

# Communicating in flood prone areas of Semarang

*A case study on the ways of communication used by students whose mobility is affected by frequent floods and new telecommunication technologies*



Tom van der Linden

Bachelor thesis, final version

Supervisor: Martin van der Velde

Radboud University Nijmegen, 05-10-2013

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## **Preface**

Choosing Indonesia as a subject for my bachelor thesis stemmed from a vacation to Bali a few years ago, which was quite a memorable experience for me as it was my first introduction to a part of the world I'd never been before. At the time I didn't know if I would get the chance to go back to Indonesia again, but I was happy to hear when I did. The fieldwork in Semarang was by far the most interesting and exciting part of writing this thesis and a very insightful trip during which I got to know a whole different side of Indonesia that most tourists don't experience. Compared to the visual beauty of Bali, Semarang as a city wasn't particularly appealing with its heavy traffic and urban chaos, but while I got to know the local students better I found a lot of beauty in their personalities, ways of interaction and general way of life. The lengthy conversations and discussions I had with them about various aspects of life such as religion, conventions, women's rights and even sexuality opened my eyes to a lot of issues in both their culture and my own and was probably the most memorable aspect of my trip.

I want to thank Martin van der Velde and Lothar Smith for making this trip possible and aiding me during the research process by discussing the progress and giving me helpful notes. I also want to thank Donny Danardono, our contact at Unika, for his warm welcome and time to help me with my research. Furthermore, I want to thank some of the students who spent a lot of time and effort to contribute to my research. The first one is Cathy, who took me and my colleague out for observations in and around her neighbourhood together with her friends Ruth, Naomi and Melissa. Next are Mona, Vera and Adele, who weren't among the respondents but helped me in finding students from flooded areas and served as translators during the interviews. Besides aiding in my research, They and their friends Joanna and Prima also spent a lot of time showing us the city and making sure we had a good time. I thank them for their friendship and hospitality.

*Tom van der Linden*

*Nijmegen, 05-10-13*

## **Summary**

The city of Semarang, Indonesia, is plagued by frequent floods that have grown worse over the last few years. The main cause of these floods growing worse is land subsidence, strengthened by a small rise of the sea level. The floods bring a lot of problems and obstacles for the everyday-life of the local community, in particular the inhabitants of the lower city that are getting more and more exposed every year.

A different development in Semarang as well as in the rest of Indonesia is the enormous growth of telecommunication. Over the last 10 years the number of mobile phone users has grown tremendously. The internet is also getting more popular rapidly with the social networking site Facebook ranking as the most visited website within Indonesia (Lim, 2011, p. 5). It is especially the younger generation that is pushing forward this recent revolution (Nielsen, 2011).

Looking through the eyes of Hägerstrand and his time-geography theory, people always interact with time and space and encounter various obstructions in their mobility. This creates an interesting relation between the increasing problem of floods as obstructions in the physical space and the telecommunication revolution that has created a growing virtual space. The goal of this research is to find out how this interaction has influenced the mobility and used ways for communication by researching a population group that is both affected by floods and among the frontrunners of the telecommunication revolution: students, in this case; the students from the Soegijapranata Catholic University (Unika) of Semarang. Based on the research goal, the following question was deduced:

*How does the mobility of students in Semarang, affected by the usage of new telecommunication technologies and floods, influence their used ways of communication?*

The results can provide valuable insights into both flood related problems and the growing implementation of telecommunication in developing countries. Because the telecommunication revolution is primarily driven by younger people, the results may also prove inspiring for the older generations that are not yet familiar with new telecommunication technologies by getting new insights in their possibilities. On a more practical note, the results can be useful for the Unika University for improving their communication with the students.

The concepts of this research were conceptualized with Hägerstrand's time-space geography and its expansions for telecommunication. The framework resulted in the conceptualization of mobility as the available time and space for activities. The activity in this case is communication; which was distinguished into four time-space dimensions of communication. Hägerstrand's time-space geography was also applied to conceptualize the impact of a flood on the mobility of students. The floods were linked to time-space constraints, resulting in two interacting dimensions of a flood as a constraint on the student's behaviour; the spatial aspect and the temporal aspect. The necessary data was gathered through a literature study and empirical work that included in-depth interviews and some supporting observations.

The results quickly showed the importance and complete integration of telecommunication in the lives of students. All of the respondents had smartphones through which they could access the virtual space; the spatial factor of telecommunication in addition to physical communication. Because of the instant access to this virtual space, a lot of travel time was eliminated, leaving more available time and space in the day of a student. It's not surprising that a lot of students prefer to use

these new ways of communication, although physical communication is still highly appreciated among the respondents.

The respondents lived in slightly higher areas of Semarang that were most vulnerable to floods from rainfall in the rainy season. Some tidal floods occurred, but these weren't considered as much of a hazard because of their low severity. The students experienced a direct impact of rainfall floods on their available physical space for communication. This led to capability constraints on the students that were unable to leave their houses and had to stay home during the flood, decreasing their daily available time and space. The severity of this constraint was determined by the duration of inundation, which dictated how long the student was restricted at home. No flood impact on the available virtual space was observed as all the respondents were able to keep their telecommunication devices safe.

Because there was little to no flood impact on the available virtual space, most students could preserve their virtual communication like they would normally do. It comes as no surprise that during a flood many of the students replaced their physical communication with virtual communication to lift the capability constraints that restricts their ability to move in physical space, causing a shift in the time-space dimensions of communication. A small number of respondents chose to meet people somewhere else instead of receiving them at home, thereby changing the location but not the communication channel. When a face-to-face meeting was unavoidable, such as a formal appointment, physical communication would be postponed, causing the coupling constraint of a meeting to shift later in time when the capability constraint of a flood is lifted. This still has major consequences for the mobility of students as their available time and space decreases. Overall, the growth of telecommunication technologies has expanded the mobility of students to such an extent that communication during a flood is not as problematic as it might have been in the past. Besides the full integration of virtual communication in the daily lives of the students, its opportunities become even more prominent during a flood when physical communication is either more difficult or impossible. This shows how the enlarged available virtual space influences the used ways for communication when the available physical space declines because of the frequent floods.

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## **1. Introduction**

The used ways for communication in Semarang are changing by two major developments affecting the mobility of the people. The first development; the growing flood problems, restrict mobility while the second development; the growth of telecommunication, creates new opportunities for mobility. This interaction between a restricted physical space and growing virtual space affects the ways people use to communicate and will be further explored in this research.

This first chapter will serve as an introduction. To begin, a background will be given in which the flooding problem in Semarang will be described and the social and scientific significance of this research will be determined. After that the goal for this research can be defined. This will lead to the main question that this research will set out to answer.

### **1.1. Background**

This research will take place in Semarang, a large city on the island Java, Indonesia. Over the last few years the city has growing flooding problems, especially in the lower regions. Three different types of floods occur. The first two are described in Dewi (2007, p. 23); one is caused by river flooding, the other caused by high tide of the sea. A third type can be added from Harwitasari and Van Alst (2011, p. 3), where floods are caused by heavy rainfall. Yevjevich (in Dewi, 2007, p.1) defines a flood as *“extremely high flows or levels of rivers, whereby water inundates flood plains or terrains outside the water-confined major river channels”*. The gravity of such a flood is usually determined by the risk of material damage and the loss of human lives.

Semarang has several rivers running through the city, all of which have a certain capacity of the amount of water that they can accommodate. If that capacity is exceeded, the river floods and causes inundation in the surrounding areas. One of the most important reasons for the capacity of a river to be exceeded is heavy rainfall. Rainfall is primarily a problem during the wet season, in which rain is significantly more extensive. Heavy rainfall in the hinterlands can cause a rise in river levels, increasing the risk of river flooding in the city of Semarang. Local rainfall in itself can also cause a flood when the amount of rain exceeds the maximum drainage capacity (Gatot et al., 2001, p. 436). This is more of a problem in the urban areas of Semarang. A research from ACCCRN (2010, p. 12) shows how rainfall during the wet season has increased over the last century, also increasing the chance of a flood within that season. In contrast, the dry season has become dryer with a decreasing number of days with rainfall. Tidal floods are a common occurrence in coastal regions as a result of high tide, a natural phenomenon that is caused by a full moon that increases the difference between high and low tide. With high tide being higher, the risk of a flood also gets bigger (Harwitasari, 2009, p. 6). This risk is higher in Semarang due to a small rise of the sea level and the growing problem of land subsidence (Harwitasari and Van Alst, 2011, p. 1).

The primary reason for land subsidence is the extreme groundwater withdrawal (Marfai and King, 2007a, p. 652). The relative impact of land subsidence is augmented by the small rise of the sea level and makes more lower city parts vulnerable to flooding (Marfai and King, 2007b, p. 1236). Besides that, land subsidence also has a number of undesired effects such as structural damage and damage to infrastructure (Hasanuddin et al., 2010, p. 3; Marfai and King, 2007a, p. 655).

The people mostly affected by land subsidence and floods are the people living in the lower parts of Semarang, where housing prices are relatively low (Marfai et al., 2007, p. 242). The floods form a



significant obstruction to the daily activities of these people. From a survey of Marfai et al. (2007, p. 243-244) we can see that many people have problems with their daily household activities, such as cleaning or cooking. This gets even worse when they lose power or running water during a flood. For many people, the frequent floods have become a part of their lives and they adapt to it. One example of adaption are the measures people take to protect themselves and their houses from the damaging effects of floods (Marfai et al, 2007, p. 244). Other forms of adaption are more indirect and formed by changing habits, such as traffic patterns that shift after people travel with different types of transportation or avoid frequently flooded roads. When looking at communication as one of the daily activities of people that requires a certain level of mobility in flooded areas, there is also a different external factor besides the floods influencing the ways in which people can communicate.

In the recent years a revolution in telecommunication has been taking place in a lot of developing countries, with Indonesia among them. Semarang is no exception to this development and experiences a growing virtual sphere in areas that are simultaneously plagued by physical obstructions due to the frequent floods. So with two major developments, one creating options and one taking options away, what happens to the mobility of people in flooded areas? How do people shift their habits for ways of communication? Within the limits of this research, a small and representative group of university students were selected to answer these questions and find out how students in frequently flooded areas experience communication when their mobility is affected by the opportunities from telecommunication technologies and the limitations of floods. Choosing university students as the research population was done because they usually come from middle class families and have access to and experience with modern communication technologies, while still facing flood related problems.

## **1.2. Research relevance**

The scientific relevance that this research holds is the expansion of Hägerstrand's time-geography theory, which will be applied in this research. While this theory is already expanded greatly in the light of the growing virtual spaces, little research deals specifically with the effects of the interaction between this virtual space and a clear physical obstruction such as a flood on the mobility of an individual or group. Although this research is relatively small, it may prove an interesting stepping stone for further research on the subject.

There is also a social relevance to this research, for it portrays the telecommunication revolution that is taking place across various developing countries and places it in context with local flood problems on a small and personal scale. These flood problems are not exceptional to Semarang though, in fact, they are becoming a growing issue all over Indonesia with floods hitting Central and East Java (Global Times, 2013), Northern Indonesia (Foxnews, 2013) and even the capital city Jakarta (BBC, 2013). This means that the results of this research are not only representative for the research population, but can also be relevant to similar cases in Indonesia or other developing countries.

To the Soegijapranata Catholic University there is also a social relevance to this research. After 20 in-depth personal interviews with Unika students living in flood risk Semarang this research has created an interesting image on student communication and flood problems. This might be inspirational for the university to awaken awareness in flood and communication related issues that would otherwise go unnoticed.

### **1.3. Research goal**

This research will focus on communication of students whose mobility is affected by the usage of new communication technologies and the impact of floods. The results will provide new insights in the growing usage of telecommunication in developing countries and the interaction with physical hazards such as floods. These new insights might contribute to solving problems or creating policies regarding telecommunication and the reduction of the experienced flood impact on communication in developing countries. The overall goal of this research is therefore of practical nature and goes as follows:

*The goal of this research is to contribute to the improvement of communication in frequently flooded areas by providing insights in the effects of floods and new telecommunication technologies on the used ways for communication of students in Semarang.*

The studying of literature on telecommunication, literature on physical constraints and literature on the floods in Semarang will give a hypothesis about the effects of telecommunication and floods on the mobility of students and how this affects communication. This hypothesis will be tested on the students of Unika, leading to the research results that will be analysed and provide a contribution to the improvement of communication in frequently flooded areas.

### **1.4. Research question**

Based on the research goal a main question for this research can be created. The primary research objects are the students in Semarang living in or near frequently flooded areas. To find out how they experience communication with two phenomena affecting their mobility; the growth of telecommunication and the frequent floods, a main research question is needed that describes the influence of the students' affected mobility on the used ways communication. For that, the following research question will be used:

*How do floods and new telecommunication technologies affect the used ways for communication of students in Semarang?*

From the main question, three sub questions are derived. The first one will go into the role of new telecommunication technologies in the everyday lives of the students. To get an idea of the expanded mobility and used ways of communication of the research objects, the following sub question is asked:

- ❖ *What is the role of new telecommunication technologies in the everyday communication of students?*

The next sub question will serve to get an idea of the impact of the frequent floods and how they constrain the research objects in their mobility;

- ❖ *How does a flood affect the students' mobility?*

The final sub question will connect the phenomena of the previous sub questions and provide the information needed about the effect of the students' changed mobility on their used ways for communication. The last question is:

- ❖ *How do students experience communication during a flood?*

With this question the role of new telecommunication technologies is tested with the constraints of a flood. The behaviour of students during this situation is vital to answer the main question, because it is during a flood where the two developments in the first sub questions cross each other and we find out to what extent students can overcome the flood constraints by using different ways for communication.

## **2. Theoretical framework**

The purpose of a theoretical framework is to provide the background for the empirical research. The people in Semarang are to various degrees constrained by floods, this can be seen as an external influence that has an impact on the mobility of people, which in turn determines the ways of communication they use. At the same time, the growth of telecommunication has influenced the people's mobility by creating a new virtual space that creates new communication possibilities that can possibly overcome the flood constraints.

To bridge the gap between the research question and the empirical research, this framework will elaborate Hägerstrand's theory of time-geography and use it to define the key concepts of this research. First, an introduction to Hägerstrand's time-geography will be presented. Then the concepts of mobility and communication will be defined and placed into the context of this research and Hägerstrand's framework. After that, the theory of Hägerstrand will be connected to the flood problems in Semarang and the possibilities for a flood to form a constraint on communication will be explored. The main concepts will be presented in a conceptual model for further operationalization.

