.2.3</th>
<th>Design Thinking</th>
<th>3-D model</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Description</strong></td>
<td>Human-centered method, centrality of the end-user</td>
<td>Organization as a social system</td>
</tr>
<tr>
<td></td>
<td>Collaboration in design team</td>
<td>Social dimension: motivation, adoption, integration</td>
</tr>
<tr>
<td></td>
<td>Less attention for integrating and adopting change and broad participation of stakeholders</td>
<td>HR of intervention organization</td>
</tr>
<tr>
<td></td>
<td>Broad participation</td>
<td>Broad participation</td>
</tr>
<tr>
<td><strong>Assessment</strong></td>
<td>Pays attention to social aspect by putting end-user central, and focusing of collaboration in team. End-user should be included in whole process, from problem definition to implementation. However, not enough attention is paid to integration, adoption, and including broad variety of stakeholders.</td>
<td>Pays sufficient attention to the integration, adoption and including broad variety of stakeholder in the social dimension. Moreover, the way in which the social aspect is reached is made clear.</td>
</tr>
</tbody>
</table>

*Table 29: Results of Design Thinking and the 3-D model on sub-variable 1.2.3*

When comparing the score of Design Thinking to that of the 3-D model, it becomes clear that the 3-D model pays more attention to the social aspect of the intervention than Design Thinking. This difference is due to the fact that whereas the 3-D model pays attention to the integration of change for all stakeholders, and a broad participation of relevant parties in the intervention, the Design Thinking does not cover these subjects sufficiently.
5.2.5 Sub-variable 1.2.4: Type of change

The sub-variable about the type of change was defined in chapter 2 as “whether an intervention method focuses on episodic change, continuous change or on both”. The norm value for this sub-variable is that it should at least be explicit what type of change the method is focusing on. Moreover, ideally the method would focus specifically on episodic change.

**Description**

In their book, Achterbergh and Vriens (2019) speak explicitly about Weick and Quinn’s theory (1999) concerning the two types of organizational change. Achterbergh and Vriens point out that instead of opposing episodic change to continuous change, like Weick and Quinn (1999) did, they sketch a contrast between episodic interventions and continuous interventions, seeing them as two modes of organizational change.

In their book, it becomes clear that the two authors believe in viewing organizations as a continuous transformation: “[…] because organizations as social systems are a flux, they cannot be ‘inert’, cannot be ‘frozen’, and therefore do not need to be ‘unfrozen’” (Achterbergh & Vriens, 2019, p. 12). This impacts their view on interventions in organizations: “[…] interventions are processes of continuous trial and error, of muddling through” (Achterbergh & Vriens, 2019, p. 14).

Although Achterbergh and Vriens (2019) seem to view organizational change from a “continuous perspective” here, they also state that the interventions of the 3-D model are intentional and deliberate, which are two characteristics of episodic change. They therefore do not take one of the two types of change as only truth, but instead emphasize on both episodic interventions and continuous interventions as a mode of change. However, the 3-D model itself is only about episodic interventions: “It is the purpose of the 3-D model to help understand and flexibly design episodic interventions in organizational structures” (Achterbergh & Vriens, 2019, p. 10).

**Assessment**

For the sub-variable about the intervention’s type of change, the 3-D model receives the maximum score of “green”. Achterbergh and Vriens (2019) explicitly refer to the distinction between continuous and episodic change by Weick and Quinn (1999), and explain how they interpret

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13 The results of the type of change of the 3-D model are substantiated in appendix 3.5.
this distinction. Moreover, the 3-D model is explicitly created for episodic interventions. These two facts result in the score that the 3-D model received.

In the table below, a summary is given of the final results of both Design Thinking and the 3-D model on sub-variable 1.2.4.

<table>
<thead>
<tr>
<th>1.2.4</th>
<th>Design Thinking</th>
<th>3-D model</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Description</strong></td>
<td>No authors mention episodic-continuous change explicitly, three authors mention any type of change explicitly Both episodic and continuous changes are needed DT created specifically for neither episodic change nor continuous change</td>
<td>Authors mention episodic-continuous change explicitly Both episodic and continuous changes are needed 3-D model created for episodic interventions</td>
</tr>
<tr>
<td><strong>Assessment</strong></td>
<td>The type of change is not very explicitly mentioned, and the method is not specifically geared towards episodic interventions</td>
<td>The type of change is explicitly mentioned by the authors, and the 3-D model is specifically geared towards episodic interventions</td>
</tr>
</tbody>
</table>

*Table 30: Results of Design Thinking and the 3-D model on sub-variable 1.2.4*

From the table above, it appears that the 3-D model scores significantly better than Design Thinking with regard to this sub-variable. This is the result from the fact that the literature about the 3-D model (1) more explicitly refers to the distinction between episodic and continuous change, and (2) is created with the purpose of episodic interventions only.

5.2.6 Sub-variable 1.3.1: Process

An intervention process was defined in chapter 2 as a specific sequence of steps that must be taken to reach the goal of the intervention. This sub-variable’s norm is that the intervention process should be explicitly explained by the authors of Design Thinking, and it must be made plausible that the activities in the process match the purpose of the intervention.

**Description**

For the 3-D model, multiple processes are described which should be executed. Achterbergh and Vriens (2019) define a process as a transformation which changes a certain begin state to an end state.

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14 The substantiation of this sub-variable can be found in appendix 3.6.
The first process that is introduced is about the four activities which all types of organizations have to complete successfully, in order to be able to meaningfully survive. These activities are 1) performing primary processes, which are the transformation processes to create products and services, 2) performing operational regulation, which is dealing with any disturbances that occur in these primary processes, 3) performing regulation by design, which is the adaptation of the organizational conditions (infrastructure) in such a way that all four activities can be performed successfully, and 4) performing strategic regulation, which is the development of goals which are related to the primary processes. Achterbergh and Vriens (2019) continue to split out the specific steps for performing strategic regulation, regulation by design, and operational regulation. All of these three activities can be seen as “experimental activities”, since they follow a continuous process of formulating, testing, and reformulating hypotheses. For example, strategic regulation includes formulating a set of goals, testing these goals, keeps the goals when the test shows that the goals are valued, and reformulating goals if the test shows that keeping them will threaten meaningful survival of the organization.

The second, third and fourth process which are explained by Achterbergh and Vriens (2019) form the core of the 3-D model: they represent the activities and steps that have to be undertaken to realize the functional, social and infrastructural goals of the 3-D model. The most extensive process is that of the functional dimension, which is split up into four activities. The first activity, diagnosis, is about identifying the problem at hand, finding the causes of these problems, and formulating the solution space. The second activity, design, entails actually finding an organizational structure which is appropriate for dealing with the problems and the causes of these problems. In the implementation phase, the third activity, the structure of the previous step is realized in the organization. The fourth activity, evaluation, is about assessing if the problems which were identified in the diagnosis are solved due to the new structure. The social dimension of the 3-D model consists of three goals which could be translated in three activities (Achterbergh & Vriens, 2019). The first activity is to create motivation among organization members to leave their current behaviour and accept the new behaviour which is proposed by the episodic intervention. In the second activity, adoption is being created. This means that the organization members out of free will show commitment to the new behaviour which helps to achieve a better structure. The third activity, creating integration, is when organization member permanently integrate the new behaviour into their repertoires, so the new structure is reproduced.
The infrastructural dimension entails designing the infrastructure of the intervention organization. However, before it is possible to do this, the gap between the current status and the desired status with regard to the functional and social goals of the intervention should be determined. After determining this gap, there should be a reflection on the what topics should be addressed to close the former gap, and how and by whom this should be done. Thereafter, the infrastructure of the intervention organization can be designed. This means that an intervention structure has to be designed, intervention technology or techniques should be selected, and the human resources and HR support measure should be selected.

Notice that the former steps of the three dimensions are more specifically described by Achterbergh and Vriens (2019). The summary of all intervention process steps and sub-steps can be found in the table in appendix 4.

Achterbergh and Vriens (2019) make it plausible that the former process steps lead to their intervention goal, which is to help understand and flexibly design episodic interventions in organizational structures. The authors argue explicitly that the combination of the steps of the functional dimension, social dimension and infrastructural dimension lead to a good episodic intervention. The functional process steps ensure that an organizational structure is designed and implemented which is able to realize the goal of the intervention. The social process steps facilitate that this well-designed structure is actually picked up on by the organization members, and implemented in their behaviour. Lastly, the infrastructural process steps lead to a good infrastructure of the intervention organization, which ensures that the process of intervening itself is well organized. Together, these three dimensions ensure an appropriate episodic intervention in organizational structures.

**Assessment**

The 3-D model score “green” on the sub-variable of the intervention process. As becomes clear from the information above, Achterbergh and Vriens (2019) are very detailed in describing which steps should be undertaken when following the 3-D model. Moreover, they explicitly substantiate how and why these exact steps realize the goal of the intervention. This makes the 3-D model a good method for supporting episodic interventions in organizational infrastructures, since the reader is able to follow the process steps that realize the intervention goal.

A summary of the final results of both Design Thinking and the 3-D model on sub-variable 1.3.1 is given in the table below.
### 1.3.1 Design Thinking and the 3-D model

<table>
<thead>
<tr>
<th>Description</th>
<th>Design Thinking</th>
<th>3-D model</th>
</tr>
</thead>
<tbody>
<tr>
<td>Iterative cycles</td>
<td>Performing primary processes, operational regulation, regulation by design and strategic regulation</td>
<td></td>
</tr>
<tr>
<td>Problem definition</td>
<td>Functional process: diagnosis, design, implementation, evaluation</td>
<td></td>
</tr>
<tr>
<td>Prototyping</td>
<td>Social process: motivation, adoption, integration</td>
<td></td>
</tr>
<tr>
<td>Representation and visualization</td>
<td>Infrastructural process: what, how, who, structure, technology, HR</td>
<td></td>
</tr>
</tbody>
</table>

When comparing the two methods, it appears that Design Thinking as well as the 3-D model receive the highest score on this sub-variable. This is due to the fact that both methods mention and explain the intervention process explicitly. Moreover, for both methods it is plausible that the explained steps lead to the intervention goal, although the 3-D model clarifies this relation more explicitly and thoroughly than Design Thinking.

### 5.2.7 Sub-variable 1.3.2: Configuration

The configuration of the intervention organization was explained in chapter 2 as “the way in which the intervention process is organized”. The configuration of the intervention organization could be an activity (including the division of tasks, strategy, personnel policy, technology and culture), and a result of this configuring activity”. This sub-variable’s norm is that the authors should at least make explicit how the configuration of the intervention organization should be executed, and/or what the result of the configuration of the intervention organization is. Moreover, this configuration should fit with the process of the intervention, and lead to the goal of the intervention.

**Description**

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15 In appendix 3.7, the substantiation of this sub-variable about the configuration of the intervention organization can be found.
The 3-D model spends one of its dimensions, the infrastructural dimension, on the configuration of the intervention organization. This dimension shows how a temporary intervention organization should be build which is responsible for making the episodic intervention successful (Achterbergh & Vriens, 2019). Since the intervention organization is a distinct organization on top of the organization undergoing the intervention, this intervention organization has its own infrastructure. According to Achterbergh and Vriens (2019), an appropriate intervention structure should be chosen, which has a division of intervention tasks that enables the organization to realize and adapt functional and social goals. Moreover, intervention technology should be chosen, which supports a good performance of the intervention tasks. Lastly, human resources should be selected which have sufficient knowledge, skills and motivation to perform the intervention tasks correctly.

To create an appropriate intervention organization infrastructure, Achterbergh and Vriens (2019) created an intervention organization, which is to be found in section 5.2.6 about sub-variable 1.3.1. In this process, the authors tell step by step how the infrastructural dimension can be completed successfully.

It is striking that the authors give in particular instructions about the process of configuring the intervention. Besides the fact that Achterbergh and Vriens (2019) state that the human resources should be knowledgeable, skilled and motivated, they do not prescribe a priori how the intervention team should exactly look. The same goes for the technology and structure; no specific technologies or structures are recommended, only the way of configuring them is described. In other words, the authors of the 3-D model give more advice on the way of organizing the configuration of the intervention organization, than about the result of this configuring process.

Assessment

The 3-D model receives a score of “green” for sub-variable 1.3.2 about the configuration of the intervention organization. Achterbergh and Vriens (2019) are explicit about how the intervention should be configured. From the above, it appeared that they are especially explicit about configuring as an activity, though they say not that much about the configuration as a result that emerges because of the configuring activity. Nevertheless, the explicitness of the authors makes sure that readers know how they should configure the intervention, and yet they receive enough freedom to arrive at multiple configuration results.
A summary of the final results of both Design Thinking and the 3-D model on sub-variable 1.3.2 is given in the table below.

<table>
<thead>
<tr>
<th>1.3.2</th>
<th>Design Thinking</th>
<th>3-D model</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Description</strong></td>
<td>Human-centered approach (Ad hoc) project basis Diverse and interdisciplinary teams</td>
<td>Infrastructural dimension: HR, technology, and structure of the intervention organization</td>
</tr>
<tr>
<td><strong>Assessment</strong></td>
<td>Explicitly mentioned by authors. More explicit about configuring as activity than as result, because of the openness of the method.</td>
<td>Explicitly mentioned by authors. More explicit about configuring as activity than as result, because of the openness of the method.</td>
</tr>
</tbody>
</table>

Table 32: Results of Design Thinking and the 3-D model on sub-variable 1.3.2

Design Thinking and the 3-D model both score good on this sub-variable. Remarkably, both of the methods focus more on the activity of configuring the intervention than on the result of this activity. This is probably due to their openness with regard to the way in which their methods are used; they don’t want to prescribe too much, since this would undermine the freedom of the reader to apply the method in a variety of situations.

5.2.8 Sub-variable 1.3.3: Instrument

Sub-variable 1.3.3 about the instrument of the intervention was defined as “a toolbox which consists of a set of techniques, rules, and/or procedures, and which is put forward by an intervention method for the purpose of guiding the process in the proposed configuration of the intervention, in such a way that the goal of the intervention can be reached”. The norm for this sub-variable is that the method should at least take into account the possibility of using instruments, and be explicit about this possibility.

**Description**

Achterbergh and Vriens (2019) provide no description of specific instruments which always should be used for episodic interventions. Rather, their opinion is that the intervention team can choose among a variety of tools which can be classified by the goals and activities that the tools may serve. The term “intervention technology” is presented for all “tools and techniques that

16 The substantiation of this sub-variable about the instruments of the 3-D model is to be found in appendix 3.8.
can be selected to support the performance of intervention activities by the human resources that are involved in the intervention” (Achterbergh & Vriens, 2019, p. 326). Examples of intervention technology are games that help integrating the new work in the minds of those who have to do this work, discussion fora where the members of intervention teams can learn from each other’s experiences during the intervention, etc.

As stated above, the intervention technologies can be classified based on activities and goals served. Intervention activities are divided between operational and regulatory intervention activities. Regulatory activities are related to operational, design and strategic regulation. Operational activities can be divided into activities to realize functional goals – diagnosis, design, implementation and evaluation – and activities to realize social goals – motivation, adoption, integration and creating/maintaining change relationships. Based on this classification, there are three intervention technology types to be distinguished. First, dedicated technologies serve one goal or activity. Second, cross-functional technologies are able to serve multiple goals and activities. Third, enabling technologies are only indirectly related to a goal or activity, since they provide general conditions to successfully execute certain activities.

Instead of describing characteristics about some intervention instruments, Achterbergh and Vriens (2019) provide four heuristic principles which can be applied to all intervention technologies. The first principles states that the tools and techniques should only be used in interventions with the purpose of supporting intervention activities. Sometimes, the choice of intervention technologies is guided by organizational politics instead of its intended goal, and this should be avoided. The second principle states that cross-functional techniques are to be developed when the intervention team wants to exploit possible affinities between the social and functional goals of operational activities. In the third principle it becomes clear that the third type of intervention technologies, the broad enabling tools and techniques, should be designed via a trial and error process or step-by-step process. The fourth and last principle gives guidance when problems arise with regard to what a specific technology requires from its users. If the users of the technology have not got the knowledge, skills or motivation to use the intervention technology properly, the technology or HR should be adapted, and not the functional or social goals.

Although Achterbergh and Vriens (2019) state that a range of different techniques can be used for interventions, they do only a few suggestions, such as group discussions, surveys, observation and document analysis.
Assessment

The 3-D model receives a “green” score with regard to the instrument of the intervention. Although Achterbergh and Vriens (2019) provide no specific instruments for the 3-D model, they describe instructions about how to find the right instrument in certain intervention situations. The explicit instruction shows that the authors take into account that there is a variety of instruments which could help with intervening. The instructions of the author give the reader freedom to choose their own instruments, yet help with finding the right instrument. However, because Achterbergh and Vriens (2019) provide almost no instruments themselves, the reader should have or gain information about the instruments in the intervention field.

A summary of the final results of both Design Thinking and the 3-D model on sub-variable 1.3.3 is given in the table below.

<table>
<thead>
<tr>
<th>1.3.3</th>
<th>Design Thinking</th>
<th>3-D model</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Description</strong></td>
<td>Instrument categories:</td>
<td>No description of specific instruments</td>
</tr>
<tr>
<td></td>
<td>Visualization and representation</td>
<td>Operational intervention activities: (1) with functional goals and (2) with social goals.</td>
</tr>
<tr>
<td></td>
<td>Identifying what the stakeholders want and need</td>
<td>Regulatory activities: related to operational, design and strategic regulation.</td>
</tr>
<tr>
<td></td>
<td>Understanding the problem at hand</td>
<td>Three intervention technology types: (1) dedicated technologies – serve one goal/activity, (2) cross-functional technologies – serve multiple goals and activities, and (3) enabling technologies – only indirectly related to a goal/activity, since they provide general conditions to successfully execute activities.</td>
</tr>
<tr>
<td></td>
<td>Coming up with new ideas</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Choosing between alternative ideas and design options, or improving them</td>
<td></td>
</tr>
<tr>
<td><strong>Assessment</strong></td>
<td>A variety of instruments with different purposes is provided and explicitly explained. However, there are little instructions about how and when to use these instruments.</td>
<td>No specific instruments are proposed, but instructions are provided on how to choose an appropriate instrument.</td>
</tr>
</tbody>
</table>

Table 33: Results of Design Thinking and the 3-D model on sub-variable 1.3.3

When comparing the assessment of Design Thinking and the 3-D model, both appear to have received a good score. Nevertheless, their assessment differs, since the methods seem to provide the opposite of each other with regard to this sub-variable. Whereas Design Thinking gives a lot of instruments but without many instructions, the 3-D model shows only the instruction without giving many intervention instruments.
5.3 Key variable 2: Infrastructure

5.3.1 Sub-variable 2.1.1: Theoretical and conceptual substantiation of the infrastructural object

In chapter 2, the definition which was given of sub-variable 2.1.1 about the theoretical and conceptual substantiation of the infrastructural object was as follows: “the extent to which an author makes explicit the theories and concepts from other authors on which his/her views about the infrastructure are based, or the extent to which an author explains a new theory or concept about the infrastructure as an object which is brought forward by the method”. The norm of this sub-variable is that both methods should make explicit on which theories or concepts their views with regard to the three aspects of infrastructures – HR, technology, and structure – are based, and/or define the own theories they have. The methods should be sufficiently based on at least one theory, or come with an extensive description of a new theory or concept they have created.

Description

The infrastructural statements which are made in the book about the 3-D model are largely based on cybernetics theory. Four authors who describe concepts and theories with regard to the infrastructure have influenced Achterbergh and Vriens (2019) the most: De Sitter (1994), Ashby (1958), Luhmann (1984), and Beer (1979). These authors largely come from the field of Organization Design, or at least wrote one or more scientific works about the organizational infrastructure, and especially about the structural part of this infrastructure.

The first author which is used by Achterbergh and Vriens (2019) to substantiate their findings about the infrastructure, is De Sitter (1994). His design theory is used to link the design parameters of the organizational structure (which will be explained in section 5.3.3) to the behaviour of the organization (the essential variables, which will be explained in section 5.3.2). Moreover, Achterbergh and Vriens (2019) adopt De Sitter’s opinion that an adequate structure should have the lowest possible design parameter values. The design parameters, essential variables and the relationship between them form an important core of the 3-D model, and are substantiated by being based on a scientific design theory.

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17 In appendix 3.9, the results for sub-variable 2.1.1 are substantiated.
Ashby (1958) is the second author who is influential for the substantiation of the infrastructural object of the 3-D model. In line with Ashby’s cybernetics theory (1958), the structures which are designed with the 3-D model should be designed in such a way that as little disturbances as possible do emerge, which is called attenuation, or have sufficient built-in regulatory potential to deal with the remaining disturbances and their effects, which is called amplification. This is the key idea of the 3-D model, and guides the process and configuration which is proposed by this model. Moreover, the theory of De Sitter (1994) is partly based on Ashby’s ideas.

The third author who’s theory substantiates the statements about the organizational infrastructure, is Luhmann (1984). According to his theory, interaction premises structure the flow of interactions, because they point at a set of possible next interactions from which one interaction is selected. This process forms the core of the production process, which is structured by these decision premises, and influences the way in which Achterbergh and Vriens (2019) have created their functional and social dimension of the 3-D model.

Beer (1979) is the fourth author who guides how the 3-D model is constructed with regard to the organizational infrastructure. Achterbergh and Vriens (2019) derive design heuristics for this infrastructure from the theory of Beer (1979). For example, the order in which the production structure should be designed first, and the control structure should be designed second, is a design heuristic which originates from his theory. According to Beer (1979), the reason for this design order, is that one should first start with designing the structure in such a way that the number of disturbances is minimal (attenuation), after which the required regulatory potential in the control structure can be implemented, so the leftover disturbances can be dealt with (amplification).

Besides being explicit about the scientific theories on which the statements about the organizational infrastructures are based, Achterbergh and Vriens (2019) also clarify their new theories and concepts surrounding this infrastructure. For example, chapter 3 in their book is completely devoted to explaining the structure of organizations. Their views are largely based on the work of academic authors, but when a new relationship between different theories is created by Achterbergh and Vriens (2019), this is substantiated and explained by them. It should be noted, however, that this substantiation is especially done for the organizational structure, and not that much for the statements they make about human resources and technology.

It should be noted that both the theories and concepts of other authors, and those of Achterbergh and Vriens (2019) themselves, are in particular about the organizational structure, and not that much about human resources and technology. This is logical, since the goal of the
3-D model is to help support those episodic interventions that are geared towards changing the organizational structure, and not the whole infrastructure.

**Assessment**

Achterbergh and Vriens (2019) receive a score of “orange” for sub-variable 2.1.1 about the substantiation of the infrastructure as an object for the intervention. As stated above, the authors explicitly have based their statements about the infrastructure on the work of several academic authors. Moreover, their own theories and concepts about this infrastructure are explained thoroughly. It must be noted, however, that this substantiation is especially done with regard to the organizational structure, and not that much for theories and concepts regarding human resources or technology. The consequence of this is that readers who want to the 3-D model to intervene in the whole infrastructure, should search for other theories and methods that provide theories and concepts about HR and technology. Therefore, the authors receive a score of “orange” on this sub-variable.

The results of the 3-D model on sub-variable 2.1.1 are summarized in table 34 below.

<table>
<thead>
<tr>
<th>2.1.1</th>
<th>Design Thinking</th>
<th>3-D model</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Assessment</strong></td>
<td>Disadvantage: no explicitly mentioned theoretical and conceptual substantiation of the infrastructural object. So, reader should obtain specific design theories and methods, depending on the intervention’s object. Advantage: the openness of the method allows using other methods and theories which provide this substantiation.</td>
<td>The theories and concepts concerning the organizational infrastructure are substantiated by either using the work from academic authors, or explaining their own new theories and concepts. This is done mostly for the organizational structure, and less for human resources and technology. So, reader should obtain specific design theories and methods about HR and technology.</td>
</tr>
</tbody>
</table>

*Table 34: Results of Design Thinking and the 3-D model on sub-variable 2.1.1*
When comparing Design Thinking and the 3-D model with regard to their assessment, both methods score “orange” on sub-variable 2.1.1. This can be explained by the fact that the 3-D model, in contradiction to Design Thinking, substantiates their statements about the organizational structure, but does not provide theories and concepts about HR and technology. And, since Design Thinking has no statements about the infrastructure, these statements are also not substantiated by the authors of this method. As a result, for both methods, the reader should search for additional theories and methods which provide substantiated theories and concepts about the whole infrastructure.

5.3.2 Sub-variable 2.1.2: Essential variables
In chapter 2, the sub-variable about essential variables was defined as “variables which should be kept between certain norms to reach the goal(s) of the organization”. The norm of this variable is that when talking about infrastructures, the essential variables of all three aspects of these infrastructures should be identified and explained. Moreover, norm values of these essential variables should be clear.

Description
The essential variables of Achterbergh and Vriens (2019) are based on the essential variables of De Sitter (1994).

The first essential variable is the quality of organization, which is the potential of the organization to realize and adapt the contribution of the organization to society in a manner that is both efficient and effective. This entails criteria of flexibility, control over order realization, and potential for innovation (De Sitter, 1994). The norm of flexibility is reached when there are short production cycle times, sufficient product variations, and a sufficient product mix. When there is a reliable production time, reliable production, and effective quality control, the norm of control over order realization is reached. Lastly, the potential for innovation reaches its norm when there is a strategic product development, and there is a short innovation time (De Sitter, 1994).

The second essential variable is the quality of work, which is about the extent of meaningfulness of jobs in an organization. This essential variable consists of criteria a low level of absenteeism and personnel turnover (De Sitter, 1994). This norm is reached when there are

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18 In appendix 3.10, the results for sub-variable 2.1.2 are substantiated.
sufficient opportunities to (1) be involved, (2) learns, and (3) develop controllable stress con-
ditions.

Every organization should meet the former criteria and their norms to be able to survive, ac-
cording to Achterbergh and Vriens (2019). It is important to note that these essential variables
are based on De Sitter (1994), who created his theory for changing the organizational structure,
and not specifically for changing HR and technology. Therefore, the essential variables are
especially geared towards the organizational structure, in a lesser extent towards HR, and in the
least extent towards technology.

Assessment
The 3-D model receives a score of “orange” with regard to the essential variables. Achterbergh
and Vriens (2019) are very specific about the essential variables of their method, and substan-
tiate their essential variables by basing them upon the theory of an organizational design re-
searcher, De Sitter. They do not only explain what the essential variables entail, they also give
more specific norms which provide the reader with a good sense of when a certain essential
variable is sufficiently high or low. This provides the reader with a clear picture of the essential
variables that are important to measure when designing an episodic intervention in an organi-
zational structure. However, the essential variables are especially created for changing the or-
ganizational structure, which causes the essential variables to be not sufficiently geared towards
human resources and technology. The result of this is that the reader should look for theories
and methods which provide these kinds of essential variables. Therefore, the 3-D model score
“orange” on this sub-variable.

The results of the 3-D model on sub-variable 2.1.2 are summarized in table 35 below.

<table>
<thead>
<tr>
<th>2.1.2</th>
<th>Design Thinking</th>
<th>3-D model</th>
</tr>
</thead>
</table>
| **Description** | Not applicable | Quality of organization  
Quality of work  
Norm variables included |
| **Assessment** | Disadvantage: no explicitly mentioned infrastructural essential variables. So, reader should obtain specific design theories and methods which provide these essential variables, depending on the intervention’s object. | Explicitly mentioned structural essential variables which are explained based on the theory of an organization design theorist. Norms are given for each essential variable. However, essential variables not geared towards |
Advantage: the openness of the method allows using other methods and theories which provide these essential variables. HR and technology. So, reader should obtain specific design theories and methods which provide these essential variables.

Table 35: Results of Design Thinking and the 3-D model on sub-variable 2.1.2

When comparing Design Thinking and the 3-D model with regard to their assessment, both methods score “orange” on this sub-variable. This is the case because of the fact that the 3-D model, in contradiction to Design Thinking, provides various essential variables and their norm values, but does not provide essential variables which are sufficiently geared towards HR and technology. Design Thinking does not specify essential variables with regard to the infrastructure at all.

