The Impact of Availability Heuristic and Confirmation Bias on Team Dynamics Through a Game Theoretical Lens

Ruben Lucas Maria Mastwijk | S1143475 | Ruben.Mastwijk@ru.nl
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Femke Bekius | Niina Erkama

Abstract

Critical-care teams operate in high-stakes environments where cognitive shortcuts can lead to misdiagnoses and treatment delays. This thesis employs a game-theoretical framework to examine how the availability heuristic and confirmation bias influence decision-making in paediatric intensive care units. Drawing on the Volunteers' Dilemma, Battle of the Sexes, and Principal–Agent models, semi-structured interviews were conducted with six physicians, nurses, and trainees across three hospitals, of which two were in the Netherlands and one in Belgium. Using a hybrid deductive–inductive Gioia methodology, transcripts were coded to identify first-order concepts, second-order themes, and aggregate dimensions. Results indicate that past cases and initial diagnoses act as anchors in coordination (Battle of the Sexes), while established hierarchies in the Volunteers' Dilemma and transparent communication in Principal–Agent scenarios effectively mitigate heuristic-driven distortions. By integrating cognitive insights into normative game theory, this research clarifies where structured protocols reduce bias and offers practical recommendations, such as real-time outcome registries and formalised discussion protocols, to enhance critical-care decision-making.

Acknowledgement

Use of Artificial Intelligence

For some parts of this research, I used (generative) artificial intelligence (Gen AI) tools, Grammarly and ChatGPT. These tools were only used for language improvement (e.g., spelling and grammar improvement); no results were generated with one of these tools. Everything generated by AI was reviewed against the existing literature, and any errors were corrected. No literal copy-pasting was done.

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1. Introduction

Decisions made in critical care settings are a matter of life and death; in environments where every second counts, even a slight deviation from optimal decision-making can result in severe consequences for patient survival and quality of care (Hendee, 2001). Cognitive errors, such as those arising from the availability heuristic and confirmation bias, can distort team judgments, leading to misdiagnoses, treatment delays, or inappropriate interventions (Mancuso et al., 2014). Given that healthcare systems bear not only the human cost but also substantial financial burdens associated with medical errors, enhancing decision-making processes in critical care has significant implications for society (Makary & Daniel, 2016). Improving team performance by mitigating these biases could save lives, reduce treatment costs, and foster greater public trust in healthcare institutions. Research conducted by Croskerry (2013) demonstrates that cognitive biases can profoundly impact clinical decision-making, potentially resulting in catastrophic errors in high-stakes environments. Furthermore, research indicates that team dynamics are crucial for achieving optimal outcomes (Salas et al., 2005).

While the foundational work of Tversky and Kahneman (1974) and Nickerson (1998) has offered considerable insights into the impact of cognitive biases on individual decision-making, the interplay of these biases within team dynamics remains underexplored, particularly in high-stakes environments such as critical care. Although there is a wealth of literature on cognitive biases at the individual level and game theory as a normative framework for decision-making is accessible (Gibbons, 1992; Osborne & Rubinstein, 1994), few studies have combined these perspectives to examine how biases such as the availability heuristic and confirmation bias collectively impact team-based decisions, the papers who have done this are Croskerry (2013) and Daily et al. (2024).

This research is distinctive in that it employs a game-theoretical framework to model individual choices and investigate the strategic interactions within a team. By analysing team dynamics through frameworks such as the Volunteer's Dilemma, Battle of the Sexes, and Principal–Agent Framework, this study seeks to reveal how coordination, role assignment,

and incentive misalignments interact with cognitive biases in critical care decision-making. Combining both fields of study is vital for importing both theoretical understanding and practical outcomes in healthcare. The research question throughout this process will be as follows:

Research question:

How do the availability heuristic and confirmation bias relate to the team dynamics regarding decision-making in critical care?

Supporting Questions:

What themes represent the availability heuristic and confirmation bias?

Which themes of the "Battle of the Sexes", "Volunteers Dilemma" and "Principal-Agent problem" are apparent in the team dynamic of the critical care unit?

The supporting questions are implicitly answer in the results. Three core theoretical concepts—cognitive biases, team dynamics, and game theory—provide the foundation for this research. Cognitive biases are systematic mental shortcuts or tendencies that can skew decision-making; for example, the *availability heuristic* leads individuals to judge events as more likely if examples come readily to mind (Tversky & Kahneman, 1974). Both availability and confirmation bias can negatively impact decision-making quality in critical care by skewing the team's judgment when under stress. Research has revealed various biases that influence healthcare professionals, illustrating the prevalence and intricacy of these cognitive errors (O'Sullivan & Schofield, 2018).

Team dynamics refers to the behavioural and social interactions among team members that influence how they work together. Phenomena such as norms arising from leadership hierarchy and shared ways of thinking and acting determine how effectively the group coordinates under pressure (Kozlowski & Ilgen, 2006). Game theory, the study of strategic decision-making among rational actors, involves interactions where the action of one player influences the decision made by the other player. Every game has a payoff structure which depends on the actions of the players. So the pay-off of one player is dependent on the action of another player. Provides a helpful framework for analysing decision-making in environments with multiple actors; this study employs it to model and analyse these team

interactions. (Gibbons, 1992). Game theory is well-suited for modelling team interactions, as it provides a systematic way of examining an interaction with defined boundaries. The team dynamics will primarily be modelled through three specific game theoretical models: “Volunteer’s Dilemma,” “Battle of the Sexes,” and “Principal–Agent,” as the literature suggests their relevance in the medical sector (Geurts et al., n.d.).

This paper is structured as follows: The next part is a Theoretical Background section reviewing literature on game theory, team dynamics, cognitive biases, and heuristics, establishing the conceptual framework. The third section outlines the methodology, including research design, strategy, data collection, analysis, and ethical review. The fourth section presents empirical findings based on the outlined protocol. The fifth section interprets the results and discusses their implications. The sixth section concludes the paper with a discussion of limitations.

2. Theoretical Background

This paper intersects several theoretical fields to provide a holistic view of team dynamics in critical care for children with head trauma. First, it addresses cognitive heuristics and related biases. Next, it examines game theory and specific games used in this study. Finally, it reviews existing literature on decision-making in teams.

2.1. Biases

Cognitive biases are ingrained patterns of deviation from rational judgment that affect how individuals interpret information and make decisions (Kahneman, 2011). Such biases can lead healthcare professionals to make suboptimal decisions in high-stakes environments, such as critical care. Two biases particularly relevant to clinical decision-making are the availability heuristic and confirmation bias (Croskerry, 2013).

2.1.1. Availability heuristic

The availability heuristic refers to people's tendency to place disproportionate emphasis on things at the forefront of their minds or for which examples are readily accessible (Tversky & Kahneman, 1974). In other words, vivid or recent memories unduly influence one's perception of what is likely. This can lead to overestimating the likelihood of dramatic, memorable events and underestimating more common, less memorable ones (Gilovich & Griffin, 2002).

Availability bias is a well-documented bias that leads to deviations from perfect rationality in high-pressure medical settings (Daily et al., 2024). Hayibor and Wasieleski (2008) discovered that when a group relies on the availability heuristic for decision-making, their decisions become skewed. Consequently, the decisions made collectively are also affected by the availability heuristic. Bounhez et al. (2023) reviewed interprofessional decision-making and noted that effective teams share and interpret information collaboratively, although biases can interfere. One insight from Bounhez et al. (2023) is that once an initial frame or narrative is established within a team, availability bias can amplify that narrative.

2.1.2. Confirmation Bias

Confirmation bias is another pervasive cognitive bias, characterised by the tendency to seek out or interpret information in ways that reinforce one's pre-existing beliefs or hypotheses. Individuals tend to favour evidence that supports their views while discounting or ignoring contradictory information (Nickerson, 1998).
Both availability and confirmation bias can impair decision quality in critical care by distorting the team's judgment under pressure. Studies have documented numerous biases affecting healthcare professionals, highlighting the commonality and complexity of these cognitive pitfalls (O'Sullivan & Schofield, 2018).

The fast-paced and uncertain environment of an ICU, characterised by information overload, stress, and time pressure, provides fertile ground for these biases to manifest (Croskerry, 2013). Recognising these biases is, therefore, essential. By integrating an awareness of cognitive biases into our framework, we acknowledge that decision-making in critical care is not a purely rational process; psychological factors may lead team members away from the optimal decisions that a completely "rational" analysis (such as a game-theoretic model) might predict (Kahneman, 2011; Tversky & Kahneman, 1974). Tversky & Kahneman (1974) set the stage for our application of game theory, allowing us to explore where actual behaviour diverges from theoretical rationality, potentially due to biases or other human factors. In the following subsection, we will focus on the collective context in which these decisions are made—the team—and examine how team dynamics influence decision outcomes.

2.2. Team Dynamics

Team dynamics is a central concept in this research. It refers to how teams cooperate, communicate, and make decisions (Kozlowski & Ilgen, 2006). Since team dynamics is an abstract and extensive construct, the next section will be dedicated to breaking down the relevant literature, its implications, and the theoretical lens applied to team dynamics.

2.2.1. Game Theory

Game theory can be used to analyse the interactions between different actors who influence one another during decision-making (Gibbons, 1992). Game theory models a single decision or a string of sequential choices as "games." A game is a situation in which multiple individuals select an action. These individuals are known as "players." All players engage in the game according to a "strategy," which is a player's choice based on the available information and circumstances. The goal of the strategy is to maximise the individual's "pay-off." This pay-off can be defined in concrete monetary terms and in more abstract units. A general economic way of expressing the pay-off someone receives is "utility." Utility represents the worth or value of something. A Nash equilibrium is reached when no player can achieve a better outcome individually. The Nash equilibrium does not necessarily have to be a Pareto optimal or best solution; it is a stable solution (Osborne & Rubinstein, 1994).

