Certainty-Seeking Minds: The impact of Cognitive Closure on Uncertainty Management.

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M12 BSc Thesis PSY (2024-1A)

THE JOINT EFFORT - INVESTIGATING PREREQUISITES FOR HIGH-QUALITY COLLABORATION

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January 22nd, 2025

Abstract

This thesis examines the role of Need for Cognitive Closure (NFC) as a dispositional construct influencing individual and group behaviors during uncertainty. Using the strategic board game *Scotland Yard* as a controlled yet dynamic research setting, this study investigates how varying levels of NFC shape decision-making processes and uncertainty management for individuals within group settings. In total, 14 participants were grouped, engaged in gameplay sessions and were recorded and analyzed through Braun and Clarke's framework of Reflexive Thematic Analysis. Specifically, five key themes about NFC in relation to uncertainty management were selected: Restriction of Hypotheses, Elevated Judgmental Confidence, Attribution of Behavior to Character, Task Orientation Over Socioemotional Engagement, and Consensus Striving and Pressure Toward Uniformity. High NFC individuals demonstrated a preference for reducing uncertainty by limiting hypotheses, displaying elevated confidence in decisions. Meanwhile, low NFC participants exhibited greater flexibility, explored diverse possibilities, and prioritized socioemotional engagement over task efficiency.

Introduction

Amid these complexities of modern dynamics, continued research into uncertainty is becoming essential for understanding how individuals navigate challenges and adapt to change (Cameron, 2006). The field of educational psychology specifically plays a crucial role in exploring the psychological factors that influence learning and knowledge transfer within uncertainty, offering valuable insights into how individuals may best navigate their own uncertainties (Qvortrup et al., 2016). Today, people often feel overwhelmed by the sheer volume of information from countless sources, along with the doubts and anxieties that arise from trying to process it all (Gehrke et al., 2012). This thesis examines how individual tendencies and dispositions influence approaches to handling uncertainty. It aims to highlight the need for adaptive, holistic, and personalized strategies to help individuals thrive in uncertain times and circumstances.

Uncertainty in education refers to a concept that affects teachers, curricula, group dynamics, and students in learning environments. For teachers, uncertainty arises from the unpredictable nature of instructional contexts, requiring them to develop reflective practices, flexibility and adaptive strategies to navigate uncertainty and meet the needs of students. The curriculum must balance structured objectives with the flexibility to accommodate the implementation of educational goals which often involves unpredictability (Suceava, 2020). Group work, in particular, introduces additional layers of uncertainty, as collaborative efforts depend on the dynamics of interpersonal interactions, shared responsibilities, and varying levels of contribution among participants. Lastly, for students, uncertainty serves as both a challenge and an opportunity for growth, encouraging the development of problem-solving skills and tolerance for uncertainty, with traits like the Need for Cognitive Closure (NFC) playing a critical

role in shaping how they navigate and resolve uncertain situations (Jordan, 2015). Educators play a critical role in guiding students through these experiences, transforming uncertainty into an opportunity for exploration and discovery; teaching that coping with uncertainty essentially means actively engaging with it and navigating its complexities through deliberate and informed action (Schumpe et al., 2017).

Despite its significance, much of the existing research on uncertainty in education adopts fragmented approaches, focusing narrowly on specific aspects such as individual decision-making or instructional strategies, while overlooking how distinct uncertainty management styles exert their influence. The uncertainty management disposition known as Need for Cognitive Closure (NFC) reflects an individual's preference for firm answers to mitigate the discomfort of ambiguity. High NFC individuals prioritize quick resolutions, while those with low NFC are more inclined to explore multiple possibilities. NFC contributes to and shapes individual behaviors within groups during decision-making scenarios. This gap in the research highlights the need for comprehensive studies that integrate these dimensions, offering a deeper understanding of how a specific uncertainty management framework (NFC) shapes educational outcomes (Suceava, 2020).

When addressing and dealing with uncertainty the array of potential strategies within individuals manifests in different ways. For example, Jordan (2015) shows that some people will have developed a rich set of tactics and a wide range of strategies with which they can experiment and gather new information to deal with the uncertainties and the unknown. These people will often explore multiple possibilities, seek diverse perspectives, and actively gather new information to remain flexible in their decision-making.

Jordan (2015) also highlights this distinction in a study on uncertainty styles, where one group of students reduced ambiguity immediately, while another maintained higher levels of uncertainty, exploring different possibilities before reaching a solution. Research indicates that individuals who work with uncertainty in open tasks often engage more deeply and produce creative, well-considered solutions. However, those favoring quick closure may miss opportunities for deeper exploration, particularly in tasks requiring creativity and open-ended inquiry (Dağtaş & Şahinkarakaş, 2024). These contrasting tendencies significantly shape how uncertainty is managed, particularly in group decision-making, where diverse approaches influence the dynamics and outcomes of collaboration (Jordan, 2015). Understanding how individuals confront and handle uncertainty in varying ways, especially through the lens of uncertainty management styles and the NFC framework, underscores the importance and essence of this thesis.

There are overwhelming quantities of information and challenges paired with an ever-growing unwillingness or even paralyzing inability to manage these uncertainties (Griffin & Grote, 2020). The current limited understanding of uncertainty management styles and of how individuals navigate these challenges in varied settings, highlights a critical area for educational research to explore (Mortimore, 2000). Effectively dealing with and understanding uncertainty can even lead to higher levels of self-efficacy, willingness to confront harder tasks and adopt more responsibilities (Peterson et al., 2019). NFC represents one of the exciting and important frameworks that explain why individuals react to uncertainty in the way they do (Jordan, 2015). Given these circumstances, the present study advances the following research question.