5.3.3 Sub-variable 2.1.3: Parameters
The sub-variable about parameters was defined in chapter 2 as ”characteristics of the infrastructure which can have a varying value, and with which an organization can design its infrastructure. The role of parameters is to give the essential variables their norm values”. The norm of variable 2.1.3 is that when talking about infrastructures, the parameters of all three aspects of these infrastructures should be identified and clarified.

Description
Achterbergh and Vriens (2019) speak explicitly in their book about parameters which guide the description and assessment of organizational structures. For the 3-D model, the seven structural parameters by De Sitter (1994) are used. The authors have chosen for De Sitter’s set of parameters, since “it seems to be a complete set and effectively encompasses most of the parameters put forward by others” (Achterbergh & Vriens, 2019, p. 54).

According to De Sitter, the design parameters can be divided into three types. The first type of design parameters are “those related to the production structure”, consisting of “the degree of functional concentration”, “the degree of differentiation of operational activities”, and the degree of specialization of operational activities” (Achterbergh, 2019, p. 54). The production structure is about the grouping and the coupling of tasks which are operational, which realize the primary processes. The second type of design parameters are “those related to the control

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19 In appendix 3.11, a substantiation of the results for this sub-variable about parameters are presented.
structure”, comprising “the degree of differentiation of regulatory activities into parts”, “the degree of differentiation of regulatory activities into aspects”, and “the degree of specialization of regulatory activities” (Achterbergh & Vriens, 2019, p. 55). The control structure entails of the grouping and the coupling of regulatory tasks, which realize the three forms of regulation – strategic regulation, regulation by design, and operational regulation. The third and last type of design parameters entails “one design parameter describing the relation between operational and regulatory activities, and hence the relation between the production and control structure – the degree of separation” (Achterbergh & Vriens, 2019, p. 55).

It is important to note that these parameters are based on De Sitter (1994), who created his theory for changing the organizational structure, and not specifically for changing HR and technology. Therefore, the parameters are especially geared towards the organizational structure, in a lesser extent towards HR, and in the least extent towards technology.

**Assessment**

The 3-D model receives a score of “orange” with regard to this sub-variable. As can be concluded from the above, Achterbergh & Vriens (2019) explicitly state the parameters of the organizational structure, and explain with examples what each parameter means. Thereby, they provide the buttons to the reader which can be pushed to create a well-designed structure, just as what you would expect from a method which supports episodic interventions in organizational infrastructures. However, these parameters are especially created for changing the organizational structure, which causes the parameters to be not sufficiently geared towards human resources and technology. The result of this is that the reader should look for theories and methods which provide these kinds of parameters. This results in the above named score.

The results of the 3-D model on sub-variable 2.1.3 are summarized in table 36 below.

<table>
<thead>
<tr>
<th>Design Thinking</th>
<th>3-D model</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Description</strong></td>
<td>(1) degree of functional concentration</td>
</tr>
<tr>
<td>Not applicable</td>
<td>(2) degree of differentiation of operational activities</td>
</tr>
<tr>
<td></td>
<td>(3) degree of specialization of operational activities</td>
</tr>
<tr>
<td></td>
<td>(4) degree of differentiation of regulatory activities into parts</td>
</tr>
<tr>
<td></td>
<td>(5) degree of differentiation of regulatory activities into aspects</td>
</tr>
</tbody>
</table>
### Assessment

**Disadvantage:** no explicitly mentioned infrastructural parameters. So, reader should obtain specific design theories and methods which provide these parameters, depending on the intervention’s object.

**Advantage:** the openness of the method allows using other methods and theories which provide these parameters.

**Explicitly mentioned structural parameters which are explained based on the theory of an organization design theorist. However, parameters not geared towards HR and technology. So, reader should obtain specific design theories and methods which provide these parameters.**

<table>
<thead>
<tr>
<th>Table 36: Results of Design Thinking and the 3-D model on sub-variable 2.1.3</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Assessment</strong></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td><strong>5.3.4 Sub-variable 2.1.4: Relation between parameters and essential variables</strong></td>
</tr>
<tr>
<td>In chapter 2, the relation between parameters and essential variables was defined as “the way in which a certain value of a parameter influences an essential variable, or the value a parameters should have in order to maintain an essential variable in its norm value”. The norm of variable 2.1.4 is that when talking about infrastructures, the relationship between the parameters and essential variables of all three aspects of these infrastructures should be identified and explained.</td>
</tr>
<tr>
<td><strong>Description</strong></td>
</tr>
<tr>
<td>The relation between the seven parameters of De Sitter (1994) and the proposed essential variables of the 3-D model are explicitly related to each other by Achterbergh and Vriens (2019). The value of all the seven parameters can vary, and these values determine the characteristics of the organization’s structure. This organizational structure enables or disables certain behaviour of the members of the focal organization.</td>
</tr>
<tr>
<td>When the design parameter’s values are high, the structure disables organizational members to act in ways that contribute positively to the essential variables of the organization (Achterbergh &amp; Vriens, 2019). The structure itself becomes a disturbance, leading to even more</td>
</tr>
</tbody>
</table>

---

20 The results of sub-variable 2.1.4 are substantiated within appendix 3.12.
disturbances, and there is not enough regulatory potential to deal with these disturbances. This leads to a situation where the organization is not reaching the norms of one or more essential variables (Achterbergh & Vriens, 2019).

When the design parameter’s values are low, the structure actually enables the members of the focal organization to show behaviour that positively contributes to the organization’s essential variables, thereby exerting amplification and attenuation (Achterbergh & Vriens, 2019).

It is important to note that this relationship is based on De Sitter (1994), who created his theory for changing the organizational structure, and not specifically for changing HR and technology. Therefore, the parameters, essential variables and their relationship are especially geared towards the organizational structure, in a lesser extent towards HR, and in the least extent towards technology.

Assessment
Again, the 3-D model gets a score of “orange” on this sub-variable. Not only have Achterbergh and Vriens (2019) explained the relationship between the infrastructural parameters and essential variables extensively, but this relationship is also based on a theory from an organization design researcher. Because the relationship between the parameters and essential variables is specified, it becomes possible as a reader to design the structure parameters in such a way that it leads to essential variables which stay in their prescribed norms. This fits with a good method which supports episodic interventions in organizational infrastructures. However, the essential variables, parameters and relation between them are especially created for changing the organizational structure, which causes them to be not sufficiently geared towards human resources and technology. The result of this is that the reader should look for theories and methods which provide these kinds of essential variables, parameters and relationship between them. This results in the score above.

The results of the 3-D model on sub-variable 2.1.4 are summarized in table 37 below.

<table>
<thead>
<tr>
<th>2.1.4</th>
<th>Design Thinking</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Description</strong></td>
<td>Not applicable</td>
</tr>
</tbody>
</table>
reach the norm values of the essential variables.
A low parameter value structure leads to the organization being better able to reach the norm values of the essential variables.

Assessment

| Disadvantage: no explicitly mentioned relationship between infrastructural parameters and essential variables. So, reader should obtain specific design theories and methods which provide these relationships, depending on the intervention’s object. | Explicitly mentioned relation between structural parameters and essential variables which are explained based on the theory of an organization design theorist. However, essential variables, parameters and relationship between them not geared towards HR and technology. So, reader should obtain specific design theories and methods which provide these. |

Table 37: Results of Design Thinking and the 3-D model on sub-variable 2.1.4

In this sub-variable, the 3-D model and Design Thinking again score the same. This is due to the fact that Achterbergh and Vriens (2019) have specified the relation between infrastructural parameters and essential variables, whereas the authors of Design Thinking have not done this, but that the 3-D model is only geared towards the organizational structure, and not towards HR and technology.

5.4 Key variable 3: Method

5.4.1 Sub-variable 3.1: Methodological metaphor & paradigm
Sub-variable 3.1 is about the methodological metaphor and paradigm of the method’s authors. The methodological metaphor was defined in chapter 2 as “a simplified image used by authors to describe their own method, their used methodology or their view on methodology”. The methodological paradigm was defined in this chapter as “the underlying view with which someone looks at scientific research”. The norm value for this sub-variable is that the methodological metaphor and paradigm should be mentioned explicitly by the authors. Moreover, ideally the method gives space to multiple paradigms, since this creates a more open view towards science.
Description\textsuperscript{21}

The authors of the 3-D model have a certain view on the methodological metaphors and paradigms. With regard to the 3-D model as a method, Achterbergh and Vriens (2019) use multiple metaphors. They use words like “technique”, “tool” and “template” to refer to the 3-D model.

The epistemological paradigm of Achterbergh and Vriens (2019) is somewhere between objectivist and subjectivist, and tends more to objectivist. On the one hand, the authors see the world as observable and testable, since they make use of a variety of hypotheses which can be tested. For instance, the activities of strategic regulation, regulation by design, and operational regulation are seen as a process of formulating, testing, and reformulating hypotheses. They think that variables about the world can be measured, and one objective result will come out of these measurements. This fits the epistemological view of an objectivist researcher. On the other hand, however, they acknowledge that the explicit or implicit assumptions of people could influence their view on the world and their behaviour, which fits the view of a subjectivist researcher. For example, Achterbergh and Vriens (2019, p. 289) make the following statement: “For instance, once organization members see their organization as a machine, it is probable that they start to act accordingly, which, in turn, reinforces their way of seeing”.

Assessment

The score of the 3-D model on sub-variable 3.1 is “orange”. Achterbergh and Vriens (2019) make implicitly use of a methodological metaphor to refer to the 3-D model. They also show their views with regard to scientific epistemology, by making statements about the use of hypotheses and the influence of assumptions on people. Because the authors are not only objectivist or subjectivist, they stay open to multiple perspectives on science. However, in contrast to their metaphor and paradigm with regard to organizations and interventions, the authors do not state their methodological metaphor and paradigm explicitly. This results in a score of “orange”.

In the table below, a summary is given of the final results of both Design Thinking and the 3-D model on sub-variable 3.1.

<table>
<thead>
<tr>
<th>3.1</th>
<th>Design Thinking</th>
<th>3-D model</th>
</tr>
</thead>
<tbody>
<tr>
<td>Description</td>
<td>M: Tool with various purposes</td>
<td>M: Tool, technique, template</td>
</tr>
</tbody>
</table>

\textsuperscript{21} In appendix 3.13, a substantiation for this sub-variable about the methodological metaphor and paradigm concerning the 3-D model is to be found.
**P:** Epistemological pluralism; both subjectivist and objectivist

**Assessment**

Authors are quite explicit on their methodological metaphor and paradigm, and stress epistemological pluralism, which promotes looking at science from various perspectives.

**P:** Between subjectivist and objectivist, tends to objectivist

Authors are not explicit on methodological metaphor and paradigm, but this can be deduced from their book. Are open to both methodological paradigms, which promotes looking at science from various perspectives.

*Table 38: Results of Design Thinking and the 3-D model on sub-variable 3.1*

When comparing Design Thinking and the 3-D model, it becomes clear that Design Thinking scores better than the 3-D model on this sub-variable. This is due to the fact that, in contrast to Design Thinking, the 3-D model does not explicitly state their methodological metaphor and paradigm.

**5.5 Conclusion 3-D model**

In this section, a conclusion is given about the description and assessment of the 3-D model as a method which supports episodic interventions in organizational infrastructures. The summarized results of this method for all sub-variables of the metamodel are shown in Table 39.

<table>
<thead>
<tr>
<th>Description</th>
<th>Assessment</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1.1</strong> M: intervening is like sailing an unruly sea Organization as flux and transformation, organism, brain (together the viable systems metaphor) P: functionalist paradigm and social interpretivist</td>
<td>Explicit information about intervention metaphor, not about intervention paradigm. Variety of metaphors and paradigms, which allows to see organizations and interventions from multiple perspectives. Power views are acknowledged as having a potential effect on interventions, but organization is not seen as constellation of interests.</td>
</tr>
<tr>
<td><strong>1.2.1</strong> Explicitly mentioned Reason why: Help understand and flexibly design episodic interventions in organizational structures Object: Episodic interventions (kind) in organizational structures (object) of organizations that currently have complex and hierarchical structures (context) Application area: Not limited to certain industry or profession Examples: healthcare, butcher’s business, construction work</td>
<td>Explicitly mentioned and explained. The content of the goal and object fits with a method supporting episodic interventions in organizational infrastructures, and the application area is broad enough to fit to this.</td>
</tr>
<tr>
<td><strong>1.2.2</strong> Weick and Quinn (1999): episodic versus continuous interventions. Schein (1969): goals of the social dimension.</td>
<td>Explicit substantiation of theories and concepts surrounding interventions is there, both for theories and</td>
</tr>
</tbody>
</table>
Luhmann (1984): organizations as social systems, background foundation for social dimension. Own theories and concepts about interventions and relationships between them are fully explained.

<table>
<thead>
<tr>
<th>1.2.3</th>
<th>Organization as a social system</th>
<th>Pays sufficient attention to the integration, adoption and including broad variety of stakeholder in the social dimension. Moreover, the way in which the social aspect is reached is made clear.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Social dimension: motivation, adoption, integration</td>
<td></td>
<td></td>
</tr>
<tr>
<td>HR of intervention organization</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Broad participation</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>1.2.4</th>
<th>Authors mention episodic-continuous change explicitly</th>
<th>The type of change is explicitly mentioned by the authors, and the 3-D model is specifically geared towards episodic interventions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Both episodic and continuous changes are needed</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3-D model created for episodic interventions</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>1.3.1</th>
<th>Performing primary processes, operational regulation, regulation by design and strategic regulation</th>
<th>Intervention process is explicitly and extensively mentioned by the authors, and it is made plausible by them that these steps actually lead to achieving the intervention goals.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Functional process: diagnosis, design, implementation, evaluation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Social process: motivation, adoption, integration</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Infrastructural process: what, how, who, structure, technology, HR</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>1.3.2</th>
<th>Infrastructural dimension: HR, technology, and structure of the intervention organization</th>
<th>Explicitly mentioned by authors. More explicit about configuring as activity than as result, because of the openness of the method.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>1.3.3</th>
<th>No description of specific instruments</th>
<th>No specific instruments are proposed, but instructions are provided on how to choose an appropriate instrument.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operational intervention activities: (1) with functional goals and (2) with social goals.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Regulatory activities: related to operational, design and strategic regulation.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Three intervention technology types: (1) dedicated technologies – serve one goal/activity, (2) cross-functional technologies – serve multiple goals and activities, and (3) enabling technologies – only indirectly related to a goal/activity, since they provide general conditions to successfully execute activities.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>2.1.1</th>
<th>Based on academic authors who created theories about the organizational infrastructure.</th>
<th>The theories and concepts concerning the organizational infrastructure are substantiated by either using the work from academic authors, or explaining their own new theories and concepts. This is done mostly for the organizational structure, and less for human resources and technology. So, reader should obtain specific design theories and methods about HR and technology.</th>
</tr>
</thead>
<tbody>
<tr>
<td>De Sitter (1994): parameters, essential variables, and relationship</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ashby (1958): attenuation, amplification, influenced De Sitter</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Luhmann (1984): production process, interactions and interaction premises</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Beer (1979): design heuristics, f.e. design order</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Own new theories and concepts explained.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>2.1.2</th>
<th>Quality of organization</th>
<th>Explicitly mentioned structural essential variables which are explained based on the theory of an organization design theorist. Norms are given for each essential</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quality of work</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Norm variables included</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
variable. However, essential variables not geared towards HR and technology. So, reader should obtain specific design theories and methods which provide these essential variables.

2.1.3 (1) degree of functional concentration
(2) degree of differentiation of operational activities
(3) degree of specialization of operational activities
(4) degree of differentiation of regulatory activities into parts
(5) degree of differentiation of regulatory activities into aspects
(6) degree of specialization of regulatory activities
(7) degree of separation

Explicitly mentioned structural parameters which are explained based on the theory of an organization design theorist. However, parameters not geared towards HR and technology. So, reader should obtain specific design theories and methods which provide these parameters.

2.1.4 A high parameter value structure leads to the organization not being (completely) able to reach the norm values of the essential variables.
A low parameter value structure leads to the organization being better able to reach the norm values of the essential variables.

Explicitly mentioned relation between structural parameters and essential variables which are explained based on the theory of an organization design theorist. However, essential variables, parameters and relationship between them not geared towards HR and technology. So, reader should obtain specific design theories and methods which provide these.

3.1 M: Tool, technique, template
P: Between subjectivist and objectivist, tends to objectivist

Authors are not explicit on methodological metaphor and paradigm, but this can be deduced from their book. Are open to both methodological paradigms, which promotes looking at science from various perspectives.

Table 39: Results of the 3-D model

When looking at the table above, it appears that the 3-D model scores a “green” on eight third order sub-variables of the metamodel, and an “orange” on five third order sub-variable of the metamodel. This means that for the biggest part of the sub-variables, the authors of the 3-D model reached the norm, by explicitly giving a description of the sub-variable, which sufficiently fits with the a priori constructed norms. The specific description and assessment results will be discussed per second order sub-variable.

With regard to sub-variable 1.1, which is about the intervention metaphor and paradigm, it appears that intervening is compared with sailing on an sea which is unruly. The metaphor of the organization is flux and transformation, organism, and brain, is together named the “viable systems metaphor”. Since the authors of the 3-D model display a subjectivist as well as an objectivist epistemology, and take a regulating view on the hegemonic order, their intervention paradigm is both functionalist and social interpretivist. The explicitness about the intervention
metaphor and the variety of metaphors and paradigms leads to a green score on this sub-variable. A point of improvement is that the 3-D model pays little attention to power relations in its intervention metaphor and paradigm, which could wrongfully hide this aspect of interventions from the reader.

The results of sub-variable 1.2, about the organizational interventions theory, are as follows. The 3-D model is a method with the goal to help understand and flexibly design episodic interventions in organizational structures. The method’s object are episodic interventions in organizational structures of organizations that have a complex and hierarchical structure. It can be applied to any industry or profession. The authors of the 3-D model base their intervention views on known academic authors such as Weick and Quinn (1999), Schein (1969), and Luhmann (1984), and come with their own substantiated theories and concepts. The social aspect is thoroughly present in the 3-D model, since it sees organizations as social systems, and therefore devotes a whole dimension to the social aspect of interventions. The authors of the method also stress the need for broad participation and adoption of the intervention. The 3-D model is specifically geared towards episodic interventions. With regard to this second order sub-variable, the 3-D model gets a maximum score, due to its explicitness and the content which fits a method that support episodic interventions in organizational infrastructures.

With regard to sub-variable 1.3, about the intervention organization, the 3-D model has four process types. The first one is the process which happens in every organization, which is performing primary processes, operational regulation, regulation by design, and strategic regulation. The other three process types are similar to the three dimensions of the 3-D model. The first, functional process, consists of diagnosis, design, implementation and evaluation. The second, social process, entails creating motivation, adoption, and integration. The third, infrastructural process, consists of discovering the what, how, and who, and designing the structure, technology, and HR of the intervention organization. The configuration of the intervention is to be found in this latest, infrastructural dimension. When looking at the instruments that are provided for the purpose of the 3-D model, it appears that the authors of the method do not provide specific instruments, but provide the reader with advice on how to choose among the broad variety of instruments which are available to guide interventions. Just as with the previous sub-variable, the 3-D model scores green on all third order sub-variables. Again, the authors of the 3-D model are explicit about this sub-variable, and the content of the third order sub-variables is coherent.

Sub-variable 2.1, which is about infrastructure theory, is covered thoroughly by the authors of the 3-D model, although they focus almost only on the organizational structure, and
not on HR and technology. The author’s views on the infrastructure are based on a diversity of academic authors, like De Sitter, Ashby, Luhmann, and Beer. Their own new theories and concepts surrounding the infrastructure are also sufficiently substantiated. The 3-D model proposes the quality of organization and the quality of work as essential variables, and states the norms of these essential variables. There are also seven structural parameters identified for the organizational structure. The relation between these parameters and the essential variables, is that when the value of the parameters is lower, the value of the essential variables will be higher, and thereby be better. However, despite their explicitness and scientific substantiation with regard to this sub-variable, the authors receive an orange score for all sub-variables, since they do not focus sufficiently on the HR and technology aspects of the infrastructure.

The results of sub-variable 3.1, about the methodological metaphor and paradigm, are as follows. The 3-D model as a method is compared with a tool, technique, and template. The epistemology of the authors is somewhere between subjectivist and objectivist, since both epistemologies come back in their book. However, the authors tend to have an objectivist epistemology. This sub-variable receives an orange score, because of the inexplicitness with regard to the methodological metaphor and paradigm. However, this metaphor and paradigm can be deduced from the 3-D model book, and the authors stay open to both methodological paradigms.

To give a final conclusion, the 3-D model is an appropriate method which supports episodic interventions in organizational infrastructures. Its explicitness, theoretical and conceptual substantiation, and content that fits a method supporting episodic intervention in infrastructures with regard to the intervention metaphor and paradigm, the organizational interventions theory, and the intervention organization are the positive points of the method. The lack of theory about the HR and technology part of the infrastructure, the lack of explicitness with regard to the methodological metaphor and paradigm, and the lack of providing extensive views about the organization as constellation of power interests, are its negative points.
Chapter 6: Conclusion & discussion

6.1 Conclusion

The aim of this research is to answer the following research question:
“What can be learned about the appropriateness of Design Thinking and the 3-D model as methods which support episodic interventions in infrastructures, by describing and assessing the two methods as methods for episodic interventions in organizational infrastructures?”

To answer this research question, six articles of Design Thinking and the only book about the 3-D model were systematically described and compared using a metamodel which was constructed by the researcher. The conclusion of this thesis will be given by giving the answers on each sub-question which was created in chapter 1. To provide a quick overview, only important, remarkable and summarized results will be given.

6.1.1 Sub-question 1

The first, theoretical sub-question is: “Which variables and norms have to be included into the metamodel in order to be able to describe and assess methods for the purpose of episodic interventions in organizational infrastructures?”

To arrive at variables and norms for the metamodel of this thesis, the goal of the metamodel was taken as a starting point. This goal is to enable the description and assessment of methods for the purpose of episodic interventions in organizational infrastructures. By means of this goal, three key variables were identified: one about interventions in organizations, one about infrastructures in organizations, and one about the method itself. These key variables were split into second order sub-variables, which were again split into third order sub-variables when this was needed. With the help of the academic literature, logical thinking, and an iterative process, thirteen different sub-variables were included in the final metamodel.

The first key variable, which is about interventions, consists of three different second order sub-variables: the intervention metaphor and paradigm, organizational interventions theory, and the intervention organization. The second key variable about infrastructures, entails one second order sub-variable about infrastructure theory. The third key variable, which is about the method as such, exists of one sub-variable about the methodological metaphor and paradigm.
6.1.2 Sub-question 2
The second, empirical sub-question is: “What is the description of Design Thinking along the chosen sub-variables?”

From the results about interventions, it appears that Design Thinking’s intervention metaphors of the organization are flux and transformation, culture, sensemaking, and machine. Both a functionalist and social-interpretivist intervention paradigm were to be found.

The goal of Design Thinking is to (1) solve complex problems, and (2) stimulate innovation. The method focuses on a broad variety of objects and application areas, among which organizations in all kinds of fields. Besides the book of Simon (1969), no clear theoretical and conceptual background was given for the intervention statements of the method. Design Thinking puts the end user central, and focuses on collaboration in intervention teams, but does not explicitly stress the acceptation of change or participation of a broad variety of stakeholders. The method is not specifically geared towards episodic or continuous change.

Key characteristics of its intervention organization are iterativity, problem definition, prototyping, visualization, human-centeredness, and ad hoc projects with diverse intervention teams. Design Thinking presents a lot of different instruments which could be used to execute the method’s principles.

When looking at the infrastructure, the results reveal that Design Thinking does not include any information about the organizational infrastructure. Therefore, no descriptive results were to be found for this sub-variable.

From the results about the method as such, it appears that Design Thinking’s methodological metaphor is a tool which has various purposes. The authors of the method stress epistemological pluralism, so the methodological paradigm is both objectivist and subjectivist.

6.1.3 Sub-question 3
The third, empirical sub-question is: “What is the description of the 3-D model along the chosen sub-variables?”

From the results about interventions, it appears that the 3-D model compares intervening with sailing an unruly sea, and uses the “viable systems metaphor” for organizations, which consists of views of the organization as flux and transformation, organism, and brain. Their intervention paradigm is both functionalist and social-interpretivist.
The 3-D model’s goal is to help understand and flexibly design episodic interventions in organizational structures. The objects of the method are episodic interventions in structures of organizations with a complex and hierarchical structure, and the method can be applied in any field. The views of the method’s authors are based on numerous academic authors, and there new substantiated intervention theories and concepts are introduced in the 3-D model. The social aspect of interventions appears in the 3-D model in its social dimension, and in the statements of the authors about broad participation and the acceptation of interventions. The 3-D model is geared towards episodic interventions.

The results suggests that the authors of the 3-D model explicitly explain processes with regard to the functional, social, and infrastructural dimension. This latest, infrastructural dimension tells how the interventions should be configured. There are no specific instruments provided for the 3-D model, but the authors give advice to their reader about how they should select one of the variety of instruments.

From the results about infrastructures, it appears that the 3-D model is based on numerous academic authors, and present its own substantiated theories and concepts. Its essential variables are the quality of organization and the quality of work, and it introduces seven structural parameters with regard to the organizational infrastructure. The relation between these parameters and essential variables, is that a low value of the parameters leads to a higher and better value of the essential variable. However, there is almost only content regarding the organizational structure, and not that much about human resources and technology, which are the two other parts of the infrastructure.

When looking at the 3-D model as a method in itself, this method is compared with a tool, technique, and template. Both subjectivist and objectivist epistemologies are found in the book about the method, although the authors tend toward an objectivist methodological paradigm.

6.1.4 Sub-question 4
The fourth, analytical sub-question is: “What is the assessment of Design Thinking and the 3-D model, with regard to the used sub-variables of the metamodel and their norms?

Design Thinking scores “orange” on eight of the third order sub-variables, and “green” on five of the third order sub-variables. So, for the largest part, the norm is not fully reached, but does not form a massive problem for Design Thinking as a method which supports episodic interventions in organizational infrastructures.
Design Thinking receives an orange score for the third order sub-variables about the intervention metaphor and paradigm, the theoretical and conceptual substantiation with regard to interventions, the social aspect of the intervention, the type of change, the theoretical and conceptual substantiation with regard to infrastructures, the essential variables, the parameters, and the relationship between these essential variables and parameters. The reasons for the orange score on these sub-variables are the inexplicitness, the lack of perspectives on the power relations in organizations, the lack of theoretical and conceptual substantiation, the lack of content which fits a method that supports episodic interventions in organizational infrastructures, as is the case with the type of change which is not geared towards episodic interventions and the insufficient attention to the social aspect of interventions. Since Design Thinking does not make specific statements about the organizational infrastructure, it receives only orange scores with regard to these sub-variables.

Design Thinking receives a green score for the third order sub-variables about the goal of the intervention, the interventions process, the configuration of the intervention, the intervention instruments, and the methodological metaphor and paradigm. The reasons for the green score on these sub-variables are its explicitness, the coherence between the content of different third order sub-variables about the intervention organization, and the presence of multiple perspectives on organization metaphors, intervention paradigms, and methodological paradigms.

The 3-D model scores “green” on eight of the third order sub-variables, and “orange” on five of the third order sub-variables. This means that for the biggest part of the sub-variables, the 3-D model reached the a priori constructed norm.

The method receives a green score on all of the third order sub-variables, except for the methodological metaphor and paradigm, and all third order sub-variables about infrastructural theory. The reasons for the green scores are its explicitness, the coherence between the content of different third order sub-variables about the intervention organization, the presence of multiple perspectives on organization metaphors and intervention paradigms, content which fits a method that supports episodic interventions in organizational infrastructures, such as the presence of the social aspect, and the focus on episodic interventions. Moreover, the theoretical and conceptual substantiation with regard to interventions was clearly present in this method.