### **2.1. Time and space with Hägerstrand**

During the late 1950s and 1960s, many geographers systematically attempted to conceptualise time and space, with an increasing number of them turning to scientific methodology, quantitative methods and spatial analysis (Merriman, 2012, p. 15). In this traditional paradigm of geography, time and space were seen as separate, following Newtonian ideas of absolute space as a real, perceptible phenomenon, an idea already challenged by Leibniz who claimed that we need to understand space as we understand time; nothing more than merely relatively (Blaut, 1961, p. 3; Janelle, 2001, p. 15747; Curry, 1995, p. 13). This is where Swedish geographer Torsten Hägerstrand asked; *"what about people in regional science?"* (1970); a question stemmed from a humanistic concern with the general quality of life and the everyday freedom of an individual. His focus on the freedom to undertake action in time and space, which he found to be of greater importance than what people actually do, also served to pinpoint occurring barriers that were the reason for so called non-events, laying the first foundations for the role of constraints in his framework (Pred, 1977, p. 210). Although other geographers began to develop increasingly behavioural, individualistic approaches such as Janelle's concepts of time-space convergence and human extensibility (1973), it is Hägerstrand who would become known as 'the father of time-geography' (Gren, 2003, p. 209). His model of society stood out by attempting to *"capture the movement and activity participation of people through graphic representation of their simultaneous and sequential space and time locations"* (Janelle, 2001, p. 15747).

Hägerstrand (1970, p. 10) presented the idea of a life path, starting at birth and ending with death, thereby placing an individual (or observed object) in the centre of a situational context (Pred, 1977, p. 211). This path can be limited to various scales like a day path or a week path. Its purpose is to show the significance of continuity in the sequence of situations and the everlasting interaction between time and space (Hägerstrand, 1982, p. 323). *"Just as a car with no engine has no movement, space with no time has no dynamic."* (Thrift, 1977, p. 4). Time flows the same way for everyone and because moving around in space takes time, they are inseparable (Hägerstrand, 1970, p. 10; Thrift, 1977, p. 4; Miller, 2005b, p. 10).

A person encounters various constraints in his daily path. These constraints range from biological necessities such as the need to sleep and eat, to constraints set by a person's society such as legal rules. "An individual can never free himself from such constraints" (Hägerstrand, 1970, p. 10). Hägerstrand distinguishes three major groups of constraints: capability constraints, coupling constraints and authority constraints (1970, p. 12); Capability constraints are mainly of physiological nature such as the need to sleep for a few hours. Different than other constraints that are predominantly distance oriented, most capability constraints have a predominant time orientation; requiring a person to be at one place, usually a home base, for a fixed duration of time. Coupling constraints define where, when and for how long a person has to join with other individuals, tools and materials to form production, consumption and other social activities. When two or more daily paths cross, they form a bundle, suggesting some sort of interaction between the individuals can take place. Authority constraints relate to time-space entities, also called domains or control areas, within which things and events are under control by an authority figure, which can be an individual, group or institution. Some of these are based on custom, such as a place in line in the theatre, while others have a strong legal status, such as a person's allowance to be in a home, state or country (Hägerstrand, 1970, p. 12-16). Besides these, various other constraints limit a person's behaviour such as the indivisibility of a person, the limited ability to do multiple tasks at once and many more, eventually influencing almost all forms of interaction involving human beings (Pred, 1977, p. 208).

The potential daily path of a person can be visualized in a time-space prism. For this, Hägerstrand (1970, p. 12) uses a (temporal) home as the base from which a person's day path begins. From here a person will have the ability to trade time for space within a maximum daily range (Miller, 2005a, p. 381). An example of possible daily prisms is presented in figure 1, which contains three different daily prisms with various ranges in time and space. The walker has a limited maximum range in space, while a car has given the driver a greater mobility and enlarges the maximum distance that can be travelled. The flyer can also overcome greater distances, but the maximum time in this place is limited by the time lost flying.

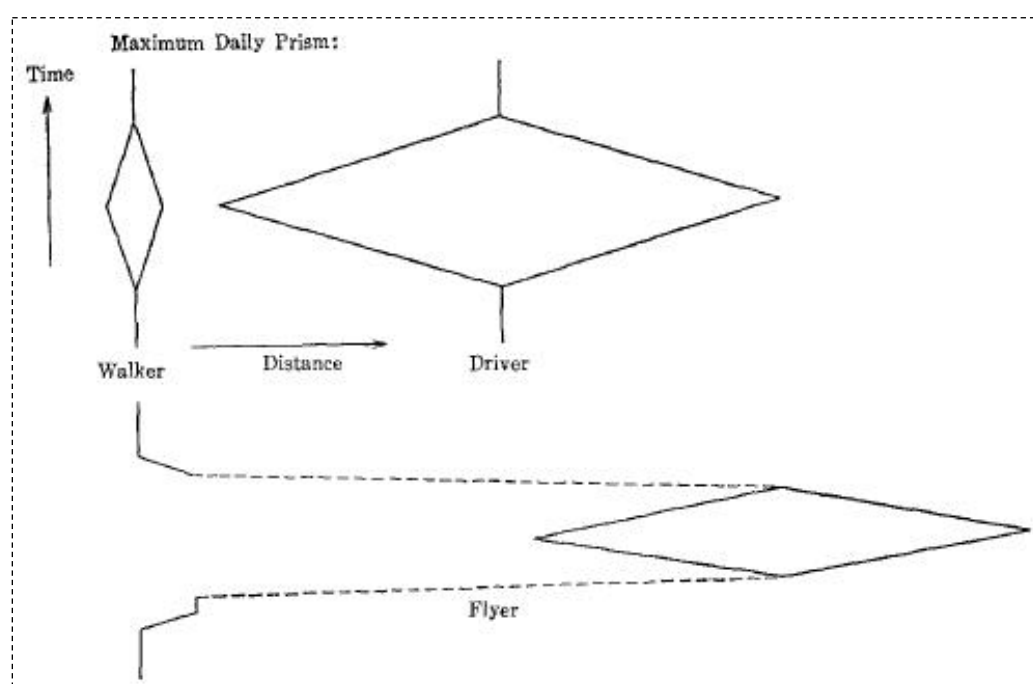


Figure 1: Maximum daily prism (Hägerstrand, 1970, p. 13)

In the decades that followed, Hägerstrand's time-geography has been elaborated upon by himself and his Lund group, but it also became a foundation for other geographers who used time-geography for their own researches (Kraak, 2003, p. 1989-1990). Pred for example acknowledges the countless opportunities for applying time-geography, since time-space paths are universally followed (1977, p. 217). Another geographer who used time-geography in his work is Miller, he says: *"the space-time or time-geographical framework is a broad and powerful perspective from which to analyse human behaviour"* (1991, p. 287). These are just a few examples of implementations and expansions of Hägerstrand's time-geography, which has evolved a lot over the years and is adjusted for many modern inventions, including telecommunication. But before we address the subject of communication in relation with Hägerstrand's time-geography, it will first be defined within the context of this research.

## **2.2. Defining research concepts**

The central concept for this research is communication. This is however a broad concept and needs to be defined within the limits of this research. As noted in the introduction of this chapter, communication will be approached as an activity that requires time and space. The available time and space that people have to undertake activities can also be seen as their mobility. So when we introduce the floods that impact the physical space and the telecommunication that creates opportunities in the virtual space, it is fair to state that they both affect a person's mobility. The goal of this research was to provide insights in these effects on mobility that eventually determine the used ways of communication, hence a geographical approach to communication was needed to follow up on that promise.

The easiest way to define communication is when a person sends out a message and another person receives it. When sending out a message, the message goes through a so called communication channel. A communication channel can be defined as: *"a medium through which a message is transmitted to its intended audience, such as print media or broadcast (electronic) media."* (BusinessDictionary, 2013). It also defined as simply: *"the ways in which people communicate"* (Collins, 2013).

There are various kinds of these communication channels and choosing one depends, at first, on the mobility of the person wanting to communicate. In the first paragraph the mobility of a person was defined as the available time and space for activities, with the activity in this case being communication. The mobility of a person in this context can be determined by for example the ability to reach someone in space for a face to face conversation, the access to an internet connection for sending an email or the access to a mobile phone for making telephone calls. It also depends on the mobility of the receiver of the message whether or not he is able to gain access to the same communication channel as the sender to receive a message.

Within a person's mobility, the concept of choice and preference for a person to use certain means for communication can be introduced. However, because of the research limitations this will be put to the background. The focus instead will be on the mobility of people; their available time and space for communication or to put it simple: their capabilities for communication, in part influenced by new communication technologies that create new opportunities and affected by constraints given form by the frequent floods.

To research the influence of the mobility affected by the usage of new telecommunication technologies and frequent floods of students on the used ways for communication, communication in this research will be defined as the usage of a certain communication channel to send or receive messages. In this definition, the capabilities for communication of a person are the available time and space for a certain activity, otherwise known as their mobility. Communication channels are the various ways a message can be send through time and space. With communication defined within the context of this research, we can now link it to Hägerstrand's time-geography.

### **2.3. Communication as a time-space activity**

Within a person's maximum daily prism there is room for various activities that require time and space. So how exactly does the activity of communication fit into this daily prism? We decided to approach communication as an activity that requires mobility. Mobility allows people to move around in space within a certain limit of time. Connecting mobility and communication in the context of a daily prism is quite easy for the most direct way of communicating, which is face to face communication. It requires the coincidence of at least two individuals in both time and space; a crossing of their daily paths. However, in recent decades communication technology has evolved rapidly. Thanks to inventions such as mobile phones and the internet, we can now communicate without having to move in physical space and are electronically connected to the so called virtual space or cyberspace (Kitchin, 1998, p. 385). It is both an expansion of mobility (it is easier to overcome spatial distances, providing more free time in one's daily path) as it is an expansion of the possible ways for communication (it created more communication channels). Classical time-geography recognises the existence of the, what in this research will be named virtual space, but its role is overshadowed by the physical dimension (Raubal, Miller and Bridwell, 2004, p. 245). This is why an expansion on Hägerstrand's framework is required in which this enlarged mobility and the opportunities for new ways of communicating are better incorporated.

To complement Hägerstrand's time-geography framework we can introduce the earlier mentioned theory of human extensibility, first presented by Janelle in 1973. *"Extensibility measures the ability of a person (or group) to overcome the friction of distance through transportation or communication"* (Adams, 1995, p. 267). Extensibility as a measurement tool doesn't focus so much on moving over greater distances, but rather on the expansion of opportunities for human interaction (Janelle, 1973, p. 11). This concept has become very interesting over the past decades with the radical growth of various tools for telecommunication, which are great facilitators to extent a person's presence far beyond one's geographical position (Janelle and Gillespie, 2004, p. 668). Through the increased extensibility by telecommunication, a person can overcome great distances while losing a minimal amount of time, therefore creating greater mobility and more temporal freedom, increasing one's maximum daily prism.

Extending presence via telecommunication channels connects a person to the virtual space. Being connected to this virtual space is called tele-presence, the spatial factor of telecommunication. This is in addition to physical presence, the spatial factor for communication that requires movement in physical space (Miller, 2005b, p. 22; Yu and Shaw, 2005, p. 3). When connecting these spatial factors to the temporal ones, two distinctions in time can be made: synchronous and asynchronous. Synchronous communication requires two people to have coincidence in time, while asynchronous communication does not. This creates a total of four dimensions of ways people can communicate with on the one hand the spatial distinction between virtual and physical space and on the other



hand the temporal distinction between synchronous and asynchronous. Janelle was the first to conceptualize these four dimensions, but the model has been adapted by various researchers over the years. The version below was presented by Miller (2005a), who based it directly on Janelle's original model.

Temporal	Spatial	
	physical presence	telepresence
Synchronous	Synchronous presence (SP) face to face	Synchronous telepresence (ST) telephone instant messaging television radio teleconferencing
Asynchronous	Asynchronous presence (AP) refrigerator notes hospital charts	Asynchronous telepresence (AT) mail e-mail fax machines printed media webpages

Figure 2: Time-space dimensions of communication (Miller, 2005a, p. 388).

The abbreviations in figure 2 stand for Synchronous Physical presence (SP), Asynchronous Physical presence (AP), Synchronous Tele-presence (ST) and Asynchronous Tele-presence (AT). To sum up:

- Synchronous physical presence requires at least two individuals to have coincidence in both time and physical space for communication.
- Asynchronous physical presence only requires coincidence in physical space, not in time.
- Synchronous tele-presence requires at least two individuals to have coincidence in both time and virtual space.
- Asynchronous tele-presence only requires coincidence in virtual space, not in time.

Does this mean that being tele-present is completely independent from the physical space? It does not. Acquiring tele-presence still requires a person in physical space to access the virtual space through a node (Ellegård and Vilhelmson, 2004, p. 294). A node is a device in the physical space that connects a person to the virtual space. With that in mind, one last distinction can be made for the place where a person accesses the virtual space. This can either be in-home or out-home. *"In-home activities occur at home while out-home activities occur elsewhere"* (Miller, 2005, p. 21). This is a meaningful distinction because out-home communication requires movement in space, which re-introduces the spatial factor for telecommunication if tele-presence cannot be acquired from a person's home. This distinction is of course also of effect on communication that already required physical presence. For a face to face meeting for example, the amount of movement it requires differs whether the meeting is at a person's home or somewhere else.

In conclusion; communication is an activity that requires a certain degree of mobility, with more mobility leading to better communication as people have more options to overcome communication obstacles. This mobility has been greatly expanded thanks to innovations in telecommunication.



People can extend their presence through a virtual space in addition to only communicating in the physical space, creating a total of four time-space dimensions for communication. Two of which require a physical presence that might involve out-home transportation, the other two only tele-presence in a virtual space. However, if a person needs to go out-home to access this virtual space, physical movement is still required and thus physical space and its possible obstructions are still an important factor for a person's ability for telecommunication.

## **2.4. Time-space constraints on communication**

Now that we have established how various ways of communication use time and space, both physical and virtual, we can look at the ways a flood can obstruct these. Telecommunication created a greater extensibility, improving the mobility of people wanting to communicate. This mobility, consisting of the available time and space for a person to do activities, is also affected by floods, but in a constraining way. Just like greater mobility allows for better communication, so can decreased mobility constrain the options for communication. As said before, constraints are a key element to Hägerstrand's time-geography theory. The mobility of a person is determined by the available time and space, so when conceptualizing floods as constraints on mobility, we can distinguish two factors of flood constraints; the first is the spatial factor (space) and the second is temporal factor (time). In this section, both factors of flood constraints will be discussed, followed by a section on the known interaction between these constraints on mobility by floods and the increased mobility by new telecommunication technologies.