How does Need for Cognitive Closure (NFC) shape the behaviors of individuals within groups when navigating uncertainty in decision-making scenarios?

Literature Review

Understanding Uncertainty

Uncertainty can be described as the subjective experience of questioning, doubting, or feeling unsure about how events will unfold, how to interpret the present and how to make sense of past experiences. It shapes how individuals process information, make decisions, and adapt to uncertain situations, particularly in group settings where collaboration, differing perspectives and the drive to take action are essential (Jordan, 2015).

Three well-established frameworks for understanding uncertainty have been developed and established themselves over time. These are Tolerance of Ambiguity, Uncertainty Orientation, and NFC (Jordan, 2015). Then, Tolerance for Ambiguity refers to individuals' comfort with unclear situations. Those who exhibit this trait embrace uncertainty and explore it openly, while those with low tolerance seek clarity quickly, often to soothe their increasing anxiety (Kazamia, 1999). Uncertainty Orientation distinguishes between individuals who actively seek out uncertain situations to gain knowledge and those who prefer to avoid ambiguity, favoring clear and predictable environments (Sorrentino et al., 2008). Lastly, NFC, a consistent and measurable trait highlights the desire for definitive answers, those with this characteristic seek out quick solutions, sacrificing deeper understanding (Ragan et al., 2014; Leary & Hoyle, 2013; Sorrentino et al., 2008). These three frameworks show how individuals' approaches to uncertainty shape their style learning and potential in problem-solving strategies.

Need for Cognitive Closure

While all three uncertainty management styles contribute to learning outcomes, the variable of NFC manifests in the most distinct, observable behavioral differences among individuals (Dağtaş & Şahinkarakaş, 2024), marking it as an attractive area for research. The desire for definitive answers manifests in risk aversion and a tendency to opt for safer and immediate choices to reduce uncertainty (Dağtaş & Şahinkarakaş, 2024). NFC functions as a cognitive stopping mechanism that facilitates the formation of definitive conclusions during decision-making processes. While this behavior provides stability, it can limit deeper engagement and hinder creative problem-solving (Jordan, 2015). Additionally, high NFC individuals take less time to make decisions and even feel more confident about their answers (Schumpe et al., 2017). In contrast, those with low NFC are more flexible and open to new information, often engaging more deeply with material. However, they may sometimes require external prompts to bring closure and avoid procrastination (Kruglanski & Fisher, 2018). Understanding these differences is critical for educational research, as varying levels of NFC impact both individual and group learning outcomes (Schumpe et al., 2017).

This thesis zeroes in on NFC because it offers a specific, novel, clear, measurable and encompassing framework for analyzing how individuals manage uncertainty, heavily impacting their decision-making processes and openness to incorporating new information. Studies have documented how high and low levels of NFC influence behavior, particularly in contexts requiring swift action or creative problem-solving (Kruglanski & Webster, 1996). For example, Heim and Keil (2017) found that in today’s information-rich environments, where technology use increases by about 5% each year, the ability to effectively manage uncertainty is more critical than ever.

NFC is influenced by both intrinsic traits and situational factors, which together shape how individuals respond to uncertainty. Personal attributes, often measured using scales or questionnaires, reflect baseline NFC levels and a desire for closure. External conditions such as a collaborative setting can also heighten or diminish the NFC, emphasizing the role of context in managing uncertainty (Edwards, Gilroy, & Hartley, 2014). These factors underscore the variability in how NFC manifests across different scenarios and provide a foundation for studying NFC in dynamic environments.

Effects of NFC regarding individuals within groups

To further understand the implications of NFC, it is important to also have a clear comprehension of the functioning of individuals within groups. Many essential mechanisms for managing uncertainty tend to change in accordance with the environment. Individuals within groups face alleviating stressors differently, particularly in situations with decision-making pressures (Schumpe et al., 2017). Research shows important distinctions in behavior among NFC variation within groups; for example, high NFC individuals acting within a group show reduced capacity for empathy and perspective taking. This is exacerbated when members of the group are dissimilar to themselves. High NFC members find it harder to step out of their own viewpoint and actually prefer abstract labeling in groups; this has the effect of reducing clarity in communication but allows for the label to cover a wider array of answers, thus acting as a blanket cover for uncertainty (Leary & Hoyle, 2013). Moreover, high NFC members are more task oriented, but care less about socio-emotional group dynamics compared to low NFC members. High NFC members also prefer autocratic group leadership styles, and are more susceptible to bias effects such as transference and correspondence. Correspondence bias means high NFC individuals attribute behaviors to unrelated factors (Leary & Hoyle, 2013).

Expression of uncertainty in collaborative contexts

Evidence from Edward, Gilrow, and Hartley (2014) indicates that the effectiveness of collaboration in managing uncertainty in educational contexts depends on key elements, including communication, clear goals and structure, and the capacity to reconcile differing viewpoints (Edwards, Gilroy, & Hartley, 2014). In collaborative environments where these factors are present, uncertainty can be reframed as an opportunity for deeper inquiry and exploration, leading to adaptive problem-solving. However, given the scope of this thesis, which attempts to elicit an environment without clear structured guidance and a cohesive framework, collaboration may instead heighten uncertainty, resulting in cognitive overload and inefficiencies in decision-making processes. Additionally, participants will have no prior experience working together as a team, which may lead to challenges in establishing effective communication and a potential difficulty in accepting and integrating differing viewpoints (Edwards, Gilroy, & Hartley, 2014).