The method gets an orange score for all sub-variables about the infrastructural theory. Although the authors of the 3-D model were very explicit with regard to these sub-variables, there was a lack of theory about the HR and technology parts of the infrastructure. The method
also receives an orange score on the sub-variable about the methodological metaphor and paradigm. The reason for this orange score is the inexplicitness with regard to the methodological metaphor and paradigm, although it is possible to deduct this implicitly from the book about the 3-D model. Other points of improvement are the lack of extensive perspectives on the power relations in organizations, where the organization is seen as a constellation of different interests.

6.1.5 Sub-question 5
The fifth, analytical sub-question is: “What are the differences and similarities between Design Thinking and the 3-D model, with regard to their assessment on the used sub-variables of the metamodel and their norms?”

The similarities between Design Thinking and the 3-D model are their good scores with regard to the goal of the intervention, the intervention process, the configuration of the intervention organization, and the intervention instruments. Both methods were explicit with regard to these sub-variables, and provided coherent content which suits a method supporting episodic interventions in organizational infrastructures. Both methods show multiple perspectives with regard to organization metaphors, methodological metaphors, and methodological paradigms. Remarkably, both methods lack extensive focus on power relations in organizations and interventions. Another similarity between the methods is that they both scored orange on all sub-variables regarding the organizational infrastructure. However, there are different reasons for this, since the 3-D model only lacked theory on HR and technology of the infrastructure, and Design Thinking lacked theory about the whole infrastructure.

The differences between Design Thinking and the 3-D model are the difference in scores with regard to the intervention metaphor and paradigm, the theoretical and conceptual substantiation with regard to interventions, the social aspect of the intervention, and the type of change. On these sub-variables, the 3-D model scored higher, due to its better explicitness, the better fitting content, and the presence of theoretical and conceptual substantiation with regard to the intervention. With regard to the methodological metaphor and paradigm, Design Thinking scores higher, since it pays more explicit attention to its methodological world views, and explains its epistemological perspective more explicit.

6.1.6 Main research question
To give an answer to the main research question, from the description and assessment of Design Thinking and the 3-D model it can be learned that both methods are appropriate as a method
which supports episodic interventions in organizational infrastructures. However, from the results of this description and assessment, it appeared that the 3-D model is a more appropriate method for this purpose than Design Thinking, since the 3-D model received more green than orange scores, whereas Design Thinking received more orange than green scores.

Despite the fact that Design Thinking is not explicitly intended to be a method supporting episodic interventions in infrastructures, its openness and explicitness with regard to the intervention organization and methodological metaphor and paradigm make it an appropriate method. However, its lack of content about the organizational infrastructure, its lack of explicitness theoretical and conceptual substantiation concerning the organizational interventions theory, and its lack of explicitness regarding the intervention metaphor and paradigm make the method less appropriate than the 3-D model.

The 3-D model is an appropriate method for supporting episodic interventions in infrastructures, due to its explicitness, theoretical and conceptual substantiation, and content which fits a method supporting episodic intervention in infrastructures with regard to the intervention metaphor and paradigm, the organizational interventions theory, and the intervention organization. Points of attention for the reader are its lack of content about the HR and technology parts in their infrastructural theory, its lack of explicitness with regard to the methodological metaphor and paradigm, and its lack of providing extensive perspectives on the power relations in organizations where the organization is seen as a constellation of different interests.

6.1.7 The methods as complements and advice for the reader

In this extra section, some additional conclusions are given about using the two methods. First, the way in which Design Thinking and the 3-D model could learn from each other will be explained. Second, the way in which the reader could use both methods as supporting methods for episodic interventions in organizational infrastructures will be described.

Based on the results above, it is concluded that each of the two methods has different up- and downsides. Therefore, they could learn from each other and be used as complements by the reader. Design Thinking is especially good for involving people in the diagnosis and solution phase of an intervention, and does this more extensive than the 3-D model. Moreover, the Design Thinking is more explicit on their methodological views. Design Thinking is also better in coupling design, implementation, and evaluation, since it really focuses on iterative cycles in which continuous feedback is given, and design proposals are adapted by using this feedback. With regard to these three aspects, the 3-D model could learn from Design Thinking. However, the 3-D model pays more attention to the social aspect of the intervention, in the
sense of involving a broad set of stakeholders, and making sure that the intervention gets accepted across these stakeholders. Moreover, the 3-D model shows its strengths in the way it scientifically substantiates its statements about interventions and infrastructures. The 3-D model also shows more content about intervening specifically in an episodic way than the Design Thinking method. With regard to these three aspects, Design Thinking could learn from the 3-D model.

The advice to the reader is as follows. Both methods could – perhaps in combination – be used for supporting episodic interventions in organization infrastructures. However, it would be necessary to search for other methods and theories which dive deeper into the HR and technology aspects of the infrastructure, since these subjects are not sufficiently discussed in these methods. Moreover, it would be good for the reader to also search for methods and theories which also look at the different power relations in organizations, since both methods pay too little attention to this aspect of interventions.

6.2 Discussion

In the discussion, a possible explanation for the results will be given in section 6.2.1. In section 6.2.2, the implications of this thesis for the theory in this field will be explained, and in 6.2.3, the implications for practice will be described. Finally, in section 6.2.4, a methodological reflection with regard to this thesis is given.

6.2.1 Explanations for the results

Design Thinking received a considerable amount of orange scores in the assessment of this thesis. Two reasons could possibly explain this result.

A first reason for the substantial amount of orange scores could be that Design Thinking is a very open method, which is not created specifically for intervening episodically in infrastructures. This results in an orange score for all sub-variables about the infrastructure, since the method does not provide information about intervening in this type of object. It also leads to an orange score for sub-variable 1.2.4, since the method is not specifically geared towards episodic interventions. However, Design Thinking’s openness also allows its users to search for other theories or methods which provide information about intervening in infrastructures, which partly solves this problem. Nevertheless, readers of literature about Design Thinking
should keep in mind that when they want to intervene specifically in (a part of) an infrastructure, additional literature is needed which guides this kind of intervention.

A second possible reason for the amount of orange scores, is that Design Thinking primarily is grounded in practice, and the method is only recently becoming more popular in the academic world (Kimbell, 2011). This could be a reason why a lot of the literature about Design Thinking is not fully based on scientifically substantiated facts, but on experiences from the field. This is the biggest reason why for example sub-variable 1.2.2, about the substantiation of claims about interventions, got an orange score. When Design Thinking is becoming more situated in the academic field, perhaps this will positively influence the amount of theoretical and conceptual substantiation. Design Thinking being situated in practice could also clarify why the method is very explicit with regard to organizing the intervention in practice – although it could also be the other way around, that this explicitness explains why it got popular in practice in the first place.

The 3-D model received almost only green scores in the assessment of this thesis. Just as with Design Thinking, there are two possible reasons for this positive outcome.

A first possible reason for the fact that so many sub-variables got a maximum score, is that the method of the 3-D model is specifically created as a model to support episodic interventions in organizational structures, which forms one part of the infrastructure. Since this goal is so close to the way in which the method is assessed – namely, as a method supporting episodic interventions in organizational infrastructures – it is logical that this method scores so high when assessing it as this kind of method. This could also explain why the 3-D model scores higher than a method like Design Thinking, which is not specifically created for a goal which lies close to the way in which the methods are assessed.

A second reason for the high amount of green scores, could be that the 3-D model, in contrast to Design Thinking, is grounded in a more scientific field, instead of a practical field. The authors of the 3-D model, Achterbergh and Vriens (2019), are both professors at the Radboud University, who have gained a lot of experience in the scientific field of Organizational Design and Organizational Change. As such, their theories and concepts are more likely to be explicitly clarified, and are more likely to be substantiated by work from the scientific field, than a method which originated in the non-academic practice field.
6.2.2 Theoretical implications

This thesis complements the existing literature about intervention methods and methods for organizational design in the business field. The way in which this thesis delivers its theoretical contribution, will be explained in the following section.

The metamodel which was constructed in this thesis is relevant for the scientific literature, since it delivers a contribution to the literature about metamodels for the purpose of describing and assessing design intervention methods. To the best knowledge of the researcher, not earlier a metamodel has been created to describe and assess the methods of Design Thinking and the 3-D model, so this thesis fills this theoretical gap.

The metamodel in itself could also be used for future scientific research that shows overlap with the subject of this thesis. For example, when a researcher would want to study other design intervention methods such as Lean, this metamodel could be copied for this study. The metamodel could even be used for studying intervention methods, by ignoring the second key variable about infrastructures, or for studying design methods, by ignoring the first key variable about interventions.

Finally, this thesis gives more insight into the way in which a metamodel could be created for an academic method description and assessment. The four steps which were used to create an appropriate metamodel, could for instance be used in any study where the researcher wants to describe and assess methods.

The results which were gathered with this thesis are also relevant for the academic literature, since insight is given in a systematic description of two organizational intervention methods (3-D model and Design Thinking) to design episodic interventions. No earlier research was conducted about describing the 3-D model and Design Thinking as methods which specifically supports episodic interventions in infrastructures. The results of this study fill this theoretical gap.

Moreover, the two methods are assessed along the lines of the chosen sub-variables from the metamodel, and these assessment results contribute to the literature about designing episodic interventions. For instance, the two methods were not yet assessed with a metamodel as method which support episodic interventions in infrastructures, and the 3-D model was not yet compared with the Design Thinking method on such an assessment. So, the results of this study deliver two contributions which – to the best knowledge of the researcher – have not been made before in the current literature about Design Thinking and the 3-D model.
In the scope of this research, it was only possible to describe and assess two out of all design intervention methods. The advice for follow-up research is therefore to conduct a similar study to find out how other design intervention methods such as Lean and Agile could be described and assessed as methods supporting episodic interventions in organizational infrastructures. Another advice for follow-up research is to also thoroughly compare the descriptions of Design Thinking, the 3-D model, and other design intervention methods. The scope of this thesis was not large enough to allow for such a comparison, although this comparison would provide insight into the similarities and differences between design intervention methods.

6.2.3 Practical implications

Besides delivering a theoretical contribution, this thesis also delivers a contribution to the existing literature about design intervention methods for practitioners. The way in which this thesis delivers its practical contribution, will be explained in the following section.

This thesis delivers a contribution to practice, since the systematic description and assessment of Design Thinking and the 3-D model makes it possible for designers in the business field to select and judge these two intervention methods on their appropriateness for designing episodic interventions in organizational infrastructures. In other words, when someone wants to select a method for intervening episodically in an infrastructure, he/she could use the outcomes of this thesis to judge if Design Thinking and the 3-D model – or a combination of them – would be appropriate methods to use for guiding the intervention.

Another way in which this thesis delivers a contribution to practice, is that the variables of the created metamodel could be used by practitioners in the field to describe and assess other methods which show overlap with Design Thinking and/or the 3-D model, which facilitates the selection and judgment of other design intervention methods. If we take the example of the previous case again, this person could use the metamodel to judge other design intervention methods, such as Lean, in their appropriateness to guide the intervention he/she plans to undertake.

6.2.4 Reflection

In line with the Dutch Code of Conduct on Scientific Practice (Nederlandse Gedragscode Wetenschapsbeoefening), it is necessary to critically reflect on the limitations of this study, and
the implications for this study’s validity and reliability. Moreover, there should be a reflection about the own role as a researcher and the choices which have been made throughout the study.

First of all, as stated in section 3.3, the reliability and validity of this research is secured, by making the research process as explicit as possible, and using a tailor-made metamodel which ensures that this literature study measures exactly what it wants to measure. The a priori argumentation why this literature study is scientifically sound, still applies after its conduct, since the metamodel stayed tailor-made throughout this study, and the research process indeed has been described explicitly. Nevertheless, some methodological limitations of this thesis should be disclosed to the reader.

A first limitation of this research, is that it was beyond the scope of this thesis to encompass the entire amount of literature which is available for the method of Design Thinking. Therefore, a maximum amount of six articles or books had to be selected to represent Design Thinking. Although the selection criteria for the literature were substantiated by means of scientific literature in section 3.2.2, the amount of six articles or books still slightly diminishes the generalizability to the entire method of Design Thinking. In other words, although the chosen articles and books form a good representation of the method, it would have been better to include more literature for this study. A recommendation for future research is therefore to include other articles and books about Design Thinking, to check whether the results are the same.

Second, the reader should bear in mind that this thesis is based on the use of a metamodel which is self-made. The key variables and sub-variables of this metamodel are to a large extent based on the academic literature, and the way in which it is tailor-made gives the metamodel more validity. However, this metamodel is not yet thoroughly tested by academics, and therefore it is possible that a few variables have to be adapted or added to optimize the metamodel. Since the measuring instrument of this thesis is not fully validated, the internal validity and content validity could be slightly lower (Verhoeven, 2007). Future research could dive deeper into the scientific soundness of the metamodel as a whole.

Third, the choice has been made by the researcher to create a metamodel which includes a lot of variables. On the one hand, this created the possibility to execute a comprehensive description and assessment of Design Thinking and the 3-D model. On the other hand, however, this
limited the possibility to analyse much literature about Design Thinking, or compare the description results of the 3-D model and Design Thinking. Therefore, in hindsight it would have been better to dive deeper into less variables.

Fourth, the reader has to take into account that at the beginning, the researcher was better known with the 3-D model than with Design Thinking. Although the researcher has tried to remain objectivity by systematically assessing both methods and describing the research process steps explicitly, it is possible that the researcher had an unintended and unconscious more positive attitude towards the 3-D model. Moreover, in contrast to the results of the 3-D model, the results of Design Thinking have not been checked with an expert of this method. An advice for follow-up research is to do an extensive peer review which includes both experts about the 3-D model and Design Thinking.
Reference list


*Administrative science quarterly*, 25(4), 605-622.


Appendix 1: Substantiation for the description of Design Thinking

1.1 Sub-variable 1.1 Intervention metaphor & paradigm

<table>
<thead>
<tr>
<th>Authors</th>
<th>Intervention metaphor &amp; paradigm</th>
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| Simon (1969)| M: Intervention as: “Making complex designs that are implemented over a long period of time and continually modified in the course of implementation has much in common with painting in oil. In oil painting every new spot of pigment laid on the canvas creates some kind of pattern that provides a continuing source of new ideas to the painter. The painting process is a process of cyclical interaction between painter and canvas in which current goals lead to new applications of paint, while the gradually changing pattern suggests new goals” (Simon, 1996, p. 163).

“These alternatives of design are familiar to architects. They are familiar also to composers, who must decide how far the architectonics of a musical structure will be evolved before some of the component musical themes and other elements have been invented. Computer programmers face the same choices, between working downward from executive routines to subroutines or upward from component subroutines to a coordinating executive” (Simon, 1996, p. 129).

Organization as flux and transformation: “The central task of a natural science is to make the wonderful commonplace: to show that complexity, correctly viewed, is only a mask for simplicity; to find pattern hidden in apparent chaos” (Simon, 1996, p. 1). “Various among us favor quite different tools for analyzing complexity and speak nowadays of "chaos," "adaptive systems," and "genetic algorithms" ” (Simon, 1996, p. ix).

Organization as machine: “In the face of real-world complexity, the business firm turns to procedures that find good enough answers to questions whose best answers are unknowable” (Simon, 1996, p. 28). “For some purposes, central planning based on statistics provides the basis for coordinating behavior patterns” (Simon, 1996, p. 31). “The next main section of this chapter deals with nearly decomposable systems. It proposes that it is not assembly from components, per se, but hierarchic structure produced either by assembly or specialization, that provides the potential for rapid evolution” (Simon, 1996, p. 193).

Organization as organism: “We have become accustomed to the idea that a natural system like the human body or an ecosystem regulates itself. This is in fact a favorite theme of the current discussion of complexity which we will take up in later chapters. We explain the regulation by feedback loops rather than a central planning and directing body” (Simon, 1996, p. 33). “Problem Solving As Natural Selection” (Simon, 1996, p. 193). “Social planning without fixed goals has much in common with the processes of biological evolution” (Simon, 1996, p. 165). “If the inner system is properly designed, it will be adapted to the outer environment, so that its behavior will be determined in large part by the behavior of the latter, exactly as in the case of 'economic man' ” (Simon, 1969, p. 11).

P: Functionalist paradigm: Regulating, since there is little attention for power, inequality, domination etc. Objective/subjective: see sub-variable 3.1. Objective. “If we were to assign a single cause to our good fortune, we would have to attribute it to being born in the right place at the right time: in a society that is able to
**maintain order** (through public organizations), to **produce efficiently** (largely through business organizations), and to maintain the infrastructure required for high production (again largely through public organizations)” (Simon, 1996, p. 155). “For some purposes, central planning based on statistics provides the basis for coordinating behavior patterns” (Simon, 1996, p. 31).

| Buchanan (1992) | M: Intervention as: ?
| **Organization as culture**: “As an instrument of **cultural** life, design is the way we create all of the artifacts and communications that serve human beings, striving to meet their needs and desires and facilitating the exchange of information and ideas that is essential for civil and political life” (Buchanan, 2001b, p. 38).
| “Signs, things, and actions are organized in complex environments by a **unifying idea** or thought” (Buchanan, 1992, p. 10). “Depending on how a designer wishes to explore and organize experience, the sequence could just as reasonably be regarded as a descent from chaotic environments to the unity provided by symbols and images” (Buchanan, 1992, p. 10). |
| **P: Functionalist paradigm**: Regulating, since there is little attention for power, inequality, domination etc. Objective/subjective: see sub-variable 3.1. Objective. “**Neo-positivism**, pragmatism, and various forms of phenomenology have strongly influenced design education and practice in the twentieth century” (Buchanan, 1992, p. 6). “Design is the human power of conceiving, **planning**, and making products that serve human beings in the accomplishment of their individual and collective purposes” (Buchanan, 2001a, p. 9). “The kind of understanding that designers must have in order to work most **effectively** in concrete situations […]” (Buchanan, 2001a, p. 18). |
| **Brown (2008)** | M: Intervention as: Creation of the electric lightbulb by Edison, in combination with the “system of electric power generation and transmission” (Brown, 2008, p. 85). **Enacted sense making**: He conceived “of a fully developed marketplace, not simply a discrete device” (Brown, 2008, p. 85).
| “invention”, “trial and error”, “learn something” (Brown, 2008, p. 86). “Innovation is hard work; Edison made it a profession that blended art, craft, science, business savvy, and an astute understanding of customers and markets” (Brown, 2008, p. 86). “The design process is best described metaphorically as a system of spaces rather than a predefined series of orderly steps. The spaces demarcate different sorts of related activities that together form the continuum of innovation. Design thinking can feel chaotic to those experiencing it for the first time” (Brown, 2008, p. 88). **Organization as flux and transformation**: “[…] Design thinking has much to offer a business world in which most management ideas and best practices are freely available to be copied and exploited. Leaders now look to innovation as a principal source of differentiation and competitive advantage; they would do well to incorporate design thinking into all phases of the process” (Brown, 2008, p. 86). |
| **P: Social interpretative paradigm**: Regulating, since there is little attention for power, inequality, domination etc. Objective/subjective: see sub-variable 3.1. Between objective and subjective, but tends towards subjective. “Prototypes should command only as much time, effort, and investment as are needed to generate useful **feedback** and evolve an idea. […] The goal of prototyping isn’t to finish. It is to learn about the strengths and weaknesses of the idea and to identify new directions that further prototypes might take” (Brown, 2008, p. 87). “Involve many disciplines form the start” (Brown, 2008, p. 89) = **broad participation**. |
**Organization as brain**: learning is central – “With determined leadership, organizations can develop the skills, structures, and processes to generate value from valuable insights gained via the knowledge funnel” (Martin, 2010, p. 39). Addresses exploration and exploitation. Adapts theory of Senge about systems thinking (Dunne & Martin, 2006).

**P: Social interpretative paradigm**: Regulating, since there is little attention for power, inequality, domination etc. Objective/subjective: see sub-variable 3.1. Subjective. System’s thinking: “Martin suggests that designers would think about the system as a whole and thereby envisage the consequences of their actions” (Dunne & Martin, 2006, p. 520).

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| Dorst (2011) | **M: Intervention as**: creating new themes, leading to new frames (Dorst, 2011, p. 527).  
**Organization as**:  
First problem solving approach, then reflection-in-action approach (Dorst & Dijkhuis, 1995).  
**P: Social interpretive and functionalist paradigm**: Regulating, since there is little attention for power, inequality, domination etc. Objective/subjective: see sub-variable 3.1. First objective epistemology (problem solving approach), then subjective epistemology (reflection-in-action approach). Both approaches can be helpful for Design Thinking (Dorst & Dijkhuis, 1995).  
Functionalist: Problem solving approach. “Describing design as a rational problem solving process is particularly apt in situations where the problem is fairly clear-cut, and the designer has strategies that he/she can follow while solving them” (Dorst & Dijkhuis, 1995, p. 274).  
Social interpretivist: Reflection-in-action approach. “Describing design as a process of reflection-in-action works particularly well in the conceptual stage of the design process, where the designer has no standard strategies to follow and is proposing and trying out problem/solution structures” (Dorst & Dijkhuis, 1995, p. 274). “Person constructing his/her reality” (Dorst & Dijkhuis, 1995, p. 263). |

“instrument to uncover and include obvious and hidden needs” (Brenner & Uebernickel, 2016, p. xv).  
**Organization as culture**: “To bring about big changes in companies through Design Thinking, it must be understood that company culture needs to be addressed when training employees” (Brenner & Uebernickel, 2016, p. xv). “It is all about teamwork, leadership, and innovation culture” (Brenner & Uebernickel, 2016, p. 62).  
**Organization as theatre**: “The human in different roles, for example, as customer, employee, entrepreneur, or user, is gaining favor in many disciplines” (Brenner & Uebernickel, 2016, p. xv). |
Organization as sensemaking: “To be more concrete, organizations have their own languages, which has an impact on sensemaking in given situations or adapting to conjectured situations” (Brenner & Uebernickel, 2016, p. 199).

P: Functionalist: regulating, since there is little attention for power, inequality, domination etc. Between objectivist and subjectivist, but tends to objectivist. For the biggest part objective, real phenomena can be measured objectively (f.e., hidden needs of customers can be made explicit by examining these needs). “Design Thinking is a proven and robust instrument to uncover and include obvious and hidden needs in innovation-, development-, and problem-solving processes” (Brenner & Uebernickel, 2016, p. xv). “We learn from design practice how important it is to translate and operationalize often intuitive, subjective judgment into robust evaluations” (Brenner & Uebernickel, 2016, p. 106).


1.2 Sub-variable 1.2.1 Goal

<table>
<thead>
<tr>
<th>Authors</th>
<th>Goal</th>
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<tbody>
<tr>
<td></td>
<td>“The Curriculum for Social Design: [...]”</td>
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<tr>
<td></td>
<td>(Simon, 1996, p. 166).</td>
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<tr>
<td></td>
<td>“Often we shall have to be satisfied with meeting the design objectives only approximately” (Simon, 1996, p. 12).</td>
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<tr>
<td>Object</td>
<td>“The Curriculum for Social Design: [...]”</td>
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<td></td>
<td>“Most engineering is done in the context of business and governmental organizations” (Simon, 1996, p. 152).</td>
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<td>“If the problems relate to physical objects, they (or their solutions) can be represented by floor plans, engineering drawings, renderings, or three-dimensional models. Problems that have to do with actions can be attacked with flow charts and programs” (Simon, 1996, p. 133-134).</td>
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<td>“In city planning, for example, the boundary between the design of physical structures and the design of social systems dissolves almost completely” (Simon, 1996, p. 151).</td>
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<td></td>
<td>“Designing the Evolving Artifact” (Simon, 1996, p. 139).</td>
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</tbody>
</table>

Application area
Professional schools (Simon, 1996, p. 112; 113): “Schools of **engineering**, as well as schools of **architecture, business, education, law, and medicine**, are all centrally concerned with the process of design” (Simon, 1996, p. 111). “Engineering, medicine, business, architecture, and **painting** are concerned not with the necessary but with the contingent -- not with how things are but with how they might be -- in short, with design.” (Simon, 1969, p. xi). Works for ill-defined problems in **different areas** (Simon, 1973).

“The movement toward natural science and away from the sciences of the artificial proceeded further and faster in engineering, business, and medicine than in the other professional fields I have mentioned, though it has by no means been absent from schools of **law, journalism, and library science**” (Simon, 1996, p. 112).

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**Buchanan (1992)**

**Goal**

**Solving indeterminate or wicked problems.** “[…] Most of the problems addressed by designers are wicked problems. […] Wicked problems are a class of social system problems which are ill-formulated, where the information is confusing, where there are many clients and decision makers with conflicting values, and where the ramifications in the whole system are thoroughly confusing (Buchanan, 1992, p. 15).

“Indeterminacy implies that there are no definitive conditions or limits to design problems” (Buchanan, 1992, p. 16).

“Conceiving, planning, and making” is the final cause, in the sense that it identifies the sequence of goals towards which design thinking and practice move. “Products” represent the formal cause, in the sense of the formal outcome of the design process that serves human beings. And “in the accomplishment of their individual and collective purposes” represents the material cause of design, in the sense that the subject matter or scope of application of design is found in the activities, needs, and aspirations of human beings” (Buchanan, 2001a, p. 9).

“What we do believe is that design offers a way of **thinking about the world** that is significant for addressing many of the **problems** that human beings face in **contemporary culture**” (Buchanan, 2001b, p. 38).

**Object**

Four specific areas where design thinking can be used (Buchanan, 1992, p. 9-10):

1. **Symbolic and visual communications** (graphic design)
2. Material (tangible) **objects** (industrial design)
3. Activities and organized **services** (service design)
4. Complex (intangible) **systems or environments** for living, working, playing, and learning (interaction design) – “These range from information and communication systems, electrical power grids, and transportation systems to managerial organizations, public and private institutions, and even national constitutions” (Buchanan, 2001b, p. 38).

“Design is an art of invention and disposition, whose scope is universal, in the sense that it may be applied for the creation of **any human-made product**” (Buchanan, 2001a, p. 9).

“And the products are **more than physical objects.** They are **experiences or activities or services**, all of which are integrated into a new understanding of what a product is or could be (Buchanan, 2001a, p. 9).

**Application area**
“No single definition of design, or branches of professionalized practice such as industrial or graphic design, adequately covers the diversity of ideas and methods gathered together under the label” (Buchanan, 1992, p. 5).

Four specific areas where design thinking can be used (Buchanan, 1992, p. 9-10):
1. Graphic design
2. Industrial design
3. Service design
4. Interaction design

Examples Design Thinking professions: “industrial design, engineering and marketing […]” (Buchanan, 1992, p. 20).

“The subject matter of design is potentially universal in scope, because design thinking may be applied to any area of human experience” (Buchanan, 1992, p. 16).

“The alternative, common among some design theorists and researchers, is to believe that design must ultimately be reduced to one or another of the other disciplines—i.e. cognitive science, engineering, fine art, anthropology, marketing, and so forth” (Buchanan, 2001a, p. 17).

“We believe that conscious attention to the way designers work in specialized areas of application such as communication or industrial design is relevant for work in other areas” (Buchanan, 2001b, p. 38).

**Brown (2008)**

**Goal**
“[…] “design thinking” – a methodology that imbues the full spectrum of innovation activities with a human-centered design ethos” (Brown, 2008, p. 86). “Match people’s needs with what is technologically feasible and what a viable business strategy can convert into customer value and market opportunity (Brown, 2008, p. 86)”

**Object**
“Its objectives are no longer just physical products; they are new sorts of processes, services, IT-powered interactions, entertainments, and ways of communicating and collaborating – exactly the kinds of human-centered activities in which design thinking can make a decisive difference” (Brown, 2008, p. 86).

“Thinking like a designer can transform the way you develop products, services, processes—and even strategy” (Brown, 2008, p. 85).

**Application area**
“[…] Design thinking has much to offer a business world in which most management ideas and best practices are freely available to be copied and exploited” (Brown, 2008, p. 86).

**Martin (2009)**

**Goal**
Balance through generative reasoning (Martin, 2009).

“Design-thinking firms stand apart in their willingness to engage in the task of continuously redesigning their business. They do so with an eye to creating advances in both innovation and efficiency” (Martin, 2009, p. 38).