### **2.4.1. The spatial constraints of floods**

Floods can form a spatial constraint in two ways: if it obstructs a person from attaining a physical presence and when it obstructs a person from attaining tele-presence. The direct impact of a flood is the obstruction of space by inundation, which constraints a person's physical mobility for the duration of inundation. Although this is not exactly a capability constraint (which is oriented on biological needs), it does have strong similarities because of the impact on the maximum daily range and the restriction at a home base for a certain amount of time. Whether this is because a person has to sleep for a fixed amount of time or has to stay at home for a fixed amount of time because the surroundings are flooded; when placed in a maximum daily prism this would in both cases mean a straight line instead of room for activities. It is therefore that the restriction of a person to a home base for the duration of inundation is considered as a capability constraint in this research even though it doesn't exactly match the general definition.

Parker (In Dewi, 2007, p. 12) presents a schematic categorization of flood damage after inundation. One of the distinctions that are made is between direct and indirect damage. Direct damage consists among other things of damage to roads and buildings (Wuryanti, in Harwitasari, 2009, p.9; Parker, in Dewi, 2007, p. 12). This can be seen as a possible capability constraint for a person that has to move around in space to attain a physical- of tele-presence, but it can also form a constraint for a person that wishes to receive someone in-home for a face-to-face meeting who has to move around in the now obstructed space. The latter is more relatable to a coupling constraint, which determines when, where and for how long a person has to interact with others. The crossing of two or more daily paths was called a bundle. When the ability to form a bundle is constrained because of a flood, the two or more individuals wishing to communicate might have to change the time of their meeting. This results in a coupling constraint on top of the capability constraints of a flood, further decreasing the maximum daily range beyond the time of inundation.

Indirect damage can be damage to electricity and means of communication such as telephone lines, this can form a constraint for a person that wishes to extend presence through the virtual space. It doesn't necessarily lock a person down in one physical place as it would do with capability constraints, but it rather excludes one from reaching a place, in this case the virtual space. This seems more like an authority constraint because of the restriction of access to a place, but again doesn't precisely fit the definition as authority constraints are about domains or areas controlled by an authority figure to protect recourses. A flood is not a conscious being, nor does it seek to protect recourses in its domain, it thus would be too farfetched to connect the restriction of the virtual space by a flood to an authority constraint. It might still be considered as some form of a capability constraint if we look at Hägerstrand's precise definition of capability constraints; "*capability constraints are those which limit the activities of the individual because of his biological construction and/or the tools he can command*" (1970, p. 12). The virtual space is accessed through a node, which in this context can be seen as a tool for the individual to command to increase his maximum daily range. A flood that constrains the person from using the node, constrains the capability to extend presence over the virtual space. Besides the inability to attain tele-presence, indirect damage may also influence physical communication when a person is unable or unwilling to receive guests because the negative in-home effects of the flood such as power failure. Here again coupling constraints can arise when face-to-face meetings are postponed and take away some of the daily freedom of an individual at another time.

## 2.4.2. The temporal constraints of floods

Temporal constraints relate to time so to understand the temporal constraints a flood can create, we first have to address the temporal factors of a flood itself. In the introduction three types of floods came to light: river flooding, floods as a result of rainfall and tidal flooding. The students in this research live in areas of Semarang which are slightly higher than the lowest and poorest of areas near the coast. These higher areas may not be affected as much by tidal floods, but are vulnerable to floods as a result of rainfall. To get an idea of the temporal factors of a rainfall flood, we can take a look at a survey held by Harwitasari & Van Alst (2011, p. 5-6) among the people that experienced tidal flooding in Semarang. Although this might not be the same as rainfall floods, the characteristics can be seen as similar and be used as the temporal factors of a flood. The first one is the number of years a flood was experienced, the second is the frequency of floods and the finally the duration of inundation. The same factors were also used in the Harwitasari survey of 2009 (p. 34). The results were the same and are presented in figure 3.

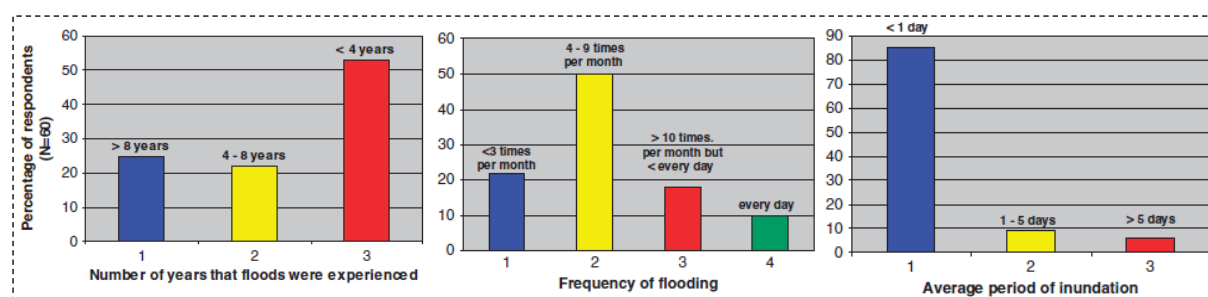


Figure 3: Survey results on flood experience (Harwitasari & Van Alst, 2011; Harwitasari, 2009)

When connecting these factors to Hägerstrand's life path we can see the temporal characteristics can be placed on various scales. Ranging from a span of years (number of years a flood was experienced), to a span of months/days (frequency of floods) and the last one on a span of days/hours (duration of

inundation). It will primarily be the last two factors, frequency and duration, that will be of importance to this research because they have the biggest effect on the daily level in which the activity of communication can be placed.

Some temporal constraints were already mentioned among the spatial constraints; the coupling constraints caused by postponing face-to-face meetings as a consequence of the inundated surroundings. This is an important point as it reminds us that although we discuss the spatial and temporal constraints separately, they actually are just two sides of a single coin. One cannot be present without the other. What is interesting here is that as time flows naturally, the spatial constraints are eventually lifted when the flood disappears. Its existence however echoes through time to arise coupling constraints later in the life path of an individual that has postponed a face-to-face meeting.

### **2.4.3. Effects of telecommunication on the constraint experience**

The main question asks for the effects of this mobility, affected by the two developments, on the used ways for communication. Both the time-space geography of telecommunication and time-space constraints have been discussed, now this section will explore some of the effects of their interaction on the mobility of a person. According to Schwanen and Kwan; *“there is a broad consensus that modern ICTs are capable of lifting time-space constraints, but disagreement exists about the extent of that relation”* (2008, p. 1362). So we know there is a relation between the use of telecommunication technologies and the severity of time-space constraints, but its impact on a person’s mobility is not explicit. There is definitely an effect on some constraints that are moderated thanks to telecommunication technologies. One example of this is the earlier mentioned indivisibility of a person, which is somewhat relaxed thanks to the increased extensibility, making it possible for a person to attain tele-presence in multiple places at once (Kwan, 2000). This ability for multi-tasking is also time-saving, relieving possible temporal constraints (Schwanen and Kwan, 2008, p. 1364). Schwanen and Kwan eventually conclude that it is primarily temporal constraints that created more flexibility in a person’s daily activities (2008, p. 1374).

Rye (2010) studied the impact of digital communication on the daily lives of student’s in Jakarta, an Indonesian city similar to Semarang in size and urban features. One interesting note is the mentioning of congestion in the city as a physical constraint (p. 92). Thanks to telecommunication, the research object could attain tele-presence and stay in touch with fellow students and tutors while waiting for the traffic to calm down. *“In this way, communication technology enabled students to save time as they did not have to use the transportation network and they could avoid congested public spaces”* (Rye, 2010, p. 92). Furthermore, Rye found the amount of travelling through the physical space decreased among students, as they substitute movement in space with virtual communication (2010, p. 92).

In conclusion; we’ve discussed the ways a flood can form a constraint and how the use of telecommunication can provide some relaxation of this. Although the extent of this relaxation isn’t perfectly clear, a broad consensus exists about the possibilities of lifting time-space constraints through telecommunication. Some examples already show how telecommunication provides some relief on temporal constraints and spatial obstructions such as traffic congestion that can be avoided by communicating through the virtual space. However with a spatial obstruction such as a flood that can reach someone’s house, simply avoiding it might not be an option.

## 2.5. Conceptual model

The conceptual model visualizes the theoretical framework and makes the theoretical concepts more operational. The models also relate to the sub questions and consist of the information that is needed to answer them. First the main conceptual model will be presented. This is followed by two operational models on the independent factors and two operational models of the latent and dependable factors.

### 2.5.1. Main conceptual model

The main conceptual model represents the necessary data to answer the main question; *how do floods and new telecommunication technologies affect the used ways for communication of students in Semarang?*

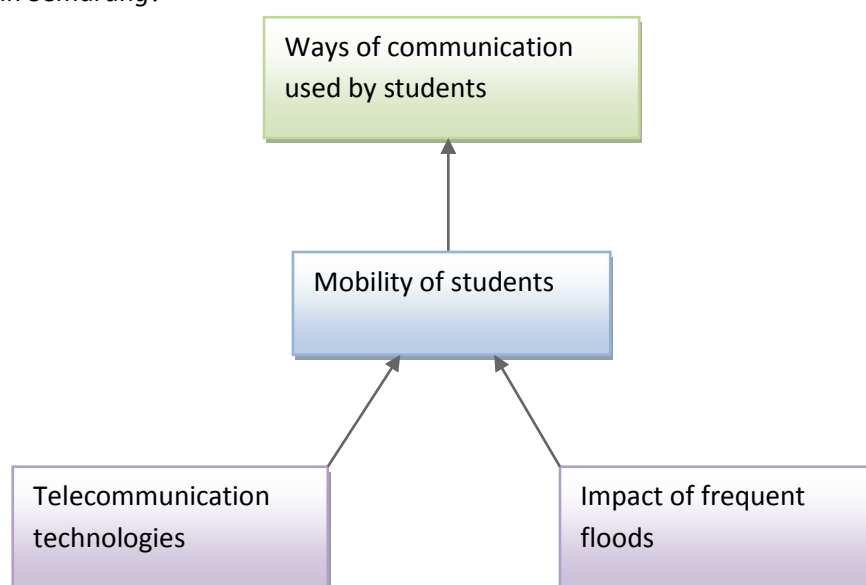


Figure 4: Main conceptual model

Communication was defined as an activity that requires mobility. The used ways of communication is therefore a dependant factor determined by the mobility of students, which is a latent variable in this model. The two independent factors affecting mobility are telecommunication technologies and the impact of frequent floods. The interaction between these factors shapes the mobility of students during a flood, which in turn affects their used ways for communication, visualized by the arrow between mobility of students and the ways of communication used by students. Information on these influences was needed to answer the first two sub questions and will now be further discussed.

### 2.5.2. Causal relations between independent and dependent factors

In this paragraph we will discuss how the independent factors of this research affect the mobility of students. Two models will be presented, following the first two sub questions. The first sub question was: *what is the role of new telecommunication technologies in the everyday communication of students?*

This question was asked to get an idea of the opportunities for mobility created by telecommunication technologies and how they are integrated in the everyday lives of the students. The most important characteristic of telecommunication is the creation of the virtual space which expands mobility and can be accessed through nodes in the physical space. The operationalization for telecommunication as an independent factor is fairly simple:

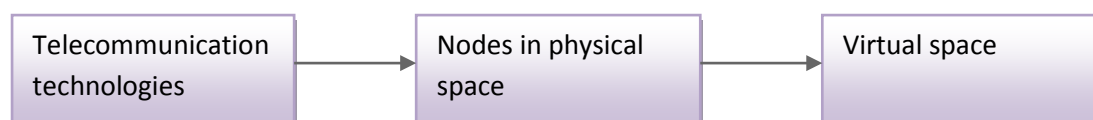


Figure 5: Operational model 'telecommunication technologies'

The model represents the chain of events through which tele-presence is created. Telecommunication technologies have created numerous nodes, such as computers and telephones, through which persons can extend their presence over the virtual space, thereby attaining tele-presence. This process is visualized by the one-headed arrows.

The second sub question was: *How does a flood affect the students' mobility?*

In the theoretical framework, Hägerstrand's ideas about time-space constraints were linked to the consequences of floods. A distinction was made between the temporal and spatial aspects of a flood constraint. The frequent floods are an external influence on the mobility of the research objects, making it an independent factor in this research.

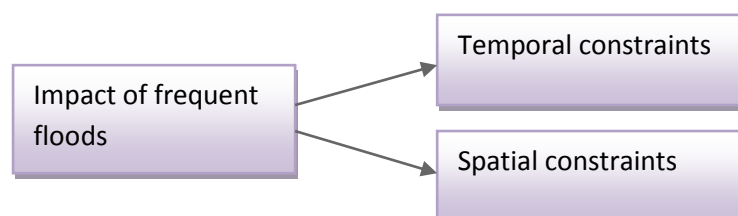


Figure 6: Operational model 'constraints by floods'

Floods impact the students' surroundings and cause direct and indirect damage. When this flood damage restricts the mobility of students it forms a constraint. The impact of floods affects mobility in two different aspects: the available time and available space. This leads to two types of constraints; temporal constraints and spatial constraints. The causal effect is visualised by the two one-headed arrows pointing towards their associated type of constraints.

### 2.5.3. Operational model latent variable

Now that we know how the independent factors affect the mobility of students, we can further operationalize this concept with the following operational model:

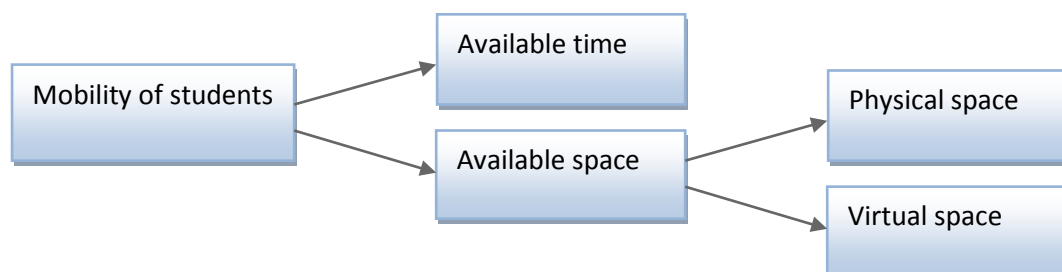


Figure 7: Operational model 'mobility of students'

Mobility was defined as the available time and space for the activity of communication, with the available time and space referring to the capabilities for communication. Within the available space of a person a distinction is made between physical space and virtual space. Connecting this model to the previous ones, we can see how the first independent factor, telecommunication technologies,

affects the mobility of students by creating a virtual space, thereby influencing the available space and thus the mobility of a person. We can also see the link between the available time and space and the spatial and temporal constraints by floods that affect these.