Method

Research Design

The study's approach combined descriptive quantitative data from NFC Scale scores with qualitative analysis of individual gameplay behaviors, such as decision-making, strategy use, and group interactions; including communication, negotiation, and collaborative problem-solving. This focus highlights how individuals with varying levels of NFC behave differently both in their personal approach to the game and in their contributions to group dynamics.

Participants

In total, 14 participants were recruited through convenience sampling. The sample had an average age of 26 years (SD = 3.06), with ages ranging from 22-33 years. The median age was 25 years, and the distribution was slightly skewed toward younger individuals. The sample included 10 males (71%) and 4 females (29%). The study was approved by the Ethics Committee at the University. All participants provided informed consent prior to their involvement and were thoroughly debriefed after the study's completion.

Materials

Scotland Yard Board Game

The primary material is the aforementioned board game *Scotland yard*. This idea stems from an important contribution to this study; Leary and Hoyle's Handbook of Individual Differences (Leary & Hoyle, 2013), which highlights the challenges researchers face in identifying environments that naturally elicit NFC behaviors. This is particularly relevant in group contexts where decision-making and uncertainty management are critical.

To address this, the present study utilizes the board game as a controlled yet dynamic research setting, designed to mimic real-world conditions that require individuals to navigate uncertainty, collaborate, and adapt under pressure. The game inherently involves persistent uncertainty, as players work together to deduce the hidden movements of "Mr. X," an opposing "spy" player, while relying on incomplete and ambiguous information. This setup creates a unique balance of individual decision-making and collective strategy, allowing participants to engage in problem-solving while managing the constant demands of the game that elicit uncertainty. This constant need to process limited information, anticipate the actions of others,

and make decisions under pressure mirrors the complexity of real-world scenarios, making Scotland Yard an ideal tool for studying uncertainty management behaviors.

Participants engage with the game both individually and as part of a group, where they must collaborate to achieve a shared objective. This dual engagement provides opportunities to observe how individuals with varying NFC levels handle uncertainty, adapt their strategies, and contribute to group decision-making. The novelty of the game for many participants adds an additional layer of unpredictability, further enhancing its ability to elicit behaviors related to uncertainty. By using Scotland Yard as a structured yet flexible research tool, this study not only addresses gaps in NFC literature but also contributes insights into collaboration, and decision-making in uncertain contexts.

Questionnaire: NFC Scale

The materials used in this study included the validated 15-item short form of the NFC Scale (Roets & Van Hiel, 2007; Webster & Kruglanski, 1994), which provided a quantitative measure of participants NFC score. This scale uses a 6-point Likert format to generate scores ranging from 15-90, offering reliable differentiating descriptive statistics to showcase NFC levels. A positively indicative example question from the questionnaire is: "I find it frustrating when a person's statement can be interpreted in multiple ways." The 15-item NFC Scale demonstrated good model fit indices (CFI = .98) (Roets & Van Hiel, 2011). Principal Component Analysis identified a clear one-dimensional structure for the 15-item selection, accounting for 36.7% of the variance. The scale showed strong internal consistency (Cronbach's alpha comparable to the full scale ≥ 0.85) and adequate test-retest reliability ($r = .79$), making it a robust and reliable alternative to the original 41-item scale (Roets & Van Hiel, 2011).

Data Collection Tools: Audio and Video Recordings

Additionally, a smartphone voice recorder was used to capture verbal interactions and thought processes, while a high-resolution camera documented non-verbal cues and group dynamics. These recordings provided a comprehensive dataset for analyzing individual and group decision-making behaviors.

Framework for Data Analysis

The work of Leary and Hoyle (2013; chapter 23 in particular) regarding cognitive dispositions provides an extensive literature review of NFC. The authors outline four group processes and seven interpersonal processes that describe how uncertainty is managed in individuals within groups. Out of these 11 processes, five were ultimately chosen as a deductive pre-existing framework for data analysis. This represents a subset of the initial categories that were relevant for this analysis. The relevance of the selected categories was determined by the focus on individuals acting within groups rather than groups entirely, as well as the constraints of the study environment, which allowed for the exploration of only specific categories to elicit NFC in this environment. For example, addressing uncertainty relevant phenomena like "transference" would require collecting additional data about participants' personal relationships, which was beyond the scope of this study. Ultimately, this led to five distinct themes that effectively showcase how individuals with different levels of need for closure manage uncertainty within groups. These are further outlined in the data analysis below.

Procedure

Participants were seated at a table in a relaxed, informal setting designed to mimic a home environment for playing the board game Scotland Yard. Upon arrival, informed consent was obtained in accordance with ethical guidelines approved by the University. Participants then

completed the NFC Scale to establish baseline NFC levels. Following this, participants were randomly grouped consisting of 4–5 members. Minimal instructions were provided, with participants simply being encouraged to "figure out the game and play one round." This approach was intended to foster natural interactions and necessitates decision-making processes. Voice and video recordings were set up and captured both verbal and non-verbal behaviors during gameplay, ensuring a thorough record for subsequent analysis. Each session lasted approximately one hour or until the game was completed. The initial steps, including the questionnaire, consent process, and pseudonymization, required an additional 15 minutes. After gameplay sessions, participants were debriefed about the study's purpose, and any questions they had were addressed. This approach ensured a naturalistic but also uncertain setting for observing NFC-related behaviors while maintaining ethical considerations such as participants drinking coffee, tea or using the restroom.

Data Analysis

To analyze the data generated during gameplay, this research employs Braun and Clarke's (2006) thematic analysis framework. This qualitative approach allows for the identification of patterns and themes in the behaviors and strategies observed, providing a comprehensive understanding of how individuals and groups manage uncertainty in dynamic settings. Reflexive thematic analysis (RTA) as outlined by Braun and Clarke (2006) was employed to analyze the data. This deductive approach was guided by pre-existing NFC-related theoretical frameworks. Data consisted of transcribed group interactions that had been recorded during gameplay and were systematically analyzed to identify recurring behavioral patterns indicative of NFC tendencies.