Game theory formalises essential elements of decision-making: actors' preferences, information, and interaction rules. By adjusting these elements, different types of "games" can model various real-world scenarios (Luce & Raiffa, 1957). For example, games can be cooperative or non-cooperative, symmetric or asymmetric in terms of roles, zero-sum or non-zero-sum, and static or dynamic (Bekius & Meijer, 2020). Game theory is well-suited to illustrate the interactions within the medical field, particularly in regards to various expectations, such as healthcare professional-patient interactions and specific decision-making processes (Yeung & Makkapati, 2023).

Some prominent game-theoretic scenarios in the healthcare sector include the Battle of the Sexes, the Principal-Agent game, and the Volunteers' Dilemma. These games are particularly relevant to the healthcare sector for the following reason: during the care of an individual, one person who steps up and takes responsibility can benefit the entire team (Volunteers' Dilemma). Information asymmetries can arise during critical care, and conflicting agendas may emerge (Principal-Agent game). Finally, a team of different health professionals shares the same end goal: curing or helping the patient; nevertheless, opinions on the best approach may vary significantly (Battle of the Sexes) (Geurts et al., n.d.). These games will be further explored in the following sections. These three games provide an initial set of games to

model team dynamics in the critical care units. Additional appropriate games could be added to this model.

2.2.1.1. Volunteer's Dilemma

The Volunteer's Dilemma describes a situation in which a group of people would all benefit if one individual incurs a cost or takes on an inconvenience. However, each person prefers that someone else volunteer for the task. In this scenario, everyone has two choices: volunteer (incur the cost) or wait (do nothing) (Murnighan et al., 1993). If at least one person volunteers, the group gains a shared benefit; if nobody volunteers, the worst outcome occurs, and everyone loses. Crucially, the volunteer typically does not receive much additional benefit from acting – they may even incur a personal cost – so each individual is incentivised to take a "free ride" and hopes someone else will step up (Kollock, 1998).

The Nash equilibrium is established through mixed strategy, where players volunteer in a particular ratio based on the cost and payoff of the situation (Diekmann, 1985). The classic example arises from the bystander effect in emergencies: many people might witness someone in distress, and all would be relieved if one person intervenes, but each bystander hesitates, thinking another will do it. If everyone hesitates, no one will act, and the outcome will be disastrous (Campos-Mercade, 2020). A paper by Diemann Przepiorka (2015) examined how different cost-benefit structures affect the emergence of volunteering norms. For instance, if the cost of volunteering is low for one member relative to others, that member might consistently take on the volunteer role, establishing a norm. Conversely, if costs are evenly distributed, group members might volunteer in turns, or a stalemate could arise. Murnighan et al. (1993) demonstrated the volunteer's dilemma in action, exploring how group size affects the probability of volunteering – paradoxically, larger groups can make

volunteering less likely because each individual feels that someone else will step forward (diffusion of responsibility). As is illustrated by Figure 1

Figure 1: Volunteers' dilemma payoff matrix

2.2.1.2. Battle of the Sexes

The Battle of the Sexes is a classic two-player coordination game that involves both cooperation and conflict. Traditionally, it is framed as a narrative of a couple deciding on an evening activity: one partner prefers event A, while the other prefers event B, but both would rather attend the same event rather than be apart at different ones. Each player has a distinct preferred outcome, yet they share a common interest in coordinating their choices (Osborne & Rubinstein, 1994; Luce & Raiffa, 1957). The game, therefore, features two favourable outcomes and a less desirable outcome if they fail to coordinate. There are two Nash equilibria corresponding to each actor's preference, contingent upon the participation of the other player. In the critical care sector, such a game may arise when two healthcare professionals have different preferences or options regarding a patient's best course of action. Neither option may be incorrect, but if the professionals do not integrate their expertise, the result is significantly poorer than if they select one of the two options (Geurts et al., n.d.). This is visually portrayed in Figure 2. Rapoport (1997) demonstrates that in critical care settings, details such as the timing of information release can influence the game's outcome, even when the primary pay-off remains constant. These findings support the idea that sometimes it matters more how the game is played than what game is played (Bekius et al., 2021; Cui, 2015).

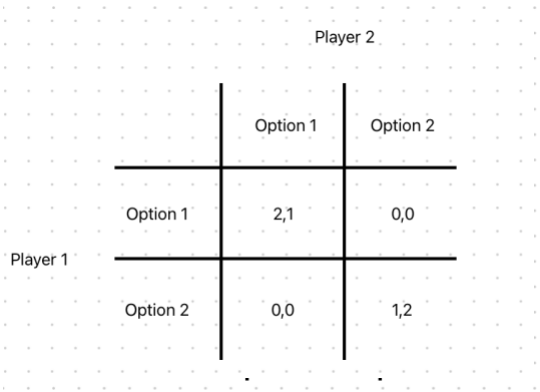

Figure 2: Battle of the Sexes payoff matrix

2.2.1.3. Principal-Agent Game

The Principal-Agent model is not a single game, but a framework that describes situations in which one party (the principal) delegates work or decision-making authority to another party (the agent) who has private interests or information. Nash equilibrium is achieved when cooperation is structured so that, given the contract, the agent's optimal strategy (i.e., the action that maximises their utility while adhering to the incentive compatibility constraint) and the principal's strategy (i.e., the cooperation offer that maximises the principal's expected payoff while ensuring participation) are mutually optimal (Bolton & Dewatripont, 2004).

The essence of the Principal-Agent problem lies in the fact that the principal's interests are not entirely aligned, particularly when the principal cannot fully monitor the agent. This conflict of interest and information asymmetry can lead to suboptimal outcomes. The agent may defect or choose a course of action that benefits themselves at the principal's expense (Braun & Guston, 2003). The phenomenon is illustrated in Figure 3. The relevance of this model to the healthcare sector is evident in how information asymmetry manifests in these cases, coupled with the potential misalignment of agendas (Geurts et al., n.d.). In his paper, Nguyen (2011) demonstrated that the Principal-Agent problem can occur in various forms within the healthcare context, whether between a patient and a healthcare professional or in relationships between individuals. The paper examines the significant impact of misaligned agendas.

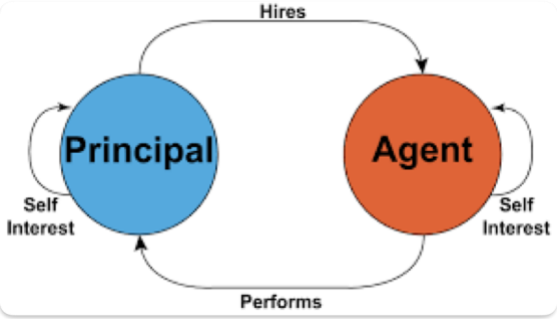

Figure 3: An illustration of the Principal-Agentproblem

2.2.2. Decision-Making in Team Settings

A study by Klug Bagrow (2016) quantitatively analysed numerous team projects and identified key factors influencing team success and dynamics. Among their findings, team size and the diversity of experience emerged as critical factors. Smaller teams tended to coordinate more quickly, whereas larger teams faced increased complexity in aligning all their members. Diversity—having team members with different backgrounds or areas of expertise—could enhance problem-solving while also introducing friction or communication barriers. Coordination patterns may lead to the establishment of various structures within the group, such as subgroups that coordinate internally (Zhou et al., 2015). Klug Bagrow (2016) also noted that the number of individuals in leadership roles affects dynamics. This perspective aligns with Stanford (2010), which indicates that increasing the number of players or teams can exponentially heighten the possible Nash equilibria of the games played, while also increasing the complexity.

A complementary study supporting the rapid complexity of decision-making in the healthcare sector is by Zanin et al. (2023), which explores decision-making related to end-of-life situations. They found that team dynamics and relationships have a significant influence on the decisions made. These disagreements on the best course of action are not merely medical judgments; they are shaped by each professional's values, experiences, and interactions (i.e. team dynamics). To further illustrate the dynamics, it is not just inter-professional relationships that affect judgment and choices. In life-threatening conditions, social and cultural contexts significantly impact decisions. Factors such as legal regulations, cultural expectations (for example, an aversion to withdrawing life support), and the role of family input create a complex environment for the team (Oskouie et al., 2024).

One way to enhance team functioning and dynamics over the long term is through fair allocation of rewards. This leads to a more stable and higher-quality performance for the team in the long run. If team members feel rewarded and recognised for their contributions in proportion to their efforts, they are more likely to contribute and cooperate in the future (Yan et al., 2020). Axelrod (1984) asserts that the "Tit-for-Tat" strategy is the most beneficial strategy an individual can adopt in the long run, suggesting that with repeated interactions, such as those occurring within teams in the healthcare sector, consistent cooperation (unless

defected against) yields optimal results for the individual. The experiment also suggests that this could lead to a self-selection of a group comprised solely of "Tit-for-Tat" individuals, resulting in consistent cooperation and optimal outcomes. However, subsequent research has nuanced this idealised image of universal collaboration. Lee & Lee (2022) investigate conditions under which a degree of defection (non-cooperation) might enhance group performance. A slight defection can encourage the group to explore alternative solutions if the "cost" of defection is relatively low or the personal payoff substantial. Their paper found that when defection penalties were not overly severe, the highest group performance did not occur with 0% defection but with a small percentage of defectors. The intuition is that occasional dissent or competition within a group can stimulate critical thinking and prevent inertia. However, excessive defection leads to net negative results.