#### **2.5.4. Operational model dependent factor**

During a flood, the mobility of students is affected by both flood constraints and telecommunication technologies which determines their used ways for communication. An operational model for the used ways for communication is needed to answer the final sub question; *How do students experience communication during a flood?* It is presented in the following figure:

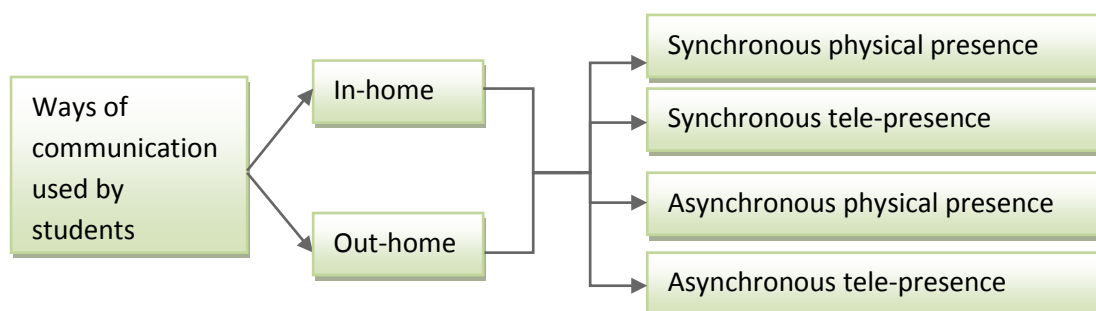


Figure 8: Operational model 'ways of communication used by students'

To visualize the used ways for communication of students we can use the four dimensions of communication as explained in the theoretical framework (table 1). This will give an idea of the ratio between various dimensions of communication, including the ones created thanks to new communication technologies. Then, to further answer the question we can first make the distinction between in-home or out-home communication. This distinction is made because it determines the need for mobility in physical space that might be impacted by a flood. Whether a person communicates in-home or out-home, it happens within the four dimensions. This is visualized by the path of arrows from in-home and out-home communication to the four dimensions of communication.

### **3. Methodology**

This chapter provides the method that is used for gathering data and analysing it in order to answer the research question. First the research strategy will be explained, this will be done by looking at the required type of data to answer the research questions and connecting it to the method best suited to find this data. After that, the methods for gathering the research data will be further elaborated. Finally the way the gathered data was analysed will be discussed.

#### **3.1. Research strategy**

The research aims to contribute to the understanding of human behaviour in reaction to a phenomenon by providing empirical data on a selected population that is representative for this phenomenon. Since the data on human behaviour that is needed to follow through on the research goal consists of personal experiences, its understanding requires a more in-depth approach. This research can hence be defined as a qualitative research instead of a quantitative research (Verschuren & Doorewaard, 2007). To build on the knowledge that is already known, empirical research was used for this research. This generates new data on a specific population, in this case, the students who live in or near frequently flooded areas in Semarang.

This research aims to provide an image on the way these students interact with flood impact on communication and new communication technologies and will be descriptive, of small scale and require a more in-depth strategy. Verschuren and Doorewaard (2007) present various research strategies, but a case study is the one that is best fitting to this research, for it resembles all of the characteristics of the approach that is needed to answer the research questions. With the case study as strategy we must first select the case, which in this research consists of students who live in or near frequently flooded areas in Semarang.

The research question is about understanding a phenomenon. This will be done by selecting a so called instrumental case which is a specific case to best understand the phenomenon (Creswell, 2012, p. 98). The instrumental case for this research is the Soegijapranata Catholic University of Semarang. This university is a good representation of the case for it has students from middleclass populations and students that live in or near frequently flooded areas. The selected case should be thoroughly understood and described based on various sources of information (Creswell, 2012, p. 98-99). To do this, there is made use of various literature sources and then there is the empirical research itself, which consisted of 4 weeks of fieldwork in Semarang, where the necessary data was gathered to answer the research questions.

#### **3.2. Research methods**

The empirical data was gathered during the fieldwork in Semarang. This data will serve to answer the research questions so for the data gathering a fitting method was to be found. For that we'll take another look at the first two sub questions:

- ❖ What is the role of new telecommunication technologies in the everyday communication of students?
- ❖ How does a flood affect the students' mobility?

To answer these questions, information is needed about the students and various aspects of their individual lives and experiences. For such a complexity, in-depth interviews will be necessary to



gather the data. Observations can complement these interviews and create a richer context around them.

The research was conducted in the Soegijapranata Catholic University of Semarang, but as said before, not all students are the best representatives for answering the research questions. Besides just being a student in Semarang, the case required students that also live in or near frequently flooded areas. To find and select these specific students, approaching authorities at the university with access to student information seemed to be the easiest way.

When a specific number of students that were relevant for this research were selected, data about their experience with two phenomena was needed: the role of telecommunication in their lives and the role of floods and their impact on communication. The best way to get this was by having in-depth interviews, these often have a semi-structured character and the flexibility to give the respondents enough space to share their stories like they experience it. The interviewer can of course still direct the course of the interview by creating clusters of questions with various possible sub questions in order to guide the interview to make sure the necessary data is gathered.

For the first sub question, the information needed was about the students' access to the virtual space through nodes in the physical space and how this affected their mobility. To get this information, the respondents were asked about the ways of communication they have access to and prefer to use. The effects on mobility were measured by asking how respondents feel about physical communication versus telecommunication. Since they are students that spend a lot of time at Unika, the university is an important part of the available time and space of students and thus their mobility. This is why questions about the role of telecommunication in the university were also asked. The mobility of the students reaches more places than just at Unika so questions on additional out-home means for telecommunication were asked by incorporating other out-home communication activities such as meeting points or Wi-Fi hotspots.

For the second sub questions, information was needed about the student's experiences with floods and the impact they have on their capabilities for communication. To get an idea on the time-space factor of the floods, questions were asked about characteristics like their severity, duration and frequency. After that, more in-depth questions followed about the impact on the capabilities for communication. For telecommunication, this was about the impact on internet and telephone connections, but also on the shifting preferences for ways of communication during a flood. To cover the subject of physical communication, questions were asked about the accessibility of their houses to others and their own abilities to visit people and places. To fully answer the question on how floods affect mobility, a last section was added to gather data on the interaction between flood constraints and telecommunication technologies. This data will provide more insights in the extent to which the overall mobility of students is affected for better or worse.

In-depth interviews will provide a lot of stories and personal experiences of the research population, but to better place it in context with the case, observations can also be useful to create a clearer image of the data from the interviews. Things to observe for the first sub question about communication are for example the ways people at Unika communicate, how they behave when in groups; do they talk a lot with each other or spend a lot of times looking at their cell phones? How active are they on social networking sites? Also asking simple questions about contact information can give you an idea of their preferred ways of being contacted. This information on the bigger



context of communication also gives some extra assurance that the selected respondents were indeed representative for the research population; meaning they reflect the average Unika student in communication use and accessibility. For the second sub question the houses and neighbourhoods of the research objects were observed; the visible impact of floods and the ways they adapt to them. This was done to get an objective idea of the severity of the flood, instead of only relying on the subjective stories from the research objects.

With the gathered data from the first two sub questions, we can go on to the third and final sub question:

❖ *How do students experience communication during a flood?*

This question builds on the knowledge from the previous sub questions and required data on the students' actual behaviour regarding their used ways for communication when the two phenomena of floods and telecommunication meet. It is the interaction between these that was necessary to measure the affected mobility and its effect on the used ways for communication. In-depth interviews helped to gather this data by asking students how they communicate during a flood when their mobility is affected the most. Questions went into for example the experiences with physical communication during a flood and alternative options for means for communication that were obstructed by floods.

### **3.3. Selecting the respondents for data gathering**

A total of twenty people were interviewed for this research. For the selection of these people only two real conditions were set: first, they had to be a student at the Soegijapranata Catholic University of Semarang. This was done because students were chosen as research objects due to their representation of the researched phenomenon and Unika was a good representative of the students that were needed; a more expensive university with students from middle class populations. The second condition was that the students had to live in a frequently flooded area, although no real conditions were set for the type of floods or their frequency. This resulted in respondents that experienced floods differently and gave various impressions of the constraints a flood caused.

The first student was selected by our contact person at the Unika University. He was able to connect us to a female student living in a frequently flooded area. He suggested we started with her and create a snowball effect to find the other respondents. Although the snowball effect resulted in only four respondents, the other sixteen were found through various contacts made at the university during the four weeks of fieldwork. Most of them came from different neighbourhoods in Semarang, but during the interviews it quickly became clear that they faced similar circumstances regarding the floods.

As mentioned earlier, twenty respondents were interviewed during the fieldwork. All of them were selected based on personal relations. The contact person at Unika selected the first student because he knew she lived in a frequently flooded area. The student invited her friends for the same reason. The sixteen remaining respondents were also selected by contacts made at the university because they lived in frequently flooded areas. Eventually the specific selection of students may have been out of our hands, but all of the respondents met the conditions we asked of them. They all came from various flood prone areas of the city, which consequently gave a diversified impression of the experience of floods. A more detailed overview of the respondents can be found in the appendix.

### **3.4. Gathering the research data**

The data gathering started the moment we first visited Unika and observations could be made on the student's communication behaviour. Besides the general observation of the university and its facilities a few places are worth mentioning regarding the answering of the first sub question on communication. Unika had a large open-air cafeteria where a lot of students gathered to take their breaks and have something to eat. Another location was the library, where also a lot of students could be found, but because of the library's unspoken rule of silence, in a more individual and quiet context. Observing these places for some time created a good image on the ways of communication that were popular among the students.

The observations continued with the tour around the neighbourhood of one of the respondents and various flood risk areas in Semarang, for which a full day was planned. We stopped at places of interest and did an observation. This included primarily of taking pictures of these places. The purpose of this was to get a more objective idea of the impact of floods on the surroundings and thereby creating a clearer context that would be very helpful in the upcoming interviews.

After the observations around Semarang, the first four interviews followed at the house of one of the respondents that joined us during the observation. The rest of the interviews were conducted at Unika, where a special room was reserved for the interviews to be done in private. Of the first four respondents, two spoke English fluent enough to help translating with the others. There were also a lot of respondents that didn't speak English, for those interviews a translator was used.

### **3.5. Analysing research data**

Creswell (2012, p. 199) shows the various ways of analysing case study data. He first mentions that a case study analysis should consist of a detailed description of the case and its setting. Following this method, the case for this research has been described in chapter 4. Because there are two major independent factors in this research; the occurrence of floods and the global development regarding telecommunication, it was important to first thoroughly describe the setting before addressing the actual problem regarding the students' experienced flood impact on communication. The case description therefore begins with an in-depth look at the students' flood problems and ways of communication, followed by their experience of communication during a flood.

After the case description the gathered data was analysed. The chosen method for this had to ensure the research goal was realised; finding insights in the relation between the usage of telecommunication and the experienced flood impact on communication of students of the Unika University of Semarang. Stake (in Creswell, 2012, 199) advocates four ways to interpret and analyse data. One of these is categorical aggregation, where; *"the researcher seeks a collection of instances from the data, hoping that issue-relevant meanings will emerge"* (Creswell, 2012, p. 199). This is in contrast to direct interpretation, where the researcher only looks at a single instance and draws meaning from it. Because this is an instrumental case trying to understand a phenomenon and the relations within it, categorical aggregation is better suited for this research (Stake, 1995, p. 77). This way the analysis can focus more on relations that the research questions seek to identify. When looking at the collection of data, establishing issue-relevant meanings was done by looking for patterns such as reoccurring behaviour among the respondents which may prove meaningful for answering the research questions. It was from these patterns that naturalistic generalizations were drawn which could be applied to the case and population it represents.

## 4. Students in Semarang

This chapter will examine the empirical data that was gathered from the literature study and the four weeks of fieldwork in the city of Semarang. Its purpose is to portray an image of the lives of students and their experiences with communication and floods. All respondents have been assigned a number to avoid confusion when the stories of twenty students are discussed. A table with more detailed information on the individual students can be found in the appendix. The appendix also consists of the interview guide that was used during the interviews.

The first thing that will be addressed is the frequent floods that plague Semarang and its students. This one will begin with a general context about the floods in Semarang followed by the personal experiences of the students. After that the second impact on mobility will be discussed; the growth of telecommunication in Indonesia; this will give the case better context and will help to understand it better. In the next paragraph the scope will again be narrowed to the students in Semarang to examine in detail how this development has affected their mobility and used ways for communication. The paragraph that follows discusses the impact of floods on the capabilities for communication and how the students react to this. The chapter ends with a conclusion to reflect on the gathered data in relation with the conceptual model before the analysis.

### 4.1. Floods in Semarang

Semarang suffers from three types of floods; tidal floods, rainfall floods and river floods. Tidal flooding is a growing hazard near the coastal areas. Harwitasari (2009, p. 33) created a map of these areas, presented here in figure 9. The blue areas represent areas that experience tidal floods.