“Most businesses, in terms of strategy, structure, process and culture, have tended to favor exploitation and reliable replication of a proven success formula in the present(a reliability orientation) over exploration and
search for a new formula that might be more relevant in the future (a validity orientation)” (Martin, 2009, p. 41).

“[…], for a design firm, it’s all about solving ‘wicked’ problems” (Dunne & Martin, 2006, p. 513).

**Object**

“Design could be anything, not just products, but also an organization or a pricing strategy” (Dunne & Martin, 2006, p. 513).

“Design thinking is the way designers think: the mental processes they use to design objects, services or systems, as distinct from the end result of elegant and useful products” (Dunne & Martin, 2006, p. 517).

**Application area**

**Management and business** problems in **organizations**: “[…] The most successful businesses will balance analytical mastery and intuitive originality in a dynamic interplay that I call ‘design thinking’” (Martin, 2009, p. 38).

“The advantage, which emerges from the design-thinking firms’ unwavering focus on the creative design of systems, will eventually extend to the wider world. From these firms will emerge the breakthroughs that move the world forward” (Martin, 2009, p. 7).

“The design-thinking organization applies the designer’s most crucial tool to the problems of business” (Martin, 2009, p. 40).

Design thinking organisations reconcile analytical and intuitive thinking. They stand apart in their willingness to continuously redesign their business (Martin, 2009).

**Dorst (2011)**

**Goal**


“Potentially paradoxical problematic situations arise when their conventional problem solving fails” (Dorst, 2011, p. 530).

**Object**

“[…], business and management communities, who feel an urgent need to broaden their repertoire of strategies for addressing the complex and open-ended challenges faced by contemporary organisations” (Martin, 2011, p. 522).

“[…], organisations that operate in other professional fields” (Dorst, 2011, p. 522). (other than design)

“The missing element is a ‘what’ (an object, a service, a system) that still needs to be created” (Dorst, 2013, p. 6).

“Design practices can interface with organisations on different levels” (Dorst, 2011, p. 531):

1) “As the design practices that address problems in an existing frame (Abduction-1);

2) As design practices that involve framing (Abduction-2), where the frame originates from the existing company practice;

3) As the adoption of a new frame that has been brought or developed by an outsider;

4) As the creation of a new frame through the investigation of themes, in a deeper transformation of the organisations’ own practices. This last level is where design-based practices and organisational innovation are most intimately linked” (Dorst, 2011, p. 531).
Three layers of design practice:

“1. Project: where the real design work takes place.

2. Process: designers develop their own ways of working, specific and quite explicit processes that underpin all the projects in the firm.

3. Field/practice: the organisational, intellectual and physical environment in which a type of design practice can take shape” (Dorst, 2010, p. 136; Dorst, 2011, p. 526).

“The rationale behind this categorisation is that design is not just an activity in projects, but that experienced designers develop up their own processes that work across projects in a firm or professional practice” (Dorst, 2011, p. 526).

Application area

“[…] Paradigm for dealing with problems in sectors as far afield as IT, Business, Education and Medicine” (Dorst, 2011, p. 521). “This comparison between the four different reasoning patterns establishes the design professions as thinking fundamentally differently from fields that are predominantly based on analysis (Deduction, Induction) and problem solving/engineering (Normal Abduction)” (Dorst, 2013, p. 7).

Brenner & Uebernickel (2016)

Goal

“Creating entrepreneurial value through customer value” (Brenner & Uebernickel, 2016, p. 6).

“[…] Design Thinking is an innovation method” (Brenner & Uebernickel, 2016, p. 7).

“Design Thinking is a proven and robust instrument to uncover and include obvious and hidden needs in innovation-, development-, and problem-solving processes” (Brenner & Uebernickel, 2016, p. xv).

Object

“Design Thinking is a procedure to design innovation processes comprehensibly” (Brenner & Uebernickel, 2016, p. xv).

“Design Thinking is a proven and robust instrument to uncover and include obvious and hidden needs in innovation-, development-, and problem-solving processes.

“The expert interviews conducted for this research show that the strong focus on customer needs is very helpful for corporate entrepreneurship; strong customer orientation can even lead to changes in the company culture. […] Many companies suffer today because the time an innovative idea about a product or service takes to reach the market is too long. Design Thinking helps to accelerate this process” (Brenner & Uebernickel, 2016, p. 17).

“Changes in company and innovation culture, like those initiated by Design Thinking, take place in traditional fields in strategy and innovation research” (Brenner & Uebernickel, 2016, p. 19-20).

Application area

“Design Thinking at Stanford University began in the engineering department, but it subsequently spilled over into other areas like product design, robotics, microelectronics, human-computer interaction, learning, bio design and also to venture design” (Brenner & Uebernickel, 2016, p. 16).

Increasingly important in management (corporate entrepreneurship) and in information systems development (Brenner & Uebernickel, 2016, p. 17).
“Its pragmatic core and understandability allow application in many other contexts.” (Brenner & Uebernickel, 2016, p. xv)

“Changes in company and innovation culture, like those initiated by Design Thinking, take place in traditional fields in strategy and innovation research” (Brenner & Uebernickel, 2016, p. 19-20).

“Design Thinking offers a platform to answer different questions from areas such as problem-solving, design of business models, facilitation, mediation, visualization, and innovation in one process” (Brenner & Uebernickel, 2016, p. xv).

“Design Thinking can be defined as a field, in which many scientists and practitioners from various disciplines work and publish” (Brenner & Uebernickel, 2016, p. 4).

1.3 Sub-variable 1.2.2 Theoretical and conceptual substantiation of interventions

<table>
<thead>
<tr>
<th>Authors</th>
<th>Theory</th>
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<tbody>
<tr>
<td>Simon (1969)</td>
<td>Based on:</td>
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<tr>
<td></td>
<td>Own theory: “Martin’s view of constraints as inspiration to design differs from that of some other thinkers. Simon (1996), along with Boland and Collopy (2004), sees the design process as one of inventing subject to constraints: Constraints are seen as limits to the creative process rather than a means of generating new ideas” (Dunne &amp; Martin, 2006, p. 519).</td>
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<td>“If a general systems theory is too ambitious a goal, it might still not be vain to search for common properties among broad classes of complex systems. The ideas that go by the name of cybernetics constitute, if not a theory, at least a point of view that has proved fruitful over a wide range of applications. It has been highly useful to look at the behavior of adaptive systems in terms of feedback and homeostasis and to apply to these concepts the theory of selective information. The concepts of feedback and information provide a frame of reference for viewing a wide range of situations, just as do the ideas of evolution, of relativism, of axiomatic method, and of operationalism” (Simon, 1996, p. 173-174).</td>
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<td>“In the circumstances that create it, the catastrophe mechanism is effective and the metaphor evocative, but in practice, only a limited number of situations have been found where it leads to any further analysis” (Simon, 1996, p. 175).</td>
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<td>“It is also beside the point to ask whether the later stages of the development were consistent with the initial one whether the original designs were realized. Each step of implementation created a new situation; and the new situation provided a starting point for fresh design activity” (Simon, 1996, p. 163).</td>
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</table>
“Making complex designs that are implemented over a long period of time and continually modified in the course of implementation has much in common with painting in oil. […] The painting process is a process of **cyclical interaction** between painter and canvas in which current goals lead to new applications of paint, while the gradually changing pattern suggests new goals” (Simon, 1996, p. 163).

“Our discussion of design when the alternatives are not given has yielded at least three additional topics for instruction in the science of design:

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**Buchanan (1992)**

**Based on:**

“A strikingly different repositioning is now beginning in the profession of graphic design and visual communication. In the late nineteenth and early twentieth centuries, graphic design was oriented toward personal expression through image making. It was an extension of the expressiveness of the fine arts, pressed into commercial or scientific service. This was modified under the influence of "communication theory" and **semiotics** when the role of the graphic designer was shifted toward that of an interpreter of messages” (Buchanan, 1992, p. 11-12).

“One might argue that efforts to introduce **deconstructionist literary theory** into graphic design have often led to a loss of freedom and imagination in effective communication, contrary to the claims of its proponents” (Buchanan, 1992, p. 12).

“It is possible to see in **graph theory**, and, notably, the theory of directed graphs, a mathematical expression of the doctrine of placements” (Buchanan, 1992, p. 15).

“The origins of modern design research may be traced to the early seventeenth century and the work of Galileo Galilei. Galileo’s Dialogues Concerning Two New Sciences was the culmination of thirty years of personal research into the motion of bodies, and the book presents his **theory of motion**” (Buchanan, 2001a, p. 3).

**Own theory:**

(no theory about interventions themselves?)

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**Brown (2008)**

**Based on:** …

**Own theory:**

Design Thinking leads to more innovation. Innovating quickly and appropriately in line with customer’s needs leads to a sustainable competitive advantage in comparison with the competitors of a company (Brown, 2008).

“No matter where we look, we see problems that can be solved only through innovation” (Brown, 2008, p. 92).

(About how innovation emerges): “it was the result of hard work augmented by a creative human-centered discovery process and followed by iterative cycles of prototyping, testing, and refinement (Brown, 2008, p. 88).

“Time and again we see successful products that were not necessarily the first to market but were the first to appeal to us emotionally and functionally” (Brown, 2008, p. 92).

Applying the three steps of the Design Thinking process (inspiration, ideation, implementation) in an iterative way leads to innovation results (Brown, 2008).

You need designers with a Design Thinker’s profile in your team, and people from multiple disciplines (Brown, 2008).
<table>
<thead>
<tr>
<th>Source</th>
<th>Based on:</th>
<th>Own theory:</th>
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<tbody>
<tr>
<td>Martin (2009)</td>
<td>(Dunne &amp; Martin, 2006)</td>
<td>Leaders have to invest in and change “their organizations’ structures, processes, and norms” and their “cultures and routines”, so there is a balance between intuitive thinking and analytical thinking (Martin, 2009, p. 7). Businesses most of the time have more focus on analytical thinking and exploitation than intuitive thinking and exploration (Martin, 2009, p. 7). By investing in exploration as well as exploitation, a balance between innovation and efficiency is achieved, as well as a both reliability and validity. This gives the firm a competitive advantage (Martin, 2009, p. 26). “In conventional management thinking, constraints are seen as an undesirable barrier to the generation and implementation of ideas; for a designer, however, constraints are embraced as the impetus to creative solutions” (Dunne &amp; Martin, 2006, p. 518).</td>
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<tr>
<td>Dorst (2011)</td>
<td>“Multiple models of design thinking have emerged over twenty years of research, based on widely different ways of viewing design situations and using theories and models from design methodology, psychology, education, etc. Own theory: designers look broad at problems from multiple perspectives and stakeholders. By distilling themes from a complex open-ended and sometimes paradoxical situation, stimulate the development of new frames. These new frames form a reaction or even solution to the paradox which was central in the problematic situation (Dorst, 2011)”</td>
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<tr>
<td>Brenner and Uebernickel (2016)</td>
<td>“Design Thinking is a body of knowledge that started from the design field as a conception method and from Simon’s science of the artificial in the 1960s” (Brenner &amp; Uebernickel, 2016, p. xv). “The basis for scientific work, with the development of corporate information systems, was done by Simon (1969), with his seminal work “The Sciences of the Artificial” ” (Brenner &amp; Uebernickel, 2016, p. 17). Own theory: “Design Thinking is interdisciplinary, based on knowledge and insights from engineering, management, industrial design, anthropology, information management, and ethnography. Its pragmatic core and understandability allow application in many other context. […] Design Thinking works best when teams are heterogeneous” (Brenner &amp; Uebernickel, 2016, p. xv). Using the mindset of Design Thinking (see “organization” sub-variable) leads to innovations and solutions to problems: “Design Thinking as mindset is characterized by the simultaneously playful and solution-oriented combination of these principles. Experienced design thinkers recognize those principles as “given” and use them to create innovative and customer-oriented solutions” (Brenner &amp; Uebernickel, 2016, p. 10).</td>
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“In our Design Thinking projects with students and practitioners over the past 10 years, we realized that applying the principles alone—without structure—is too demanding for novices. To address this, we developed a two-stepped process model consisting of a micro and macro process, together with the engineering department of Stanford University” (Brenner & Uebernickel, 2016, p. 10).

“Design Thinking works only when tools and methods used are aligned with this new way of thinking” (Brenner & Uebernickel, 2016, p. 13).

1.4 Sub-variable 1.2.3 Social aspect

<table>
<thead>
<tr>
<th>Authors</th>
<th>Social aspect</th>
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<tr>
<td>Simon (1969)</td>
<td><strong>Understanding the problem-solving patterns, cognitive behaviour and psychology of the end-user.</strong> Chapter 2 considers the psychology of the user (Simon, 1969). “At micro social levels of design it is tacitly assumed that the professional architect, attorney, civil engineer, or physician works for a specified client and that the needs and wishes of the client determine the goals of the professional's work” (Simon, 1996, p. 150). “In the traditional professional-client relation, the client's needs and wants are given. The environment (including the functioning of the body) is to be adapted to the client's goals, not the goals to the environment. […] In the more complex world in which we actually live, the professional engineers possess substantial discretion to give professional considerations priority over the goals of the organization. If they choose to exercise that discretion, they must decide who the client is” (Simon, 1996, p. 152-153). <strong>Client central:</strong> “The client seeks to control professionals not only by defining their goals of design but also by reacting to the plans they propose.” (Simon, 1996, p. 153) “Identifying the client. Professional-client relations, society as the client, the client as player in a game.” (Simon, 1996, p. 166). <strong>Motivation:</strong> “In any planning whose implementation involves a pattern of human behavior, that behavior must be motivated. […] The members of an organization or a society for whom plans are made are not passive instruments, but are themselves designers who are seeking to use the system to further their own goals” (Simon, 1996, p. 153). <strong>Participation:</strong> “Variety, in the limits of satisfactory constraints, may be a desirable end in itself, among other reasons, because it permits us to attach value to the search as well as its out come to regard the design process as itself a valued activity for those who participate in it” (Simon, 1996, p. 130).</td>
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<tr>
<td>Buchanan (1992)</td>
<td>“Out of such concerns has emerged a new domain of design thinking and new directions of professional practice. We call this domain “interaction design” because we are focusing on how human beings relate to other human beings through the mediating influence of products” (Buchanan, 2001a, p. 11). “It is true that the new digital products have helped designers focus on interaction and the experience of human beings as they use products. However, the concepts of interaction have deep roots in twentieth-century design thinking and have only recently emerged from the shadow of our preoccupation with “visual symbols” and “things” ” (Buchanan, 2001a, p. 11).</td>
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</table>
“What has changed today is what we mean by a system. The focus is no longer on material systems—systems of “things”—but on human systems, the integration of information, physical artifacts, and interactions in environments of living, working, playing, and learning” (Buchanan, 2001a, p. 12).

Brown (2008) Design thinker personality profile: empathy (Brown, 2008, p. 87; Brown, 2009, p. 115): understand multiple perspectives and problems of end-user, through observation. “They can imagine the world from multiple perspectives—those of colleagues, clients, end users, and customers (current and prospective). By taking a “people first” approach, design thinkers can imagine solutions that are inherently desirable and meet explicit or latent needs. Great design thinkers observe the world in minute detail. They notice things that others do not and use their insights to inspire innovation” (Brown, 2008, p. 87).

Brown, 2009, p. 115): understand multiple perspectives and problems of end-user, through observation. “[…] innovation activities with a human-centered design ethos. By this I mean that innovation is powered by a thorough understanding, through direct observation, of what people want and need in their lives and what they like or dislike about the way particular products are made, packaged, marketed, sold, and supported” (Brown, 2008, p. 86).

Collaboration: “Collaboration. The increasing complexity of products, services, and experiences has replaced the myth of the lone creative genius with the reality of the enthusiastic interdisciplinary collaborator. The best design thinkers don’t simply work alongside other disciplines; many of them have significant experience in more than one. At IDEO we employ people who are engineers and marketers, anthropologists and industrial designers, architects and psychologists” (Brown, 2008, p. 87).

Martin (2009) Centrality of end-user: “The team engages in ethnographic observation, open-ended questions, and experimentation—all of which are grounded in an abiding respect for the views and values of the end user. The user is of vital importance, and is treated that way by all concerned” (Martin & Riel, 2010, p. 17).

“[…] MBAs have to learn collaborative skills. They have to learn to listen to other people and understand their reasoning process” (Dunne & Martin, 2006, p. 514).

“Martin places a good deal of emphasis on empathy with others as part of the design process. A designer works with other people on two levels: (1) By understanding users’ perspectives and their needs, and (2) by collaborating with peers” (Dunne & Martin, 2006, p. 519).

“[…] a designer would consider the interests of all stakeholders, customers, shareholders, and society at large, not just one” (Dunne & Martin, 2006, p. 520).


“Where the sciences help to analyze and understand complex issues, and engineering turns this understanding into brilliant technical solutions by sophisticated problem solving, design in its process and approach connects this technical prowess to the complexity at the human side of the issue” (Dorst, 2013, p. 3).

Brenner and Uebernickel (2016) “[…] contact with humans, and visualization of results as prototypes are examples of these principles” (Brenner & Uebernickel, 2016, p. xv).

Mindset principles (Brenner & Uebernickel, 2016, p. 8-9):
1. Innovation is made by humans for humans: “Design Thinking is a deeply human-centered method. At the root of every innovation are human needs. As a consequence […] various steps of the innovation process are
executed differently than in traditional innovation processes. Those steps and settings include interaction, emergence and solving of conflicts during the process, as well as physical spaces where the innovation process takes place that must reflect a different “nature” in their spatial design.”

5. **Test early with customers:** “Design Thinking forces innovators to be in constant and direct contact with end customers.”

“To bring about big changes in companies through Design Thinking, it must be understood that company culture needs to be addressed when training employees” (Brenner & Uebernickel, 2016, p. xv).

“One particular challenge is the combination of divergent and convergent thinking—and the mindset and openness that this demands from the team” (Brenner & Uebernickel, 2016, p. 15).

“Fifth, open feedback is necessary to allow for improvement of ideas—this holds for constructive criticism in the team, as well as collection of opinions from target users; it makes alternative ways clear and leads to deliberation” (Brenner & Uebernickel, 2016, p. 73).

### 1.5 Sub-variable 1.2.4 Type of change

<table>
<thead>
<tr>
<th>Authors</th>
<th>Type of change</th>
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</table>
| Simon (1969)| **Continuous change:** “Making complex designs that are implemented over a long period of time and **continually modified** in the course of implementation has much in common with painting in oil. […] The painting process is a process of **cyclical interaction** between painter and canvas in which current goals lead to new applications of paint, while the gradually changing pattern suggests new goals” (Simon, 1996, p. 163). “Social planning **without fixed goals** has much in common with the processes of biological evolution. Social planning, no less than evolution, is myopic. Looking a **short distance** ahead, it tries to generate a future that is a **little better** (read "fitter") than the present. In so doing, it creates a new situation in which the process is then repeated.” (Simon, 1996, p. 165).

“The external environments of thought, both the real world and long-term memory, undergo **continual change**. In memory the change is **adaptive**. It updates the knowledge about the real world and adds new knowledge. It adds new procedures that contribute to the skills in particular task domains and improves existing procedures” (Simon, 1996, p. 100).

“It will (or should) bias our investments in the direction of structures that can be shifted from one use to another, and to knowledge that is fundamental enough not soon to be outdated knowledge that may itself provide a basis for **continuing adaptation** to the changing environment” (Simon, 1996, p. 158).

| Buchanan (1992) | **Episodic change:** “In situations where a brief specifies in great **detail** the particular features of the product to be **planned**, it often does so because an owner, corporate executive, or manager has attempted to perform the critical task of transforming problems and issues into a working **hypothesis** about the particular features of the product to be designed” (Buchanan, 1992, p. 17).

“Problem solution is a synthetic sequence in which the various requirements are combined and balanced against each other, yielding a final **plan** to be carried into production” (Buchanan, 1992, p. 15).

“Furthermore, design is the way we **plan** and create actions, services, and all of the other humanly shaped processes of public and private life. These are the interactions and transactions that constitute the social and
economic fabric of a country. Finally, design is the way we **plan** and create the complex wholes that provide a framework for human culture” (Buchanan, 2001b, p. 38).

**Continuous change:**
“In fact, many scientists and business professionals, as well as some designers, continue to find the idea of a linear model attractive, believing that it represents the only hope for a "logical" understanding of the design process. However, some critics were quick to point out two obvious points of weakness: one, the actual sequence of design thinking and decision making is **not a simple linear process**; and two, the problems addressed by designers do not, in actual practice, yield to any linear analysis and synthesis yet proposed” (Buchanan, 1992, p. 15).

| Brown (2008) | **Episodic change:** “Experimentalism. Significant innovations don’t come from incremental tweaks. Design Thinkers pose questions and explore constraints in creative ways that proceed in entirely new directions” (Brown, 2008, p. 87).  
**Episodic and continuous change:** “Blend big and small projects. Manage a portfolio of innovation that stretches from short-term incremental ideas to longer-term revolutionary ones. Expect business units to drive and fund incremental innovation, but be willing to initiate revolutionary innovation from the top” (Brown, 2008, p. 91).  
**Continuous change:** “By applying a human-centered design methodology, they were able to create a relatively small process innovation that produced an outsize impact” (Brown, 2008, p. 88). |
| --- | --- |
| Martin (2009) | There must be a **balance between continuous change and episodic change**. Exploration and exploitation must be balanced (Martin, 2009, p. 20):  
1) Exploration: “long-term, uneven, scattered, characterized by false starts and significant leaps forward”. Resembles episodic change.  
2) Exploitation “short-term, systematically honing and refining in the current knowledge stage, accomplished by measured, careful incremental steps”. Resembles continuous change. |
| Dorst (2011) | **Continuous change:** “This reasoning pattern can lead to the impression that designers are just playing around with ideas a bit in what may look to be a childishly playful, trial-and-error process. Yet this is the only way to create progress in Design Abduction, and designers have developed sophisticated practices to achieve a good framing of the problem situation” (Dorst, 2013, p. 9).  
“The embedding of this higher layer of design thinking into the organisation will create an environment in which the pursuit of novelty and progress becomes a natural part of the firms’ overall practice, instead of an ad-hoc panic-born scramble for novelty” (Dorst, 2010, p. 137).  
**Episodic change:** Dorst gives an example where designers intentionally look into a problem situation which is externally driven, and propose a big change (Dorst, 2013, p. 9-12).  
Depends on existing frame / new frame and whether this frame is developed in the current context and practices of the organization (Dorst, 2010). |
| Brenner and Uebernickel (2016) | **Continuous change:** “Most methods to develop information systems lead to abstract models. These are, often through a step-by-step process, refined to lower abstraction layers. Many decision makers do not understand such models. Design Thinking goes in another direction” (Brenner & Uebernickel, 2016, p. 8). |
“Furthermore, in design practice, problem and solution rarely follow a clear, linear sequence. In contrast to a universal route map of design process, briefing (making sense of the issues and challenges at hand) is a continuous, recurring element, rather than just the first sequential step of design” (Brenner & Uebernickel, 2016, p. 135).

**Episodic and continuous change:** “However, the reason for the great value of radical innovations is that companies that have succeeded over the long haul punctuate ongoing incremental innovation with radical innovations that create new markets and business opportunities. In the next breath, it must be noted that the radical innovation is like a start-up for a continuous improvement, i.e. incremental innovations, through which the gains of radical innovation are sustainable” (Brenner & Uebernickel, 2016, p. 43).

**Episodic change:** “First, Design Thinking strives for radical innovation to answer wicked problems—the novelty of ideas and the envisioning of their implementation are the highest goals of a Design Thinking project in various contexts, thus requiring a large portion of creativity” (Brenner & Uebernickel, 2016, p. 73).

“Whereas scientists focus on contributions that can be easily delimited and described in detail, Design Thinking promotes radical innovation that changes far more than one single factor” (Brenner & Uebernickel, 2016, p. 73).

### 1.6 Sub-variable 1.3.1 Process

<table>
<thead>
<tr>
<th>Authors</th>
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<tbody>
<tr>
<td>Simon (1969)</td>
<td><strong>Searching, choosing and testing alternatives against criteria.</strong> “[…] Think of the design process as involving, first, the generation of alternatives and, then, the testing of these alternatives against a whole array of requirements and constraints. There need not be merely a single generate-test cycle, but there can be a whole nested series of such cycles. The generators implicitly define the decomposition of the design problem, and the tests guarantee that important indirect consequences will be noticed and weighed.” (Simon, 1969, p. 74). To get to the optimal design decision, this process is needed (Simon, 1969).</td>
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<td></td>
<td><strong>Iterative cycles:</strong> “Each step of implementation created a new situation; and the new situation provided a starting point for fresh design activity. […] Making complex designs that are implemented over a long period of time and continually modified in the course of implementation has much in common with painting in oil. […] The painting process is a process of cyclical interaction between painter and canvas in which current goals lead to new applications of paint, while the gradually changing pattern suggests new goals” (Simon, 1996, p. 163). “The Curriculum for Social Design: […]”.</td>
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<td></td>
<td><strong>Data for planning.</strong> Methods of forecasting, the use of prediction and feedback in control.</td>
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<td></td>
<td><strong>Identifying the client.</strong> Professional-client relations, society as the client, the client as player in a game.</td>
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<td></td>
<td><strong>Designing without final goals.</strong> Designing for future flexibility, design activity as goal, designing an evolving system” (Simon, 1996, p. 166).</td>
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<td>“There are two ways in which design processes are concerned with the allocation of resources. First, <strong>conservation of scarce resources</strong> may be one of the <strong>criteria</strong> for a satisfactory design. Second, the design process</td>
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itself involves **management of the resources of the designer**, so that his efforts will not be dissipated unnecessarily in following lines of inquiry that prove fruitless” (Simon, 1996, p. 124-125).

**Representation/visualizing:** “In fact architecture can almost be taken as a prototype for the process of design in a semantically rich task domain. The emerging design is itself incorporated in a set of external memory structures: sketches, floor plans, drawings of utility systems, and so on. At each stage in the design process, the partial design reflected in these documents serves as a major stimulus for suggesting to the designer what he should attend to next” (Simon, 1996, p. 92).

**Buchanan (1992)**

Linear model: “[…] The design process is divided into two distinct phases: **problem definition** and **problem solution**. Problem definition is an analytic sequence in which the designer determines all of the elements of the problem and specifies all of the requirements that a successful design solution must have. Problem solution is a synthetic sequence in which the various requirements are combined and balanced against each other, yielding a final plan to be carried into production” (Buchanan, 1992, p. 15).

“Designers are correct in believing that they are quite familiar with research and that **research** is an essential part of the design process” (Buchanan, 2001a, p. 19). 

“In fact, many scientists and business professionals, as well as some designers, continue to find the idea of a linear model attractive, believing that it represents the only hope for a "logical" understanding of the design process. However, some critics were quick to point out two obvious points of weakness: one, the actual sequence of design thinking and decision making is **not a simple linear process**; and two, the problems addressed by designers do not, in actual practice, yield to any linear analysis and synthesis yet proposed” (Buchanan, 1992, p. 15).

**Brown (2008)**

“Thinking like a designer can transform the way you develop […] processes” (Brown, 2008, p. 85).

“The design process is best described metaphorically as a system of spaces rather than a predefined series of orderly steps. The spaces demarcate different sorts of related activities that together form the continuum of innovation. Design thinking can feel chaotic to those experiencing it for the first time” (Brown, 2008, p. 88).

Design process (Brown, 2008, p. 88-89):

1. **Inspiration**: “the search for solutions”.

   “**Expect success**: build implementation resources into your plan → What’s the business problem? Where’s the opportunity? What has changed (or soon may change) → Look at the world: observe what people do, how they think, what they need and want → What are business constraints (time, lack of resources, impoverished customer base, shrinking market) → Involve many disciplines from the start (e.g., engineering & marketing) → Pay close attention to “extreme” users such as children or the elderly → Have a project room where you can share insights, tell stories → How can new technology help? → Are valuable ideas, assets, and expertise hiding inside the business? → Organize information and synthesize possibilities (tell more stories!).”

2. **Ideation**: “generating, developing, and testing ideas that may lead to solutions”.