In addition to the decision to cooperate, a crucial factor is the power structure within the hierarchy. Cui (2015) provides insight into the significant impact of decision-making power on the outcomes of decisions made. A clear hierarchy can streamline decisions and help align incentives if the leader sets the right tone. However, when decision-making power is concentrated, the control of the decision is limited. When someone at the top of the decision hierarchy is biased, this can easily anchor the team on the wrong path and produce suboptimal outcomes (Mancuso et al., 2014). Research by Daily et al. (2024) suggests that specific, structured approaches to group decision-making outperform others. For instance, requiring each team member to present an independent assessment before group discussion can mitigate hierarchical dominance. These processes ensure that more information is considered and prevent early fixation. Another key insight from strategic group decision research is that the process of decision-making can matter more than the decision itself (Bekius et al., 2021; Cui, 2015). Process fairness and transparency contribute to team cohesion and effectiveness. If team members believe the decision process was fair (even if the outcome is not each individual's top choice), they are more likely to accept and commit to the group decision (Colquitt et al., 2001).

Every decision-making process in a press can be partly structured using rational economic models, but these models also influence irrational heuristics and biases. The following section will summarise the current literature on the intersection of these two fields of study.

2.3. Biases Related to Team Dynamics

While limited, there is literature on the relationship between biases and team dynamics. Hayibor and Wasieleski (2008) found that when individuals rely on the availability heuristic, their ethical decision-making can become skewed—they may assess scenarios based on easily recalled outcomes rather than through thorough analysis. If inevitable consequences or case histories are especially salient to several team members, these outcomes can dominate discussions in group settings. Regarding confirmation bias, Sobkowicz (2017) demonstrated that it could lead to polarisation, which the author refers to as a "frozen" belief. Such frozen beliefs stem from confirmation bias; when these beliefs differ between sub-groups, they can catalyse a split within the team and diminish the functional team dynamic.

Bounhez et al. (2023) reviewed interprofessional decision-making and observed that effective teams share and interpret information collaboratively, though biases can intervene. One insight from their work is that once an initial frame or narrative is established in a team, both confirmation and availability biases can combine to *amplify* that narrative. Team members will seek to confirm evidence and tend to recall and share anecdotes that support it. Dissenting information may become lost, particularly if it is complex or less eye-catching. Studies on diagnostic error have similarly pointed out that doctors often recall a recent dramatic case and unconsciously base their current diagnostic reasoning on it, sometimes leading to misdiagnosis (Mancuso et al., 2014). Monterey and Schultz (2019) indicate in their paper that even a team's boundaries affect biases. Their research highlights that ingroup favouritism can create a preference for cooperation within a team while curtailing favouritism for information from outside the group. The main theoretical concepts relevant to the paper are presented in the conceptual model in Figure 1 below. The conceptual model provides an overview of all the core concepts enabling this research to answer the research question.

Theoretical Construct	**Definitions/Key Concepts**	**Mechanism/impact on Team Dynamics**	**Key References**
Availability Heuristic	A cognitive shortcut is where individuals	In critical care teams, salient or recent cases	- Tversky & Kahneman (1974)

	estimate the frequency or importance of events based on the ease with which examples come to mind.	can be overemphasised, possibly skewing collective judgments.	- Gilovich & Griffin (2002) - Hayibor & Wasieleski (2008) - Bounhez et al. (2023)
Confirmation Bias	The tendency to seek, interpret, and remember information in a way that confirms pre-existing beliefs or expectations.	In critical care, teams focus on data or expert opinions that align with their initial assumptions, reinforcing existing group norms	- Nickerson (1998) - Sobkowicz (2017) - Bounhez et al. (2023)
Game Theory	A framework that models strategic interactions among actors to maximise payoff.	In critical care teams,	- Gibbons (1992) - (Luce & Raiffa, 1957)
Volunteer's Dilemma	It is a game in which each individual benefits if at least one person incurs a cost (volunteers), but everyone prefers someone else to volunteer.	Crucial interventions might be delayed during critical care situations if team members hesitate or assume someone else will step up. Hierarchy and cost structures can influence who eventually volunteers.	- Diekmann & Przepiorka (2015) - Murnighan et al. (1993)
Battle of the Sexes	It is a game in which two players have different preferences but benefit from a coordinated decision.	Specialists may each favour distinct approaches during critical care but still need a unified plan to optimise patient outcomes. Failure to coordinate yields worse results than choosing either approach.	- Osborne & Rubinstein (1994) - Rapoport (1997)

Principal-Agent Problem	The dynamic occurs when one party (the principal) delegates work to another (the agent) with information asymmetry and differing incentives.	In hospital settings, doctors (agents) and administrators (principals) may have conflicting objectives, such as allocating resources versus ensuring the quality of patient care. Misaligned incentives and information asymmetry can lead to suboptimal patient decisions.	- Braun & Guston (2003)
Team Dynamic	Behaviour and cognitive processes that guide team interaction include norms, leadership, and communication.	Communication, hierarchy, and shared mental models can amplify or mitigate cognitive biases. Teams facilitating open dialogue and diverse input arrive at better decisions under pressure.	- Klug & Bagrow (2016) - Zanin et al. (2023) - Oskouie et al. (2024)

Table 1: Conceptual model

3. Methodology

3.1 Research Design

This study employed a qualitative, interpretivist research design to explore how cognitive biases affected decision-making processes in paediatric intensive care units (PICUs) and how these processes matched or differed from predictions based on classical game-theoretical models. The research in rooted an interpretivist approach arose from the understanding that decision-making in high-stakes medical settings is a highly contextual, socially constructed process that cannot be fully grasped through purely quantitative or positivist methods (Creswell & Poth, 2018).

While classical game theory is based on the assumption of fully rational agents operating under fixed payoffs and complete or partial information (Osborne & Rubinstein, 1994), clinical decision-making in the PICU is influenced by a combination of objective clinical indicators, institutional frameworks, interpersonal dynamics, and psychological mechanisms such as cognitive biases. Understanding these dynamics requires a methodological approach capable of engaging with the meanings and interpretations that actors assign to their decisions, as well as the social interactions that influence those decisions in real time.

To address this need, the study employed the Gioia methodology (Gioia et al., 2013), which is specifically designed to structure qualitative analysis in a way that keeps close links to participants' language and experiences while gradually abstracting to higher-level theoretical categories. This method supported both inductive discovery, enabling unexpected patterns to emerge from the data, and deductive testing of theoretical propositions based on the Volunteer's Dilemma, the Battle of the Sexes, and the Principal–Agent problem, along with the confirmation bias and availability heuristic.

The research was therefore situated at the crossroads of theory-driven inquiry and exploratory investigation. Deductive coding was guided by the theoretical frameworks discussed in Section 2, while inductive coding allowed for the incorporation of novel insights from the interviews, even when they did not directly align with existing theoretical constructs. This dual approach maintained theoretical sensitivity while being attentive to empirical

complexity, resulting in a richer and more nuanced understanding of how cognitive biases function in practice.

3.2 Data Collection

The empirical material was gathered through semi-structured interviews, a method well-suited to eliciting detailed accounts of complex experiences while providing space for participants to introduce new relevant topics (Patton, 2015). An interview guide (Appendix A) was created based on the theoretical frameworks described in Section 2. This guide ensured all interviews addressed core topics such as perceptions of responsibility, consensus-building processes, communication with non-medical stakeholders, and how past cases influence current decision-making. At the same time, the semi-structured format allowed for flexibility, enabling the interviewer to explore relevant leads that participants spontaneously raised.

3.2.1. Participants

Participants were selected through purposive sampling, a non-probability approach designed to ensure the sample included sufficient variation to capture a range of perspectives. The aim was conceptual richness: by including individuals from different professional roles, levels of experience, and institutional contexts, the study aimed to identify patterns that persisted across roles while also recognising role-specific differences. Recruitment targeted three Western European hospitals with established paediatric intensive care units: Ghent University Hospital in Belgium, Radboud University Medical Center in the Netherlands, and Maastricht University Medical Center in the Netherlands.

The final sample consisted of six participants, distributed across these three sites. Table 1 provides an overview of the participant characteristics.

Participant Code	Role	Institution	Country	Year of Experience
P1	ICU Physician	Ghent University Hospital	Belgium	6 years,a children's intensivist
P2	ICU Physician	Radboud University Medical Center	Netherlands	6 years as a children's intensivist
P3	ICU Nurse	Radboud University Medical Center	Netherlands	7 years on children's IC
P4	ICU Nurse	Radboud University Medical Center	Netherlands	25 years
P5	Medical Trainee (Clinical Student)	Maastricht University Medical Center	Netherlands	2,5 years
P6	Medical Trainee (Clinical Student)	Maastricht University Medical Center	Netherlands	2 years

Table 2: Participant list

Interviews were conducted either face-to-face at the participants' workplace or through video conferencing platforms, depending on logistical constraints and the participants' preferences. The interviews lasted from 45 to 90 minutes. All interviews were audio-recorded with the participants' informed consent and then transcribed verbatim. Transcriptions were checked against the recordings for accuracy.

To ensure the validity of the research instrument, the research question and interview guide were reviewed twice: first by a professor with expertise in game theory to verify conceptual and technical accuracy, and then by a practising PICU physician to confirm medical relevance and feasibility. This dual review process improved both the theoretical strength and the contextual suitability of the data collection tool.