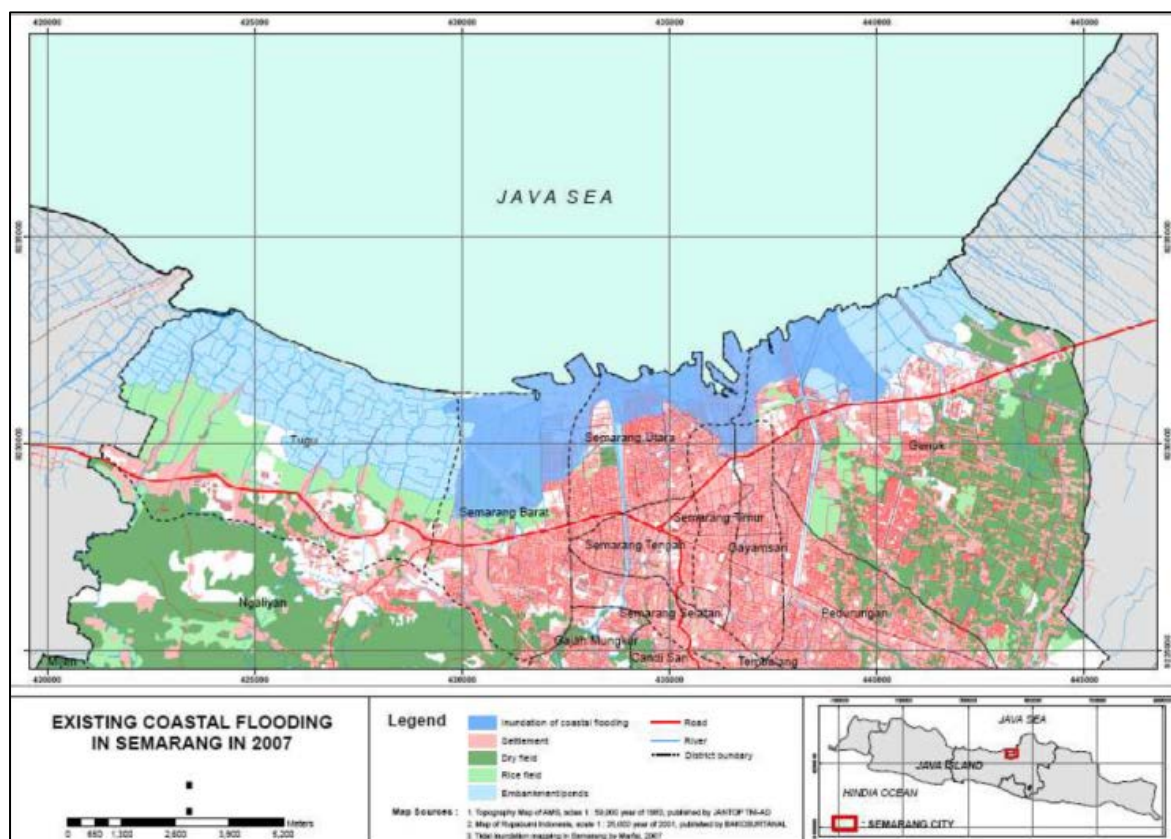


Figure 9: Coastal flooding in Semarang (Harwitasari, 2009, p. 33)

While the students from this research came from the north of Semarang, none of them lived in these blue coloured areas and therefore didn't experience problematic tidal floods. Instead, most of them came from areas that are coloured red on the map, bordering with the blue areas. When the students were asked about the type of floods they experience, all of them pointed out floods from rainfall as the most problematic. A small number also mentioned the tidal floods, but these weren't considered to be much of an obstruction to the daily activities of the students. During the observations around the neighbourhood, one respondent showed us the impact of tidal flooding, which was significantly less thanks to measures to enhance the drainage of surplus water (figure 10).



Figure 10: Drainage systems

The gravity of rainfall floods varies among the respondents. Some of them heightened their house to protect themselves from the floods, one of them is respondent 2; *"[floods happen] only in the neighbourhood. You've seen my house right? It's a bit higher so I don't experience the flood entering my house, just the road and the neighbourhood"*. When discussing the frequency of the floods, many respondents had trouble giving an average number of flood occurrences. According to respondent 15, the number of floods are; *"uncountable, because every time there is only a little rain it can cause a flood. If it rains every day, the flood is every day"*. Respondent 17 also states: *"when the hard rain comes, the flood comes"*. Most of the respondents settled around an average flood occurrence of two or three times a month, with some of them emphasising on the rainy season in which floods occur more often. Some respondents also make the distinction between floods that only reach the neighbourhood and floods that inundate their houses. The most extreme floods for example happen around one or two times a year, inundating the houses of respondents 12, 10 and 8 who would normally only experience a flooding around the neighbourhood.

The duration of a flood is also diversified. Respondent 18 experiences a flood once a month with a duration of; *"on average only 2 hours, but I also experienced a two day flood. It usually happens in the evening and then the next day, it is gone"*. Respondent 15, who experienced a higher frequency of floods, says: *"when it starts at night, the next afternoon, the flood is gone"*. Another example is respondent 13, she experiences floods around three or four times a month of which one inundates her house. The duration of these floods is only fifteen to thirty minutes. Although many respondents experience different durations of inundation, they all have the floods by rainfall in common. One reason for the differences in the duration of inundation is given by respondent 17, who claims the floods got worse because of a large new building in his neighbourhood, lessening the drainage capacity of the ground.



The floods are in various ways experienced as constraining by most of the respondents. A lot of the respondents stay at home for the duration of inundation, with only a few exceptions that can do their normal daily activities. Respondent 1 says she is restrained at home because the access to the main road is blocked by the water. Even when the flood hasn't started, she usually has to be at home for; *"if we have heavy rain we must anticipate the flood. Putting things not on the floor, we have to move it to the higher place"*. This is also the experience of respondent 12 who has to stay at home because his family *"is unprepared to put stuff in higher places and sometimes I have to cancel appointments with someone because the flood is coming"*. Respondent 20 also has a shift in priorities; *"when the flood is very bad I take my car and take it to a higher place and go back to my house"*. Another example is the rather exceptional experience of respondent 15 who has to stay at home *"because my house sometimes becomes a shelter for the neighbourhood. My house is the only to get elevated. In my neighbourhood, especially for old people, women and children sleep in my house and the men sleep in their own house to keep the stuff"*. Later in the interview she adds *"we can consider the house as a shelter, because my family provides the needs that everyone has like a bed or blankets, food for all the people in the neighbourhood"*.

#### **4.2. Growth of telecommunication in Indonesia**

This century's rapid increase of telecommunication has been a silent revolution in Indonesia (Sudiro & Bouma, n.d., p. 1). This is not exclusive to Indonesia though, as similar revolutions have been taking place in various developing countries. In Africa for example, telecommunication has penetrated its way into some of the most remote places over the last 10 years (De Bruijn, 2012, p. 245). An estimated 50% of the African population now has access to a mobile phone, this was almost non-existent 10 years ago (De Bruijn, 2012, p. 248).

*"The growth of mobile telephony in Africa became possible after the liberalization of the telecommunications market and its escalation has been astonishing"* (De Bruijn, 2008, p. 3). De Bruijn (2012, p. 245) also speaks of the democratization of the communication landscape, an event that can also be found in the recent history of Indonesia. In May of 1998 President Suharto stepped down after a dramatic period of crisis and riots, ending a 32 year dictatorship and starting an era of reformation that would be known as the *reformasi* (Time, 2013). Since then, two elements have influenced the media development in Indonesia. The first is the return of freedom of expression and the second is the rapid infiltration of the market economy (Lim, 2011, p. 1). *"As a consequence, in the last decade since the end of Suharto's centralized media regime, the media sector has simultaneously undergone a democratization process whilst expanding tremendously and giving way to increasing media corporatization"* (Lim, 2011, p. 1). Lim (2011, p. 8) further states that the growth resulted in over 200 million mobile phone users in 2010, making it the most popular tool for communication. In figure 11 it can be seen that it is especially the younger population that drives the growth.

Accessing the internet is, in comparison to the mobile phone, a relatively newer activity in Indonesia, which has grown especially popular under the middle class populations (Lim, 2011, p. 1). The students of Unika, which is a private and slightly more expensive university, are generally from these middle class populations.

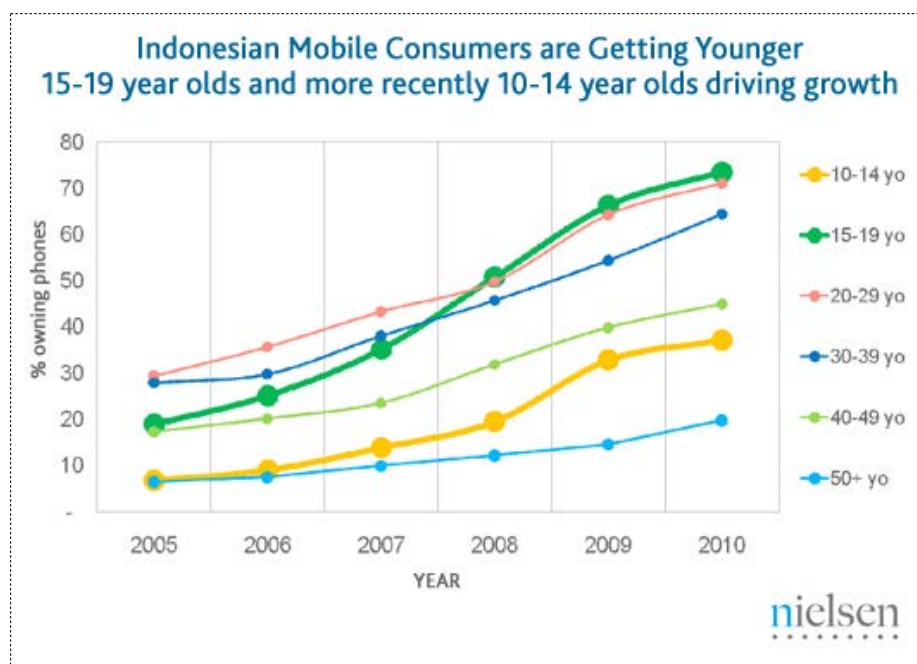


Figure 11: Indonesian mobile owners by age (Nielsen, 2011)

So far the growth of telecommunication seems to be given life by the newer generation of Indonesia. It is foremost the younger ones from middle class families that fully occupy the possibilities of the virtual space. The students of Unika can be considered a part of this group and can thus be considered a good image of what the future of telecommunication in Indonesia will look like. They are among the population with the largest extensibility, making them the front runners of the virtual space. The next paragraph will take a more detailed look at the experience of telecommunication among the students and how this has affected their mobility.

### **4.3. The role of telecommunication**

This paragraph will create an image of how the students communicate and how telecommunication has affected their capabilities; their mobility, to do so. During the interviews, students were first presented with a checklist for in-home means for telecommunication and asked about their experience with people coming over to their houses. For out-home communication, the students were presented with another checklist, this time for their means for communication at Unika. This emphasis on Unika was done due to the importance of the university in the students' lives as most of them spend a lot of time there. The university may serve as a second 'home' from which students can, among other things, access the virtual space. A different set of questions was asked for other out-home means for communication, such as meeting points and Wi-Fi hotspots. In this paragraph, the results on both in-home and out-home communication will be examined.

#### **4.3.1. In-home means for communication**

All twenty respondents were presented with a checklist for available means for telecommunication. The results on these questions were almost unanimous. All of the students had a computer or laptop at home, as well as internet. There was only one respondent (respondent 13) without her own internet connection, but she used a nearby hotspot, which was reachable from her house. Although every respondent had access to an internet connection, their feelings on the quality varied from student to student. Only one respondent defined the quality of his connection as 'bad', but the

majority ranges from 'decent' to 'very fast'. This variable seems to be determined by the internet provider, based on statements by two respondents; *"the internet connection depends on the provider"* - *"the connection depends on the signal from the provider"* (respondent 13; respondent 2). Furthermore, all of the respondents had a telephone and mobile phone at home. When asked about the types of mobile phones the respondents had, all of them had either a smartphone or Blackberry, or both. All mobile phones had internet access, although the source is a variable factor here as most respondents had an internet package, but some could only access the internet from a Wi-Fi location.

Besides the availability for means of telecommunication, respondents were also asked about their preferred ways to use these. Most respondents named more than one option, but the majority of them preferred to use BlackBerry Messenger and/or WhatsApp, which are both online text messaging applications for respectively the BlackBerry and smartphone. SMS text messaging was also popular among the respondents. Only one individual mentioned calling as a favourite way of telecommunicating.

When talking with the respondents about physical communication and guests coming over to their house, their experiences became more diversified. Most respondents had guests coming over regularly, but about a quarter of the respondents claimed rarely or never receiving guests at their house. Two of them, respondent 20 and respondent 11, state that they rather meet at other places, such as a mall. Respondent 16 also rarely has guests coming over and adds that this is because of the frequent flooding of his neighbourhood. More on this subject will follow in the coming paragraph on the flood impact on mobility and communication.

#### **4.3.2. Out-home means for communication**

As mentioned in the introduction, Unika is viewed as a second home base from which the students communicate, either physically or virtually through a node. The respondents came from different faculties, so the amount of time they spend at the university differs. On average they stay around four or five full days a week, with two real exceptions of students who are working on their graduation projects and only have to be at the university one day a week (respondents 18; 19). The respondents were asked about the various facilities for communication that the university provides and how they experience them.

Unika provides numerous computers and has its own internet network. Some of the respondents use the computers, but most of them only use the Wi-Fi access for their laptop or cell phone. The respondents were asked about their feeling towards the quality of the internet in comparison to the one they have at their house, but this again varies from student to student. Most of the students with a good internet connection at their house will think less of the connection at Unika, while the students with a slower connection at home prefer the Unika network.

The bulletin boards are placed in every faculty as a physical place for students to communicate by placing messages and receiving information. Most of the respondents say they read the messages every now and then, with the exception of respondents 12 and 20; who say that they never look at them as they pass them. Respondent 18 reads the bulletin sometimes, but isn't especially satisfied about them: *"the bulletin boards are not good enough to get information, it would be much better if we could get the information from the website so that we don't have to go to the bulletin boards"*. She further says that the website is now only useful to check test results. A few respondents also used the bulletin boards to send out messages. One of them is respondent 15; *"I read [the bulletin*

boards] a lot, since I'm in the committee of our faculty, I place a lot of information there". When asked if she felt like the bulletin boards were the best place to send out information, she simply stated: *'that is the best place'*. This sentiment was however not shared by her fellow students that also use the bulletin boards to place messages. Respondents 16 and 17 both use the bulletin boards to place information about events, but don't feel like they're the best way to communicate. Respondent 17 says; *"it's not really effective, because other people don't really see the bulletin boards, just pass by"*. Respondent 16 also elaborates on the decreased usage of the bulletin boards as *"Unika now also sends SMS to everyone in the college"*. This mass text message service is also used by respondent 8, who sends out announcements for an organization of which she is the leader. She feels like the bulletin boards aren't sufficient and therefore uses Blackberry messenger as well.