   “**Brainstorm** → Make many sketches, concoct scenarios → Build creative frameworks (order out of chaos) → Apply integrative thinking → Put customers in the midst of everything; describe their journeys → Prototype, test, prototype, test… → Tell more stories (they keep ideas alive) → Communicate internally – don’t work in the dark! → Prototype some more, test with users, test internally.”

3. **Implementation**: “charting of a path to the market”.

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Execute the vision: engineer the experience → Help marketing design a communication strategy → Make the case to the business – spread the word → Move on to the next project – repeat.”

Iterative cycles of prototyping, testing and refinement (Brown, 2008, p. 88): “Projects will loop back through these spaces – particularly the first two – more than once as ideas are refined and new directions taken” (Brown, 2008, p. 89). “[...] the process also featured endless rounds of trial and error” (Brown, 2008, p. 86). Applying the three steps of the Design Thinking process (inspiration, ideation, implementation) in an iterative way leads to innovation results (Brown, 2008).

Inspiration phase (Brown, 2009):
1. Divergent exploration of problem space: collect data with various perspectives.
2. Synthesis: convert observations into insights.

Knowledge funnel: three steps of the knowledge funnel process (Martin, 2010, p. 37; Martin, 2009, p. 7-8):
1. Pinpointing a market opportunity (Selecting and exploring a particular “mystery” to be solved – What might the impact of post-war mobility be on American eating habits?).
2. Devising an offering for that market (An initial heuristic or “rule-of-thumb” that helps narrow the field of inquiry and work the mystery down to a manageable size. Way of thinking about the mystery that provides a simplified understanding of it and allows those with access to the heuristic to focus their efforts. – Americans want a quick, convenient, tasty meal).
3. Codifying its operations (Converting heuristic from a general rule of thumb to a fixed formula = an algorithm – Kroc systematized McDonald’s).

It’s a model for how businesses of all sorts can advance knowledge and capture value, and is basically the same route followed by successful business innovators in every domain.”

The cycle of Design Thinking (Dunne & Martin, 2006, p. 518):
Generate ideas (abduction) → predict consequences (deduction) → test → generalize (induction) → repeat.


“Give business managers first-hand design thinking experience (e.g. develop deep user understanding, visualise and prototype new possibilities)” (Martin, 2009, p. 86)

Combining and balancing abductive, inductive and deductive reasoning (Martin, 2009). Design thinking is seen as an ongoing cycle of generating ideas (abduction), predicting consequences (deduction), testing, and generalizing (induction) (Skoldberg et al., 2013). “In design, the imaginative step involves abductive reasoning—asking not what is true, but what could be true” (Martin & Riel, 2010, p. 18). “Abductive reasoning is [...] a third form of reasoning alongside deduction and induction. Deductive (from the general to the specific) and inductive (from the specific to the general) reasoning are both grounded in the scientific tradition and allow the analyst to marshal established principles or existing data to converge on particular conclusions. Abductive logic offers a line of reasoning between [...] analytically thinking and [...] intuitive thinking. [...] The design thinker can add abductive logic to the reasoning repertoire to lead the organization through the knowledge funnel. And [...] the design thinker uses an explicit form of logic and a process that, while less certain and clear than analytical thinking, has promise for producing advances with greater consistency and
replicability than pure induction. The design thinker therefore enables the organization to balance exploration and exploitation” (Martin, 2010, p. 41). “With a design model we would like to think outside the existing alternatives and create new alternatives” (Dunne & Martin, 2006, p. 514).

Two ways of thinking that must be balanced (Martin, 2010, p. 38):
1) **Analytical thinking**: “the goal is mastery through rigorous, continuously repeated analytical processes. If judgment, bias, and variation can be eliminated, […] great decisions will be made and much value created.

2) **Intuitive thinking**: “[…]the art of knowing without reasoning. This is the world of originality and invention.”

“Systems thinking”, visualizing a design or managerial problem as a system of structures, patterns and events, rather than just the events alone—and understanding the impact of changes in one component on the others, and on the system as a whole” (Dunne & Martin, 2006, p. 518).

**Dorst (2011)**

**Abductive reasoning.** Four types of academic reasoning (p. 523-525):

- Deduction: What + how = 
- Induction: What + ? = outcome
- Normal abduction: ? + how = outcome
- Design abduction: ? + ? = outcome → this type of reasoning belongs to Design Thinking. "Work backwards […] starting from the value that needs to be created" (Dorst, 2011, p. 525).

What = elements in the situation.
How= how elements interact.

Abductive reasoning:
“Design practices can interface with organisations on different levels” (Dorst, 2011, p. 531):

1) “As the design practices that address problems in an existing frame (Abduction-1);

2) As design practices that involve framing (Abduction-2), where the frame originates from the existing company practice;

3) As the adoption of a new frame that has been brought or developed by an outsider;

4) As the creation of a new frame through the investigation of themes, in a deeper transformation of the organisations’ own practices. This last level is where design-based practices and organisational innovation are most intimately linked” (Dorst, 2011, p. 531).

Nine-step model of frame creation (Dorst, 2013, p. 10):

1) **Archaeology**: analysing the history of the problem owner & of the initial problem formulation.

2) **Paradox**: analysing the problem situation: what makes this hard?

3) **Context**: analysing the inner circle of stakeholders.

4) **Field**: exploring the broader field.

5) **Themes**: investigating the themes in the broader field.

6) **Frames**: identifying patterns in the themes to create frames.

7) **Futures**: exploring the possible outcomes and value propositions.
8) **Transformation**: investigate the change in practices required for implementation.
9) **Integration**: draw lessons from the new approach & identify opportunities.”

“Then we can create design interventions, and reflect upon them on the basis of these models, in an iterative process” (Dorst, 2013).

Brenner and Uebernickel (2016)

“As a process, Design Thinking is seen as a combination of a micro- and a macro-process” (Brenner & Uebernickel, 2016, p. 3).

Innovation process (Brenner & Uebernickel, 2016, p. 10-13):

Macro-process (step 1-3 diverging, step 5-7 converging):

1) The first step of the macro process “**Design Space Exploration**” explores the so-called design space, based on the challenge. In this step, literature and web research, as well as talks with experts, are recommended. Design thinkers must first gather their own experiences of the relevant industry sector.”

2) In the second step, “**Critical Function Prototype**”, the first prototypes are developed.”

3) In the next phase, a so-called “**Dark Horse Prototype**” is developed. The name of this prototype comes from horse racing. The “Dark Horse” is the horse that nobody bets on, yet it wins. The solution space is extended and room emerges for new, even more innovative solutions. The dark horse prototypes often scare novices because of their sheer creativity and almost completely disregarded boundary conditions.”

4) With the step “**Funky Prototype**”, the divergent phase is closed. This step aims to merge the best ideas from all prototypes developed thus far into one prototype, building toward the final prototype.”

5) **Functional Prototype**: “Requirements and boundaries of the final solution are fixed. It is crucial to decide, based on prior prototypes and insights, which solution ideas and which prototypes should be part of the final prototype. The Functional Prototype needs to be much more specific than prior prototypes, providing clear insights into customer acceptance and which needs can be satisfied.”

6) The next step is the “**X-is-finished-Prototype**”, which serves to detect one key functionality (“X”) and what effort is required to realize the final prototype. In this step, the team decides which parts can be included in the final prototype.”

7) The “**Final Prototype**” comprises all functions necessary to satisfy realizable customer needs. This prototype’s degree of detail needs to be extremely high, so that comprehensive testing with customers is possible. The final prototype is accompanied by a presentation showing the process and attributes of the solution. Incidentally, during the last 10 years, numerous videos were also created to clarify and explain projects to a general audience.”

Micro-process: “In each of the prototype-oriented macro steps, the micro process is conducted several times.”

1) The first process step “**Define the problem**” means that a so-called challenge, the problem brief, is worked out. The challenge describes the problem-to-solve in form of a question.”

2) The second step, “**Needfinding & Synthesis**”, is aimed at revealing end customers’ needs. We differ between obvious and hidden needs. The team builds up expertise in the topic under scrutiny. Expert interviews, literature and web search help to reach a knowledge level needed to have fruitful talks with customers.”

3) In the third step, “**Ideate**”, teams are encouraged to find solution ideas through brainstorming.”

4) The aim of the step, “**Prototype**”, is to build prototypes that can be tested in the next step with customers.”
5) “In the next step, “Test”, prototypes are tested with end customers.” Testing and learning are connected, since while testing, Design Thinkers get important clues whether a prototype works, or reasons why it does not.”

6) (Re)define the problem: ”Following the step “Test”, it has to be verified whether the original problem brief was the right one: more concretely, whether the innovation fulfilled obvious or hidden needs of customers. If a positive answer is given, a new micro process can begin. If the answer is negative, the challenge needs to be reformulated based on the new insights.”

Design never ends: “[…] work must proceed iteratively in cycles. Whenever a solution idea has been tested, questions will be posed about whether it contributes to a solution for the original problem brief and whether the initial problem brief was the right one” (Brenner & Uebernickel, 2016, p. 9).

1.7 Sub-variable 1.3.2 Configuration

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<th>Authors</th>
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1. Bounded rationality. The meaning of rationality in situations where the complexity of the environment is immensely greater than the computational powers of the adaptive system.
[…].
4. Organizations in social design. Not only is social design carried out mainly by people working in organizations, but an important goal of the design is to fashion and change social organization in general and individual organizations in particular.
5. Time and space horizons. The discounting of time, defining progress, managing attention” (Simon, 1996, p. 166). |

Buchanan (1992)     | (Does not really speak about interventions and their organization)
|                    | “Designers conceive their subject matter in two ways on two levels: general and particular. On a general level, a designer forms an idea or a working hypothesis about the nature of products or the nature of the humanmade in the world. […] In actual practice, the designer begins with what should be called a quasi-subject matter, tenuously existing in the problems and issues of specific circumstances. Out of the specific possibilities of a concrete situation, the designer must conceive a design that will lead to this or that particular product.” (Buchanan, 1992, p. 17). |

|                    | “As a liberal art of technological culture, design points toward a new attitude about the appearance of products. Appearance must carry a deeper, integrative argument about the nature of the artificial in human experience. This argument is a synthesis of three lines of reasoning: the ideas of designers and manufacturers about their products; the internal operational logic of products; and the desire and ability of human beings to use products in everyday life in ways that reflect personal and social values. Effective design depends on the ability of designers to integrate all three lines of reasoning. But not as isolated factors that can be added together in a simple mathematical total, or as isolated subject matters that can be studied separately and joined late in the product development process” (Buchanan, 1992, p. 20). |
Brown (2008)

Being broad generalist and a team-based approach to innovation, with a diverse team (Brown, 2008, p. 86). Design Thinker’s personality profile (Brown, 2008, p. 87):

1. **Empathy** (understand multiple perspectives and problems of end-user -> through observation, see below).
2. **Integrative thinking** (see all salient aspects of a problem and create solutions that improve on existing alternatives) 3. **Optimism** (one potential solution is better than existing alternatives)
4. **Experimentalism** (pose questions and explore constraints in creative ways that proceed in new directions)
5. **Collaboration** (work or even be interdisciplinary).

How to make Design Thinking part of the innovation drill (Brown, 2008, p. 90-91):

1. Begin at the beginning (involve design thinkers at start of process).
2. Take a human-centered approach (discover behaviour, needs and preferences, by observation).
3. Try early and often (rapid experimentation and prototyping).
4. Seek outside help (co-create with customers and consumers).
5. Blend big and small projects (incremental innovation bottom-up by business units, revolutionary innovation top-down).
6. Budget to the pace of innovation (as project proceeds, rethink funding approach).
7. Find talent any way you can (from interdisciplinary programs, and/or train non-designers).
8. Design for the cycle (plan assignments in line with inspiration-ideation-implementation).

Three concerns for successful design: Desirability (from users’ perspective) - viability (commercially) - feasibility (technically). (https://designthinking.ideo.com/ ) (Brown, 2009).

Martin (2009)

**Centrality of end-user:** “The team engages in ethnographic observation, open-ended questions, and experimentation—all of which are grounded in an abiding respect for the views and values of the end user. The user is of vital importance, and is treated that way by all concerned” (Martin & Riel, 2010, p. 17).

“As distinct from managers, whose work flow is centered around ongoing, permanent assignments, designers work on a “project” basis, where the project has a specific deadline, and, once completed, disappears from sight” (Dunne & Martin, 2006, p. 517).

Principles to change an analytical culture to a more intuitive culture:

- Have designers sit inside the core business teams rather than have them segregated in a central staff function; (Martin, 2009, p. 86)
- Build a network of design experts as a sounding board for the business teams, e.g. external design board; (Martin, 2009, p. 87)
- Give business managers first-hand design thinking experience (e.g. develop deep user understanding, visualise and prototype new possibilities); (Martin, 2009, p. 86)
- Free up time for managers to stare into the next mystery by refining the algorithm that enables handing over routine parts of managers’ jobs to juniors; (Martin, 2009, p. 89)
- Change the strategy process to include dialogue about possibilities rather than presentation of the one and only answer (strategy is a design exercise); (Martin, 2009, p. 111)
- Change the reward systems by allocating rewards to those who solve wicked problems; (Martin, 2009, p. 127)
- Make the solving of wicked problems a high-status assignment; (Martin, 2009, p. 177)
Implement an ad hoc project organisation for true discovery activities with true (client) collaboration and clearly defined projects that come to an end at a specified date; (Martin, 2009, p. 119), “Ad-hoc teams and collaborating for a specific purpose” (Dunne & Martin, 2006, p. 518).

Connect with innovators outside the company and develop their creations (not all creations have to come from in); (Martin, 2009, p. 96)

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**Dorst (2011)**

Levels of design expertise / ways of operating in design practice (Lawson & Dorst, 2009):

1. Naïve / Choice based: adequate for everyday use in conventional situations. Superficial set of design solutions that they know.
2. Novice / Convention based: the exploration of what design is, finding the rules of the game. First time students encounter design as a series of activities, as a process.
3. Advanced beginner / Situation based: recognition that design problems are highly individual and situated. Less amenable to the use of standard solutions.
4. Competent / Strategy based: can handle and understand all the normal kinds of situations in the design domain. Strategic thinking. More control over project.
5. Expert / Experience based: more or less automatic recognition of situations and a quick, intuitive and dead sure response.
6. Master / Creating new schemata: their work is seen as representing new knowledge in the field.
7. Visionary / Redefinition of the field: explicitly developing or even redefining the design field that they are working in” (Dorst, 2010, p. 135).

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**Brenner and Uebernickel (2016)**

“Iterative development, contact with humans, and visualization of results as prototypes are examples of these principles” (Brenner & Uebernickel, 2016, p. xv).

“Design Thinking works best when teams are heterogeneous” (Brenner & Uebernickel, 2016, p. xv).

“Analogous to other processes in the company, innovation processes can be structured and replicated to a certain extent. Design Thinking is a procedure to design innovation processes comprehensibly. Relying on single, unique persons with a specific genius is replaced by a reproducible process” (Brenner & Uebernickel, 2016, p. xv).

Mindset principles (Brenner & Uebernickel, 2016, p. 8-9):

1. **Innovation is made by humans for humans**: “Design Thinking is a deeply human-centered method. At the root of every innovation are human needs. As a consequence […] various steps of the innovation process are executed differently than in traditional innovation processes. Those steps and settings include interaction, emergence and solving of conflicts during the process, as well as physical spaces where the innovation process takes place that must reflect a different “nature” in their spatial design.”

2. **Combination of divergent and convergent thinking**: “Design thinkers enhance the solution space through following unconventional paths, i.e. thinking divergently. At different points in the innovation process, existing, fixed frame conditions are “crashed”. […] When engaging in convergent thinking, a few feasible solutions emerge.”

3. **Fail often and early**: “Design Thinking, in practice, means coming up with many ideas and testing them with end customers to learn what works.”

4. **Built prototypes that can be experienced**: “Fast and easily comprehensible prototypes are built that allow a new idea to be tested. […] We differentiate between different resolution prototypes: those with low resolution
are often only sketches or paper mock-ups, while high-resolution prototypes can be, for example, programmable interfaces.”

5. **Test early with customers:** “Design Thinking forces innovators to be in constant and direct contact with end customers.”

6. **Design never ends:** “[…] work must proceed iteratively in cycles. Whenever a solution idea has been tested, questions will be posed about whether it contributes to a solution for the original problem brief and whether the initial problem brief was the right one.”

7. **Design Thinking needs a special place:** “To conduct Design Thinking projects successfully, special spaces are required: designed according to the teams’ needs and equipped with the right materials.”

### 1.8 Sub-variable 1.3.3 Instrument

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<tr>
<th>Authors</th>
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<tbody>
<tr>
<td>Simon (1969)</td>
<td><strong>Means-ends analysis</strong> (Simon, 1996, p. 121). Determining the optimal design decision. Because resources are scarce, the designer needs to have tools at hand that allow him to decide between different designs. Business concepts such as utility theory and cost/benefit analysis are useful tools that can be used to quantify different design alternatives based on their values to different stakeholders.</td>
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<td>“4. The exploitation of parallel, or near-parallel, factorizations of differences. Means-end analysis is an example of a broadly applicable problem-solving technique that exploits this factorization” (Simon, 1996, p. 124).</td>
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<td></td>
<td>“This relation of program to environment opened up an exceedingly important role for computer simulation as a tool for achieving a deeper understanding of human behavior” (Simon, 1996, p. 21).</td>
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<td><strong>Heuristic methods</strong> provide an especially powerful problem-solving and decision-making tool for humans who are unassisted by any computer other than their own minds, hence must make radical simplifications to find even approximate solutions” (Simon, 1996, p. 28).</td>
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<td></td>
<td><strong>Utility theory</strong> and <strong>statistical decision theory</strong> as a logical framework for rational choice among given alternatives.</td>
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<td></td>
<td>The body of techniques for actually deducing which of the available alternatives is the optimum. (Simon, 1996, p. 118).</td>
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<td><strong>Design</strong> could be seen as the tool to change existing situations in preferred ones. “Design like science is a tool for understanding as well as for acting” (Simon, 1996, p. 164).</td>
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<td>“<strong>Adaptation of standard logic</strong> to the search for alternatives. Design solutions are sequences of actions that lead to possible worlds satisfying specified constraints. With satisficing goals the sought-for possible worlds are seldom unique; the search is for sufficient, not necessary, actions for attaining goals. […]”</td>
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<td></td>
<td><strong>Decomposition:</strong> “To design such a complex structure, one powerful technique is to discover viable ways of decomposing it into semi-independent components corresponding to its many functional parts” (Simon, 1996, p. 128). About the interactions between and in subsystems.</td>
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</table>
**Representation:** this makes a solution transparent. “If the problems relate to physical objects, they (or their solutions) can be represented by floor plans, engineering **drawings**, renderings, or **three-dimensional models**. Problems that have to do with actions can be attacked with **flow charts and programs**” (Simon, 1996, p. 133). “Solving a problem simply means representing it so as to make the solution transparent. If the problem solving could actually be organized in these terms, the issue of representation would indeed become central. […] A view a deeper understanding of how representations are created and how they contribute to the solution of problems will become an essential component in the future theory of design” (Simon, 1996, p. 133).

**Simulation:** “[…] a technique for achieving understanding and predicting the behavior of systems” (Simon, 1996, p. 13). “Simulation may even take the form of a thought experiment, never actually implemented dynamically” (Simon, 1996, p. 14). Simulation is seen as a source to create new knowledge (Simon, 1996, p. 14-15).

“**The Curriculum for Social Design:** […]


---

**Buchanan (1992)**

“Design problems are “indeterminate” and “wicked” because design has **no special subject matter** of its own apart from what a designer conceives it to be” (Buchanan, 1992, p. 16).

**Placements:** “Placements have boundaries to shape and constrain meaning, but are not rigidly fixed and determine. The boundary of a placement gives a context or orientation to thinking, but the application to a specific situation can generate a new perception of that situation and, hence, a new possibility to be tested. […] Individual designers often possess a personal set of placements, developed and tested by experience. […] This is where placements take on special significance as tools of design thinking. They allow the designer to position and reposition the problems and issues at hand. Placements are the tools by which a designer intuitively or deliberately shapes a design situation, identifying the views of all participants, the issues which concern them, and the invention that will serve as a working hypothesis for exploration and development” (Buchanan, 1992, p. 17-18). Because of placements, problem formulation and solution go hand in hand rather than as sequential steps.

“Indeed, we found that engineers and, particularly, industrial designers went directly to **user observation** and **interviews** with potential users. The technique was not the classic form of focus group discussion— though some use of focus groups was made in some cases. Instead, there were conversations with potential users and, sometimes, the conversations were shaped around modest product prototypes that elicited comments and observations” (Buchanan, 2001a, p. 20).

“Design, too, uses the **case study method**, and there are organizations in the United States that promote the creation and dissemination of case studies as a basis for understanding a wide range of issues, ranging from branding and identity systems to new product development” (Buchanan, 2001a, p. 18).

---

**Brown (2008)**

Brown (2009) highlights the importance of shifting from abstract to physical and back, which unlocks imagination, thus strengthening exploration. He recommends various ways of prototyping intangibles— from drawing rough **sketches** (Brown, 2008, p. 88), using **post-its**, to acting out different business model scenarios as **skits**. **Role-plays** add value, as they help innovators build empathy to all business model participants. Another recommended way to make business models tangible is to develop whole “**customer journeys**” (Brown, 2008, p. 88), where a fictional customer is taken through all stages of a new business model scenario; from the first
interaction with the respective company through all relevant “touch points” to experience the value of the innovative business model.

Rough sketches and rough prototypes (ambiguous media) encourage divergent conversations with many possible changes, while high-resolution process models and CADs (mathematized media) encourage convergent discussions that tend to produce small changes. The underlying argument is that the use of different media implies different levels of design idea completeness, triggering different kinds of feedback. Design thinkers can also use both ambiguous and mathematized media together in so-called hybrid media models, where rough sketches are combined with photographs, drawings, and text. Hybrid models allow for flexibility in exploring the relationships of different elements with each other. Design thinkers can use this framework to guide conversations, depending on how confident they feel about their idea, what kind of feedback they are requesting and how they want to communicate their concepts.

Observation (Brown, 2008, p. 86): “[…] Innovation is powered by a thorough understanding, through direct observation, of what people want and need in their lives and what they like or dislike about the way particular products are made, packaged, marketed, sold, and supported.”

“Reflection” to understand the perspectives and needs of users (Dunne & Martin, 2006, p. 519).

Brainstorming and prototyping: “[…] The innovation teams explored potential solutions through brainstorming and rapid prototyping (prototypes of a service innovation will of course not be physical, but they must be tangible. Because pictures help us understand what is learned through prototyping, we often videotape the performance” (Buchanan, 1992, p. 87).

Martin (2009)


Not about individual cognitive styles and does not present sets of material practices; rather, he focuses on systems of organization (Kimbell, 2011).

“Consider a prototypical project team tackling a wicked design problem. It does so using a set of proven tools and techniques: The team dives first into understanding the user and how his or her needs connect to the problem at hand. Then, with that understanding in mind, the team begins to prototype and test solutions that seek to address the interactions user’s needs. Along the way, the team thinks deeply and carefully about the best way to interact with users to get the answers they need. The team engages in ethnographic observation, open-ended questions, and experimentation—all of which are grounded in an abiding respect for the views and values of the end user” (Martin & Riel, 2010, p. 17).

“The practices include qualitative approaches to deeply understand users (in addition to traditional quantitative measures) […] and iterative crafting of strategy (rather than linear planning)” (Lafley, Norman, Brown, & Martin, 2013, p. 10).

“Chris Argyris discusses fundamental insights about how people learn through the skill of inquiry (Argyris & Schön, 1978). One version of this is appreciative inquiry (Cooperrider & Whitney, 1999), where the emphasis is on better understanding what the other person is thinking” (Dunne & Martin, 2006, p. 515).

Three key tools for Design Thinkers (Martin, 2009, p. 162-163).:
**Observation:** to obtain deep user-centered understanding of consumers and other stakeholders, Design Thinkers have to gain new contradicting information by observing.

**Imagination:** making a “inference to an explanation” requires this. With the information that is obtained through observation, an explanation needs to be thought of. The inference can be tested with prototypes, to see if the given explanation holds in reality.

**Configuration:** “translating the idea into an activity system that will produce the desired business outcome”.

<table>
<thead>
<tr>
<th>Dorst (2011)</th>
</tr>
</thead>
<tbody>
<tr>
<td>The designing disciplines can be seen to lean on five main design activities in meeting their abductive challenges:</td>
</tr>
<tr>
<td><strong>1. Formulating:</strong> identifying of the key issues in a problem arena and the framing of these in a new and original manner.</td>
</tr>
<tr>
<td><strong>2. Representation:</strong> problems and solutions (in words and sketches, sometimes using quite sophisticated visualization techniques) [...]. By sketching an idea, looking at it critically, altering it, taking a step back again, etc.</td>
</tr>
<tr>
<td><strong>3. Moving:</strong> moves can be entirely original or they can be further developments of moves that are part of the designer’s repertoire or the general design culture.</td>
</tr>
<tr>
<td><strong>4. Evaluating:</strong> Early on in the project, [...] this evaluation necessarily takes on a subjective nature. Later on, [...] the evaluations should be much more formal and objective.</td>
</tr>
<tr>
<td><strong>5. Managing:</strong> Design projects are hard to plan and control. [...] Briefing tends to be a continuous process as the design options develop [...] – this makes resource planning very difficult” (Dorst, 2010, p. 133).</td>
</tr>
</tbody>
</table>

| Observation: “Our forecast can be verified by observations, confirming that we have considered all the players in the situation correctly and have a sound grasp of the pattern of relationships through which the sun and the planets in the solar system interact” (Dorst, 2013, p. 4). |

Brenner and Uebernickel (2016) “Seven tools that give an impression how Design Thinking projects work” (Brenner & Uebernickel, p. 14-15):

– **Stakeholder Map:** [...] In management sciences, many approaches (especially the stakeholder-approach) begin with a holistic analysis of stakeholders, that can be distinguished from a solely shareholder-oriented firm strategy. The stakeholder map attempts to identify all parties that are relevant for the problem brief. In our Design Thinking projects, we realized that it is important to identify extreme users. [...] 

– **Empathy Map:** [...] The empathy map analyzes talks and interviews with stakeholders, especially end customers. These talks are categorized into four categories: “Say” (quotations and central terms), “Do” (observed behaviors), “Think” (assumptions of thoughts) and “Feel” (emotions).

– **5-Whys:** [...] The 5-Why method’s basic premise is: in the course of analysis, participants repeatedly ask “why”, leading everyone deeper into the root-cause of a problem or some similar phenomenon. [...] 

– **AEIOU-Method:** [...] The AEIOU method defines dimensions to structure a problem: “Activities”, “Environment”, “Interactions”, “Objects” and “Users”. [...] 

– **Persona-Method:** [...] Personas are [...] artificial, invented persons. As archetypes, they embody the behavior or personality characteristics of a group of persons, e.g. digital natives of the age 16–19. These personas are named—for example Bob, Himo, Mari-Lu. [...]
– **Observation**: The observation of stakeholders, especially customers, is a proven method to reveal obvious and hidden needs. During, or after, the observation of a person, clarifying questions can be asked. When shadowing, researchers accompany a person over a longer period of time as closely as possible. […]

– **Storytelling**: […] In Design Thinking projects, storytelling is used to present innovative ideas or solution possibilities effectively. In many Design Thinking projects, videos emerge, parallel to the prototypes, showing the prototype in a real-life situation or in a process.”

“It forces the users in these disciplines to enhance their methods and toolboxes” (Brenner & Uebernickel, 2016, p. xv).

“Design Thinking is a proven and robust instrument to uncover and include obvious and hidden needs in innovation-, development-, and problem-solving processes” (Brenner & Uebernickel, 2016, p. xv).

“As a toolbox, Design Thinking refers to the application of numerous methods and techniques from various disciplines: design, but also engineering, informatics, and psychology” (Brenner & Uebernickel, 2016, p. 3).

“The range of 47 methods and tools described by Schindlholzer (2014, p. 121f) range from guidelines to design workspaces to methods to define personal strengths and weaknesses, from moderation methods to hints about how 3D printing can be used to build prototypes. In our experience, deployment of appropriate methods is one of the core success factors of Design Thinking projects” (Brenner & Uebernickel, 2016, p. 13).