3.3 Operationalisation

The operationalisation of theoretical constructs was guided by the frameworks outlined in Section 2, with detailed mappings provided in Appendix B. Essentially, each of the three game-theoretical models was adapted to the PICU context, combined with cognitive biases, resulting in a set of observable indicators for deductive coding. The Volunteer's Dilemma concerns the Battle of the Sexes, the Principal-Agent problem, confirmation bias, and the availability heuristic. While these operational definitions provided a deductive basis for coding, the Gioia methodology also supported the development of inductive categories. For example, although "information asymmetry" was an expected theme within the Principal–Agent framework, inductive analysis uncovered an additional nuance.

3.4 Data Analysis

The data analysis followed the systematic approach outlined by Gioia et al. (2013), ensuring that the connection between raw data, emerging concepts, and the final theoretical

contribution was transparent and traceable. All interviews were transcribed verbatim and analysed in multiple iterative stages.

The initial stage involved familiarising oneself with the content, where each transcript was read several times to develop a general understanding of the material. During this phase, key quotes, provisional codes, and brief analytical memos were documented in an Excel file. This early mapping served as a form of content mapping (Visser et al., 2005), enabling patterns, recurring themes, and notable differences to become apparent. Next, first-order coding was performed. These codes were kept as close as possible to participants' own words to maintain authenticity and avoid premature theoretical interpretation. This led to a broad range of descriptive codes, many of which reflected the participants' own phrasing and perspectives. In the second stage, second-order themes were created by grouping related first-order codes. At this point, theoretical constructs from the literature, particularly the Volunteer's Dilemma, Battle of the Sexes, Principal–Agent problem, Availability heuristic, and Confirmation Bias, were used to guide interpretation. This stage also incorporated inductive findings that expanded or refined existing frameworks. The final stage integrated these themes into overarching dimensions aligned with game-theoretical models and cognitive biases. This process involved continuous comparison between the empirical data and the relevant literature, ensuring each dimension was both theoretically significant and firmly rooted in the data.

To improve clarity, a colour-coding system was used during the analysis. Each first-order code was given a unique colour, which was consistently applied across transcripts and analytic documents. This visual organisation provided a clear overview of how raw data fragments developed into second-order themes and broader categories. The colours served as visible links between the interview material, inductive coding, and deductive theoretical categorisation, ensuring the analytical process remained systematic and easy to verify. The full coding tree, previously presented in Appendix C, is now included in the main text (see Figure 4) to facilitate readers' understanding of the progression from first-order codes to higher-level categories.

3.5 Validity and Reliability

Validity in qualitative research concerns how effectively a study captures the phenomena it aims to explore (Lincoln & Guba, 1985). In qualitative research, it relates to credibility, transparency, and reflexivity. External validity, also known as transferability, depends on providing sufficient contextual detail for readers to assess the relevance of findings to other settings (Patton, 2015). To ensure validity, this study employed triangulation, member checking, and external auditing. Triangulation was achieved by gathering data from various professional roles and institutions, ensuring that the results reflected diverse perspectives.

Reliability in qualitative research emphasises transparency and consistency in the research process (Gioia et al., 2013). This was achieved by keeping detailed documentation of the coding. A reflexive stance was maintained throughout, with the researcher actively re-evaluating their choices over time, and bubble checks were carried out to guide decisions. A comprehensive codebook was used to ensure consistency in coding, and iterative comparisons between data and emerging themes helped uphold analytical rigour. Feedback from peers with expertise in qualitative methods and healthcare decision-making further improved the confirmability of the findings.

3.6 Ethics

Ethical considerations followed the principles outlined by Kaiser (2009) for protecting participant confidentiality in qualitative research. All participants received detailed information about the study's aims, procedures, and their rights, including the right to withdraw at any stage without consequence. Written informed consent was obtained prior to data collection. Additionally, three months after finishing this research, all data will be removed from personal devices.

Anonymity was maintained by removing identifying information from transcripts and replacing participant names with pseudonyms or codes. Data were stored in encrypted files on password-protected devices, in compliance with the General Data Protection Regulation (GDPR). Given the sensitive nature of PICU decision-making, particular care was taken to

ensure that discussions did not cause undue emotional distress. Participants were reminded that they could decline to answer any question and could pause or stop the interview at any time.

4. Results

This section answers the main question: *"How do the availability heuristic and confirmation bias influence team dynamics in critical care?"* The main dimensions were defined deductively, while some themes emerged both deductively and inductively from interview coding. The first-order codes, also identified inductively, are detailed below.

4.1. Team Dynamics

This study models team dynamics across three hospitals using three game-theoretical scenarios, analysing decision-making about life-sustaining measures for children with head trauma. These scenarios include assigning responsibility, resolving disagreements, and communicating with non-medical stakeholders, employing the Volunteer's Dilemma, Battle of the Sexes, and Principal-Agent problem. Actor actions are influenced by both game rules and broader hospital protocols. The next section reviews these three decision-making games.

4.1.1. Volunteers' Dilemma

The Volunteers' Dilemma models situations where one actor bears the cost of a decision, either due to authority, responsibility, or better knowledge (Diekmann & Przepiorka, 2015). This relates to team dynamics. The analysis led to the following themes: 'Structure based on Information' and 'Responsibility Assignment'.

4.1.1.1. Structure based on information

It became evident that the level of authority in decision-making was closely linked to the amount and type of information a team member held. One co-student (P5) explained that "*the rest of the team also logically relies on that information and on that doctor's opinion. So it's not coming from a "I know better" stance; it's more that I have more information, more tools to explain to you why I'm making this choice."* This emphasises how authority in paediatric ICU decision-making is not simply a matter of formal hierarchy, but also of informational capital. Those with more complete, case-specific data naturally influence the course of discussions, not through competitive assertion of expertise, but because the team recognises their superior ability to justify and contextualise choices.

The same principle applies to those more deeply involved in a case. Another co-student (P6) noted that "*you can clearly see that the lead clinician for a child like that, often the one doing the admission and the initial conversations with the parents, is understandably, much more involved."* Here, involvement in the early and most critical stages of care creates a form of situational authority. The lead clinician accumulates both medical facts and contextual understanding of the patient's trajectory, which in turn positions them as the logical decision-maker.

A head physician (P1) further emphasised that this authority also derives from broader medical knowledge, stating that*, "of course, stems from your solid knowledge of this particular subject… However, in principle, I believe that having more information also gives you more say. And I think that applies broadly, if you have more knowledge, you're, in principle, better entitled to make a given decision."* These excerpts clearly illustrate that the person who should take responsibility or has the authority to act is often largely determined by the amount of information available to them.

Interviews show that authority in paediatric ICU decision-making depends less on hierarchy and more on informational capital. Those with the most detailed, case-specific knowledge lead discussions because their insights are based on medical data and context. The team sees this as a logical result of their greater ability to explain and justify decisions.

4.1.1.2. Responsibility Assignment

The Volunteer's Dilemma describes situations where it is unclear who should take responsibility, potentially delaying action until someone steps forward. In the paediatric ICU context studied here, interviews indicated that such ambiguity is rare due to the clear delineation of responsibilities. As one physician (P1) explained, "*Usually the responsibilities are clear: if a patient is on our ward, we're responsible for them, so ultimately all decisions and everything that's done goes through us."* Another doctor (P2) echoed this sentiment, noting simply that "*the person who carries the responsibility is always clear."* This clarity of role allocation appears to be embedded in both formal protocols and the unit's culture, ensuring that decision-making chains are well understood. The data suggest that the clear assignment of responsibility significantly reduces the likelihood of a Volunteer's Dilemma

occurring, in contrast to some accounts in the literature that depict such role ambiguity as a frequent problem in healthcare.

When the rare situation does occur where someone must step forward, the decision usually follows an informal yet consistent rule: the person with the most relevant information, whether from their medical expertise or specific case knowledge, takes the lead. This reflects an information-driven hierarchy that matches responsibility with competence and involvement, thus further shielding the team from hesitation or indecision.

4.1.2. Principal-Agent Problem

This section examines the Principal-Agent problem in paediatric ICU care, focusing on reducing information asymmetry and aligning incentives to prioritise the child's welfare. The next subsections address each in turn.

4.1.2.1. Information Asymmetry

In classical Principal–Agent theory, information asymmetry is a key feature and a common source of tension: those with expert knowledge (the agents) hold crucial details that principals, often patients or their families, may not fully access or understand (Braun & Guston, 2003). In the paediatric ICU context studied here, both the team's structure and its culture are explicitly designed to reduce these gaps, although they cannot be entirely eliminated.

A key technical tool in reducing asymmetry is the electronic medical record. As one physician noted (P1), in that sense, there isn't much informational asymmetry on my end. Another elaborated that, *"especially nowadays with electronic patient records, that kind of information is just very well available."* However, they also highlighted an inherent limitation: *"When I talk with parents, I write up a report. Speaking with the parents is different from reading the report, because the actual conversation I had… so that's really something. But I think that's an asymmetry that will always exist everywhere."* This observation points to a structural reality: while digital records provide transparency and consistent access, they cannot fully capture the tone, emotion, and subtleties of sensitive conversations. As one nurse (P3) explains, *"A similar sentiment was echoed by a nurse, who*

noted that documentation is often very matter-of-fact… usually noted point by point: 'By Dr. XYZ it was decided to stop treatment' with little emotional nuance."