To cover the remaining means for out-home communication, the respondents were asked about meeting points and the usage of Wi-Fi hotspots. Meeting points were particularly popular among the respondents who didn't receive (a lot of) guests at their houses. This subject was partly covered in the previous paragraph, where respondents 20 and 11 stated that they rather meet people at public places. Wi-Fi hotspots were used by some of the respondents, but almost no one especially travelled to these places to attain tele-presence. Instead, they only access the Wi-Fi hotspots incidentally as they come across them. Three exceptions are to be made for respondents 16, 18 and 19 who say they do travel to places such as the Mall, cafés and restaurants to use the internet connection.

#### **4.4. Flood impact on mobility and communication**

In this paragraph the impact of floods on the students' mobility and the students' used ways of communication as a result of this will be addressed. The interview questions on this subject were asked with the same structure as the question on ways of communication; with a distinction between flood impact on in-home means for communication and the flood impact on out-home means for communication. The most important of these seems to be the flood impact on in-home means for communication; this is where the flood was directly experienced by the respondents. This however, doesn't mean the flood impact on out-home communication should be neglected, for the influences of a flood might reach further than their immediate impact, changing the student's behaviour in both their usage of in-home and out-home means for communication.

##### **4.4.1. Flood impact at home**

On the subject of telecommunication a flood could be problematic in two ways: it could impact the internet connections and/or the telephone connections. During the interviews the respondents that experience the inundation of their homes during a flood were asked if the floods damaged the wiring, but this was only the case for two respondents. One of them, respondent 3, says: *"sometimes the water comes in the house and the internet connection will be cut off"*. The second one, respondent 12, also experiences the loss of internet when *"sometimes the electricity goes off and then it of course has an impact on the internet connection"*. The telephone lines and mobile phone network were still okay though. One of the major problems with rainfall floods for many of the respondents were their unpredictability but most of them were, somewhat paradoxically, prepared for that. To protect their belongings, respondents would place their stuff in higher places. Among these respondents is respondent 4, who places her computer above the ground to make sure it doesn't get damaged if a flood happens to enter her house (figure 12). In this way, most respondents were able to preserve telecommunication devices, even during the flooding of their home.



An interesting note here that came up during the discussion of the flood impact on telecommunication was that some respondents didn't necessarily experience internet problems because of the floods. Respondent 13 confirmed that as long as the electricity didn't go off, there was no real flood impact on the internet connection. For some respondents, there was however an experienced impact on the internet connections because of the heavy rainfall prior and during a flood. Respondent 16 states *"with the flood there is not [a problem], but the hard rain causes a bad connection"*. Respondent 16 belonged to the majority of respondents that prefer to communicate via BlackBerry Messenger, which requires an internet connection. When asked how she reacts to a slower connection she said she simply postponed messaging until the connection got better again. Respondent 18 also experiences a bad internet connection during the hard rain, but this wasn't really problematic for her as she could still call and text people using her mobile phone.



Figure 12: Elevated computer at respondent 4's home

With these few exceptions taken into account, it's clear that the majority of students didn't experience a problematic flood impact on their ability to reach out via telecommunication. The internet connection is more vulnerable in some cases, but this is compensated for thanks to the uninfluenced telephone lines and mobile phone networks.

In the paragraph on in-home means for communication it was briefly mentioned that some respondents never had guests over at their house, in some cases because of the frequent floods. One of them was respondent 16 who instead uses the telephone as an alternative to face-to-face meetings. The respondents that did have guests coming over regularly all experienced a heavy flood impact. There was a general feeling of inaccessibility among the respondents due to the inability and unwillingness of other people to reach their homes. Respondent 12 regularly has friends over, but this changes during a flood when: *"my friends can't access my house"*. Another respondent is respondent 18, she says that during a flood: *"some of the people don't want to come to my house"*. The list goes on; *"when they (my friends) know there is a flood in my home, they no go"* (respondent 17); *"[during a flood] people can't access my home"* (respondent 14); *"the people rarely come to my house [during a flood]"* (respondent 6). The respondents' reactions were universal, but there was some variation in their ways of coping with the lack of physical accessibility. Many of the respondents say they chose to texting or chatting as an alternative way for communication. There are some exceptions though, especially when the respondent insists on a face-to-face meeting because of emergencies, formal appointments and personal preferences. Respondent 18 for example says: *"when it's an emergency situation, I call a taxi [for myself], but when it's not really an emergency I call or text"*. Respondent 17 also chooses to text or chat in most cases, but when he really wants to meet his friends he says: *"my friend has a store and we make a meeting point there"*. Other respondents such as respondents 9 and 12 choose to simply postpone face-to-face meetings if they are necessary, but impossible during a flood.

#### **4.4.2. Flood impact out-home**

While there is obviously no flood impact on the facilities of Unika (it is located in the hilly area in the south), some respondents do find their behaviour at the university changing as a result of the floods at home. One example of this came from respondent 15 who stays longer at the university during a flood; *“because my mother doesn’t allow me to come home during the flood”*. Respondent 15 is not alone in this as more students stay longer at the university out of safety issues. Although this doesn’t immediately affect communication, it does constrain the students to one place, taking away some of their mobility. A different example was given by respondent 11. When his neighbourhoods begins to flood, respondent 11 receives a call from his mother and he is *“forced to go home”* before the flood gets too bad. Respondent 14 also has to get home earlier from the university to avoid the coming flood, lessening their available time at Unika, while others are forced to stay longer.

Besides the flood impact on the time at Unika, the respondents were also asked about their experience with Wi-Fi hotspots during a flood. Because most respondents didn’t deliberately travel to out-home Wi-Fi locations, there was no real flood impact on this issue. There were three exceptions of students who did sometimes especially travel to these places to use the internet, they were respondents 16, 18 and 19. For respondent 19, there was no real impact because she didn’t experience many floods and didn’t use the Wi-Fi hotspots that often for the two to ever conflict with each other. Respondents 16 and 18 however do state that they have to stay at home during the flood and are therefore unable to travel anywhere to access the internet.

#### **4.5. Conclusion**

To conclude the interviews a final interview question was asked to respondents 6 and 7 (the question wasn’t added to the interview guide until the sixth respondent) about their overall opinion on the relation between new telecommunication technologies and the experience of communication during a flood. A question that turned out rather difficult to explain and was left out from the interviews that came after them. After a considerable amount of time discussing the question with the translator, respondent 7 replied: *“technology helps a lot to communicate with other people so that’s why the flood doesn’t have a big impact”*. When elaborating on what this means for face-to-face communication during a flood: *“I choose to chat with someone else instead of meeting the person directly”*. Respondent 6 had a similar opinion and said: *“the new technologies helps a lot because now he can contact his friends by chat or telephone that don’t want to come to his house”*.

The data presented in this chapter was the result of the literature study and four weeks of fieldwork, during which observations and in-depth interviews were conducted. Before we analyse the data it is important to note that telecommunication technologies and floods have a complex interaction that affects the mobility of the students in numerous ways, influencing many aspects of their lives. This research takes a geographical approach on this by focussing on the mobility as the available time and space to undertake the activity of communication, thereby simplifying the wider social dynamics that are involved with general conceptions of mobility and communication.

## **5. Analysing the results**

Analysing the results will be done by linking the previously presented empirical data to the theoretical framework and its conceptual models. The conceptual models were set up to provide a visualisation of the necessary data to answer the research questions. In this chapter those conceptual models will be used to aggregate the results in the right order so that the research questions can be answered. The first section will deal with the role of telecommunication in the mobility of students. This is followed by the impact of floods on mobility. The final section will link the previous two by examining the change in the used ways for communication during a flood. This way the influence of the affected mobility on the used ways for communication can be measured.

### **5.1. The role of telecommunication**

In the theoretical framework the four time-space dimensions for communication were discussed. The spatial factor made a distinction between physical and virtual communication, the latter one depending on nodes in physical space through which tele-presence is acquired. The amount of physical space that is required for communication depended on whether or not communication was conducted in-home or out-home. In this paragraph, the empirical data on the role of telecommunication in the everyday communication of students will be linked to the associated conceptual models. We will discuss the nodes through which students can access the virtual space and how this has changed their mobility and used ways for communication. The dimensional image of the used ways of communication will give an idea about the ratio between various means for communication and provide insights in the role of telecommunication within these.

The first thing that should be kept in mind during the analysis is that although in both the conceptual model and the interview questions a distinction was made between in-home and out-home communication, this is not as black and white in reality as it might have been in the past. During the observations at Unika, it became almost instantly clear how much mobile phones have transformed the behaviour of people; they allow the students to attain and maintain tele-presence for as long as their batteries hold (which with portable chargers is as good as infinite). Also, thanks to internet packages for mobile phones students are no longer reliant on Wi-Fi connections to access the internet, completing the unlimited access to the virtual space. It would appear as the students have become their own home base or node from which to attain tele-presence. This also has consequences for the temporal factors of the virtual space dimensions (synchronous tele-presence and asynchronous tele-presence. With relatively recent instant messaging applications such as Whatsapp for smartphones and BlackBerry Messenger for Blackberries, the line between synchronous tele-presence and asynchronous tele-presence has become somewhat of a grey area. Technically speaking these applications would be asynchronous because it doesn't necessarily require two people to be connected to the virtual space at the same time. On the other hand, they also allow chatting when two people do have coincidence in time. In practice this switching between synchronous and asynchronous messaging happens sporadically, blurring the lines between them and making any kind of conceptualization ever more complex.

The conceptual model begins with the role of telecommunication in the everyday communication of students was the telecommunication technologies that created nodes in the physical space through which the student can extend their presence over the virtual space. To extend their presence from home, all students had multiple nodes to access the virtual space and attain tele-presence via various communication channels. They had home phones and mobile phones to call other people who were

synchronously connected to the virtual space. The internet, which is possibly the largest bundle of communication channels, could also be accessed by students via their computers, laptops or mobile phones for applications such as Skype and chatting. Besides synchronous telecommunication, the internet also allows for asynchronous telecommunication with among others; emailing, social networking and the previously mentioned messaging applications for smartphones and BlackBerries. SMS texting is also way of asynchronous telecommunication that doesn't require an internet connection and although it is still popular among the respondents, most of them prefer the newer internet messaging applications.

The options to access the virtual space through nodes out-home were also numerous. In the empirical chapter we discussed the importance of the university in the lives of the students which provides a large internet network and enough computers to serve as nodes. Most students bring their own laptops and mobile phones though to access this network. A laptop requires this Wi-Fi network to access the virtual space, but this is not necessary for mobile phones as most respondents also had internet packages for those. Because a laptop is not a device primarily made and used for communication it will for now be left out of the analysis to stay on the subject of communication. The consequence of students bringing their own node to access the Unika network is that the students, just like they use various Wi-Fi hotspots coincidentally when they are available, also use the Unika network, not as a real necessity but rather an extra convenience.

All this shows us the overabundance of possibilities for telecommunication which has a strong effect on the mobility of students. While their available physical space doesn't change because of telecommunication, the vastness of the virtual space forms an enormous asset to the overall available space for students. The importance of students having mobile phones as portable nodes is that they become more and more independent from stationary nodes in physical space for extending their presence over the virtual space, eliminating the time that is needed to travel to these nodes, even if it is just a few seconds in-home when a student calls with the mobile phone in his or her pocket, rather than walking to the home telephone. Comparing the convenience of communicating over the virtual space instead of physical communication is more significant. The almost instant access to the virtual space has the ability to annihilate the time that would be needed for physical communication such as a face-to-face meeting. The attaining of tele-presence doesn't cost that much time which greatly expands the available time students have to actually communicate with people or do other activities.

While there is an overabundance of telecommunication devices that increased the mobility of students, physical communication was still valued among the respondents. The physical communication of the students was an important aspect to understand the role of telecommunication in the broader sense of communication, consisting of the four dimensions as presented in the theoretical framework. Most respondents receive guests at their house regularly, with some exceptions who rather meet people someplace else. These face-to-face meetings can be placed within the synchronous physical presence dimension, requiring two people to be at the same place, at the same time. To do so, movement in physical space is needed for at least one of the individuals. When for example the face-to-face meeting is at the respondents' home, this would require movement in physical space from the person that is coming over. Another dimension of physical communication was reserved for asynchronous physical presence, but this dimension wasn't really of relevance for in-home communication as it is primarily used in public places.

One of these public places is Unika, which was thoroughly discussed in the empirical chapter. The bulletin boards within the faculties of this university are a good example of asynchronous and physical means for communication for movement in space is required to view its messages, but no coincidence in time is needed between the sender and receiver. Most of the respondents use these bulletin boards only to receive information. The few that also use them to send out messages, didn't really feel that they were the best way to reach the targeted receivers. The reason for this was the new ability to mass text students at the university. This is a good example of shifting dimensions; from the physical space to the virtual space.

So what is to be said about the overall role of telecommunication in the daily lives of the students? One thing that is certainly confirmed is the complete integration of the most modern devices for telecommunication in the lives of the respondents, making them a suitable reflection of the youth driving the telecommunication revolution within Indonesia. Telecommunication affected the mobility of students in a constructive way by creating a virtual space that expands the overall available space and increasing the available time by eliminating time lost by travelling. Probably the most remarkable aspect about this is the almost unlimited access to the virtual space thanks to latest mobile phone technologies, assuring a constant tele-presence for the respondents through portable nodes. To what extent this has taken over the dimension of synchronous physical communication can't be said for sure within the limits of this research, but we do know that the respondents still value communicating in person based on the amount of guests they receive in-home and the people they meet out-home. The asynchronous aspect of physical communication however has been more clearly affected by new telecommunication technologies, as was shown by the shifting usage from the bulletin boards to text messaging in order to send out information. An explanation for this might be the fact that the bulletin boards weren't really used for personal messages, but rather for one individual or organisation to reach out to as many people as possible. With the majority of people now constantly being connected to the virtual space it seems like a logical evolution that this is now the best place to reach a wider audience.

## **5.2. Impact of floods**

To analyse the impact of floods on the students' capabilities for communication, two constraint factors of a flood were discussed; the spatial factor and the temporal factor. Here it should also be noted that, just like the space-time dimensions of communication, these are not black and white in practice. In the theoretical framework it was already mentioned that there is a complex relation between the spatial and temporal factors in which it is difficult to say which is more determinative for a change in human behaviour. The result of this is that a flood is never just a spatial constraint or a temporal constraint, but always a combination of the two. This is where categorical aggregation can help to make some sense of the data by searching for relevant meanings within the spatial and temporal categories while at the same time keeping the dynamics between them in mind. First, the impact of floods on the available space for students will be addressed, followed by the impact on the available time. Both will be examined with Hägerstrand's constraint theory.