1.9 Sub-variable 3.1 Methodological metaphor & paradigm

<table>
<thead>
<tr>
<th>Authors</th>
<th>Methodological metaphor &amp; paradigm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Simon (1969)</td>
<td>M: “Design like science is a tool for understanding as well as for acting” (Simon, 1996, p. 164). Design could be seen as the <strong>tool</strong> to change existing situations in preferred ones. “Designing as valued <strong>activity</strong>” (Simon, 1996, p. 164). <strong>P:</strong> <strong>Objective</strong>: “Problem solving theories introduced by Simon (1992) provided a framework for this extension in the scope of design studies by allowing the study of designers and design problems in the paradigm of technical rationality. He also provided a sound, rigorous basis for much of the existing knowledge in design methodology. This paradigm, in which design is seen as a <strong>rational problem solving process</strong>, has been the dominant influence shaping prescriptive and descriptive design methodology ever since. Most of the work done in design methodology today still follows the assumptions, view of science and goals of this school of thought” (Dorst &amp; Dijkhuis, 1995, p. 261-262). “There is much stress on the rigour of the analysis of design processes, <em>objective</em> observation and direct generalizability of the findings. Logical analysis and contemplation of design are the main ways of producing knowledge about the design process. Simon quotes <em>optimization theory</em> as a prime example of what he believes a science of design could and should be” (Dorst &amp; Dijkhuis, 1995, p. 262).</td>
</tr>
</tbody>
</table>
“Such a reading would reveal the positivist features of Simon’s approach and help to explain why many designers are somewhat disenchanted with the book. […] One may reasonably disagree with aspects of Simon’s positivist and empiricist view of design as a science” (Buchanan, 1992, p. 9).

“For Simon, the "artificial" is an "interface" created in a materialist reality: "I have shown that a science of artificial phenomena is always in imminent danger of dissolving and vanishing. The peculiar properties of the artifact lie on the thin interface between the natural laws in it and the natural laws without." (Simon, 1969, p. 57). This is one expression of the positivist or empiricist philosophy that guides Simon’s theory of design” (Buchanan, 1992, p. 18-19).

Buchanan (1992)

M: “An instrument of cultural life […]. One of the practical disciplines of responsible action” (Buchanan, 2001b, p. 38). “In this sense, design is emerging as a new discipline of practical reasoning and argumentation” (Buchanan, 1992, p. 19).

P:
Objective:
“Instead of yielding productive integrations, the result is often confusion and a breakdown of communication, with a lack of intelligent practice to carry innovative ideas into objective, concrete embodiment” (Buchanan, 1992, p. 8).

“The doctrine of placements will require further development if it is to be recognized as a tool in design studies and design thinking, but it can also be a surprisingly precise way of addressing conceptual space and the non-dimensional images from which concrete possibilities emerge for testing in objective circumstances” (Buchanan, 1992, p. 13).

“In this sense, a definition, whether formal or descriptive, is like a hypothesis in research: it gathers together what will be investigated and sets the relation of causes that will become the themes of subsequent inquiry” (Buchanan 2001a, p. 9).

“The common trait of applied research in design is the attempt to gather from many individual cases a hypothesis or several hypotheses that may explain how the design of a class of products takes place, the kind of reasoning that is effective in design for that class, and so forth” (Buchanan, 2001a, p. 18).

“The boundary of a placement gives a context or orientation to thinking, but the application to a specific situation can generate a new perception of that situation and, hence, a new possibility to be tested” (Buchanan, 1992, p. 13).

“On a general level, a designer forms an idea or a working hypothesis about the nature of products or the nature of the humanmade in the world” (Buchanan, 1992, p. 17).

“Neo-positivism, pragmatism, and various forms of phenomenology have strongly influenced design education and practice in the twentieth century” (Buchanan, 1992, p. 6).

Objective and subjective: “If design theory has often tended toward neo-positivism, design practice has tended toward pragmatism and pluralism, with phenomenologists in both areas” (Buchanan, 1992, p. 6).

Brown (2008)


P: Between subjective and objective, but tends towards subjective.
Subjective: “His approach was intended not to validate preconceived hypotheses but to help experimenters learn something new from each iterative stab” (Brown, 2008, p. 86). “Integrative thinking: they not only rely on analytical processes (those that produce either/or choices) but also exhibit the ability to see all of the salient – and sometimes contradictory – aspects of a confounding problem and create novel solutions that go beyond and dramatically improve on existing alternatives” (Brown, 2008, p. 87).

“To incorporate more intuitive thinking into an analytical culture, the organisation must open up new definitions of proof, embrace some degree of subjectivity as not just inevitable but valuable” (Martin, 2009, p. 54).

Objective: “By this I mean that innovation is powered by a thorough understanding, through direct observation, of what people want and need in their lives and what they like or dislike about the way particular products are made, packaged, marketed, sold, and supported” (Brown, 2008, p. 86).

Martin (2009)


P:

Subjective: “But there would be some people who don’t like the idea of this type of MBA because they think it should be analytical, quantitative, number crunching, deductive–inductive, self-oriented, all of those things. […] these people would either not be interested or get weeded out in the application process” (Dunne & Martin, 2006, p. 515).

“A decision attitude is about solving existing, stable problems with clearly specified alternatives through the use of analytical decision tools. By contrast, those with a design attitude view each problem as an opportunity for invention that includes a questioning of basic assumptions and a resolve to improve the state of the world” (Dunne & Martin, 2006, p. 519).

Subjective and objective:

“[…] Martin argues that management research is at a point of diminishing returns, because its practitioners are locked into a single paradigm and are unwilling to accept others. […] Martin believes that designers are open to multiple perspectives” (Dunne & Martin, 2006, p. 520).

“Embedded as they are in a single world view and epistemology, some business faculty will find it difficult to accept the different types of knowledge implied by design thinking” (Dunne & Martin, 2006, p. 522).

“[…] design thinking addresses several of these dissatisfactions because it involves epistemological pluralism” (Dunne & Martin, 2006, p. 522).

Dorst (2011)

M: “new paradigm for dealing with problems” (Dorst, 2011, p. 521). Two paradigms with different metaphors for Design Thinking as a method (Dorst & Dijkhuis, 1995):

Problem solving approach: “looking at design as a rational search process, in which the scope of the steps taken towards a solution is limited by the information processing capacity of the acting subject” (Dorst & Dijkhuis, 1995, p. 262).

Reflection-in-action approach: “Any design problem is unique, a ‘universe of one’, and a core skill of designers lies in determining how every single problem should be tackled. […] He sees design as a ‘reflective conversation with the situation’” (Dorst & Dijkhuis, 1995, p. 263).

P:

First objectivist: “The ‘first generation’ methods of design methodology in the early 1960s were heavily influenced by the theories of technical systems. The positivist background of these theories made for design
being seen as a **rational** (or rationalizable) **process**” (Dorst & Dijkhuis, 1995, p. 261). “There is much stress on the rigour of the analysis of design processes, *objective* observation and direct generalizability of the findings. Logical analysis and contemplation of design are the main ways of producing knowledge about the design process.” (Dorst & Dijkhuis, 1995, p. 262).

**Later subjectivist:** “A radically different paradigm was only proposed some 15 years later, by Schön (1983), describing design as a process of **reflection-in-action.** This **constructionist** theory can be seen as a reaction to the problem solving approach” (Dorst & Dijkhuis, 1995, p. 262). “Any design problem is unique, a 'universe of one', and a core skill of designers lies in determining how every single problem should be tackled. […] Problems are actively set or "framed" by designers, who take action (make 'moves') improving the (perceived) current situation.” (Dorst & Dijkhuis, 1995, p. 263).

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### Brenner and Uebernickel (2016)

**M:** “body of knowledge […]. Design Thinking offers a platform to answer different questions” (Brenner & Uebernickel, 2016, p. xv).

“We illustrate how the field developed […] toward a strong core today, manifested in an innovation process and a specific Design Thinking culture” (Brenner & Uebernickel, 2016, p. xv).

**P:** Between objectivist and subjectivist, but tends to objectivist. Experience of user central (subjectivist): “Another central principle of Design Thinking is: build prototypes that can be experienced” (Brenner & Uebernickel, 2016, p. 8). “Design Thinking encourages subjective empathy with the user (Brenner & Uebernickel, 2016, p. 73).

But for the biggest part objective, real phenomena can be measured objectively (f.e., hidden needs of customers can be made explicit by examining these needs). “Design Thinking is a proven and robust instrument to uncover and include obvious and hidden needs in innovation-, development-, and problem-solving processes” (Brenner & Uebernickel, 2016, p. xv). “We learn from design practice how important it is to translate and operationalize often intuitive, subjective judgment into robust evaluations” (Brenner & Uebernickel, 2016, p. 106).
## Appendix 2: Summarized results of Design Thinking

### 2.1 Sub-variable 1.1 Intervention metaphor & paradigm

<table>
<thead>
<tr>
<th>Authors</th>
<th>Intervention metaphor &amp; paradigm</th>
</tr>
</thead>
</table>
| Simon (1969)    | **M:** Making and implementing design is like painting in oil – cyclical interaction between painter and canvas.  
**Organization as flux and transformation:** find pattern hidden in chaos. Adaptive systems and genetic algorithms.  
**Organization as machine:** central planning as basis for coordinating behavior patterns. Hierarchic structure produced by assembly or specialization.  
**Organization as organism:** ecosystem which regulates itself, feedback loops, biological evolution, problem solving as natural selection, design inner system so it can adapt to outer environment.  
**P:**  
**Functionalist paradigm:** regulating and objective. Maintain order, produce efficiently. Coordination by central planning. |
| Buchanan (1992) | **M:** Organization as culture: design is an instrument of cultural life. Organizations consist of unifying idea or thought.  
**P:** Functionalist paradigm: regulating, objective. Neo-positivism, planning, effectiveness. |
| Brown (2008)    | **M:** Intervention as: creation of the electric lightbulb by Edison, enacted sense making, invention, trial and error, learn something. Design process is described metaphorically as system of spaces rather than predefined series of orderly steps, it is chaotic.  
**Organization as flux and transformation:** leaders look to innovation as source of differentiation and competitive advantage.  
**P:** Social interpretative paradigm: regulating, between objective and subjective, tends towards subjective. Feedback, broad participation. |
| Martin (2009)   | **M:** Intervention as: exploring wicked problems, balancing innovation and efficiency, and combining deductive, inductive and abductive reasoning.  
**Organization as brain:** learning and knowledge is central, addresses exploration and exploitation, adapts systems thinking theory of Senge.  
**P:** Social interpretative paradigm: regulating, subjective. System’s thinking: think about system as a whole. |
| Dorst (2011)    | **M:** Intervention as: creating new themes, leading to new frames.  
First problem solving approach, then reflection-in-action approach (Dorst & Dijkhuis, 1995).  
Problem solving approach: **Organization as machine.** Designer as information processor, design process as rational search process. Optimization theory, natural sciences.  
Reflection-in-action approach: **Organization as sensemaking:** “Design knowledge as artistry of design. Art/ the social sciences. Themes as sense-making tool.  
**P:** |
**Table 40: Sub-variable 1.1 – Intervention metaphor & paradigm of Design Thinking**

### 2.2 Sub-variable 1.2.1 Goal

<table>
<thead>
<tr>
<th>Authors</th>
<th>Goal</th>
</tr>
</thead>
</table>
| **Simon (1969)**   | **Reason why** | Solving problems.  
                           Creating a desired state of affairs. Changing existing situations into preferred ones.  
                           Fashion and change social organizations in general and individual organizations in particular.  
                           We have often to be satisfied with meeting the design objectives approximately.  
                           **Object**  
                           Social organizations in general and individual organizations in particular. Business and governmental organizations.  
                           Problems related to physical objects or related to actions. Design of physical structures, social systems or evolving artifacts.  
                           **Application area**  
                           Professional schools: Business, engineering, architecture, painting, education, law, medicine.  
                           Works for well-defined and ill-defined problems. |
| **Buchanan (1992)**| **Reason why** | Solving indeterminate or wicked problems, thinking about the world that is significant for addressing problems of humans in contemporary culture.  
                           **Final cause:** conceiving, planning, making  
                           **Formal cause:** products  
                           **Material cause:** the accomplishment of individual and collective purposes (activities, needs, and aspirations of humans)  
                           **Object** |
Symbolic and visual communications;
Material (tangible) objects;
Activities and organized services;
Complex (intangible) systems or environments for living, working, playing, and learning – information and communication systems, electrical power grids, transportation systems to managerial organizations, public and private institutions, and national constitutions
Design may be applied for the creation of any human-made product

**Application area**
Applicable to almost anything: visual communication, tangible objects, activities and organizational services, intangible systems or environments for living.
Professions: f.e. industrial design, engineering and marketing.

<table>
<thead>
<tr>
<th></th>
<th></th>
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</thead>
<tbody>
<tr>
<td>Innovation with human-centered design ethos: feasibility – desirability – viability.</td>
<td></td>
</tr>
<tr>
<td><strong>Object</strong></td>
<td></td>
</tr>
<tr>
<td>Human-centered activities: physical products, processes, services, strategy, IT-powered interactions, entertainments, and ways of communicating and collaborating.</td>
<td></td>
</tr>
<tr>
<td><strong>Application area</strong></td>
<td></td>
</tr>
<tr>
<td>Business.</td>
<td></td>
</tr>
<tr>
<td>Products, processes, services, IT interactions, entertainments, ways of communicating/collaborating.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Martin (2009)</th>
<th>Reason why</th>
</tr>
</thead>
<tbody>
<tr>
<td>Solving wicked problems.</td>
<td></td>
</tr>
<tr>
<td>Balance between innovation and efficiency.</td>
<td></td>
</tr>
<tr>
<td>Balance exploitation (reliability orientation) and exploration (validity orientation) for competitive advantage.</td>
<td></td>
</tr>
<tr>
<td><strong>Object</strong></td>
<td></td>
</tr>
<tr>
<td>Products, organization, pricing strategy, objects, services, systems.</td>
<td></td>
</tr>
<tr>
<td><strong>Application area</strong></td>
<td></td>
</tr>
<tr>
<td>Management and business problems.</td>
<td></td>
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</table>

<table>
<thead>
<tr>
<th>Dorst (2011)</th>
<th>Reason why</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dealing with open, complex problem situations.</td>
<td></td>
</tr>
<tr>
<td>Paradoxical problematic situations.</td>
<td></td>
</tr>
<tr>
<td><strong>Object</strong></td>
<td></td>
</tr>
<tr>
<td>Contemporary organisations, organisations that operate in professional fields. Object, service, system</td>
<td></td>
</tr>
<tr>
<td>Three layers: project, process, field/practice. Design is not just activity in projects, design processes work across projects in firm or professional practice.</td>
<td></td>
</tr>
<tr>
<td>Design practices interface with organisations on different levels:</td>
<td></td>
</tr>
<tr>
<td>1. Address problems in existing frame (Abduction-1)</td>
<td></td>
</tr>
<tr>
<td>2. Framing, frame originates from existing company practice (Abduction-2)</td>
<td></td>
</tr>
<tr>
<td>3. Adoption of new frame, developed by an outsider</td>
<td></td>
</tr>
<tr>
<td>Creation of new frame through investigating themes</td>
<td></td>
</tr>
<tr>
<td><strong>Application area</strong></td>
<td></td>
</tr>
</tbody>
</table>
Interface with organisations on different levels.

**Brenner and Ueberrnickel (2016)**

<table>
<thead>
<tr>
<th>Reason why</th>
<th>Innovation method.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Creating entrepreneurial value through customer value.</td>
<td>Radical innovation to answer wicked problems.</td>
</tr>
<tr>
<td>Uncover and include obvious and hidden needs in innovation-, development-, and problem-solving processes.</td>
<td></td>
</tr>
</tbody>
</table>

**Object**


**Application area**

DT began at engineering department.

Product design robotics, microelectronics, human-computer interaction, learning, bio design and venture design. Management and information systems development.

*Table 41: Sub-variable 1.2.6 - Goal of Design Thinking*

### 2.3 Sub-variable 1.2.2 Theoretical and conceptual substantiation of interventions

<table>
<thead>
<tr>
<th>Authors</th>
<th>Theory</th>
</tr>
</thead>
<tbody>
<tr>
<td>Simon (1969)</td>
<td><strong>Based on:</strong> Utility theory and statistical decision theory as a framework for rational choice among alternatives. Cybernetics: look at behaviour of adaptive systems in terms of feedback and homeostasis, and apply to these concepts theory of selective information. Also uses ideas of evolution, relativism, axiomatic method, and of operationalism. <strong>Own theory:</strong> Simon sees the design process as one of inventing subject to constraints: Constraints are seen as limits to the creative process rather than a means of generating new ideas. Each step of implementation creates new situation; and the new situation provides a starting point for fresh design activity. Making complex designs that are implemented over a long period of time and continually modified in the course of implementation is process of cyclical interaction.</td>
</tr>
<tr>
<td>Buchanan (1992)</td>
<td><strong>Based on:</strong> Communication theory and semiotics: role of graphic designer is shifted toward interpreter of messages. Graph theory: is mathematical expression of doctrine of placements. Theory of motion: origins of modern design research are based on this. <strong>Own theory:</strong> No own theory about interventions.</td>
</tr>
<tr>
<td>Brown (2008)</td>
<td><strong>Based on:</strong> No theories or concepts of other authors were found. <strong>Own theory:</strong></td>
</tr>
</tbody>
</table>
Design Thinking leads to more innovation. Innovating quickly and appropriately in line with customer’s needs leads to a sustainable competitive advantage.

Innovation emerges as a result of hard work augmented by a creative human-centered discovery process and followed by iterative cycles of prototyping, testing, and refinement.

Applying the three steps of the Design Thinking process (inspiration, ideation, implementation) in an iterative way leads to innovation results.

You need designers with a Design Thinker’s profile in your team, and people from multiple disciplines.

<table>
<thead>
<tr>
<th>Martin (2009)</th>
<th>Based on:</th>
</tr>
</thead>
<tbody>
<tr>
<td>User-centered design, and seeing constraints as a stimulation for design: Norman</td>
<td></td>
</tr>
<tr>
<td>Use observations to understand the needs of users: Leonard and Rayport</td>
<td></td>
</tr>
<tr>
<td>Focus on collaboration and understanding users: Kelley</td>
<td></td>
</tr>
<tr>
<td>Epistemological pluralism in management education: Bennis and O’Toole</td>
<td></td>
</tr>
<tr>
<td>Using deductive, integrative and abductive reasoning, and working in work flow based on projects: Lester, Piore, and Malek</td>
<td></td>
</tr>
<tr>
<td>Implementing Design Thinking in management education: Simon</td>
<td></td>
</tr>
</tbody>
</table>

**Own theory:**

Leaders have to invest in and change “their organizations’ structures, processes, and norms” and their “cultures and routines”, so there is a balance between intuitive thinking and analytical thinking. Businesses most of the time have more focus on analytical thinking and exploitation than intuitive thinking and exploration. By investing in exploration as well as exploitation, a balance between innovation and efficiency is achieved, as well as a both reliability and validity. This gives the firm a competitive advantage.

For a designer, constraints are embraced as the impetus to creative solutions.

<table>
<thead>
<tr>
<th>Dorst (2011)</th>
<th>Based on: Multiple models of design thinking have emerged over twenty years of research, based on widely different ways of viewing design situations and using theories and models from design methodology, psychology, and education.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Own theory: designers look broad at problems from multiple perspectives and stakeholders. By distilling themes from a complex open-ended and sometimes paradoxical situation, the development of new frames is stimulated. These new frames form a reaction or solution to the paradox which was central in the problem.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Brenner and Uebernickel (2016)</th>
<th>Based on: started from the design field as a conception method and from Simon’s science of the artificial in the 1960s.</th>
</tr>
</thead>
<tbody>
<tr>
<td>The basis for scientific work, with the development of corporate information systems, was done by Simon, with his work “The Sciences of the Artificial”.</td>
<td></td>
</tr>
<tr>
<td>Own theory: Design Thinking is interdisciplinary, based on knowledge and insights from engineering, management, industrial design, anthropology, information management, and ethnography. Design Thinking works best when teams are heterogeneous.</td>
<td></td>
</tr>
<tr>
<td>Using the mindset of Design Thinking leads to innovations and solutions to problems. Applying the principles alone—without structure—is too demanding for novices. To address this, authors developed a two-stepped process model consisting of a micro and macro process.</td>
<td></td>
</tr>
<tr>
<td>Design Thinking works only when tools and methods used are aligned with this new way of thinking.</td>
<td></td>
</tr>
</tbody>
</table>
2.4 Sub-variable 1.2.3 Social aspect

<table>
<thead>
<tr>
<th>Authors</th>
<th>Social aspect</th>
</tr>
</thead>
<tbody>
<tr>
<td>Simon (1969)</td>
<td>Understanding the problem-solving patterns, cognitive behaviour and psychology of the end-user. Client central. Motivation of members of organization or society is important. Design process is in itself valuable for the participants in it.</td>
</tr>
<tr>
<td>Buchanan (1992)</td>
<td>Interaction design focuses in how humans relate to other humans. Interaction and experience of human begins which use products are important. Focus on human systems.</td>
</tr>
<tr>
<td>Brown (2008)</td>
<td>Design thinker should have empathy: understand multiple perspectives and problems of end-user, through observation. Innovation activities should have a human-centered design ethos: understanding what people want and need in their lives. Collaboration – Design Thinker is enthusiastic interdisciplinary collaborator.</td>
</tr>
<tr>
<td>Martin (2009)</td>
<td>Centrality of end-user. Collaborative skills (working with peers) and empathy with others (understanding users’ perspectives and needs) are important. Consider interests of all stakeholders.</td>
</tr>
<tr>
<td>Dorst (2011)</td>
<td>Analysis of the inner circle of stakeholders and the broader field of possible stakeholders is needed. Implementation of the change should be considered. Design connects technical prowess to complexity at human side of the issue.</td>
</tr>
<tr>
<td>Brenner and Uebernickel (2016)</td>
<td>Two principles of Design Thinking: innovation is made by humans for humans (interaction, emergence and solving conflicts during design process), and test early with customers. Company culture needs to be addressed when training employees. Team should participate in convergent and divergent thinking. Open feedback and constructive criticism in team, and collect opinion of target users.</td>
</tr>
</tbody>
</table>

Table 42: Sub-variable 1.2.3 – Social aspect of Design Thinking

2.5 Sub-variable 1.2.4 Type of change

<table>
<thead>
<tr>
<th>Authors</th>
<th>Type of change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Simon (1969)</td>
<td>C: continuous modification, cyclical interaction, planning without fixed goals, short distance evolution with new situation that is little better, continual and adaptive change, continuing adaptation to environment.</td>
</tr>
<tr>
<td>Buchanan (1992)</td>
<td>E: brief with detailed features of planned product, problem solution yields plan, design is about creation and planning.</td>
</tr>
<tr>
<td>Brown (2008)</td>
<td>C: design thinking is not a simple linear process. E: significant innovations don’t come from incremental change, entirely new directions should be created. E and C: innovation should consist of short-term incremental ideas to long-term revolutionary ideas. Both incremental and revolutionary innovation is needed. With design method, you can create small innovation that produces big impact.</td>
</tr>
<tr>
<td>Martin (2009)</td>
<td>There must be a balance between C and E: innovation due to exploration and exploitation must be balanced: 1)Exploration: long-term, uneven, scattered, false starts and significant leaps forward (\rightarrow) episodic change. 2)Exploitation short-term, systematically honing and refining in the current knowledge stage, accomplished by measured, careful incremental steps (\rightarrow) continuous change.</td>
</tr>
</tbody>
</table>
Dorst (2011) C: trial-and-error process. Pursuit of novelty and progress becomes natural part of the firms’ practice, instead of ad-hoc panic-born scramble for novelty. E: gives example where designers intentionally look into a problem which is externally driven, and propose a big change. Some new frames are developed outside context and practices of organization.

Brenner and Uebernickel (2016) C: problem and solution rarely follow clear, linear sequence. Briefing (making sense of issues) is not universal route map of design process or sequence step, but a continuous, recurring element. E and C: both incremental innovation and radical innovation is needed. Radical innovation is start-up for continuous improvement, and through incremental innovation the radical ones become sustainable. E: radical innovation to solve wicked problems, innovation that changes far more than one single factor.

Table 43: Sub-variable 1.2.4 - Type of change of Design Thinking

2.6 Sub-variable 1.3.1 Process

<table>
<thead>
<tr>
<th>Authors</th>
<th>Process</th>
</tr>
</thead>
<tbody>
<tr>
<td>Simon (1969)</td>
<td>Get to the optimal design decision: (1) searching, (2) choosing and (3) testing alternatives against criteria. Iterative cycles, where each step of implementation creates a new starting point for fresh design activity. Data for planning: forecasting, prediction, feedback in control → Identify the client → Design without final goals. Ways in which design processes are concerned with allocation of resources: (1) conserve scarce resources, (2) manage the resources of the designer. Representation/visualizing: emerging design is incorporated in set of external memory structures – sketches, floor plans, drawings of utility systems. Making a solution transparent.</td>
</tr>
<tr>
<td>Buchanan (1992)</td>
<td>(1) Problem definition: determine all elements of problem and specify requirements that successful design solution must have. (2) Problem solution: combine and balance various requirements against each other, yielding final production plan. Research is essential part of design process. Design Thinking and decision making is not a simple linear process.</td>
</tr>
<tr>
<td>Brown (2008)</td>
<td>Design Thinking transforms way you develop processes. Design process is system of spaces instead of predefined series of orderly steps, feels chaotic. 1. Inspiration: the search for solutions. Expect success: build implementation resources into your plan → What’s the business problem? Where’s the opportunity? What has changed (or soon may change) → Look at the world: observe what people do, how they think, what they need and want → What are business constraints (time, lack of resources, impoverished customer base, shrinking market) → Involve many disciplines from the start (e.g., engineering &amp; marketing) → Pay close attention to “extreme” users such as children or the elderly → Have a project room where you can share insights, tell stories → How can new technology help? → Are valuable ideas, assets, and expertise hiding inside the business? → Organize information and synthesize possibilities (tell more stories!). Can be divided in two phases: a. Divergent exploration of problem space: collect data with various perspectives. b. Synthesis: convert observations into insights (convergent).</td>
</tr>
</tbody>
</table>
2. Ideation: generating, developing, and testing ideas that may lead to solutions.
Brainstorm → Make many sketches, concoct scenarios → Build creative frameworks (order out of chaos) → Apply integrative thinking → Put customers in the midst of everything; describe their journeys → Prototype, test, prototype, test… → Tell more stories (they keep ideas alive) → Communicate internally – don’t work in the dark! → Prototype some more, test with users, test internally.

3. Implementation: charting of a path to the market.
Execute the vision: engineer the experience → Help marketing design a communication strategy → Make the case to the business – spread the word → Move on to the next project – repeat.

Consists of iterative cycles of prototyping, testing and refinement. Applying the three steps of the Design Thinking process (inspiration, ideation, implementation) in an iterative way leads to innovation results.

<table>
<thead>
<tr>
<th>Martin (2009)</th>
<th>Three steps of the knowledge funnel process: a model for how businesses can advance knowledge and capture value.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(1) Pinpointing a market opportunity (Selecting and exploring a particular “mystery” to be solved).</td>
</tr>
<tr>
<td></td>
<td>(2) Devising an offering for that market (An initial heuristic or “rule-of-thumb” that helps narrow the field of inquiry and work the mystery down to a manageable size. Way of thinking about the mystery that provides a simplified understanding of it and allows those with access to the heuristic to focus their efforts).</td>
</tr>
<tr>
<td></td>
<td>(3) Codifying its operations (Converting heuristic from a general rule of thumb to a fixed formula = an algorithm).</td>
</tr>
</tbody>
</table>

Iterative cycle of Design Thinking: Generate ideas (abduction) → predict consequences (deduction) → test → generalize (induction) → repeat.

Prototype and test solutions for products, services, experiences and interactions.