The initial step involved becoming familiar with the data by thoroughly reading and re-reading the transcripts to develop a comprehensive understanding of participants' behaviors. Reflective notes were carefully taken to document initial observations and identify correspondence with themes from Leary and Hoyle (2013), using this background research on NFC to contextualize emerging patterns. To reduce individual biases, pre-established codes from existing research were applied, which provided a structured and objective framework for analysis. While this approach enhanced reliability, inter-rater reliability was not included due to time constraints. Keywords and themes from Leary and Hoyle (2013) were used as a coding scheme, ensuring consistency with established frameworks. These steps were taken to minimize bias by using validated codes and established keywords, ensuring a systematic and balanced analysis.

Following this, initial coding was conducted where transcripts were systematically analyzed. Codes were generated to capture specific NFC-related behaviors such as quick decision-making, restriction of hypotheses, and consensus striving. These codes were then organized into broader themes derived from NFC literature, including restriction of hypotheses, attribution of behavior to character, and consensus striving. Table 1 summarizes the key themes, their descriptions, and representative behaviors observed during gameplay, providing an organized framework to understand the impact of NFC on player interactions and decision-making.

Table 1

Thematic Analysis Framework for Interpreting Player Behavior and Decision-Making

Theme	Description	Example excerpt of transcripts (See Appendix B, C and D)
Theme 1: Restriction of Hypotheses	High NFC individuals reduce uncertainty by narrowing the number of hypotheses considered, avoiding extensive exploration of possibilities. Players propose fewer potential locations for Mr. X, focusing on a single hypothesis early in gameplay. (Leary & Hoyle, 2013).	"Hes here guys, so predictable"
Theme 2: levated Judgmental Confidence	High confidence in judgments despite limited information. This occurs even when hypotheses are previously artificially limited. Players displaying strong conviction about Mr. X's location without complete evidence, this reduce uncertainty (Leary & Hoyle, 2013).	"*So I have this whole section basically locked up*"
Theme 3: Attribution of Behavior to Character	High NFC individuals prioritize character-based interpretations of behavior, attributing actions to traits rather than situational factors. Interpreting Mr. X's moves as indicative of personal tendencies instead of adapting to the game context. (Leary & Hoyle, 2013).	"*Look, he's twitching. We're close*."
Theme 4: Task Orientation Over Socioemotional Engagement	High NFC individuals prioritize task completion over socioemotional engagement, focusing on efficiency in achieving closure. Minimal engagement in socioemotional communication, with greater focus on	"*Somebody has to read, maybe the instructions"*

	understanding, strategizing and task orientation. (Leary & Hoyle, 2013).	
Theme 5: Consensus Striving and Pressure Toward Uniformity	High NFC individuals seek group consensus to achieve closure, sometimes at the expense of alternative perspectives. Rapid agreement on Mr. X's location while dismissing dissenting opinions or novel ideas; preference for decisions based on shared rather than unique information (Leary & Hoyle, 2013).	"*Yeah, guys, do we all agree that he's here? Yeah?"*

Themes were reviewed and refined to ensure internal coherence and alignment with the data. Data excerpts were revisited to confirm that the themes accurately represented participants' behaviors. Each theme was then clearly defined and named in relation to NFC behaviors. Quantitative NFC scores were integrated with the qualitative findings to provide additional context and insight into how NFC influences decision-making. This structured approach facilitated a nuanced exploration of the relationship between NFC and observed behaviors in the *Scotland Yard* setting.

Results

NFC Score Group and Individual Differences

Table 2 illustrates the group differences of mean NFC score, with results indicating that Group 3 had the highest NFC mean score. Table 2 indicates the individual differences. As can be seen, Participant DPK22 had the highest NFC score with 70 and participant IBV10 the lowest with 42. These scores are referred back to in later analysis. The data coding and analysis processes, which were conducted using RStudio, are detailed in Appendix E.

Table 2

Descriptive Statistics of Participants Sorted by NFC Scores

Identification code	Gender	Age	NFC
IBV10	M	22	42
LMS17	M	26	44
JSK07	F	28	44
EVM19	M	23	46
JRD29	M	28	47
RMM30	M	24	50
OCS25	F	24	51
JSK06	F	30	51
KMZ08	M	25	57
TB187	M	23	58
JBZ12	M	33	58
CSA25	F	28	65
DPK22	M	25	70
CNT31	M	25	73

Table 3

Descriptive Statistics for NFC Scores Across Groups 1–3

Group	Mean ± SD	Range (Min-Max)
1, TB187, CNT31, IBV10, EVM19, RMM30	53.8±11.95	42-73
2, JRD29, JSK06, JSK07, CSA25, JBZ12	49.8±7.92	44-63
3, LMS17, DPK22, KMZ08, OCS25	55.5±10.59	44-70

Reflexive Thematic Analysis Results

The analysis of gameplay in *Scotland Yard* revealed five key themes that illustrate how participants with varying levels of NFC navigate uncertainty, make decisions, and engage with their group. These themes include the restriction of hypotheses, attribution of behavior to character, task orientation over socioemotional engagement and lastly consensus striving. Each theme highlights specific cognitive and social mechanisms influenced by NFC tendencies, offering insights into the interplay between individual traits and situational dynamics.