Therefore, although the unit's processes and tools significantly narrow the information gap predicted by the Principal–Agent model, they cannot entirely eliminate the qualitative differences between experiencing an interaction directly and accessing it through written records. This remaining asymmetry is not a flaw of the system but a reminder that human communication involves elements that cannot be fully written down. The nature and bearer of information can also change depending on the context. As one student (P6) described, good news is often delivered directly by the nurse: *"I think it really depended on whether it was good news or bad news, because if it was good news, it was often just the nurse who went into the room. Since you all had single rooms, you were alone with the patient and the parents, and the nurse would more often be the one to tell," them, like, 'Hey, I'm here on behalf of his doctor to share this with you. We have good news, this is what the scan showed."* This highlights a subtle hierarchy and division of communicative labour: nurses and doctors collaborate to ensure families receive timely updates, while the most sensitive or complex information is reserved for direct conversations with the physician. Taken together, these findings reveal a nuanced reality: while the traditional Principal-Agent model suggests that information asymmetry can be a potential source of misunderstanding or mistrust, the structures and protocols of the ICU, such as digital documentation, transparent team meetings, and ongoing family engagement, reduce many issues typical of this traditional dynamic.

Interviews show that paediatric ICUs try to reduce information asymmetry by clear documentation and coordinated communication among staff. These tools offer broad access but can't fully capture the tone and nuance of sensitive discussions. Some asymmetry remains, not as a flaw but as an inherent part of human communication.

4.1.2.2. Efforts to align incentives

A central theme from the interviews is the remarkable effort paediatric ICU teams make to align the goals and incentives of all stakeholders, especially the medical team, the patient, and the patient's family. In traditional Principal–Agent theory, misaligned incentives are expected: the "agent" (clinician) may not always act in the best interest of the "principal"

(patient or family), and vice versa, leading to tension and mistrust. However, in the ICU, the data reveal a much more collaborative and ethically nuanced reality, where negotiation, respect, and open communication are standard.

This collaboration is based on a clear priority: the child's welfare. As one doctor (P2) said, *"we see that parents often think in terms of themselves, not of the child. And we will always seek to be advocates for the child, making the choice that, as a team, we believe is best for the child."* This stance is not about dismissing parental wishes but about recognising the complexity that occurs when parental hopes or fears differ from medical judgement.

Understanding the family's values is seen as essential to bridging this gap. One doctor (P2) explained *"what the family wants, how you give information, and how that information is received… there are several things you need to take into account, such as, for example, their beliefs."* These non-medical details, such as religious beliefs or cultural viewpoints, help the team understand what the family considers to be a possible quality of life for the child.

While collaboration remains consistent, the degree of decision-making authority granted to families varies across institutions. In some cases, boundaries are clearly defined, as one doctor (P2) emphasised, *"we don't see the parents as owners of the child."* Another noted that if a parental decision is clearly against the child's best interests, as supported by the quote, *"Then we have the parents removed from parental authority.*" In other settings, families are given greater latitude; as one co-student (P5) recounted, *"Yes, the parents say, this is definitely quality of life. We've just grown into this. And for us, it's really important. Even if he smiles just once a day, that makes our day. Then we can think, all right, whatever. Yes, exactly. So there's a lot of involvement with parents… it's really always, actually always, in consultation with family."* These findings suggest that, unlike the adversarial tension anticipated by the classical Principal–Agent model, paediatric ICU teams operate within a culture that anticipates differences and addresses them through sustained dialogue. Disagreement is not seen as a breakdown of the relationship but as part of a process of ongoing engagement, mutual understanding, and shared decision-making. When consensus cannot be reached, decisions are still made with clarity, compassion, and a steadfast focus on the child's best interests.

Bottomline interviews show paediatric ICU teams actively align goals with clinicians, patients, and families, prioritising the child's welfare. While decision-making authority varies, disagreements with families are managed through ongoing dialogue and mutual understanding.

4.1.3. Battle of the Sexes

The Battle of the Sexes models scenarios where participants encounter coordination challenges, especially when team members have conflicting preferences or priorities, which significantly affects team dynamics. The analysis identified two main themes: 'Consensus Building' and 'Hierarchy in Team Composition'.

4.1.3.1. Consensus Building

A central challenge in paediatric ICU decision-making is reaching consensus among professionals with different specialisations, perspectives, and priorities. The interviews reveal that consensus-building is both a goal and an ongoing process, requiring sustained effort and open dialogue. As one physician (P1) explained, *"in principle, you simply try to resolve it through dialogue, exchanging arguments with each other, and then, depending on whether you reach a consensus, ultimately someone has to make the final call."* This comment highlights two features of the PICU's approach: a clear commitment to open exchange, encouraging everyone to share perspectives regardless of hierarchy, and recognition that consensus, although ideal, may not always be achievable; in such cases, a decision-maker finalises the course of action. This balance between inclusivity and decisiveness reflects a pragmatic understanding of the ICU's high-stakes environment, where time, clarity, and unity are essential.

Multidisciplinary meetings (MDOs) are the crucial setting for this process. They allow physicians, nurses, and other specialists to present information, express concerns, and determine the best course of action. The dynamic closely resembles the "Battle of the Sexes" game, where the goal is not just to be "right," but to reach a single, mutually supported plan. One doctor (P2) remarked, *"only when everyone is completely 100% behind the chosen plan do we carry it out."* This highlights the importance of unified action in such high-stakes situations. However, specialisation can create challenges. A nurse observed that *"consultants often focus only on their own piece,"* which can hinder the integration of perspectives. This is

addressed by intentionally involving nurses in MDOs, ensuring their bedside observations are properly considered. As one nurse (P4) noted*, "we can sometimes point out things a doctor might not actually see."* These contributions help bridge potential blind spots in decision-making, ensuring the plan reflects both medical and practical realities of patient care. Once decisions are made, there is a strong professional norm of public alignment, even if initial preferences differed. A physician (P2) used a metaphor: *"we're deciding whether to go to a restaurant or cook at home… my preference was actually to cook at home. But now we're going out to eat, and I'm not going to spend the whole journey to the restaurant wishing I'd stayed home. Another added that it's vital for the team to speak the same language and deliver a united message…*" This emphasises the dual audience for consensus: internally, a consistent stance prevents friction among colleagues; externally, it ensures families receive clear communication even if the approach wasn't everyone's initial choice.

Consensus is not fixed; it is strengthened through moments of reassessment. Teams revisit their decisions based on new data and changing patient conditions. As one physician (P1) explained, *"In a few days, there might be a new moment to reassess: 'Okay, where do we stand now? What has this time given us? What information has it yielded, and how does that affect our current view of the prognosis?"* This quote shows that decisions are considered temporary, with time helping to inform judgment. Reassessment is used to gather new evidence, ensuring the plan stays suitable and adapts to the patient's changing condition.

In summary, consensus-building in the paediatric ICU is a collaborative, iterative process based on multidisciplinary expertise, transparent communication, and ongoing reassessment. Although the process can be slow and sometimes cumbersome, it acts as a deliberate safeguard, ensuring that decisions are not only clinically sound but also widely supported, clear, and aligned with the child's best interests.

4.1.3.1. Hierarchy in Team Composition

Hierarchy within the paediatric ICU team influences coordination, affecting how input is valued and decisions are made, despite efforts for free contribution.

Physicians openly recognise that hierarchical dynamics are unavoidable, even as they emphasise deliberate efforts to lessen their impact. One physician (P1) explicitly reflected on

this balance: *Interview: "Is there a barrier to speaking up?" Physician: "Yes, I think that's how it's experienced, so absolutely… So exactly what you're saying about those hierarchical relationships, they're always there, of course."* This statement demonstrates a clear awareness among physicians that hierarchical structures exist, yet they actively create opportunities for open discussion and shared decision-making. The same physician (P1) reinforced this idea, stating: *"I need to be open to correction, and there must be room for that. Especially for everyone to have input, so what we very often do, even in these situations, is explicitly provide space for everyone involved to share their opinion on it."* These deliberate efforts indicate an institutional recognition that hierarchy can impede open communication if not carefully managed.

However, despite these proactive measures, hierarchy remains a practical factor in decision-making. Nurses (P3) especially highlighted this tension, noting that hierarchy can sometimes limit communication: *"I think there are two things. I think hierarchy and the culture of speaking up are always somewhat of an issue… Their existence itself acknowledges that, despite good intentions, hierarchy might restrict full participation and honest communication during regular team meetings."* While everyone on the team recognises the ideal of openness and addressability, regardless of formal status, the reality remains complex. Not every voice carries equal weight, nor is every team member equally empowered to challenge the dominant perspective, especially when that perspective originates from senior clinicians. The implicit and explicit recognition of these hierarchical boundaries ensures orderly decision-making.

In summary, hierarchy in ICU teams is acknowledged and managed, with mechanisms such as moral deliberations and requests for input countering its silencing effects. Hierarchies influence decisions, shaping coordination challenges and outcomes.

4.2. Biases

4.2.1. Availability heuristic

This section examines the availability heuristic in paediatric ICU decision-making, focusing on how past cases and emotional salience shape clinical judgment.

4.2.1.1. Case-based Reasoning

Within the paediatric ICU, decisions are seldom made in isolation. Clinicians rely on memories of previous cases, especially those with unexpected or extraordinary outcomes, a phenomenon consistent with the availability heuristic. These vivid memories influence perceptions of what is achievable, subtly affecting prognosis and treatment choices.