### **5.2.1. Spatial constraints of floods**

In chapter 4.4., the flood impact on mobility and communication was discussed. The conceptual model shows how a flood impacts the mobility of students which is partially shaped by telecommunication technologies. Telecommunication expanded the available space of students by the creation of nodes through which they could extend their presence over the virtual space, in

addition to communicating in the physical space. As a result, a flood can form a spatial constraint in two ways: if it constrains a person from attaining tele-presence in the virtual space or if it constraints a person from moving in the physical space for physical communication.

Constraining the ability of students to attain tele-presence means a constraining of the physical node through which the virtual space is accessed. One way for this to happen is the loss of internet, rendering the node useless in its purpose to connect the user to the virtual space. Of all the respondents, only two experienced a loss of internet during a flood. In both these cases, the flood inundated their houses. For one of them, respondent 3, the water would rise up to twenty centimetres. There were also other respondents that experienced in-home inundation, but didn't have any problems with their abilities for telecommunication. One explanation for this is the adaption measures that the students took to preserve their belongings, including their nodes to the virtual space (such as respondent 4's computer in figure 12). Aside from the two exceptions that did experience a loss of internet connection, the others didn't share their problem. There were some respondents that experienced a slower connection during extensive rain which was inconvenient for them, but hardly constraining. It may be seen as a small temporal constraint because communicating went slower, leaving less available time for other activities, but this was too insignificant to qualify as a real constraint. Overall, most of them were able to keep their tele-presence over the internet going during a flood. Besides accessing the virtual space over the internet, this could also be done via a different channel such as telephone connections used for calling or texting. However during a flood, no one experienced any problems regarding the usage of these and were free to use them whether a flood was occurring or not. In conclusion; as far as the spatial constraints from a flood on accessing the virtual space goes, it's safe to say they are almost non-existent meaning that the available virtual space for the students remained the same. The most important reason for this is the overabundance of nodes and the ability to keep them safe during a flood. Also, the external factors determining the usefulness of the nodes such as internet providers and telephone lines remained mostly intact. When looking at the flood impact on the available physical space for students, we get a very different impression about the severity of the flood constraints.

Among the respondents that regularly had guests over a heavy flood impact was experienced on their available space to meet face-to-face with people. In the discussion on flood impact at home a list of almost universal reactions was given, showing how a flood prevents the students from meeting people in the physical space. This however comes to no surprise as a flood is a physical constraint, consequently impacting the physical world causing direct damage as was mentioned in the theoretical framework. Direct damage consists of among other things damage to buildings and roads. This last one is important because it means that a flood doesn't necessarily has to inundate one's house as it does with constraining virtual communication (which was done by constraining the in-home nodes), but can also form a constraint on physical communication when it only inundates the surroundings, such as necessary roads to access the neighbourhood. Besides from not being able to receive guests, most respondents also couldn't go out themselves, constraining them at home for the duration of inundation. This not only impacts physical communication, but also the students that wanted to attain tele-presence via an out-home node, such as Unika or a Wi-fi hotspot. Respondents 16 and 18 are an example of this; they said they sometimes travel to Wi-Fi hotspots to use the internet, but have to stay home during a flood. This restriction of movement, whether its purpose was physical communication or virtual communication via an out-home node, can be seen as a



capability constraint because it locks a student down in the home base, decreasing the maximum available space for the rest of the day. This effect is visualized in the following figure:

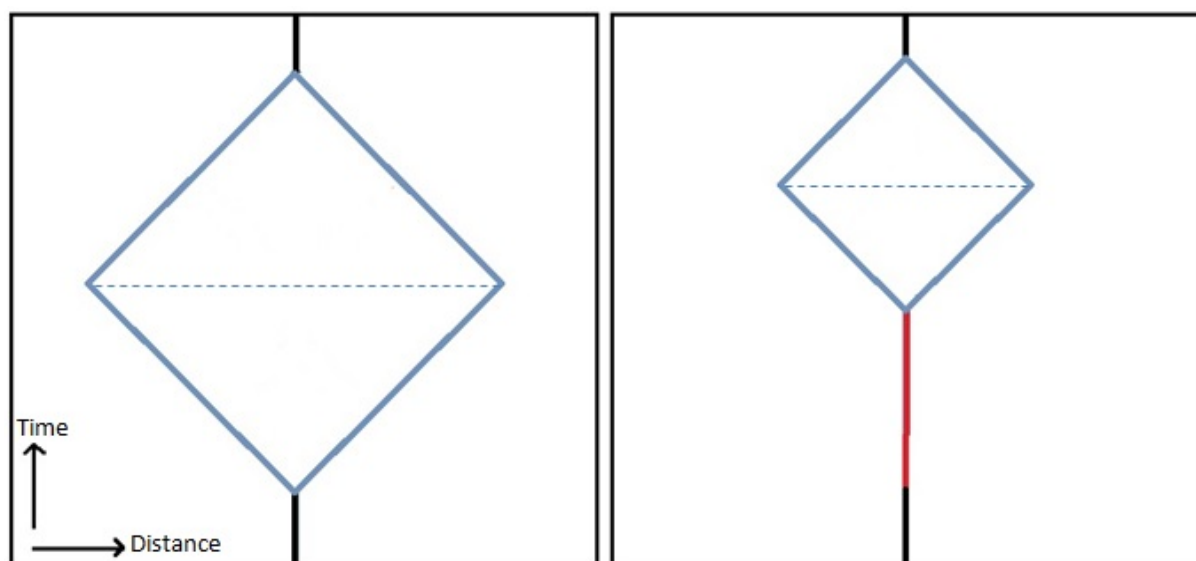


Figure 13: Impact of a flood on daily maximum range

Figure 13 shows two daily prisms; the one on the left has two black lines representing capability constraints from the time the student has to be at the home base, between them is the maximum daily range within which the student is free to communicate. To keep the visualization simple we only incorporated the maximum range in physical space. In the prism on the right we added a red line representing a flood early in the day. It immediately shows the decrease of the maximum daily range of a student. The amount of maximum available space lost as a result of this constraint is determined by the time of inundation or; the time the student is restricted at home. This is where the temporal aspects of a flood come in.

### **5.2.2. Temporal constraints of floods**

The temporal aspects of a flood impact the available time within the mobility of students and are given form by the frequency and duration of inundation. These are however more difficult to analyse as they were experienced very differently among the respondents and are, unlike the spatial constraints, not really a constraint in themselves. Instead they affect the available time that students have to overcome distances and undertake activities, in other words; it affects their maximum daily range. We've already discussed how the spatial constraints of a flood can limit the capabilities that students have to move around in physical space. With the incorporation of the temporal aspects we can place these capability constraints in context with the daily path of students and see how it affects the maximum range within it. By doing this, we can also examine the constraints that arise after a flood has occurred and its impact echoes through time. Placing these temporal factors in relation with the spatial aspects led to some interesting points which will now be discussed.

The first point of interest is about the three respondents that rarely or never received guests; two of them experienced the highest frequency of floods among all respondents. Respondent 11 tops the list with floods happening three days a week during the rainy season, followed by respondent 16 with two days of flooding every week during the rainy season. The third person was respondent 20, he experiences the average amount of two floods a month. Is the high frequency of floods such a

long-lasting constraint on the mobility of respondents 11 and 16 that they rather meet people somewhere else? During the interviews, only respondent 16 mentioned the frequent floods as a reason for the lack of guests coming over. About respondent 11 this can, unfortunately, not be said for sure.

The respondents that did have guests coming over on a regular basis experienced capability constraints; restricting them to their home-base for the duration of inundation, making it almost impossible for them to meet face-to-face with other people. Some respondents talked about situations in which a face-to-face meeting was unavoidable and had to be postponed. This creates a coupling constraint later in time after the capability constraint has been lifted and the meeting can take place. As a result; the maximum daily range decreases further because of the commitment to create a bundle with other individuals at a certain point in time. This is perhaps better explained through another daily prism:

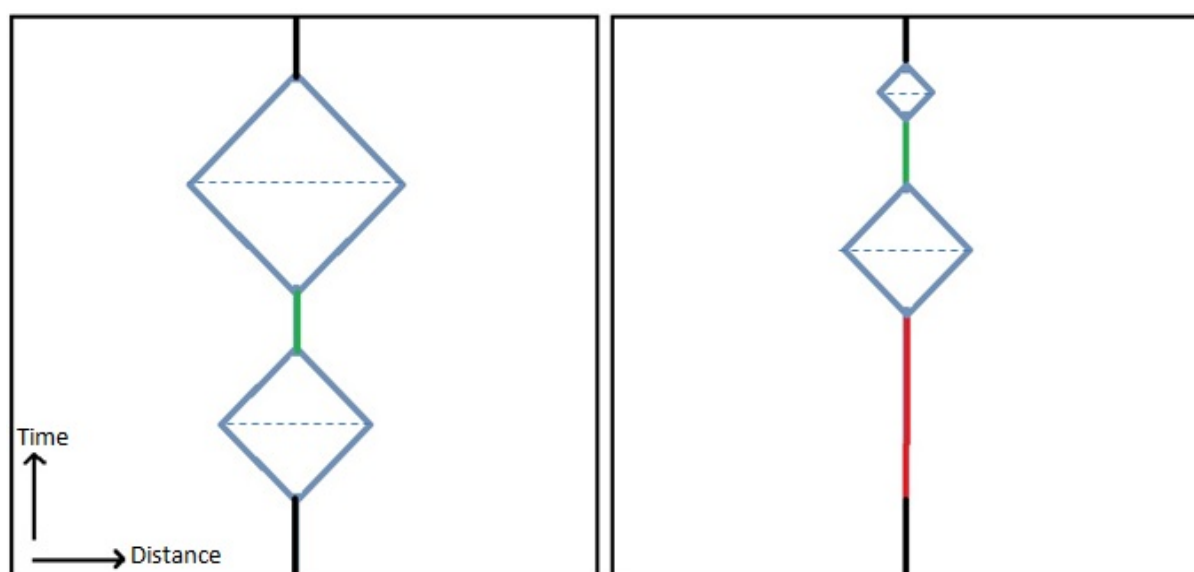


Figure 14: Shifting coupling constraint because of a flood

The daily prism on the left has a coupling constraint visualized by a green line. The student in this case receives a guest at his house for a face-to-face meeting; creating a bundle for a certain amount of time. The daily path of the guest has been left out of this figure to simplify the image. Before and after the meeting the student has freedom to move around and do activities. In the daily prism on the right we see the same flood as in figure 13, again represented by a red line. The face-to-face meeting is unavoidable (it could for example be a general practitioner coming to visit) and the student chooses to postpone the meeting until later in the day. It shows how the maximum daily range of students, which is already constrained by a coupling constraint, decreases further because of the flood. Again, this was a simplified example, in reality there are most likely many more constraints in the daily prisms of the students.

Another influence of temporal aspects of flood constraints was found in the students' behaviour regarding their time spent at Unika. A lot of the respondents had to either stay late or go home early to avoid the floods. This shows that a flood is still a significant constraint on the physical mobility of the students. It also has implications for the daily path of a student, whose maximum daily prism is now smaller due to the fixed time they have to spend later than normal at Unika or earlier than normal at home. If we consider the time spent at Unika (during class hours) as an opportunity for



communicating with other students and friends, the respondents that go home early miss out on some of these opportunities. Also the respondents that have to stay late while most other students are already gone see their freedom decreasing as they're waiting for the flood to end. As some respondents were not allowed by their parents to come home during a flood, this can even be considered as an authority constraint; an authority figure dictating the freedom of a student out of protective reasons.

In conclusion; the impact of a flood on the available time and space for communication is highly dependable on the way a person chooses to communicate. As a physical hazard, a flood is still severely constraining on the possibilities for physical communication with most respondents not being able to leave their houses during a flood to arrange face-to-face meetings (in-home or out-home) or use out-home nodes to access the virtual space. This was considered as a capability constraint as it forces students to stay at their home base, decreasing their maximum daily range as shown in figure 13. The severity of the loss is determined by the temporal aspects of a flood such as frequency and duration. In combination with other constraints, such as coupling constraints as a result of a planned meeting, a flood could decrease the maximum daily range even further if a student is forced to postpone a meeting due to the capability constraints of a flood. Authority constraints are also present for students who are forced to come home early from Unika or forced to stay out-home longer to avoid traveling through bad weather and flooding areas. The virtual space is the only place that seems unreachable for a physical constraint such as a flood as all students manage to preserve their tele-presence during a flood, either via nodes that access the virtual space over the internet or nodes that use telephone networks.

### **5.3. Used ways of communication during a flood**

We've analysed the role of telecommunication technologies in the expansion of the mobility of students and how this influenced their everyday communication. After that the impact of a flood on the students' mobility was discussed. Following the conceptual model of the third sub question, we will now analyse the ways of communication used by students during a flood. It is during a flood when the mobility of students gets affected by both the constraints of a flood and the opportunities from telecommunication technologies. Examining the used ways of communication during this situation will provide insights in the ways of communicating that are constrained and the students' ability to overcome certain flood constraints. This also fulfils the research goal of contributing to the improvement of communication in frequently flooded areas.

The theoretical framework mentioned that telecommunication can lift time-space constraints, but disagreements exist about the extent of this relation. What we know so far is that telecommunication is able to relax certain time-space constraints; one example was given on the indivisibility of a person which through telecommunication is lessened as a person is able to multi-task, relieving possible time constraints. This was also shown in the Rye's study on students in Jakarta who, thanks to telecommunication, could save time while facing the time-space constraints from traffic congestion. If this relaxation of time-space constraints by telecommunication is also the case for the students in Semarang, we'll have to take a look back at the first section of the analysis on the role of telecommunication. Here it was quickly confirmed that the students nowadays had numerous nodes from which to extend their presence through the virtual space. The respondents were able to safeguard these nodes when a flood occurred. This meant that all of them, even during a flood, could continue maintaining their tele-presence in multiple places via laptops, computers or mobile phones.

It is because of this almost unlimited access to the virtual space that we found in the next section of the analysis that flood constraints on telecommunication were as good as non-existent. Some respondents experienced a bad internet connection, but this was hardly constraining as other virtual channels such as telephone lines were still available. The flood impact on physical mobility was much more severe, so with unconstrained telecommunication possibilities, how exactly do the used ways for communication change during a flood? Can the telecommunication technologies also lift the constraints on physical communication?