These themes, grounded in the framework of Leary and Hoyle (2013), offer a robust structure for analyzing how NFC shapes behaviors when navigating uncertainty. By systematically examining gameplay through these thematic lenses the study aims to uncover the cognitive and social mechanisms individuals within groups apply to handle uncertainty.

Theme 1: Restriction of Hypotheses

This theme focused on how individuals with high NFC manage uncertainty by limiting the range of hypotheses they consider before making decisions. High NFC individuals exhibit a strong preference for reducing ambiguity, which they achieve by narrowing down possibilities (Leary & Hoyle, 2013). For example, participant *EVM19*, with a higher relative NFC score, shows that although many options are evidently possible they restrict their strategy to only two locations.

> *[0:36:19] TB187 (Group 1):I feel like he was here, yeah, intuitively. And now a taxi—that would make sense. That would make sense. That also wouldn't make sense. So if you*

went here with the underground and, yeah, in my head, it's like one of these two that is likely.

This behavior aligns with a higher NFC as this attempts to reduce and constraint possibilities. On the other hand, a lower NFC In the context of *Scotland Yard* means players are more likely to suggest multiple potential locations for Mr. X during the game. An example from participant *TB187* with a lower relative score of NFC in group 1 (see Table 2) offers several hypotheses based on the state of the game.

[0:26:28] EVM19 (Group 1): *'So from here is a taxi. So he's either here, here, here, here, or here'*

This behavior illustrates how individuals with high NFC navigate uncertainty by focusing on fewer options than low NFC individuals. However, this approach may come at the expense of a more thorough exploration of possibilities in favor of reducing ambiguity (Leary & Hoyle, 2013).

In Group 2, another contrast between high and low NFC behaviors is evident. For instance, when JSK07 (lower NFC) expresses frustration over a lack of progress:

[0:45:13] *JSK07* (Group 2): *We have to. So, no, don't. We can even feel like we're not really progressing. It's fine.*

This statement reflects uncertainty and an acceptance to not progressing as a team. At this stage, Mister X was comfortable and out of reach within the game. In quick response, CSA25 (high NFC) immediately, seconds later as first respondent narrows the focus to one hypothesis, to reduce the newly emerged uncertain aspects of the game.

[0:45:24] CSA25 (Group 2): *So maybe he's, if he took the bus, he's maybe here, right?*

Regarding Group 3, a particularly striking example of this dynamic is seen with DPK22, who holds the highest NFC score in the group. DPK22 frequently demonstrates a strong tendency to limit the range of hypotheses when navigating uncertainty.

[0:34:19] DPK22 (Group 3): *I'm pretty sure he's here. Yeah, it's a lot of yellow.*

This statement demonstrates DPK22's quick narrowing of possibilities based on the use of yellow gameplay tickets, which given the context of the game are the most uncertain. Later, their certainty resurfaces with the statement:

[0:44:42] DPK22 (Group 3)*: He's here, guys, so predictable.*

This reflects on high NFC focus on resolving ambiguity by committing to a single interpretation of the game state. This last excerpt leads to theme 2, where elevated judgmental confidence despite considering fewer options plays a key role.

Theme 2: Elevated Judgmental Confidence

The reduction in hypothesis generation often coincides with heightened confidence in judgments. High NFC individuals demonstrate a stronger sense of certainty in their evaluations. This paradoxical relationship underscores how a restricted hypothesis approach can amplify perceived decisiveness, even in the absence of exploration. The previous two excerpts by DPK22, who demonstrated the highest NFC scores are a great example of this. DPK22 limits their hypothesis to only one possibility with a comment underlying their confidence within each statement.

Additionally, From group 1, participant TB187 (High NFC) acknowledges that their assumptions are based on intuition and that many possibilities make ‘sense’ and still regards his two possibilities as likely, showing a higher level of conviction.

> [0:36:19] TB187 (Group 1)*: I feel like he was here, yeah, intuitively … it’s like one of these two that is likely …*

High NFC individuals demonstrate a higher level of conviction in their conclusions, even when based on less and limited information (Leary & Hoyle, 2013). In gameplay, this results in firm assertions about Mr. X’s location despite incomplete or ambiguous evidence. This elevated confidence is further observed in TB187s statements. TB187 frequently elevated judgmental confidence compared to other group members as shown in remarks such as:

> [0:27:50] TB187 (Group 1)*: I think we could narrow it down pretty good.*

> [0:34:46] TB187 (Group 1)*: So I have this whole section basically locked up.*

This pattern of elevated confidence stands in contrast to the behavior of low NFC individuals, such as JSK07, who frequently exhibit hesitation and uncertainty in their assessments. For example, during a critical juncture in gameplay, JSK07 remarked:

> [0:39:35] JSK07 (Group 2)*: Maybe not. Where should I go here? But should I go here? Or should we assume he may be lost?*

This indecision highlights a reluctance and less confidence within the standing hypothesis that was offered by TB187. Similarly, when faced with uncertainty about Mr. X's location, JSK07 commented,

> [0:43:12] JSK07 (Group 2)*: Should we assume he's on 111, but why would he have not 111, then?*

This showcases an ongoing internal dialogue marked by self-doubt and a lack of assertiveness. This stark difference between TB187 and JSK07 demonstrates how high NFC individuals not only restrict the range of possibilities but also approach decision-making with pronounced confidence.