Several physicians acknowledged that unexpected recoveries often leave a lasting impression, fostering a cautious yet optimistic outlook. One explained (P1), *"Statistically speaking, we've been surprised more often by how well things still turned out for children. In hindsight, that makes us lean towards optimism…"* This quote shows how past unexpected recoveries promote a careful yet hopeful outlook. Instead of seeing poor prognoses as final, clinicians are reminded that outcomes can beat expectations, prompting them to keep treatment options open longer and avoid dismissing interventions too early.

Importantly, this influence does not fundamentally change protocols. As another doctor (P2) said, *"Has that influenced us? Yes and no; it hasn't changed our strategy, but it has influenced our approach to neurological interventions."* Here, the availability heuristic does not weaken rationality; instead, it prompts re-evaluation of intervention thresholds, ensuring the team stays alert to possibilities beyond the most likely outcome.

Nurses offered a more pragmatic perspective. Since their contact with patients usually ends once the child leaves the ICU, memories of cases tend to fade unless the outcomes are particularly remarkable. As one nurse (P4) noted, *"Once they leave here, they kind of disappear from our view."* This detachment helps keep focus on the current case, lowering the risk of overemphasising exceptional stories. Nevertheless, the positive emotional residue of successful cases can still influence expectations in similar situations.

From the perspective of medical students (P5), such vivid memories can be especially uplifting in moments of uncertainty. *Interviewer: "Not putting words in your mouth, but you might say that it actually gives you a hopeful outlook in a dire situation, making you think, 'Oh yeah, it really can work out.'" Interviewee: "Yes, definitely, definitely."* This exchange shows that recalling positive outcomes boosts emotional strength and motivation during

tough cases. Even without changing the facts, this hope helps them stay involved, think creatively, and persevere through difficult decisions.

Yet clinicians remain cautious about the potential pitfalls of case-based reasoning. As one physician (P1) warned, *"...The scenario in which the child does better than we feared is the most precarious one*." Precisely because it tempts teams to over-generalise from rare successes. The prevailing attitude in the ICU is to balance these memorable cases with objective assessment, ensuring that hope is grounded in evidence rather than anecdote.

In summary, the availability heuristic in the paediatric ICU does not lead to reckless optimism or stray from established practice. Instead, it promotes a balanced approach, blending statistical reasoning with practical clinical experience, allowing for the unexpected while preserving the quality of decisions.

4.2.1.2. Emotional Salience Shaping Judgment

A more subtle aspect of the availability heuristic in the paediatric ICU concerns how emotional salience influences clinical judgment. Although not the most prominent finding, interview data suggest that strong emotional impressions can unconsciously influence subsequent perceptions and decisions.

One medical student (P5) acknowledged this effect, agreeing that *"The first impression you get in that situation actually matters quite a lot for how you're going to engage with it for the rest of the time."* Such early judgments are not made in isolation; they are reinforced by the emotional weight of the patient's initial presentation, which can set the tone for later assessments.

Communication style further enhances or reduces these effects. As one doctor (P1) noted, "T*he words you choose give a slightly different connotation, and even a small change in intonation has its effect. It all plays together."* Here, emotional salience is influenced not only by the medical facts but also by how those facts are framed through language, tone, and delivery. This framing can subtly influence how information is received and prioritised, even among experienced clinicians.

Although these influences seldom override protocols or evidence-based reasoning, their combined effect can subtly steer the team towards particular interpretations or levels of caution. By recognising how first impressions and framing operate in practice, ICU teams can deliberately protect against unintended bias, ensuring that initial emotional reactions do not unduly influence the trajectory of care.

4.2.2. Confirmation Bias

This section explores confirmation bias in paediatric ICU decision-making, examining how initial impressions or early statements can act as anchors that shape subsequent discussions, and how the team's culture of openness to adjustment works to counterbalance this effect.

4.2.2.1. Anchoring

Within critical care decision-making, anchoring bias, where early information disproportionately influences subsequent judgments (Tversky & Kahneman, 1974). This manifests in the PICU as a subtle influence. While the environment values open dialogue and multidisciplinary perspectives, interviews reveal that the initial framing of a case can establish a reference point that quietly guides later discussion.

Often, this process starts with the initial diagnostic steps. One doctor (P1) explained that *"When a patient arrives, we perform urgent interventions, then conduct a brain scan. That can reveal something that makes us ask: is this even treatable? Can we treat it or not?"* This quote illustrates how such early assessments can set boundaries for what is considered possible. Once a preliminary plan is suggested, further discussion often takes place within the limits of that initial framework.

Authority dynamics intensify this effect. As one doctor (P1) noted, *"depending on who is primarily responsible, whether I'm the one on the ward or my colleague is, that can influence the discussion."* This quote demonstrates how primary responsibility endows a clinician with greater influence, with their expertise and role naturally guiding how the team frames and discusses options. When a senior or especially knowledgeable clinician voices an opinion first, their stance tends to carry more weight, not only because of perceived expertise but also due to relational deference within the team. This makes challenging the initial position less likely, even when alternative interpretations are available. Clinicians themselves are acutely

aware of this pull. One admitted (P1), *"If the first opinion voiced is that we should all do something… then that's the initial view that emerges. I also notice in myself that when the first opinion is on the table, there's a tendency to go along with it because it becomes the central norm."* Another physician explicitly agreed with the interviewer's observation that such statements *"put down a kind of anchor… deviating from it requires a higher threshold."* This highlights both the cognitive and social dimensions of anchoring: it is not just about flawed mental shortcuts, but also about the implicit norms formed once an authoritative voice has spoken.

In practice, this means that even in an environment dedicated to discussion, the initial framing, especially by a high-status team member, can limit the range of options. The challenge is recognising when an anchor is restricting thinking and new evaluations. Without such safeguards, anchoring can subtly narrow the variety of choices considered, potentially affecting the accuracy and fairness of critical care decisions.

4.2.2.2. Openness to adjustment

A key feature of the paediatric ICU, as highlighted in the interviews, is the team's continuous willingness to reassess. Instead of adhering to initial impressions, clinicians remain receptive to new data, clinical developments, and family perspectives. This flexibility functions as a safeguard against confirmation bias, ensuring that decisions evolve as the patient's condition changes.

As one doctor (P2) said, *"new information is always coming to light, right? It's never a single static moment. New information keeps emerging, and therapy adapts to that as we go forward."* Even in cases where the focus has shifted to comfort care, monitoring and reassessment continue. *"It's not as if we stop observing… our constant aim is the child's quality of life, and any new information that arises or changes is interpreted in that light."* This quote exemplifies a mindset ensuring no significant change goes unnoticed.

The same principle applies when initial information is limited. Instead of rushing into irreversible decisions, the team patiently takes their time to gather more evidence, including additional tests, consultations, and the possibility of unexpectedly positive outcomes. As one intensivist (P2) stated, *"if medically feasible, we leave a window for the child's recovery to*

show better than predicted when evaluating injury severity." This openness is supported by collaborative decision-making. Major judgments are rarely made alone. Such as is supported by this quote (P1) *"The team comes together, we try to bring all the information to light, and then together we make an initial assessment of what we think, whether we believe it's worthwhile or not."* This shared process allows assumptions to be challenged and interpretations to be tested from multiple perspectives, reducing the risk of individual bias influencing the outcome.

In summary, the PICU's openness to change is built into both its protocols and its culture. This ongoing willingness to update plans based on new evidence keeps the patient's developing needs at the heart, encouraging not only clinical precision but also ethical transparency in some of the most challenging decisions in medicine.

4.3. Relation between the Biases and Game theoretical games

The findings reveal distinct interactions between biases and each game. The Battle of the Sexes scenario demonstrated a clear link with both cognitive biases, especially through case-based reasoning and anchoring. Memorable past cases subtly guided clinicians towards cautious optimism. The initial assessments often formed a basis for subsequent discussions, affecting how alternative information was incorporated into clinical decision-making. Nonetheless, deliberate openness to ongoing reassessment, structured multidisciplinary meetings, and explicit reflection points were consistently employed to minimise these effects.

Conversely, in the Volunteers' Dilemma scenario, biases were significantly reduced through clearly defined hierarchical responsibilities and protocols that explicitly assign authority based on information and clinical expertise. Specifically, structured emergency procedures and explicit role assignments minimised ambiguity around responsibility, leaving little room for heuristic-driven indecision or emotional anchoring.

Similarly, in the Principal–Agent scenario, information asymmetry was systematically addressed through careful documentation within electronic patient records, frequent and transparent communication with families, and consistent efforts to align medical decisions with familial values and expectations, thereby significantly reducing misaligned incentives and distorted perceptions.

5. Conclusion

This thesis explored how the availability heuristic and confirmation bias influence team dynamics in paediatric critical care decision-making. Game theoretical frameworks such as the Volunteers' Dilemma, Battle of the Sexes, and Principal–Agent models are employed to simulate this decision process. Through a literature review and thematic analysis of interviews from three paediatric ICUs, data were analysed both deductively and inductively using the Gioia methodology and mapped onto these scenarios.

This research explicitly builds on the theoretical foundations outlined in Chapter 2 by empirically verifying how biases can distort ICU interactions and clinical judgments. Instead of merely claiming that formal protocols protect interactions, the findings specifically identify practices such as hierarchical clarity in emergency interventions (Volunteers' Dilemma), comprehensive family engagement combined with transparent digital documentation (Principal–Agent), and ongoing internal reflection that effectively counteract these cognitive biases. Conversely, the Battle of the Sexes remains comparatively more vulnerable to heuristic influence due to the emotionally charged nature of initial assessments and interpersonal anchoring dynamics within multidisciplinary decision-making. Although continuous reflection on the process and information helps to reduce many of these risks.