The previous section discussed the heavy impact of floods on the students' physical mobility. Direct damage to the surroundings of the students constrained a lot of the respondents to their house for the duration of inundation, making it impossible for them to arrange face-to-face meetings. During the fieldwork the students were asked how they react to these physical constraints. Many of the respondents choose to text or chat instead of meeting face-to-face, thereby switching from one space-time dimension of communication to another. To be precise: from synchronous physical communication to (a)synchronous virtual communication. So instead of dealing with constraints in the physical space, most students seem to make the logical choice of changing lanes to the unobstructed virtual space for their communication. This lifts the capability constraint that limited the students' physical presence to their home base as they now extend their presence virtually instead. There are still some exceptions of situations in which a face-to-face meeting is necessary, in which case some respondents have to postpone their meeting as was shown in figure 14. This was an example of how a flood can form a temporal constraint on students wishing to communicate face-to-face. Overcoming the constraints of a flood is in this example impossible and reminds us that although telecommunication can lift a lot of pressure of the impact of a flood, movement in physical space is still required for various activities. Other exceptions occur when a flood causes other people to not want to go the houses of the respondents. In chapter 4.4. on the flood impact on mobility and communication, respondent 17 said he meets his friends somewhere else when they don't want to come to his house, changing an in-home face-to-face meeting into an out-home face to-face meeting. Could it be that this change will be more definitive as the frequency of floods gets higher? It did for respondent 16 and possibly respondent 11 who rarely received any guests as a result of the high frequency of floods.

Because most respondents are restricted at their house during a flood, out-home communication was also affected by the floods. For the duration of inundation, students stayed at home and out-home communication could not be conducted at all. This was not just the case for physical communication, but also for the two respondents (16 and 18) that sometimes go to Wi-Fi hotspots to use the internet and are unable to do this during a flood. This was however a rare occasion and of little significance as both could still access the virtual space at home, causing no shift in the dimension on the used ways of communication except for change from out-home to in-home.

Furthermore, there are some temporal aspects of importance as a flood decreases the maximum daily range and thus the available time and space for out-home communication after the period of inundation. This was first visualized in figure 13 and later in figure 14. The latter one showed how some respondents had to postpone their face-to-face meetings, but for most respondents this was only for unavoidable face-to-face meetings such as formal appointments. For informal communication they rather changed the way of communication to virtual channels with some exceptions that used out-home meetings points as was discussed in the previous paragraph. There

was also a flood impact on the amount of time some students spent at Unika; some had to stay longer to wait for the flood at their house to go away while others had to go home early to prevent being caught in bad weather and flooding. Whether the respondent had to stay late or go home early depended of course on what time of the day the flood occurred. In both cases; the students were constrained to one place for a certain duration of time in which they would normally have more available time and space for communication. If this also caused a change in the used ways for communication is unclear based on the gathered data, but it is likely that the only real change is the difference in the location from which communication is conducted; from in-home to out-home or vice versa.

In the conclusion on the paragraph on flood impact in the empirical chapter, two respondents gave their opinion on the influence of new telecommunication technologies. Both of them mentioned the decreased impact of floods on their mobility and explain how they can now easily contact people without having to directly meet them. It seems that the unobstructed virtual space has become a great way to avoid time-space constraints in the physical space. The students can maintain communication with friends, family and others regardless of the frequent floods in their area. The floods however are still a strong constraint on the physical space, which definitely caused some shift in the used ways for communication. Students have such easy access to the virtual space that a lot of physical communication seems to have been replaced by virtual communication. With the ever growing usage of telecommunication it can't be said for sure if this is because of the impact of floods or the general evolution of communication. They both however seem to enhance this process of change by on the one hand pushing them away from the physical space, while at the same time inviting them into the virtual space. Probably the most constraining aspect of the frequent floods are their capability constraints, limiting the available time and space of students and restricting them in one location for the duration of inundation; either in-home or out-home. These constraints could to some extent be lifted by using nodes to access virtual communication channels, but a flood does affect the location from which this is done. Although this doesn't necessarily has changed the used ways of communication, it is the result of limited mobility, taking away some of the freedom of students to utilize their preferred ways of communication.

## **6. Conclusion**

This research set out to contribute to the improvement of communication in frequently flooded areas by providing insights in the communication of students whose mobility is affected by floods and new telecommunication technologies. To do this, a case study was conducted that consisted of a literature study and four weeks of fieldwork in Semarang, Indonesia. During the fieldwork, students of the Soegijapranata Catholic University of Semarang were interviewed and observed to gather the empirical data which was presented in the empirical chapter. After analysing this data it is now time to conclude the research by answering the research questions and reflecting on the work that has been done.

### **6.1. Concluding the research**

In this first section of the conclusion, the research questions will be answered, starting with the first sub question:

- ❖ *What is the role of new telecommunication technologies in the everyday communication of students?*

To answer this question, data was needed on the effect of telecommunication technologies on the students' mobility and how they used this expanded mobility for the activity of communication. During the fieldwork, it quickly became clear that telecommunication had greatly enlarged the mobility of students and become an important part of the students' used ways of communication. At home, all of the students have various ways to access the virtual space and extend their presence to multiple locations at the same time. This was achieved thanks to numerous nodes such as laptops, computers, Blackberries and smartphones. Out-home, there are also enough ways for students to attain tele-presence. Unika provides the students with network facilities and the city of Semarang is full of Wi-Fi hotspots. The need for these is however reduced due to what is probably the biggest evolution on this subject; the ability for students to access the internet over their mobile phones, allowing them unlimited access to what is probably the largest bundle of communication channels in the virtual space, whenever, wherever. Using the mobile phone as a portable node practically eliminated the need for physical movement when attaining tele-presence. Physical communication is however still important for most students, but certain aspects of it; especially asynchronous ways of receiving and sending out information such as the bulletin boards at Unika, are being overshadowed by the possibilities of new telecommunication technologies.

The second sub question was:

- ❖ *How does a flood affect the students' mobility?*

The students in this research experienced rainfall floods, with a variable duration, frequency and severity. Hägerstrand's time-space geography was also applied here to conceptualize the impact of a flood on the mobility of students. The floods were linked to time-space constraints, resulting in two dimensions of flood constraints on the students' mobility; the spatial aspects and the temporal aspects. The mobility of students consisted of their available time and available space, with a distinction between virtual and physical space. The available virtual space for telecommunication remained the same for the respondents as they were all able to preserve their nodes during a flood. A few exceptions experienced the loss of internet or a bad connection during heavy rain, but all of them had alternative ways to extend their presence over the virtual space. The floods affected the

students especially in their available physical space by causing capability constraints, making them unable to receive guests or go out. The water didn't necessarily have to inundate the respondent's house for it to be constraining, the flooding of their surroundings and access routes necessary for physical mobility were also considered as highly constraining. The severity of the capability constraints was dependant on the duration of inundation, a temporal aspect of flood constraints. The longer the inundation lasts and the respondent is physically restricted, the less time and space is left. The available time and space for a student would become even less in combination with other constraints like for example coupling constraints. Authority constraints were also detected as some students weren't allowed to travel during a flood and the bad weather that goes prior to it. This would force some respondents to stay in out-home (at Unika) longer or go home earlier, taking away some of their available time and space.

On to the third and final sub question:

❖ *How do students experience communication during a flood?*

This question served to get an idea on how students behave when their mobility is affected by both the constraints of floods and the possibilities of telecommunication technologies. How they deal with this affected mobility during a flood shows to what extent they have the ability to overcome constraints and which constraints are still manifested. All respondents experienced a heavy impact of floods on their available physical space for communication. To compromise for this, most of them chose to use virtual communication instead, causing a shift in the time-space dimensions of communication. A small number of respondents chose to meet people somewhere else instead of receiving them at home, thereby changing the location but not the time-space dimension of communication. Another example of a change in location but not necessarily in time-space dimension of communication was as result of the authority constraints forcing students to stay longer at Unika or go home early. When a face-to-face meeting was unavoidable, such as a formal appointment, physical communication would be postponed, causing the coupling constraint of a meeting to shift later in time when the capability constraint of a flood is lifted. This still has major consequences for the mobility of students as their available time and space decreases. Because there was little to no flood impact on the available virtual space, most students could preserve their virtual communication like they would normally do.

With the information from the sub questions, the main question can be answered:

*How does the mobility of students in Semarang, affected by the usage of new telecommunication technologies and floods, influence their used ways of communication?*

The frequent floods are a physical hazard consequently having a major impact on the available physical space by restricting students in their houses for the duration of inundation and decreasing their maximum daily range for the rest of the day. Telecommunication technologies created nodes through which students could extend their presence over the virtual space in addition to only communication in physical space. This development greatly expanded the available space of students and because less movement in physical was required for virtual communication than for physical communication it also saved a lot of time, increasing the overall mobility of students. The most noteworthy aspect of this was the ability to access the internet with a mobile phone, creating a portable node to access the virtual space any place at any time. Most of the respondents stated that

they prefer to use these new ways for communication, although face-to-face communication was still valued. It comes as no surprise that during a flood many of the students replaced their physical communication with virtual communication to lift the capability constraints that restricts their ability to move in physical space. It is hard to say to what extent this is a conscious choice or if it's born out of habit from dealing with frequent floods and using telecommunication anyways, regardless of the floods. Several respondents did however acknowledge the convenience of telecommunication during a flood as they could stay in touch easily with their friends. Not all physical communication could be replaced though, resulting in students having to postpone meetings or change the location from in-home to out-home if their guests didn't want to or weren't able to come over. A more long-term shift in the used ways for communication was discovered with the two respondents that rarely to never had guests visiting their houses and experienced high frequency of floods. Only one of them confirmed that this was because of the high frequency of floods, but it is likely that the same goes for the other one. The floods in Semarang are a growing problem, so if this shift in the used ways for communication is really that definitive; it might become more prominent in the future.

## **6.2. Reflection**

This research was conducted within limited time and scale because of various personal restrictions. To start with the research process; because of the limited time for the fieldwork in Semarang we chose to interview students from the Soegijapranata Catholic University; to which we already had previously established connections. Although the students greatly represented the youth of Semarang in terms of telecommunication usage, most of them didn't experience the high severity of floods like other population groups within the city. For example the poorer people in the lower coastal areas of Semarang who experience a heavier flood impact, will most likely give a totally different image. Another problem that arose from the limited time in Semarang was the ability to fully capture the integration of telecommunication in the lives of students and their experiences of floods. We arrived just after the rainy season (in which most floods happen) so we weren't able to directly observe the occurrence of a flood and the behaviour of students during this situation.

The primary method for data gathering were the in-depth interviews with twenty students, which might not have been the best way to capture (habitual) behaviour as it is highly subjective and prone to miscommunication (especially with a translator). A better method would have been to ask respondents to keep open diaries during the rainy season and its floods so the researcher can interpret the results more objectively. This could unfortunately not be done with the timing and duration of the fieldwork. The result of using this method was the somewhat superficial data that could have been better utilized if placed in a richer context, but for will serve as a stepping stone to further in-depth research.

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## 8. Appendix

### 8.1. Interview guide

This interview guide was used as a guideline during the interviews. It consists of two sections of questions, with some questions having examples of possible sub questions to further direct the interviews. It should be noted that the interviews were semi-structured, meaning that the conversing was kept as natural as possible, giving the respondents enough room to tell their stories. This is why many cases the interview results differ from the structure presented here in this guide.

#### Introduction

What do you study here at Unika?

How many days a week are you at the university?

*Do you go home in between classes or do you stay at the university during the whole day (one trip to the university and back)*

In what area of Semarang do you live?

Do floods occur regularly?

*How often?*

*How do you experience a flood? In house? Or neighbourhood?*

*What type of flood occurs? Rainfall? Rob (tidal)?*

*What is the general duration of a (single) flood?*

*At what time of the day does a flood usually occur?*

*Are the floods predictable?*

*If not, to what extend does this cause a problem?*

*What do you do during a flood? Stay at home? Or is it not really an obstacle?*

*How do the floods change over the years? Do they get worse?*

#### Flood impact on communication

##### 1. Means for communication in home

Do you have...

- A computer or a laptop at home?
- Internet at home? How fast is it?
- A telephone at home?
- A cell phone? What type?
- Internet on your cell phone? Wi-Fi or membership/subscription

Which ways for communication do you prefer?

Does a flood cause any problems with in-home communication such as internet or telephone connections?

*What kind of problems?*

*How do you react to these problems? Alternative means for communication?*

Do you often have guests (friends/family/acquaintances/students) over at your house?

*Does this change during a flood? What happens?*

*Do you feel less accessible during a flood?*

*In what ways?*

*How do you react to this?*

## **2. Means for communication out home**

### Means for communication at Unika

Do you have access to...

- A computer with internet?
- A Wi-Fi connection for your mobile phone or laptop? Fast connection?
- A bulletin board to place/receive messages or general information?
- The Unika newspaper?

Does a flood influence the way you use the means of communication at Unika?

*Does it change the amount of time spent at Unika?*

Do you feel like the Unika University can provide better means for communication to compensate for communication problems because of floods?

### Other out home means for communication

Do you have access to...

- An internet café?
- Wi-Fi hotspots?
- Any others?

Do you use meeting points to meet with friends/family/other students?

Does a flood change the way you use these?

*How?*

<b>Final: notes? Remarks? Any other important things we might have missed?</b>
--

## **8.2. List of respondents**

<b>Respondent number</b>	<b>Name respondent</b>	<b>Gender</b>	<b>Area/street name</b>	<b>Date of interview</b>
1	Ruth	F	Radim Pateh	27 April 2013
2	Cathy	F	Puri Anjasmoro	27 April 2013
3	Melissa	F	Citarum	27 April 2013
4	Naomi	F	Nogosari	27 April 2013
5	Shenny	F	Depok	29 April 2013
6	Marcus Eric	M	Genuk	29 April 2013
7	Tania	F	Pedurungan	29 April 2013
8	Oktavia	F	Utara (Tanah Mas)	30 April 2013
9	Yosua	M	Citarum	30 April 2013
10	Edo	M	Alamat Jl. Muara Mas	30 April 2013
11	Marwanto	M	Tanah Mas	30 April 2013
12	Fransiscus	M	Tanah Mas	30 April 2013
13	Natalia	F	Pemuda	30 April 2013
14	Margareta	F	Majapahit	30 April 2013
15	April	F	Citarum	30 April 2013
16	Ayu	F	Citarum	30 April 2013
17	Wilhelmus	M	Tlogosari	1 May 2013
18	Firda	F	Indah	1 May 2013
19	Monica	F	Tanah Mas	1 May 2013
20	Indra	M	Pun Anjasmoro	1 May 2013