Theme 3: Attribution of Behavior to Character in High NFC Individuals

High NFC individuals are more likely to exhibit correspondence bias, attributing behavior to inherent traits rather than external factors. During gameplay, this emerges by players interpreting Mr. X's moves as indicative of personal characteristics rather than strategic and logical moves to situations. By attributing behavior to stable character traits rather than fluctuating situational factors, they create a sense of predictability and order in an uncertain environment (Leary & Hoyle, 2013). This theme attempts to show how High NFC individuals prioritize character-based interpretations over situational analysis in the context of finding Mr. X and dealing with uncertainty (Leary & Hoyle, 2013). In group 1 for example, Participant *CNT31* with the highest NFC score (See Table 2) responds to a previous remark:

> [0:47:42] RMM30 (Group 1)*: It's not this one. It's not this one.*

> [0:47:46] CNT31 (Group 1)*: I agree, unless he's faking us out hard.*

This illustrates how the first participant (RMM30) reduces uncertainty by claiming two spots are not possible. However, the current state of the game allowed these spots. Participant CNT31 is then the first to respond, indicating their agreement (which in turn reduces uncertainty) and then further attributes Mr. X playstyle towards their character and disposition (someone capable of bluffing) rather than objective possibilities within the game. An example of Participant EVM19 with a low NFC score shows a different response to the same situation.

> [0:49:55] EVM19 (Group 1): *Because he was there, and then he could taxi. He could have taxi there, even though I agree with the soul read.*

Here, EVM19 refers to a 'soul read' which was a character-based speculation by a previous participant. Participant EVM19 (Low NFC) opens up the discussion by allowing more hypotheses, and responding to the other players speculation by calling it a "soul read", highlighting how this strategy employed by high NFC was defined by attributing Mr. X play style to character rather than objective gameplay possibilities. Another example of high NFC participant attributing Mr. X's actions to character traits is seen in TB187's remark:

> [0:50:07] TB187 (Group 1): *We have him if he doesn't pull a stubborn move.*

This statement highlights a focus on Mr. X's perceived personality trait of stubbornness as the determining factor for the group's success. TB187 exemplifies the tendency of high NFC individuals to reduce ambiguity by relying on trait-based interpretations.

This pattern becomes clear and even more evident in the statements of DPK22, the highest NFC member of Group 3, who frequently attributes Mr. X's actions to stable character traits. For example:

> [0:44:42] DPK22 (Group 3)*: He's here, guys, so predictable.*
>
> [0:35:20] DPK22 (Group 3)*: Look, he's twitching. We're close.*

Uncertainty is again reduced by attributing actions to consistent internal characteristics. This aligns with the tendency of high NFC individuals to seek closure through character-based explanations. In contrast, lower NFC participants like EVM19 demonstrate more situational reasoning while still referencing character-based assumptions. For example:

> [0:24:05] EVM19 (Group 1): *What we were thinking was, because we thought he was somewhere over here, because it seemed like it, from the way he was looking.*

Here, EVM19 considers immediate gameplay factors, such as observed behavior, and entertains multiple possibilities, showing less reliance on trait-based interpretations compared to DPK22.

Theme 4: Prioritization of Task Orientation Over Socioemotional Engagement

High NFC individuals tend to prioritize task completion over socioemotional dynamics (Leary & Hoyle, 2013). In the collaborative setting of *Scotland Yard*, this preference will show a focus on strategy and task orientation at the expense of group dynamics or empathic communication (Leary & Hoyle, 2013).

In gameplay, the start of the game becomes particularly important. high NFC participants exhibit a clear focus on reducing uncertainty by being first to ensure task comprehension. For example, CSA25 (high NFC) quickly suggests:

[0:00:56] CSA25 (Group 2): *Somebody has to read, maybe the instructions.*

This emphasizes the need to clarify the rules. Similarly, JBZ12 the other high NFC member of group 2 then goes on to read the instructions:

[0:02:34] JBZ12 (Group 2): *Mr. X has to shake off pursuers in London. Mr. X flees by taxi, bus, or the underground. You must be particularly clever to catch Mr. X.*

Both participants demonstrate a task-oriented approach, which is utilized even when during their conversation another player was engaging in a random conversation JRD29 and JSK06 (low NFC) engages in a random exchange during the setup asking,

[0:02:20] JRD29 (Group 2)*: Do you know butterc?*

[0:01:42] JSK06 (Group 2)*: Laughing you look like Oma Dele, Oma Dele!*

This example shows that the two highest NFC members expressed the most immediate need for task orientation, while the other players with lower scores did not press this matter as fast. *Butterc* used in this excerpt by JRD29 is a public influencer that was being asked about with no contextual relation to the game itself.

Group 3 further underscores the pattern of high NFC participants prioritizing task orientation and reducing uncertainty. DPK22 (high NFC) reinforces this by being the first group 3 member to start reading the instructions aloud, stating,

[0:03:21] DPK22 (Group 3): *Mr. X takes the playing piece. In the classic design, is this supposed to be like a or the cardboard playing piece with the ...*

Once again, the highest NFC members exhibit the most immediate focus on clarifying the rules and organizing gameplay. This emphasizes the tendency of high NFC individuals to prioritize task efficiency over socialization, providing additional evidence for their need to reduce uncertainty as a behavioral pattern. Group 1 did not match this pattern as they had a member who was already familiar with the game who went on to explain it to the rest of the group.

However, even in group 1 high NFC participants like TB187 maintain this task-oriented focus through practical actions, such as organizing tickets. For example:

[0:06:54] TB187 (Group 1): *So you two still need taxi?*

[0:06:59] TB187 (Group 1): *You handed out the bus tickets, yeah.*

High NFC individuals like CSA25, DPK22, and TB187 emphasize logistical themes and engage with task clarity at the start, while lower NFC participants showed clear preference and engagement of social dynamics or speculative remarks. To underscore this, JSK07 comments about information that does not lead to understanding the game but reflect more social preferences considering ongoing uncertainties:

[0:08:06] JSK07 (Group 2): *Wow, she's intimidating. This also looks like you're powerful.*

[0:38:48] JSK07 (Group 2): *He thinks he's got us. I feel like he's getting us. Yeah, he's smug, strong. A strong team of detectives.*

These comments reflect a greater focus on group dynamics and interpersonal perceptions rather than task-oriented gameplay, underscoring the socioemotional engagement characteristic of lower NFC participants.