By mapping themes identified both deductively and inductively onto game-theoretical frameworks, this study connects abstract theoretical concepts with real-world paediatric ICU decision-making. While Section 2.3 outlined the mechanisms of the Principal–Agent problem, the Volunteer's Dilemma, and the Battle of the Sexes in general terms, the current findings demonstrate how these dynamics manifest in practice. For instance, it shows how information asymmetry is lessened through electronic patient records, how structured consensus-building helps overcome coordination challenges, and how assigning responsibilities can limit the Volunteer's Dilemma. In doing so, it offers a deeper understanding of how these games and biases influence decision-making in paediatric ICUs.

6. Discussion

This thesis examines how the availability heuristic and confirmation bias influence decision-making in paediatric critical care teams, particularly regarding the continuation or withdrawal of life-sustaining treatments. Analysing three game-theoretic scenarios from interviews in three paediatric ICUs uncovers detailed patterns.

In the Volunteer's Dilemma, hierarchy reduces biases by lowering ambiguity and emotional influence. In the Battle of the Sexes, stories and opinions act as anchors, but structured meetings and reflections counteract them. In the Principal–Agent scenario, communication and ethics discussions narrow information gaps, align interests, and reduce conflicts.

6.1 Theoretical Implications

This research aims to enhance existing theoretical frameworks by incorporating detailed psychological mechanisms within normative game theory. It clearly identifies specific interventions and practices, demonstrating how these targeted mechanisms (e.g., multidisciplinary meetings, frequent reassessments, structured communications) alter biased perceptions, thus bridging theoretical predictions and actual decision-making behaviours observed in clinical settings.

This study contributes theoretically by showing how cognitive biases interact with, rather than wholly replace, the assumptions of classical game theory. In the Volunteer's Dilemma, hierarchical structures and predefined roles alter classical payoffs, reducing perceived uncertainty and personal costs linked to decision-making responsibility. This aligns with the theory's prediction that actors weigh personal costs against collective benefit. However, unlike traditional models (Murnighan et al., 1993), clinicians in this context do not rely heavily on emotionally vivid anecdotes to guide action, as structured emergency protocols reduce the salience of such biases.

In coordination games akin to the Battle of the Sexes, this study confirms the theoretical prediction that equilibrium selection often depends on salient focal points (Osborne & Rubinstein, 1994). In practice, however, these focal points are not purely structural or pre-agreed signals; they are frequently influenced by emotionally resonant past cases and initial impressions. These experiences anchor discussions and guide consensus-building, steering

teams towards cautious optimism. This marks a subtle yet important departure from classical models, where focal points are assumed to be neutral or strategically pre-defined rather than emotionally charged.

Regarding the Principal–Agent model, this study confirms the classical prediction that decision-making authority often follows the distribution of information, those with greater informational capital naturally hold more influence (Bolton & Dewatripont, 2004). However, unlike the adversarial tension often implied by traditional models, the paediatric ICU setting demonstrates how structured mechanisms, such as detailed digital documentation, routine ethics consultations, and proactive communication, can align clinician-family incentives and significantly reduce informational gaps. This shifts the dynamic from potential conflict to cooperative, integrative decision-making, showing that information asymmetry does not inevitably lead to mistrust when managed through deliberate institutional practices.

6.2 Practical Implications

Pediatric ICUs already have strong protocols that effectively address the Volunteers' Dilemma and Principal–Agent challenges. These structured procedures ensure that information gaps are minimised and incentives are well aligned, leaving little scope for these situations to cause significant decision-making issues. The data from interviews confirms that clear hierarchical roles, systematic documentation, and transparent communication practices sustain decision quality and coordination.

The area with the greatest potential for refinement is the Battle of the Sexes context, although even here, the decision-making process is generally robust. The most notable suggestion from interviewees was for each clinician to prepare an individual written assessment of the case before multidisciplinary meetings. This could help prevent early anchoring on the first opinion voiced, allowing a wider range of perspectives to be considered before group discussion.

The availability heuristic remains the most noticeable bias in this context, as vivid past cases often shape current decisions. Interestingly, this influence usually fosters a more optimistic outlook, prompting teams to offer patients more recovery opportunities than initial

assessments might indicate. While not inherently problematic, its effect on expectations can be managed by intentionally incorporating structured second opinions, formal reassessment points, and documented criteria for prognosis updates. These measures help ensure that optimism is regularly tested against objective clinical indicators.

Maintaining strong communication structures and adding targeted measures, like pre-meeting independent assessments via an online documentation system, can improve decision quality. Each medical team member completes a written assessment before the MDO, preventing bias and promoting open discussion. Recognising how past experiences influence judgments helps foster deliberate, balanced reasoning without losing the positive bias that benefits patient care.

6.3 Limitations and Future Research

The generalisability of the findings is limited by a small, Western European sample of four medical professionals and two students from paediatric ICUs with similar resources, ethics, and norms. These factors may differ in adult ICUs, non-Western healthcare systems, or other hospital hierarchies, potentially affecting bias mitigation effectiveness. Additionally, retrospective semi-structured interviews may introduce recall bias, where participants distort or selectively remember events, and social desirability bias, where responses are shaped to present oneself more favourably. Future research with direct observation and real-time recordings could better assess bias.

From a theoretical perspective, this study adapted the Volunteer's Dilemma, Battle of the Sexes, and Principal–Agent problem from prior healthcare modelling research in a different context, specifically the paper by Geurts et al. (n.d.). While the Battle of the Sexes and Principal–Agent problem aligned well with observed decision-making patterns, the Volunteer's Dilemma was less directly applicable than expected. In theory, the dilemma involves individuals incurring a cost to benefit the group, but in this ICU setting, clear role division and predefined responsibilities largely eliminated the "volunteering" aspect.

Although some elements of shared responsibility still aligned with the model, the fit was only partial, and a different game-theoretical framework, perhaps one that better captures distributed yet interdependent decision-making authority, might have offered a closer conceptual fit. This emphasises the importance of iterative model selection in applied game-theoretical research.

Qualitative methods uncovered how cognitive biases subtly arise in the paediatric ICU, capturing subtleties in communication, decision framing, and emotional dynamics that purely quantitative approaches might miss. However, they struggle to show how frequently these biases occur or quantify their effect on patient outcomes. Quantitative methods can address this by establishing prevalence, testing statistical relationships with clinical results, and measuring effect sizes. Therefore, mixed-method designs combine contextual depth with precise, evidence-based evaluation.

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8. Appendices

Appendix A

Interview Protocol: Cognitive Biases and Team Dynamics in Critical Care Decision-Making

(English)
Introduction by the interviewer:

- In this research project we aim to better understand complex decision-making in care teams in pediatric IC units in the Netherlands (Radboudumc) and Canada (Western University). We use game theoretical concepts as the theoretical lens in this research project.

- This interview aims to explore the effect of cognitive biases (Cognitive bias refers to systematic judgment errors that arise from irrational thought processes, which can lead to distorted perceptions of reality), which are specifically the "availability heuristic" and "Confirmation bias", and team dynamics.
- Include a short introduction on game theory, cognitive bias
- The interview consists of three parts: introduction about your role in decision-making at pediatric IC (part 1), cognitive biases (part 2), team dynamics (part 3).
- Informed consent, recording, ect

Introduction by interviewee

1. Could you give a short introduction of yourself, related to your role as a healthcare professional?
    a. Are you a medical/nursing trainee?
    b. Including job description and specialisation
    c. For how long have you been practising this profession
    d. What is your role/task in a critical care team related to care for children with brain injury

Cognitive biases

Availability heuristic

2. Could you talk me through a "typical" decision-making process around the withdrawal of life-sustaining measures for a child with brain injury?

3. Individually, how do you evaluate the patient's potential for recovery?

(hint: I am trying to understand what factors you consider and how much weight you assign to them as you determine the patient's prognosis..)

4. How do you then work with your team to arrive at a consensus regarding what is in the child and the family's best interests?

5. When something out of the ordinary regarding patient care has happened recently, to which extent does this influence the decision-making? And if so, how? This can be related to the final decision or the process.
6. Could you share any 'out of the ordinary cases' that are constantly on top of your mind when making the decisions regarding sustaining or withdrawing life-sustaining measures?
7. What would you consider an 'optimal process' or an ideal scenario for decision-making around WLSM?

Confirmation bias

8. When new information becomes available, how is that information processed and integrated into the patient's management plan?
    a. If new information comes to light which contradicts the current plan of action, how is this information evaluated and integrated into the plan?
    b. Could you provide examples of situations in which new information changed the decision? What kind of information became available, and who played a role in changing the decision?
9. How do you see your colleagues/members of the clinical team react to and evaluate new information regarding the patient's condition, especially information that could influence your team's decision to continue or stop life-sustaining treatment?

Team dynamics

In the next part of the interview, I will ask about specific situations that could occur during decision-making around WLSM for unresponsive brain-injured children. I ask you to reflect on these situations from your role as [role] in a team of care professionals.

Volunteers dilemma

10. Could you provide an example of a situation where it was unclear who was responsible for a certain action or decision?
    a. Who was involved in this decision?
    b. What was your role in this situation?
    c. Did someone take the initiative in this situation? If so, who?
    d. Does formal authority play a role in this situation i.g. job title, function level of education.
    e. What did the others do? And what was your professional opinion about this?
    f. What was the result of the decision?
        i. What was your opinion on the result?

g. What was your opinion of the decision making process (everything leading up to the result)?
h. How did the other medical professionals feel about the result?
i. How did this result impact the further cooperation of the team?