Develop deep user understanding, visualise and prototype new possibilities.

Combining and balancing abductive, inductive and deductive reasoning. Design thinking is an ongoing cycle of generating ideas (abduction), predicting consequences (deduction), testing, and generalizing (induction). In design, the imaginative step involves abductive reasoning—asking not what is true, but what could be true. Abductive reasoning is a third form of reasoning alongside deduction and induction. Deductive (from the general to the specific) and inductive (from the specific to the general) reasoning allow the analyst to marshal established principles or existing data to converge on particular conclusions. Abductive logic offers a line of reasoning between analytically thinking and intuitive thinking. And the design thinker uses an explicit form of logic and a process that, while less certain and clear than analytical thinking, has promise for greater consistency and replicability than pure induction. The design thinker therefore enables the organization to balance exploration and exploitation. With a design model we think outside the existing alternatives and create new alternatives.

Two ways of thinking that must be balanced:
1) Analytical thinking: rigorous, continuously repeated analytical processes. Eliminate judgment, bias, and variation.
2) Intuitive thinking: the art of knowing without reasoning. The world of originality and invention.

“Systems thinking”, visualizing a design or managerial problem as a system of structures, patterns and events, rather than just the events alone—and understanding the impact of changes in one component on the others, and on the system as a whole.

<table>
<thead>
<tr>
<th>Dorst (2011)</th>
<th>Five main design activities for meeting abductive challenges:</th>
</tr>
</thead>
</table>
1. Formulating: identifying of the key issues in a problem arena and the framing of these in a new and original manner.

2. Representation: sketching an idea, looking at it critically, altering it, taking a step back again.

3. Moving: moves can be entirely original or can be further developments of moves that are part of the designer’s repertoire or general design culture.

4. Evaluating: Early on in the project a subjective nature, later much more formal and objective.

5. Managing: plan and control project, resource planning.

Use abductive reasoning:

1. Abduction-1: conventional problem solving, in existing frame.

2. Abduction-2 (also new ‘how’): framing in existing company practice.


5. Result: ability to investigate themes and create new frames that can be embedded in the organisation → able to better deal with its open, complex challenges in the future.

Abductive reasoning. Four types of academic reasoning:

Deduction: What + how = ?

Induction: What + ? = outcome

Normal abduction: ? + how = outcome

Design abduction: ? + ? = outcome → this type of reasoning belongs to Design Thinking. Work backwards starting from the value that needs to be created.

What = elements in the situation.

How= how elements interact.

Nine-step model of frame creation:

1. Archaeology: analysing the history of the problem owner & of the initial problem formulation.

2. Paradox: analysing the problem situation: what makes this hard?

3. Context: analysing the inner circle of stakeholders.

4. Field: exploring the broader field.

5. Themes: investigating the themes in the broader field.

6. Frames: identifying patterns in the themes to create frames.

7. Futures: exploring the possible outcomes and value propositions.

8. Transformation: investigate the change in practices required for implementation.


Reflect upon design interventions in iterative process.


Design Thinking is combination of a micro- and a macro-process: Innovation process – Macro-process (step 1-3 diverging, step 5-7 converging):
(1) Design Space Exploration: explores the design space. First gather own experiences of sector, then literature and web research, as well as talks with experts.

(2) Critical Function Prototype: the first prototypes are developed.

(3) Dark Horse Prototype: the horse that nobody bets on, yet it wins. The solution space is extended and new, even more innovative solutions emerge.

(4) Funky Prototype: the divergent phase is closed. Merge the best ideas from all prototypes developed thus far into one prototype, building toward the final prototype.

(5) Functional Prototype: Requirements and boundaries of the final solution are fixed. Decide which solution ideas and prototypes should be part of the final prototype. More specific prototype, providing clear insights into customer acceptance and needs.

(6) X-is-finished-Prototype: detect one key functionality (“X”) and what effort is required to realize the final prototype. Team decides which parts can be included in the final prototype.

(7) Final Prototype comprises all functions necessary to satisfy customer needs. Extremely high degree of detail so testing with customers is possible. Give presentation showing the process and attributes of the solution.

Micro-process: is conducted several times in each step of macro process.

(1) Define the problem: problem brief (challenge) is worked out, which describes the problem-to-solve question.

(2) Needfinding & Synthesis: revealing end customers’ needs. Expert interviews, literature and web search.

(3) Ideate: teams find solution ideas through brainstorming.

(4) Prototype: build prototypes that can be tested with customers.

(5) Test: test prototypes with end customers. Get clues whether a prototype works, or reasons why it does not.

(6) (Re)define the problem: verify if the original problem brief was right: if the innovation fulfilled customer needs. Positive answer? New micro process can begin. Negative answer? Reformulate challenge based on the new insights.

Steps of Design Thinking:

(1) Empathize: visualization, storytelling, human centricity

(2) Define: target disruptive goals, solution-based thinking, deal with ambiguity

(3) Ideate: widen choice options, form good teams, question is as important as deciding

(4) Prototype: enhance top-management buy-in, knowledge transfer, ensure bias towards action

(5) Test: accelerate learning processes

Table 44: Sub-variable 1.3.1 - Process of Design Thinking

2.7 Sub-variable 1.3.2 Configuration

<table>
<thead>
<tr>
<th>Authors</th>
<th>Organization</th>
</tr>
</thead>
<tbody>
<tr>
<td>Simon</td>
<td>Bounded rationality. Situations where the complexity of the environment is greater than the computational powers of the adaptive system.</td>
</tr>
<tr>
<td>(1969)</td>
<td>Organizations in social design. social design is carried out mainly by people working in organizations.</td>
</tr>
<tr>
<td></td>
<td>Time and space horizons. The discounting of time, defining progress, managing attention.</td>
</tr>
<tr>
<td>Buchanan (1992)</td>
<td>(Does not really speak about interventions and their organization) Designers conceive their subject matter in two ways on two levels: general and particular. On a general level, a designer forms an idea/working hypothesis about the nature of products or of the humanmade in the world. In actual practice, the designer begins with what should be called a quasi-subject matter, tenuously existing in the problems and issues of certain circumstances. Out of the specific possibilities of a concrete situation, the designer must conceive a design that will lead to a particular product. Synthesis of three lines of reasoning: the ideas of designers and manufacturers about their products; the internal operational logic of products; and the desire and ability of human beings to use products in everyday life in ways that reflect personal and social values. Effective design: ability of designers to integrate all three lines of reasoning.</td>
</tr>
<tr>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>Martin (2009)</td>
<td>Centrality of end-user: The team engages in ethnographic observation, open-ended questions, and experimentation—respect for views and values of the end user. The user is of vital importance, and is treated that way by all concerned. As distinct from managers, whose work flow is centered around ongoing, permanent assignments, designers work on a “project” basis, where the project has a specific deadline, and, once completed, disappears from sight. Principles to change analytical culture to intuitive culture: - Have designers sit inside the core business teams rather than have them segregated in a central staff function; - Build a network of design experts as a sounding board for the business teams, e.g. external design board; - Give managers first-hand DT experience (develop user understanding, visualise and prototype new possibilities); - Free up time for managers to stare into next mystery by handing over routine parts of managers’ jobs to juniors; - Change the strategy process to include dialogue about possibilities rather than presentation of the only answer; - Change the reward systems by allocating rewards to those who solve wicked problems; - Make the solving of wicked problems a high-status assignment; - Implement an ad hoc project organisation for discovery activities with (client) collaboration and clearly defined projects that come to an end at a specified date; Ad-hoc teams and collaborating for a specific purpose. - Connect with innovators outside company and develop their creations (not all creations have to come from in);</td>
</tr>
</tbody>
</table>
3. Advanced beginner / Situation based: design problems are highly individual and situated. Less standard solutions.
4. Competent / Strategy based: can handle all normal situations in the design domain. More control over project.
6. Master / Creating new schemata: their work represents new knowledge in the field.
7. Visionary / Redefinition of the field: explicitly developing or redefining the design field they are working in.

Brenner and Uebenickel (2016)

Design Thinking works best when teams are heterogeneous.

Analogous to other processes in the company, innovation processes can be structured and replicated to a certain extent. Relying on single, unique persons with a specific genius is replaced by a reproducible process.

1. Innovation is made by humans for humans: Design Thinking is a deeply human-centered method. As a consequence various steps of the innovation process are executed differently. Those steps include interaction, emergence and solving of conflicts during the process, and physical spaces where the innovation process takes place that must reflect a different “nature” in their spatial design.

2. Combination of divergent and convergent thinking: Design thinkers enhance the solution space through following unconventional paths, i.e. thinking divergently. When engaging in convergent thinking, feasible solutions emerge.

4. Built prototypes that can be experienced: Fast and easily comprehensible prototypes are built that allow a new idea to be tested. We differentiate between different resolution prototypes: those with low resolution are often only sketches or paper mock-ups, while high-resolution prototypes can be, for example, programmable interfaces.

7. Design Thinking needs a special place: To conduct Design Thinking projects successfully, special spaces are required: designed according to the teams’ needs and equipped with the right materials.

2.8 Sub-variable 1.3.3 Instrument

<table>
<thead>
<tr>
<th>Authors</th>
<th>Instrument</th>
</tr>
</thead>
</table>
| Simon (1969) | Two types of tools:  
1. Utility theory and statistical decision theory for rational choice among given alternatives.  
2. Techniques for actually deducing which of the available alternatives is the optimum.  
Means-ends analysis: determining the optimal design decision. Use business concepts such as utility theory and cost/benefit analysis to quantify different design alternatives based on their values to different stakeholders.  
Computer simulation: tool for achieving deeper understanding of human behaviour.  
Heuristic methods: problem-solving and decision making tools.  
Adaptation of standard logic to the search for alternatives.  
Decomposition: decompose complex structure into semi-independent components corresponding to its functional parts.  
Representation tools: make solution transparent. Physical objects → drawings, three-dimensional models. Actions → flow charts, programs.  
Simulation: achieving understanding and predicting behaviour of systems.  
Methods of forecasting, the use of prediction and feedback in control.  
Design itself could be seen as the tool to change existing situations in preferred ones. |
| Buchanan (1992) | Design has no special subject matter of its own apart from what a designer conceives it to be. |
Placements: boundary of a placement gives a context/orientation to thinking, the application to a specific situation can generate a new perception of that situation and a new possibility to be tested. Placements are tools by which designer intuitively/deliberately shapes a design situation, identifying the views and issues of all participants, and the invention that will serve as a working hypothesis for exploration and development.
User observation and interviews with potential users, sometimes shaped around prototypes.
Case study method.

**Brown (2008)**
Ways of prototyping intangibles: drawing rough sketches, using post-its, acting out different business model scenarios as skits, role-plays, develop customer journeys, where a fictional customer is taken through all stages of a new business model scenario. Rough sketches and rough prototypes (ambiguous media) encourage divergent conversations, while high-resolution process models and CADs (mathematized media) encourage convergent discussions.

Observation: of what people need and what they like about certain products.
Brainstorming and (rapid) prototyping: to explore solutions. Videotape the performance.

**Martin (2009)**
Martin does not present sets of material practices; he focuses on systems of organization. ’ Prototypes: to get feedback.
The team engages in ethnographic observation, open-ended questions, and experimentation.
Qualitative approaches to deeply understand users (in addition to quantitative measures) and iterative crafting of strategy (rather than linear planning).
Appreciative inquiry: better understanding what other person is thinking.
Three key tools:
(1) Observation: gain information to achieve stakeholder understanding
(2) Imagination: to get to conclusions and explanations, with the help of prototypes
(3) Configuration: translating idea into activities that produce desired outcome

**Dorst (2011)**
Kinds of design activities:
Levels of design expertise / ways of operating in design practice:
Observation: to verify forecasts.

**Brenner and Uebernickel (2016)**
Seven instruments: Stakeholder Map, Empathy Map: (analyses talks and interviews with stakeholders), 5-Whys, AEIOU-Method (Activities, Environment, Interactions, Objects, Users), Persona-Method: (artificial, invented persons, archetypes), Observation, Storytelling.
Methods to define personal strengths and weaknesses. Moderation methods.
Design Thinking forces you to enhance methods and toolboxes. The method refers to the application of multiple techniques from various disciplines. Design Thinking itself is instrument to uncover hidden needs.

Table 45: Sub-variable 1.3.3 - Instrument of Design Thinking

2.9 Sub-variable 3.1 Methodological metaphor & paradigm
<table>
<thead>
<tr>
<th>Authors</th>
<th>Methodological metaphor (M) &amp; paradigm (P)</th>
</tr>
</thead>
</table>
| Simon (1969) | **M**: a tool for understanding as well as for acting; the tool to change existing situations in preferred ones; valued activity.  
**P**: **Objectivist**: design as a rational problem solving process. Emphasizes rigour of analysis of design processes, objective observation and generalizability of findings. Logical analysis and contemplation of design as main ways to produce knowledge about design process. Sees optimization theory as example of what science of design should be. Positivist and empiricist view of design as a science: sees the artificial as an interface created in a materialist reality. |
**P**: **Objectivist**: carry innovative ideas into objective, concrete embodiment. Applied research in design as gathering hypotheses. Testing in objective circumstances. Designers form working hypotheses about the nature of products or the world. Design influenced by neo-positivism. **Objectivist and subjectivist**: design theory tends toward neo-positivism, design practice tends toward pragmatism and pluralism. |
**P**: Between subjective and objective, but tends towards subjective. **Subjectivist**: focus on learning from iterative stabs, instead of validating preconceived hypotheses. Problems consist of multiple and sometimes contradictory aspects. Not either/or, but both/and choices. Subjectivity is inevitable and valuable. **Objectivist**: needs of people are directly observable. |
| Martin (2009) | **M**: discipline, wider application of a design perspective beyond just product aesthetics, dynamic interplay, balance.  
**P**: **Subjectivist**: People who think that design and business should be analytical, quantitative, and deductive/inductive cannot be proper Design Thinkers. Design attitude is about viewing problems as an opportunity for invention that includes questioning basic assumptions. **Subjectivist and objectivist**: design thinking practitioners should accept multiple paradigms, perspectives, and epistemologies. Both analytical (objectivist) and intuitive (subjectivist) thinking is needed. Advocates epistemological pluralism. |
| Dorst (2011)  | **M**: design thinking as new paradigm for dealing with problems. Design as a reflective conversation with the situation. Two paradigms with different metaphors for Design Thinking as a method: 1) Problem solving approach: design as a rational search process. 2) Reflection-in-action approach: any design problem is unique, an universe of one.  
**P**: **First generation methods of design methodology – objectivist**: positivist background, design as a rational process. Stresses rigour of analysis, objective observation and generalizability of findings. **Later generation methods of design methodology – subjectivist**: constructionist background, design as reflection-in-action. Each design problem is unique, problems are actively framed by designers. |
**M:** Design Thinking as body of knowledge; a platform to answer different questions; a culture.

**P:** Between objectivist and subjectivist, tends to objectivist.

**Subjectivist:** how user experiences something is central, subjective empathy with user.

**Objectivist:** real phenomena can be measured objectively, f.e., hidden needs of customers can be made explicit. Intuitive, subjective judgment should be operationalized into robust evaluations.

*Table 46: Sub-variable 3.1 - Metaphor & paradigm of Design Thinking*
Appendix 3: Substantiation for the description of the 3-D model

3.1 Sub-variable 1.1 Intervention metaphor and paradigm

| M: Intervention | Intervention as: “To borrow the metaphor of the organization as a ‘liquid entity’ used by Kanter et al., setting social (and functional) goals in the case of episodic interventions is like sailing on an unruly sea, full of unpredictable currents, vortices, and winds that, in combination, continuously drive the ship off course. In order to know at all whether the ship is on or off course, navigational coordinates that constitute this course are needed (coordinates that may be reset as the situation requires this). Moreover, in order to steer the ship, even without exactly knowing the complex, intransparent, and unpredictable forces that drive the ship off course, once again, these navigational coordinates are needed. Social (and functional) goals in the 3-D model have exactly this role and status. […]. They rather are temporary prescriptive constructs that can help navigate this sea; social (and functional) goals are temporary prescriptive constructs (this is their status) that help perform and regulate episodic interventions in organizational structures (this is their role)” (Achterbergh & Vriens, 2019, p. 243-244).

Organization as flux and transformation: “Both the continuous production of new interactions and the change of interaction premises can, metaphorically, be described as a continuous process of ‘birth’, as a ‘flow’, or as a ‘flux’. Given this perspective on organizations as social systems, we would argue that being an organization and being in flux are one and the same thing. Moreover, we would argue that everything that happens in organizations as social systems happens in this flux” (Achterbergh & Vriens, 2019, p. 12). “In our book, this metaphor is that of the organization as ‘emergent’ and ‘self-organizing’” (Achterbergh & Vriens, 2019, p. 13).

Organization as machine: leads to bad structures. “As Morgan (1986) describes, many of us think of organizations as machines that can be broken down into many specialized parts, and whose functioning, i.e. the efficient realization of predetermined goals, depends on the functioning of these parts. Based on this metaphor, one may come to believe that high parameter value designs are quite ‘natural’ – in HPVSs, each part has its own designated function in a complex network of parts. The HPV structure, by means of which specialized parts are defined and connected, is deeply ingrained in the machine metaphor” (Achterbergh & Vriens, 2019, p. 81).

Organization as organism: “Other metaphors, however, may be more suitable for LPVSs. Morgan (1986), for instance, discusses thinking of an organization as an organism as an alternative. […]. It pictures organizations as learning and adaptive systems, and implies a continuous awareness of the environment and the capacity to change organizational behaviour (and goals). This idea of organizations carries with it the need for infrastructural flexibility: an infrastructure should enable learning and change to support adaptation. This perspective on organizations fits LPVSs in which tasks are in touch with the organization’s output and goals (to incorporate the environment), in which task performance takes into account the specific (changing) tasks’ circumstances, and in which tasks have the regulatory potential to co-change task goals and conditions. […]. And as these characteristics have ‘proven’ themselves as helpful in adapting to changing circumstances, they may gradually
become part of uncontested basic assumptions about how structures should be designed” (Achterbergh & Vriens, 2019, p. 97).

**Organization as viable systems – organisms, brains and flux:** “In fact, Morgan (1986) discusses several metaphors which are about adaptation, learning, and change: organizations as organisms, brains, and as flux. Although we understand his reasons for treating these metaphors separately, we prefer to take the more general cybernetic perspective of organizations as ‘viable systems’ (cf. Beer, 1979), which carries with it a more commonsense idea of organizations as systems that strive for survival and therefore need the capacity to learn, change, and adapt, and refer to this general idea as ‘organizations as organisms’” (Achterbergh & Vriens, 2019, p. 101).

**Organization as liquid entity:** “However, if pressed to choose between the ‘liquid entity’ and the ‘ice-cube’ metaphor, we would choose the former one” (Achterbergh & Vriens, 2019, p. 242).

**Organization as sense making:**
“In interaction, concepts, models, theories, and ways of working are adopted that allow organization members to make sense of and interact in the organization they are a part of” (Achterbergh & Vriens, 2019, p. 239).

**P:**

**Functionalist paradigm:** because metaphor is organism, brain and flux & transformation, which all belong to this paradigm. Regulating. There is more focus on power, inequality, domination in the 3-D model than in Design Thinking, but the power relations are not the point of focus in the model.
Recognizes power as influence on intervention:
“On closer examination, it doesn’t seem difficult to connect each of the factors mentioned previously (as well as other contingent factors that can exert their influence on the intervention’s progress) to the topic of power and politics in organizations. […] connecting power and politics to factors that can affect the progress of episodic interventions seems to do justice to the pervasiveness of power and politics” (Achterbergh & Vriens, 2019, p. 294). Objective/subjective: see sub-variable 3.1. Objective.

**Interpretivist paradigm:** also subjective. Fits with organization as sense making. Feedback and participation:
“To begin with, the intervention structure can be designed in such a way that human resources can help each other. In this case, structural conditions should enable both inter- and intra-group learning, discussing intervention tasks, and peer assessment and feedback” (Achterbergh & Vriens, 2019, p. 332). “Instead of financial compensation, ‘confidence’ in the intervention, ‘reduction of change-related uncertainty’, and ‘participation, understanding, and evidence’ should be leading. […] ‘Participation, understanding, and evidence’ means that organization members actually participate in and thereby influence the design of their own work. […]. Together, participation, understanding, and evidence can support a feeling of ‘ownership’ of the intervention which, in turn, can increase motivation” (Achterbergh & Vriens, 2019, p. 334-335).

### 3.2 Sub-variable 1.2.1 Goal

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<th>1.2.1 Goal</th>
<th>Reason why</th>
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Achterbergh and Vriens (2019)
“[…] help understand and flexibly design episodic interventions in organizational structures” (Achterbergh & Vriens, 2019, p. 10). Episodic interventions: “[…] intentional, deliberate, comprehensive changes to the organization’s structure that have their own separate temporary intervention organization” (Achterbergh & Vriens, 2019, p. 6).

Object
Applicable to: “[…] episodic interventions (kind) in organizational structures (object) of organizations that currently have complex and hierarchical structures (context)” (Achterbergh & Vriens, 2019, p. 11).

Organisational structures: “the way tasks are defined and related into a network of tasks” (Achterbergh & Vriens, 2019, p. 46).

Application area

Healthcare and construction work: “If products or services are co-determined based on client characteristics (e.g. in healthcare the service is healing clients with a particular ailment, or in the construction business the product is, for instance, building a home given the specifications of a client), then it makes sense to start with client characteristics as the main characteristic (e.g. flows in healthcare organized around types of diseases; cf. Christensen et al., 2010)” (Achterbergh & Vriens, 2019, p. 187).

Butcher’s business: “To appreciate the definition and relation of tasks into an organizational structure, based on the previous two forms of decomposition, let’s consider a simple example of a butcher who wants to design a structure (i.e. defining and relating tasks) involving four persons: three apprentices and the butcher himself” (Achterbergh & Vriens, 2019, p. 52).

3.3 Sub-variable 1.2.2 Theoretical and conceptual substantiation of interventions

Achterbergh and Vriens (2019)

1.2.2 Theoretical and conceptual substantiation of interventions

Weick and Quinn: see sub-variable 1.2.4 type of change. Episodic change: “Change involves: ‘unfreezing’ the inert organization, ‘transition’ changing the organization, and ‘refreezing’ the organization” (Achterbergh & Vriens, 2019, p. 13). “According authors who appropriate the three-stage model, the change phase should be seen as a learning (and unlearning) process in which organization members actually search for and adopt new, helping, interaction premises and interactions and shed old ones (see, for instance, Schein and Bennis, 1965; Schein, 1987; Young, 2009; Schein, 1992; Weick and Quinn, 1999)” (Achterbergh & Vriens, 2019, p. 222).

Schein: “Although this is a particularly gloomy picture of the role of basic assumptions, the fact that it is very difficult to escape them in generating and evaluating solutions to organizational questions remains. In fact, this may be one of the reasons why episodic interventions are sometimes needed, as they can help to break free from the deeply rooted beliefs about what is “right and good” (see also Schein, 1992, pp. 22ff, for the difficulty about moving beyond basic assumptions)” (Achterbergh & Vriens, 2019, p. 32).
“It is not difficult to recognize in the three social goals, the both famous and infamous three-stage model of planned change that, as the story goes, was introduced by Kurt Lewin, and among others, developed by Edgar Schein: unfreeze, change, freeze (for a critical analysis unmasking this ‘story’ as a kind of myth, see Cummings et al., 2016). Roughly speaking, the ‘unfreeze’ phase of the three-stage model relates to our ‘motivation’ goal, the ‘change’ phase relates to our ‘adoption’ goal, and the ‘freeze’ phase relates to our ‘integration’ goal” (Achterbergh & Vriens, 2019, p. 213).

Luhmann: “In this book, we conceptualize organizations as social systems. As such, organizations are involved in continuous processes of self-production (or autopoiesis, as Luhmann, 1984, calls it). In these processes of self-production, interactions are produced against a changing background of interaction premises that function as points of orientation for the production of new interactions” (Achterbergh & Vriens, 2019, p. 12).

“Meaningful interaction, which may refer to communication (Luhmann, 1984) or joint (communicative) behaviour, is required to ensure that organization members connect to each other and become more than a mere aggregate of individuals” (Achterbergh & Vriens, 2019, p. 24-25).

### 3.4 Sub-variable 1.2.3 Social aspect

<table>
<thead>
<tr>
<th><strong>Achterbergh and Vriens (2019)</strong></th>
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| **1.2.3 Social aspect**  | **Organization as social system:** “Organizations deliver their societal contribution as a social system, i.e. as a system of interlocking interactions. Although it takes some time and effort to really understand organizations as systems of interactions (cf. Giddens, 1979; Luhmann, 1984; Chapter 2 in this volume) the basic idea is simple: it means that organization members interact with each other and thereby realize the organization’s contribution. It also means that an organization is seen as the (evolving) set of these interactions” (Achterbergh & Vriens, 2019, p. 2).
| **Importance social dimension:** “Yet, in the case of organizational interventions, such a functional perspective is insufficient to make these interventions a success. Organizational interventions are interventions ‘for’, ‘by’, and ‘in’ organizations as social systems. As such, they also have a social dimension. In the end, this social dimension is about organization members interactively changing their interaction premises and the interactions based upon them as a result of an intervention” (Achterbergh & Vriens, 2019, p. 209).
| **HR of intervention organization:** “5.3: Select human resources and human resources support measures” (Achterbergh & Vriens, 2019, p. 278).
| **Step 5.3.1:** Make an inventory of gaps between required and available knowledge, skill, and motivation of human resources that were selected using goal-based criteria and bridge these gaps by means of facilitated learning, training, and measures increasing intrinsic motivation |
Step 5.3.2: Make an inventory of the required facilitation and select facilitators using: (1) instrumental job-based criteria in order to safeguard the fit between the required and available knowledge and skills of facilitators and (2) criteria related to the facilitator’s moral character” (Achterbergh & Vriens, 2019, p. 340).

Broad participation: “However, there also is an important difference between the parallel organization as portrayed by Axelrod and our conception of the intervention organization. In the intervention organization as we conceive it, in principle, all organization members can perform intervention activities. In principle, no one is excluded from participation. [...]. In ‘our’ intervention organization, in principle, all organization members and other relevant parties can participate” (Achterbergh & Vriens, 2019, p. 15).

3.5 Sub-variable 1.2.4 Type of change

| 1.2.4 Type of change | Episodic and continuous interventions: “[…] There is one seemingly small difference (with big consequences) between how we approach change in our book and how Weick and Quinn approach it in their paper. This difference is that we do not oppose episodic change to continuous change, but episodic interventions to continuous interventions, and that we regard both types of interventions as modes of organizational change” (Achterbergh & Vriens, 2019, p. 12).

Continuous change: “Being a social system called ‘organization’ means being a flux. Outside this flux, there is no organization. And because organizations as social systems are a flux, they cannot be ‘inert’, cannot be ‘frozen’, and therefore do not need to be ‘unfrozen’” (Achterbergh & Vriens, 2019, p. 12). “This social systems perspective on organizations also means that our ‘analytic framework’ is that of change as a “pattern of endless modifications in work processes and social practices” (Weick and Quinn, 1999, p. 366)” (Achterbergh & Vriens, 2019, p. 13). “[…] The intentional and deliberative character of episodic and continuous interventions does not imply that these interventions can or should evolve according to some ‘blue-print’ project plan, be approached in a ‘top-down’ fashion, or be a considered as a feat of ‘industrial engineering’. As will be argued, episodic and continuous interventions are processes of continuous trial and error, of muddling through. […] This means that in our book we do not see episodic interventions as ‘projects’ that can be planned in advance by a small group of managers, consultants, or engineers” (Achterbergh & Vriens, 2019, p. 13-14).

Episodic change:

“So, besides modes of organizational change that are not intentional and do not involve deliberation, episodic and continuous interventions are modes of organizational change that do involve intentions and deliberation” (Achterbergh & Vriens, 2019, p. 13).