Theme 5: Consensus Striving and Pressure Toward Uniformity in High NFC Individuals

High NFC individuals tend to drive for consensus, as achieving agreement helps reduce uncertainty (Leary & Hoyle, 2013). In *Scotland Yard*, this manifests as players striving for unanimous decisions about Mr. X's location, sometimes at the cost of exploring alternative perspectives and options. This behavior can lead to rapid consensus but may also suppress differing opinions or creative strategies (Leary & Hoyle, 2013).

For instance, these are some illustrative quotes that showcase TB187 how with high NFC will frequently check in with the team and search for uniformity by asking:

[0:36:53] TB187 (Group 1): *So do we all think that he's kind of around here? Or…*

and affirming agreement with statements like,

[0:39:02] TB187 (Group 1)*: Let's do that, all right.*

[0:54:46] TB187 (Group 1): *No, I agree. That's it.*

This consensus-seeking behavior also extends to strategic decisions, as TB187 suggests coordinated actions to ensure group alignment:

> [0:45:03] TB187 (Group 1)*: Should I try to block them off here first and try to rotate back to block off two entrances? Yeah?*
>
> [0:59:21] TB187 (Group 1): *And I try to hold off this section ... And then you close.*

Additionally, TB187 encourages teammates to take specific actions while seeking confirmation, stating,

> [0:49:43] TB187 (Group 1): *You could also try the underground because he is somewhere around here, right?*

By driving for group consensus, TB187 effectively reduces ambiguity and fosters a unified strategy. However, this approach often prioritizes agreement over the exploration of alternative perspectives or creative strategies, reflecting the trade-offs inherent in high NFC players' preference for clarity and closure.

In contrast to TB187's consensus-driven approach, lower NFC participants in the same group such as EVM19 exhibit a more open style of collaboration. EVM19 leaves room for individual decision-making and autonomy as demonstrated in:

> [0:34:04] EVM19 (Group 1): *Yeah, that'd be cool. I think I'm gonna do that. Does anyone object?*

Notice that this phrasing suggests a more individualistic approach, unlike TB187's more deliberate efforts to achieve group alignment. Additionally, EVM19 demonstrates a less definitive stance by entertaining multiple options and expressing tentative agreement, such as:

[0:38:56] EVM19 (Group 1): *You can do an in-betweener, yeah. Maybe, yeah, that sounds good.*

This contrasts with TB187's tendency to push for clear decisions and structured plans, reflecting the lower NFC participant's comfort with ambiguity and individual variation within the group. While high NFC individuals like TB187 prioritize reducing uncertainty through collective agreement, lower NFC participants like *EVM19* show a greater tolerance for diverse perspectives and a less rigid approach to group coordination.

The same consensus-driven behavior is observed in Group 2, where the highest NFC participant, JBZ12, consistently seeks group agreement to reduce ambiguity and streamline decision-making. For instance, JBZ12 directs the group with statements like,

[0:20:26] JBZ12 (Group 2): *We should wait until he reveals himself, and then we all, we circle.*

[1:02:00] JBZ12 (Group 2)*: Yeah, guys, do we all agree that he's here? Yeah?*

These remarks reflect an even more apparent focus on achieving unified strategies to reduce uncertainty, clearly mirroring the behavior of TB187 in Group 1 in style, urgency and tone. JBZ12 repeatedly emphasizes logistical coordination to ensure clarity, such as ensuring everyone is prepared,

[0:08:19] JBZ12 (Group 2): *Where's your purple face? You have it already there ... So everyone has, everyone has this.*

In contrast, lower NFC participants in Group 2, such as *JSK06*, exhibited a more tentative and individual approach. For example, *JSK06* asks for guidance but also expresses doubt, stating,

> [0:47:09] JSK06 (Group 2): *Where should I go? Where should I go? But also, right now, it's gonna cluster, and I feel like he may have escaped, so I think I should stick around you.*

The starkest example of this is demonstrated in Group 3 with the second highest overall NFC score by DPK22.

> [0:44:04] DPK22 (Group 3): *Get him, boys. Yeah, I do a single move.*
> [0:43:55] DPK22 (Group 3): *Oh, no, not yet. Hurry up, man. He's here. But I think it's somewhere here, the streets here.*

One can notice the difference in tone and the sense of urgency that shows DPK22's desire to reduce uncertainty by ensuring group alignment and cohesion. DPK22 also emphasizes the importance of precise direct communication.

> [0:10:46] DPK22 (Group 3): *Can you read it slowly? Because you have to announce it to us. Just read it out.*

This helped to ensure alignment and clarity within the group. In contrast, lower NFC participants, such as *RMM30,* from Group 1 demonstrate a more flexible and open-ended approach. For example, RMM30 suggests,

> [0:21:23] RMM30 (Group 1): *Okay, so each of us aims for, like, an intersection, whatever.*

These examples illustrate how high NFC participants like DPK22 use directive and structured communication to align the group and reduce ambiguity, focusing on unified strategies. Meanwhile, lower NFC participants like RMM30 show a greater tolerance for diversity in approaches.