11. Can you explain why such a situation happens/happened?

Battle of the Sexes

12. Could you provide an example of a situation where different professionals of the care team have clearly different action plans or preferred decisions about patient care?
    a. Who was involved in this decision?
    b. What was your role in this situation?
    c. Did someone take the initiative in this situation? If so, who?
    d. Does formal authority play a role in this situation i.g. job title, function level of education.
    e. What did the others do? And what was your professional opinion about this?
    f. What was the result of the decision?
        i. What was your opinion on the result?
    g. What was your opinion of the decision making process (everything leading up to the result)?
    h. How did the other medical professionals feel about the result?
    i. How did this result impact the further cooperation of the team?

13. Can you explain why such a situation happens/happened?
14. When conflicting ideas about a decision exist, how is the conflict resolved?
    a. What does the decision-making procedure look like?
    b. Who takes the lead in deciding?
    c. What happens after a decision is taken?
15. Which factors influence the decision to take a definitive course of action?

Principal-agent problem

16. Could you provide an example of a situation where you perceived that a particular (or some) healthcare professional had more influence on the decision-making process than others?
    a. Who was involved in this decision?
    b. What was your role in this situation?
    c. Did someone take the initiative in this situation? If so, who?
    d. Does formal authority play a role in this situation i.g. job title, function level of education.
    e. What did the others do? And what was your professional opinion about this?
    f. What was the result of the decision?
        i. What was your opinion on the result?

g. What was your opinion of the decision making process (everything leading up to the result)?
h. How did the other medical professionals feel about the result?
i. How did this result impact the further cooperation of the team?

17. Can you explain why such a situation happened?
18. In this situation, there is a difference in the accessibility of information among team members. If yes, can you describe this asymmetry of information?
19. Does it ever appear that a difference in (perceived best) approach not only originates from a difference in a medical point of view but is influenced by external factors? If so, what are these factors?
    a. External factors such as:
        i. Having the end responsibility and not wanting to take risks
        ii. Being more directly involved in other activities in the hospital (other patients)

Optional: I have now asked you about three specific situations that could take place around WLSM decision-making in your team. Could you think of other situations or interactions that often take place or that you recall particularly? Or, were you feeling uncertain about what to do (or not do)?

a. Who was involved in this decision?
b. Who was involved in this decision?
c. What was your role in this situation?
d. Did someone take the initiative in this situation? If so, who?
e. Does formal authority play a role in this situation i.g. job title, function level of education.
f. What did the others do? And what was your professional opinion about this?
g. What was the result of the decision?
    i. What was your opinion on the result?
h. What was your opinion of the decision making process (everything leading up to the result)?
i. How did the other medical professionals feel about the result?
j. How did this result impact the further cooperation of the team?

Closing

Questions 21 & 22, are optional if any time is left

20. Are there things that you would like to see improved in decision-making around WLSM in brain-injured children?

21. Do you have any other remarks or additional information relevant to decision-making in care teams in the Pediatric ICU that we did not cover in this interview?

- Thank the participant for his/her time and cooperation.
- Do you want to receive a transcript of this interview once I have made this? If so, I expect that I can send to you within XX days.
- Stop recording.

Appendix B

Theoretical Construct	**Definitions/Key Concepts**	**Indicators**	**Key References**	**Interview Questions**
Availability Heuristic	A cognitive shortcut is where individuals estimate the frequency or importance of events based on the ease with which examples come to mind.	- Recent or Vivid Examples - Disproportionate Emphasis on rare events - Very recent examples	- Tversky & Kahneman (1974) - Gilovich & Griffin (2002) - Hayibor & Wasieleski (2008) - Bounhez et al. (2023)	When you reflect on your experiences in the critical care unit, are there certain cases or events that tend to come to mind more often than others? Could you describe one or two such instances and explain how they influence your decisions or approach to patient care?
Confirmation Bias	The tendency to seek, interpret, and remember information in a way that confirms pre-existing beliefs or expectations.	- Cling to the initial Diagnosis - Selective Information Search - Reinforcement of pre-existing Belief	- Nickerson (1998) - Sobkowicz (2017) - Bounhez et al. (2023)	Can you recall a time when your initial impression of a patient's condition persisted, even as new information came in? How did you and your team handle any conflicting evidence during that case?
Volunteer's Dilemma	It's a game in which each individual benefits if at least one person incurs a cost (volunteers), but everyone prefers someone else to volunteer.	- Waiting for someone else - Single volunteer	- Diekmann & Przepiorka (2015) - Murnighan et al. (1993)	In situations that require urgent intervention, how does your team determine who takes the lead? Can you recall a time when there was hesitation or uncertainty about who should act, and how that situation was ultimately resolved?
Battle of the Sexes	It is a game in which two players have different preferences but benefit from a coordinated decision.	- Different preferred strategies - Negotiation / Compromise	- Osborne & Rubinstein (1994) - Rapoport (1997)	Have you experienced cases where different professionals on your team preferred different treatment approaches? How did your team manage to come to a consensus despite these differences?
Princial-Agent Problem	The dynamic occurs when one party (the principal) delegates	- Misaligned Incentives - Information	- Braun & Guston (2003)	Are there situations in your unit where the expectations or roles

Theoretical Construct	Definitions/Key Concepts	Indicators	Key References	Interview Questions
	work to another (the agent) with information asymmetry and differing incentives.	Asymmetry - Conflict over resources/goals		between different groups (such as between administrators and clinicians or between senior and junior staff) seem misaligned? How did these differences affect the decision-making process?

Table 3: Operationalisation

Appendix C

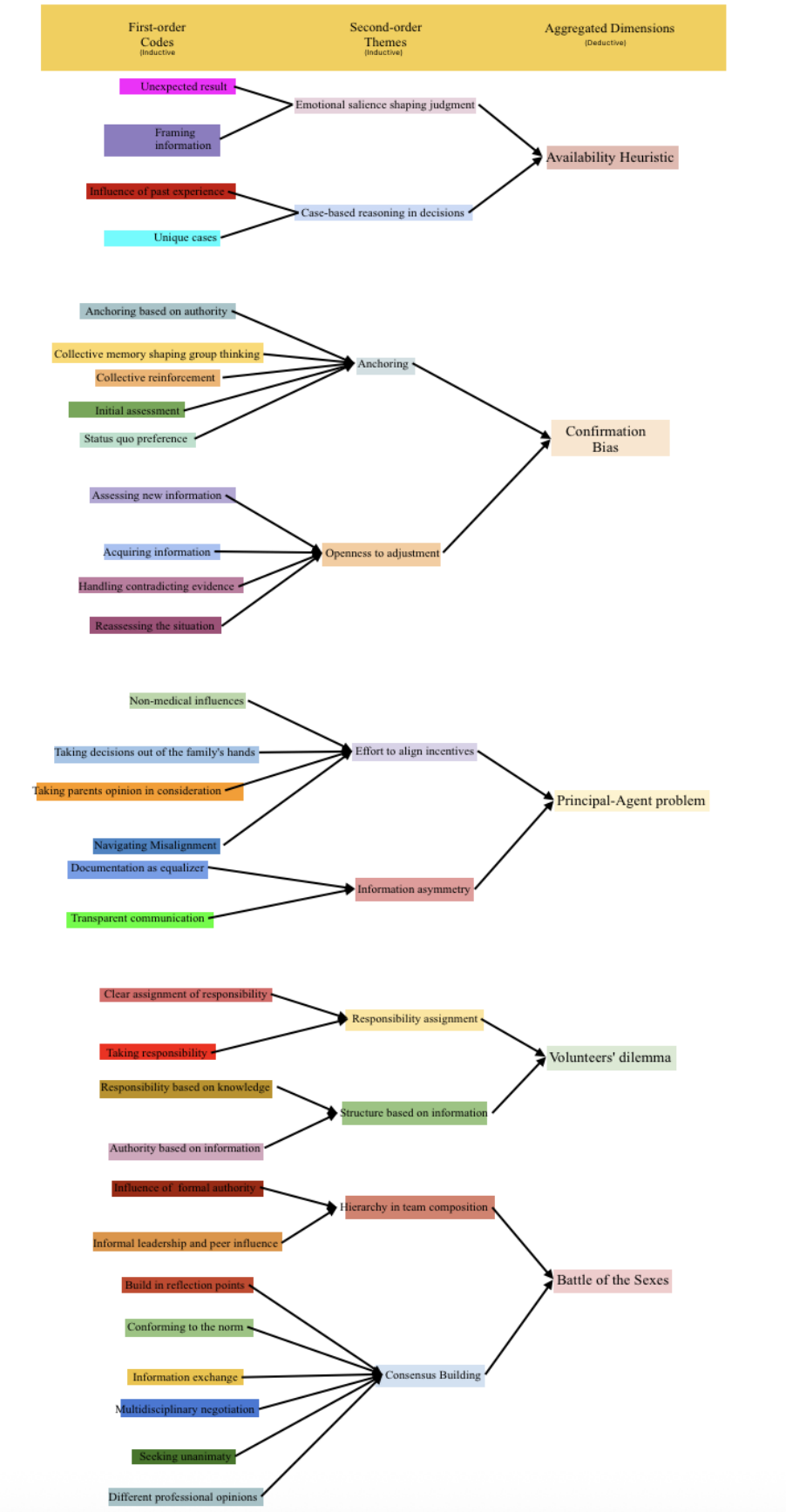

Figure 4: Gioiga Tree