3.6 Sub-variable 1.3.1 Process
1.3.1 Process

“That is, all organizations have to:
1. realize transformation process leading up to the organization’s products and services; this activity is called ‘performing primary processes’;
2. deal with disturbances in these transformation processes (to make sure that they can continue to deliver their contribution); this activity is called ‘operational regulation’;
3. set goals related to their primary processes (e.g. in terms of type of products, number of products; quality of products, and/or a contribution to society); this activity is called ‘strategic regulation’.

In addition, organizations have to:
4. make sure that ‘organizational conditions’ are installed so that all activities (including this fourth one) can be performed; this activity is called ‘regulation by design’” (Achterbergh & Vriens, 2019, p. 25).

“This process of (1) formulating a set of goals (per hypothesis), (2) testing (implementing and assessing) these goals (realizing them and finding out if they are indeed valued), (3) keeping them if it turns out that they are valued, and (4) reformulating them if it turns out that survival is threatened by keeping them is fundamental to strategic regulation” (Achterbergh & Vriens, 2019, p. 42).

“In sum, strategic regulation, regulation by design, and operational regulation are ‘experimental activities’ – they necessarily have to rely on a continuous process of formulating, testing, and reformulating hypotheses” (Achterbergh & Vriens, 2019, p. 43).

“Following Ashby’s (1958) ideas on transformations, an activity can be said to consist of three parts: a begin state, a process, and an end state (see Figure 3.2). An activity refers to the unity of these three parts, and highlights that there is some process causing the begin state to change into the end state. […] The process should make sure that this end state is realized” (Achterbergh & Vriens, 2019, p. 49).

“Functional goals of the intervention: […]

**Diagnosis:** Assessing S’s functioning relative to goal G, given condition C1 and finding a solution space

1. problem identification

“1. (Re)formulate the organization’s conception of its ‘meaningful survival’.

2. Determine the set of variables (V) describing the organization’s performance (i.e. those variables operationalizing ‘quality of organization’ and ‘quality of work’).

3. Determine the norm value(s) of all \(v \in V\) (we will refer to the norm value(s) of variable \(v_i\) as \(v_i[nv]\)).

4. Determine the actual value of all \(v \in V\) (we will refer to the actual value of variable \(v_i \in V\) as \(v_i[av]\)).
5. Determine whether there is a problematic difference (an error) between the norm value(s) and the actual value of all \( v \in V \) (we will refer to this problematic difference between the actual and norm value of variable \( v_i \in V \) as \( v_i[e] \)).

6. Determine the gap: all \( v_i \in V \) for which \( v_i[e] \) exists” (Achterbergh & Vriens, 2019, p. 156).

2. cause analysis

“Step 1: Select the set of structural parameters \( P \) that may possibly cause the problematic values of the variables establishing the gap. These structural parameters are selected based on some understanding of the relation between structure and (problematic) organizational behaviour.

Step 2: Find out, for all \( p_i \in P \), whether \( p_i \) is a problematic parameter (a possible cause of problematic organizational behaviour).

Step 2.1: Provide a ‘rich description’ of the actual, current values of all parameters \( p_i \in P \); we will refer to these descriptions of actual value(s) of parameter \( p_i \in P \) as: ‘\( p_i[av] \) in context’.

Step 2.2: Determine, for all \( v_i \in V \) for which \( v_i[e] \) exists whether, based on the design theory connecting parameters to organizational behaviour, it can be expected that \( p_i \in P \) (for all \( i \)), given its current actual value, is a cause for \( v_i[e] \). For every \( p_i \in P \) for which this can be expected, we’ll say that an error with respect to this parameter (\( p_i[e] \)) exists (i.e. that the parameter value in context is ‘too high’ and hence doesn’t have its norm value).

Step 3: Establish the list of problematic parameters: all \( p_i \in P \) for which \( p_i[e] \) exists” (Achterbergh & Vriens, 2019, p. 165-166).

3. specification of solution space: “selecting parameters that should be lowered by a change in structure” (Achterbergh & Vriens, 2019, p. 181).

Design:

“1. Parallelization – This step is about identifying (independent) production flows, dedicated to a sub-set of external order types. This is a step at the macro level, as it divides the complete production structure into independent (flow-oriented) units.

2. Segmentation – This step is about identifying relatively independent parts (segments) in the flows identified in step 1. This is a step at the meso level, as it identifies units in the macro level flows.

3. Installing task groups or teams – This step aims to select and equip groups of individuals to realize the output of the segments identified in step 2. This is a step at what de Sitter calls the micro level: the level of teamwork.

4. Assign regulatory potential to task groups to realize the output of the segments they are tied to. This is a step at the micro level, as it equips task groups with the necessary regulatory potential to realize the output of the group’s segment. Steps 3 and 4 together lead to self-coordinating task groups or teams – groups with the operational (step 3) and regulatory (step 4) potential to realize their output as independently as possible. In de Sitter’s theory, these steps are often taken together.

5. Build in the required regulation between segments to make sure that segments are aligned and can contribute to the output of the flow they belong to. This is a step at the meso level, as it takes care of regulating the integration of flow parts (segments) to yield the flow output.
6. Build in the required regulation between flows to make sure that issues between flows are regulated (e.g. strategic regulation relevant for all flows, or regulation by design for several or all flows, like dealing with shared resources). As this is regulation with respect to the integration of flows, it is a step at the macro level” (Achterbergh & Vriens, 2019, p. 183).

Design steps:
“1. Designing the production structure at the macro level: identifying flows.
2. Designing the production structure at the meso level: identifying segments.
3. Designing the production structure at the micro level: identifying teams.
4. Designing the control structure at the micro level: equipping teams with regulatory potential.
5. Designing the control structure at the meso level: regulation between segments.
6. Designing the control structure at the macro level: regulation between flows” (Achterbergh & Vriens, 2019, p. 198).

**Implementation:** Changing S’s condition from C1 to C2 in order to improve S’s functioning relative to goal G
“1. determining the difference between the current structure and the desired structure, as delineated in the design step;
2. defining executable ‘implementation’ portions – i.e. coherent and manageable parts of the complete structural change;
3. sequencing the portions from (2);
4. actually implementing the ‘portions’ in the suggested sequence” (Achterbergh & Vriens, 2019, p. 201).

**Evaluation:**
Assessing S’s functioning after implementation relative to goal G (and possible additional goals) (product evaluation) and assessing the intervention process (process evaluation). Finish intervention: something S is in condition C2, enabling S to realize goal G” (Achterbergh & Vriens, 2019, p. 108).

“1. Determine the evaluation criteria (EC1...n) – The product evaluation criteria (i.e. those pertaining to the effectiveness of the intervention) are, in fact, the variables describing the organizational performance as determined in the diagnosis. The evaluation criteria relating to the process have to do with the efficient use of resources and reaching deadlines – they refer to the efficient use of elements of intervention project infrastructure. These criteria are not determined during the diagnosis, and should be defined.
2. Determine the norm values (ECi[nv]) and actual values (ECi[av]) of these criteria (norm values for the product evaluation have already been established during the diagnosis). Norm values with respect to process variables should be determined – and are often determined before the project as well. The actual values of these criteria (i.e. the values of the criteria at the moment of evaluation) still also have to be determined.
3. Determine whether there is a problematic difference (error) between norm values and actual values of the EC's (ECi[e]).
4. Based on the outcome of step 3:
   • If there is NO problematic difference, then one should establish whether this is due to the implemented change of the structure (and not due to other circumstances, e.g. an improved economic situation). If no other circumstances can be found, then one can hypothesize that the intervention was successful.
   • If there is a problematic difference, then one should try to find out whether the lack of success is due to the implemented structure (and not some other events or circumstances). If no other circumstances can be found responsible, then one can hypothesize that the intervention was unsuccessful” (Achterbergh & Vriens, 2019, p. 204-205).

“Social goals in the intervention: […]

**Motivation:** Organization members should develop the motivation to:
- let go of current and move to new interaction premises and concomitant interaction patterns
- adopt an episodic intervention as a means to do this

**Adoption:** Based on a justifiable confidence, organization members adopt (willingly commit to) new helping interaction premises and interactions that can (re)produce an improved organizational structure that allows for the realization of the goal of the intervention

**Integration:** Organization members have irreversibly integrated new interactions and interaction premises into their repertoires that both (re)produce the organization’s new and improved structure and allow for the realization of the goal of the intervention” (Achterbergh & Vriens, 2019, p. 215).

1. Creating motivation
   a. **Sense of urgency:** “In order to be prepared to let go of old interactions and interaction premises, organization members should both understand and feel that change is urgent” (Achterbergh & Vriens, 2019, p. 215).
   b. **Shared vision:** “Although, at the initial stage of the intervention, this vision need not (and cannot) be fully developed and detailed, it should still provide a substantive and value-laden perspective on the future, a perspective that projects the change as both desirable and feasible” (Achterbergh & Vriens, 2019, p. 215).

2. Creating adoption
   a. **Inventing** refers to the search for and creation of new interaction premises and interaction patterns that improve the organization’s structure relative to the goal of the intervention” (Achterbergh & Vriens, 2019, p. 223).
   b. **Testing** refers to all kinds of procedures that may be used in order to assess the efficacy of new interaction premises and interactions that result from inventing” (Achterbergh & Vriens, 2019, p. 224).

3. Creating integration
a. **Exercising** refers to the peculiar relation between doing and training that is also relevant in cases of skill acquisition: exercising as learning by doing. [...] exercising means that organization members actually (start to) use the new (tested) structure-related interaction premises as points of orientation for the production of interactions” (Achterbergh & Vriens, 2019, p. 229).

b. **Reinforcing/adjusting** the new repertoire of interaction premises and interactions” (Achterbergh & Vriens, 2019, p. 231).

Infrastructural process:

Goal-driven design regulation:

“Step 1: Assess the current status of the episodic intervention in terms of functional and social goals that have been realized” (Achterbergh & Vriens, 2019, p. 264).

“Step 2: Select new proximate functional and social goals that should be realized in order to drive the intervention forward (this is the desired proximate state of the intervention)” (Achterbergh & Vriens, 2019, p. 268).

“Step 3: Determine the gap between the current and desired status of the intervention in terms of functional and social goals” (Achterbergh & Vriens, 2019, p. 271).

“Step 4: Reflect on what topics should be interactively addressed in what way and by whom in order to close the gap between the current and the desired status of the intervention in terms of functional and social goals” (Achterbergh & Vriens, 2019, p. 272). “Asking ‘what’, ‘how’, and ‘who’ questions with respect to functional and social goals that have been set: ‘what’ topics of interaction are relevant, ‘how’ should interaction proceed, and ‘who’ should be involved in interaction in order realize set functional and social goals” (Achterbergh & Vriens, 2019, p. 329).

“Step 5: Design the infrastructure of an intervention organization that can support the realization and adaptation of (proximate) functional and social goals

5.1: Design an intervention structure

5.2: Select the intervention technology/techniques

5.3: Select human resources and human resources support measures” (Achterbergh & Vriens, 2019, p. 278).

“Step 5.3.1: Make an inventory of gaps between required and available knowledge, skill, and motivation of human resources that were selected using goal-based criteria and bridge these gaps by means of facilitated learning, training, and measures increasing intrinsic motivation

Step 5.3.2: Make an inventory of the required facilitation and select facilitators using: (1) instrumental job-based criteria in order to safeguard the fit between the required and available knowledge and skills of facilitators and (2) criteria related to the facilitator’s moral character” (Achterbergh & Vriens, 2019, p. 340).

Improvement-driven design regulation:

“Improvements of the intervention infrastructure in the face of problems that present themselves. Three steps are involved:
Step 1: Assess the actual or projected progress of the intervention relative to selected proximate functional and social goals.

Step 2: If progress is worse than required (deviates negatively from proximate functional or social goals), search for and analyse the causes of insufficient progress.

Step 3: If required, redesign the intervention infrastructure in order to either attenuate the causes of the disappointing progress or amplify the infrastructure’s capacity to deal with the problematic effects of these causes” (Achterbergh & Vriens, 2019, p. 280).

In order to exploit opportunities that present themselves, three similar steps to the ones mentioned previously are required. […]

Step 1: Assess the actual or projected progress of the intervention relative to the selected proximate functional and social goals.

Step 2: If progress is better that specified (deviates positively from proximate functional or social goals), search for and analyse the causes of this more than satisfactory progress.

Step 3: If desirable, redefine functional or social goals in the intervention and redesign the intervention infrastructure in order to exploit the causes of more than satisfactory progress in order to realize these new goals” (Achterbergh & Vriens, 2019, p. 280-281).

3.7 Sub-variable 1.3.2 Configuration

Achterbergh and Vriens (2019)

1.3.2 Configuration

“Intervention organizations have their own infrastructure and hence their own infrastructural dimension. This intervention infrastructure consists of: (1) an intervention structure – the network of intervention tasks needed to realize and adapt functional and social goals in the intervention; (2) intervention technology – the technology or techniques supporting the performance of intervention tasks by human resources; and (3) knowledgeable, skilled, and motivated human resources (organization members, consultants, facilitators, stakeholders) who, supported by intervention technology, perform intervention tasks” (Achterbergh & Vriens, 2019, p. 257).

“The crux of both types of design regulation (and the procedures supporting them) is that selected goals on the functional and social dimensions are, somehow, translated into a design of an intervention infrastructure that can realize and adapt these goals” (Achterbergh & Vriens, 2019, p. 258).

Process of organizing the configuration of the intervention organization: see sub-variable 1.3.1 infrastructural dimension steps.

3.8 Sub-variable 1.3.3 Instrument

Achterbergh and Vriens (2019)
1.3.3 Instrument

“By intervention technology, we understand tools and techniques that can be selected to support the performance of intervention activities by the human resources that are involved in the intervention. [...] Given the number and variety of tools and techniques that can be used in episodic interventions, we will not try to classify them using their characteristic features as a basis. Instead, for purposes of classification, it is more useful to take the intervention goals and activities that can be supported by these tools and techniques as a point of departure” (Achterbergh & Vriens, 2019, p. 326).

<table>
<thead>
<tr>
<th>TABLE 8.6 Goals and activities that may be served by intervention technology</th>
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<tbody>
<tr>
<td><strong>Operational intervention activities</strong></td>
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<tr>
<td>Related to functional goals</td>
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<tr>
<td>Activities related to: Diagnosis, Design, Implementation, Evaluation</td>
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<tr>
<td>Related to social goals</td>
</tr>
<tr>
<td>Activities related to: Motivation, Adoption, Integration, Creating/maintaining change relationships</td>
</tr>
<tr>
<td><strong>Regulatory intervention activities</strong></td>
</tr>
<tr>
<td>Activities related to: Operation, Design regulation, Strategic regulation</td>
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Figure 2: Goals and activities that may be served by intervention technology. Reprinted from: Organization Development. Designing episodic interventions in organizations,” by J. Achterbergh and D. Vriens, 2019, Abingdon: Routledge. Copyright 2019 by Routledge.

Observation: “An inquiry into these questions can be realized by analysing the rich description of the actual values of functional concentration and by additional research, e.g. by means of observation, asking foremen and/or asking members of the building teams (perhaps in interviews or by means of closed questions)” (Achterbergh & Vriens, 2019, p. 175).

“Group discussions, document analysis, observation, or even a survey involving all organization members are examples of techniques that can be used as well. In general, all kinds of techniques can be used in order to find answers to the questions that support goal-driven design regulation” (Achterbergh & Vriens, 2019, p. 268).

3.9 Sub-variable 2.1.1 Theoretical and conceptual substantiation of the infrastructural object

Achterbergh and Vriens (2019)

2.1.1 Theoretical and conceptual substantiation of the infrastructural object

De Sitter: “In order to identify these characteristics, one needs to have some understanding of the relation between structure and organizational behaviour. And although different theories about this relation exist (e.g. Thompson, 1967; Galbraith, 1973; Mintzberg, 1983), we select the design theory of de Sitter (1994), which we discussed in Chapter 3, as it is, in our view, the most comprehensive and detailed theory linking structural characteristics (also ‘design parameters’) to organizational behaviour (i.e. to the variables operationalizing quality of organization and quality of work)” (Achterbergh & Vriens, 2019, p. 166).
“After describing the adequacy of organizational structures in terms of the above requirements, one may ask
which form structures should take so that these requirements can be met. Here, we follow de Sitter (1994),
who provides a general answer to this question. As he argues, the requirements for adequacy are met by
structures of which the values on the design parameters are as low as possible” (Achterbergh & Vriens, 2019,
p. 68).

Ashby: “As yet, we haven’t specified the desired characteristics of structures which make them enable the
four basic activities (arrow C in Figure 3.8). We derive these characteristics from cybernetics (cf. Ashby,
1958; Achterbergh and Vriens, 2010). […] That is, structures should have the regulatory potential to either
remove disturbing events (attenuation, cf. Achterbergh and Vriens, 2010), or to deal with the effect of disturb-

Luhmann: “As Luhmann (1984) would have it, interaction premises ‘structure’ the flow of interactions (com-
munications in Luhmann’s theory) by pointing at a set of possible, contingent ‘follow-up’ interactions from
which one is ‘selected’. It is important, then, that interaction premises do not causally determine the flow of
interactions; they do, however (as Giddens, 1979, p. 25, would have it), “constrain and enable” this flow”
(Achterbergh & Vriens, 2019, p. 38).

“A similar comparison can be made with Luhmann’s (1984) social systems theory. He describes organizations
as a continuous process of ‘self-production’ – i.e. a process in which decisions produce follow-up decisions.
This production process is structured by what he calls “decision premises”. These decision premises select a
set of possible follow-up decisions, from which one becomes the actual follow-up decision” (Achterbergh &
Vriens, 2019, p. 39).

Beer: “Based on this idea, the first overall heuristic for building such structures is that one should start with
designing the production structure, and after that, one should design the control structure. The reason for this
heuristic is that if one first designs the production structure in such a way that it is not a source of disturbances,
the control structure can be less complex, as it doesn’t need to deal with these disturbances. […] This logic
is a straightforward translation of the cybernetic idea that it makes sense to start with reducing the number of
disturbances, and only then implement the required regulatory potential (cf. Beer, 1979; Achterbergh and
Vriens, 2010)” (Achterbergh & Vriens, 2019, p. 182-183)

3.10 Sub-variable 2.1.2 Essential variables

Achterbergh and Vriens (2019)

| 2.1.2 Essential variables | -Quality of organization: “The class of criteria labelled ‘quality of organization’ expresses the organization’s
potential to realize and adapt the societal contribution in an efficient and effective way. It refers to criteria pertain-
ting to flexibility (the ability to react to fluctuations in demand by realizing short production cycle times, and
by having sufficient product variations and a variable product mix), control over order realization (the ability to
provide products and services at the expected quality standards, in a reliable and timely way), and innovativeness
(the ability to define and improve relevant products and services; or to put it more in terms of our model, the
ability to define and improve the organization’s contribution to society)” (Achterbergh & Vriens, 2019, p. 63). |
Quality of work: “The criteria belonging to the class ‘quality of work’ express the degree of meaningfulness of organizational jobs. These criteria have to do with being a ‘good employer’, and describe the effective ‘mobilitation of human resources’ (cf. de Sitter, 1994). At the same time, these criteria reflect whether organizational opportunities are created for employees to ‘live a fulfilled life’ in the context of doing their jobs (cf. Achterbergh and Vriens, 2010; Vriens et al., 2018a). De Sitter argues that there are two general indicators for quality of work: the degree of absenteeism and the degree of personnel turnover” (Achterbergh & Vriens, 2019, p. 63).

![Figure 3: Operationalization of the organizational societal contribution. Reprinted from: Organization Development. Designing episodic interventions in organizations,” by J. Achterbergh and D. Vriens, 2019, Abingdon: Routledge. Copyright 2019 by Routledge.]

### Sub-variable 2.1.3 Parameters

**Achterbergh and Vriens (2019)**

2.1.3 Parameters

“Although different authors discuss different parameters, we will use the set of seven parameters proposed by de Sitter (1994), as it seems to be a complete set and effectively encompasses most of the parameters put forward by others. We will argue that every organizational structure can be described by means of these parameters” (Achterbergh & Vriens, 2019, p. 54).

“[…] three types of design parameters can be distinguished (Achterbergh & Vriens, 2019, p. 54-55):

1. those related to the production structure; in particular, we distinguish three parameters of this type:
   a. the degree of functional concentration;
   b. the degree of differentiation of operational activities;
   c. the degree of specialization of operational activities;
2. those related to the control structure, in particular:
   a. the degree of differentiation of regulatory activities into parts;
   b. the degree of differentiation of regulatory activities into aspects;
   c. the degree of specialization of regulatory activities;
3. one design parameter describing the relation between operational and regulatory activities, and hence the relation between the production and control structure – the degree of separation.”

Other parameters which are not structure-related, but help to realize successful episodic interventions:
- Extent of realizing functional goals
- Extent of realizing social goals
- Extent of realizing infrastructural goals

To realize these goals, the organization should complete the activities which are explained in section 1.3.1 Process.

### 3.12 Sub-variable 2.1.4 Relation between parameters and essential variables

<table>
<thead>
<tr>
<th>Achterbergh and Vriens (2019)</th>
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<tbody>
<tr>
<td><strong>2.1.4 Relation between parameters and essential variables</strong></td>
</tr>
<tr>
<td>“Each of these parameters can have different ‘values’, and, dependent on these values, the organization’s structural layout has particular characteristics, enabling or disabling organization members to act in particular ways. For instance, if the value of the design parameter ‘separation’ (see later text) is ‘high’, organization members in the operating core of the organization have little decision authority regarding the regulation of their own work (cf. Pierce and Delbecq, 1977). This may not help them to learn to solve job-related problems by themselves. By contrast, if the value of this parameter is ‘low’, organization members in the operating core do have regulating capacity to deal with job-related problems themselves. In this way, design parameters can be used to describe structures” (Achterbergh &amp; Vriens, 2019, p. 54).</td>
</tr>
<tr>
<td>“As we will argue, structures with high values on the design parameters (high parameter value structures, or HPVSs) are themselves a source of disturbances and don’t have the required regulatory potential to deal with disturbances. Therefore, they face problems in realizing the four basic activities and hence will fail to meet the main criteria A and B (see Figure 3.9). As we will argue, low parameter value structures (LPVSs) will stand a better chance of realizing these criteria” (Achterbergh &amp; Vriens, 2019, p. 68).</td>
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</table>

### 3.13 Sub-variable 3.1 Methodological metaphor and paradigm

<table>
<thead>
<tr>
<th>Achterbergh and Vriens (2019)</th>
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<tbody>
<tr>
<td><strong>3.1 Methodological metaphor &amp; paradigm</strong></td>
</tr>
<tr>
<td><strong>M:</strong> Technique: “As such, designing an intervention infrastructure by means of the 3-D model necessarily presupposes some preceding, more or less embryonic, intervention infrastructure that allows for the selection of the 3-D model as a technique supporting the design of the intervention infrastructure” (Achterbergh &amp; Vriens, 2019, p. 265-266).</td>
</tr>
</tbody>
</table>
Tool: “The consultant, then, selects the 3-D model as a tool (which is an act of design regulation, too), and starts assessing the current status of the intervention in terms of functional and social goals that have been realized” (Achterbergh & Vriens, 2019, p. 267).

Template: “If we take the 3-D model as a template […], it can be argued that facilitators may be required to combine ‘knowledge that’ and ‘knowledge why’ […] with respect to: 1. Facilitation itself […] 2. Operational or regulatory intervention activities” (Achterbergh & Vriens, 2019, p. 337).

**Objective:**

“The best we can do is to formulate the ‘hypothesis’ that a particular set of goals will help us to survive meaningfully. After formulating these goals, we may try to realize them in the hope that they will indeed be appreciated as meaningful. In that case, we ‘test’ the hypothesis that these goals will help us to survive” (Achterbergh & Vriens, 2019, p. 42).

**Subjective:** “In organizations, metaphors can become ‘generators of meaning and action’. For instance, once organization members see their organization as a machine, it is probable that they start to act accordingly, which, in turn, reinforces their way of seeing” (Achterbergh & Vriens, 2019, p. 289).

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### Appendix 4 Summarized results of the 3-D model sub-variable 1.3.1

<table>
<thead>
<tr>
<th>Dimension</th>
<th>Process activities</th>
</tr>
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</table>
| Functional dimension | 1. Diagnosis  
  a. Problem identification  
  b. Cause analysis  
  c. Specification of solution space  
  2. Design  
  a. Production structure – macro level (flows/parallelization)  
  b. Production structure – meso level (segmentation)  
  c. Production structure – micro level (task groups/teams)  
  d. Control structure – micro level (regulation for task groups)  
  e. Control structure – meso level (regulation between segments)  
  f. Control structure – macro level (regulation between flows)  
  3. Implementation  
  a. Define difference between the current infrastructure and the desired infrastructure  
  b. Dividing the implementation plan into executable portions  
  c. Sequencing portions  
  d. Implementing portions  
  4. Evaluation |
a. Determine the product evaluation criteria and process evaluation criteria
b. Determine norm and actual values of these criteria
c. Determine difference between norm and actual values
d. No problematic difference -> due to changing structure? -> successful intervention Problematic difference -> due to changing structure? -> unsuccessful intervention

<table>
<thead>
<tr>
<th>Social dimension</th>
<th>1. Creating motivation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>a. Sense of urgency</td>
</tr>
<tr>
<td></td>
<td>b. Shared vision</td>
</tr>
<tr>
<td>2. Creating adoption</td>
<td></td>
</tr>
<tr>
<td></td>
<td>a. Inventing</td>
</tr>
<tr>
<td></td>
<td>b. Testing</td>
</tr>
<tr>
<td>3. Creating integration</td>
<td></td>
</tr>
<tr>
<td></td>
<td>a. Exercising</td>
</tr>
<tr>
<td></td>
<td>b. Reinforcing/adjusting</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Infrastructural dimension</th>
<th>Goal-driven design regulation:</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1)</td>
<td>Assess current status of episodic intervention in terms of functional and social goals that have been realized</td>
</tr>
<tr>
<td>(2)</td>
<td>Select new functional and social goals that should be realized to drive the intervention forward (desired state of the intervention)</td>
</tr>
<tr>
<td>(3)</td>
<td>Determine gap between the current and desired status of intervention in terms of functional and social goals.</td>
</tr>
<tr>
<td>(4)</td>
<td>Asking ‘what’, ‘how’, and ‘who’ questions with respect to functional and social goals that have been set: ‘what’ topics of interaction are relevant, ‘how’ should interaction proceed, and ‘who’ should be involved in interaction in order realize set functional and social goals.</td>
</tr>
<tr>
<td>(5)</td>
<td>Design the infrastructure of an intervention organization to realize and adapt functional and social goals:</td>
</tr>
<tr>
<td>(5.1)</td>
<td>Design an intervention structure</td>
</tr>
<tr>
<td>(5.2)</td>
<td>Select the intervention technology/techniques</td>
</tr>
<tr>
<td>(5.3)</td>
<td>Select human resources and human resources support measures</td>
</tr>
<tr>
<td>(5.3.1)</td>
<td>Make an inventory of gaps between required and available knowledge, skill, and motivation of human resources that were selected using goal-based criteria and bridge these gaps by means of facilitated learning, training, and measures increasing intrinsic motivation</td>
</tr>
<tr>
<td>(5.3.2)</td>
<td>Make an inventory of the required facilitation and select facilitators using: (1) instrumental job-based criteria in order to safeguard the fit between the required and available knowledge and skills of facilitators and (2) criteria related to the facilitator’s moral character</td>
</tr>
</tbody>
</table>

Improvement-driven design regulation:
A: Steps when problems arise:
1. Assess actual/projected progress of the intervention relative to functional and social goals
2. Progress worse than required? → analyse causes of insufficient progress.
3. If required, redesign the intervention infrastructure to attenuate causes of the disappointing progress or amplify the infrastructure’s capacity to deal with the problematic effects of these causes

B: Steps when opportunities arise:
1. Assess the actual/projected progress of the intervention relative to the selected proximate functional and social goals.

2. If progress is better that specified (deviates positively from proximate functional or social goals), search for and analyse the causes of this more than satisfactory progress.

3. If desirable, redefine functional or social goals in the intervention and redesign the intervention infrastructure in order to exploit the causes of more than satisfactory progress in order to realize these new goals.