Discussion

This thesis investigated the research question: *How does Need for Cognitive Closure (NFC) shape the behaviors of individuals within groups when navigating uncertainty in decision-making scenarios?* The thesis has identified five key themes that illustrate how NFC shapes individual decision-making within group dynamics emphasizing the varied strategies participants employ to manage ambiguity and uncertainty. These five themes are, namely, Restriction of Hypotheses, Elevated Judgmental Confidence, Attribution of Behavior to Character, Task Orientation Over Socioemotional Engagement and Consensus Striving and Pressure Toward Uniformity. They emphasize the distinct strategies employed by individuals with varying NFC levels to manage ambiguity and uncertainty.

The findings show that high NFC participants generally sought to reduce uncertainty quickly with the expected aforementioned approaches to provide more clarity and efficiency. In contrast, low NFC individuals exhibited a different tone and style and a more open, exploratory mindset, embracing more ambiguity and engaging with a wider range of possibilities. These contrasting tendencies emphasized how the need for closure shapes thinking patterns, speech and influences decision-making behaviors in relation to uncertainty. Additionally, underscoring how NFC shapes not only individual actions but also the collaborative processes within groups. These distinctions offer a deeper understanding of the trade-offs between certainty striving and adaptability or flexibility in navigating environments.

Theme 1: Restriction of Hypotheses

One key finding was the tendency of high NFC individuals to restrict the range of hypotheses considered during decision-making. Participants with higher NFC scores, such as CSA25 and TB187, consistently focused on a limited set of possibilities, reducing ambiguity by constraining the exploration of alternative strategies. In contrast, low NFC participants like EVM19 kept multiple options open, demonstrating greater flexibility. This behavior aligns with prior research by Leary and Hoyle (2013), which highlights how high NFC individuals prioritize quick closure to minimize uncertainty, often at the expense of deeper exploration.

A novel aspect of this thesis was the role of group dynamics in shaping these tendencies. For instance, in Group 1, TB187 demonstrated the ability to align with others when they reduced uncertainty on his behalf, offering a more nuanced perspective not addressed in prior literature. These findings provide new insights into how NFC operates within collaborative environments. This was particularly evident in contexts requiring real-time decision-making, with the results suggesting predictive patterns regarding how NFC influences decision-making under uncertainty.

The game's uncertainty-driven design amplified these tendencies, pushing high NFC participants to reduce options quickly to simplify decisions.

Theme 2: Elevated Judgmental Confidence

The results showed that high NFC participants do exhibit elevated confidence in their judgments despite limited evidence. This was evident in statements where participants like DPK22 expressed certainty in their conclusions based on minimal information. This finding supports the notion that high NFC is associated with a paradoxical relationship between restricted hypotheses and heightened confidence (Kruglanski & Webster, 1996). While this confidence may facilitate quicker decision-making, it also carries the risk of overconfidence and errors in ambiguous scenarios. This behavior was apparent but begs the question as to whether individuals in group settings must now not only convince themselves that their limited inquiry deserves more conviction, but also the group. The hypothesis here is that since the observation was of individuals within groups, it may occur that although high NFC individuals expressed a need to limit options and possibilities, their actual conviction may be reduced. This could be for two reasons. Firstly, because high NFC also strive for a group consensus (Theme 5) (Leary & Hoyle, 2013), if they are the ones front running limited options and constricting hypotheses to reduce uncertainty more than anyone, which is to be expected (Leary & Hoyle 2013), by the same token they would now have to make sure the group consensus is also established. This would essentially mean they would either have to add additional pressure to their point of view, or after having reduced options they now seek to reach a group consensus and therefore downplay their level of certainty. Secondly, individuals in group settings may in fact reduce their conviction because of people's innate desire to not stand out or be wrong (Florescu & Pop-Pacurar, 2015). Both of those reasons may highlight why Theme 2, while finding some evidence,

was comparatively less persuasive to the findings in other themes and subject to more limitations given group setting.

Theme 3: Attribution of Behavior to Character in High NFC Individuals

The results confidently supported the third theme which was established as a group phenomenon by Leary and Hoyle (2013) in this thesis which was the tendency of high NFC participants to attribute behavior to stable character traits rather than situational factors, aligning with prior findings (Leary & Hoyle, 2013). This correspondence bias emerged during group interactions, where participants used character-based reasoning to interpret Mr. X's moves, reflecting a preference for predictable explanations such as personality in uncertain contexts.

For instance, CNT31 remarked, "I agree, unless he's faking us out hard," emphasizing a perception of Mr. X as deceptive rather than considering situational factors. Similarly, TB187 commented, "We have him if he doesn't pull a stubborn move," which served to attribute potential outcomes to Mr. X's perceived personality trait of stubbornness. These findings align with previous research, which highlighted that individuals within group-level phenomenon use character traits instead of situational cues as a common strategy for high NFC individuals. This again is to reduce ambiguity by focusing on character-driven interpretations.

Theme 4: Prioritization of Task Orientation Over Socioemotional Engagement

High NFC individuals prioritized task completion over socioemotional group dynamics. Participants such as CSA25 and JBZ12 exhibited a strong focus on organizing gameplay and clarifying rules, often disengaging from socioemotional interactions. In contrast, low NFC participants, such as JSK07, displayed greater socioemotional engagement, contributing to group cohesion but sometimes delaying task efficiency. This pattern highlights how NFC influences group priorities, with high NFC participants valuing clarity and closure over interpersonal

dynamics (Schumpe et al., 2017). This theme seems to have the highest predictive element in group settings. This is because when five group members express a stable character trait and are confronted with the same situation, then the likelihood of the initial expression of this trait to be corresponding to the situation is quite high. This was demonstrated very clearly in the findings. In both Groups 2 and 3, which had no player who had previously played this game, the participants who felt the need to read the instruction manual, which would be the first task to reduce uncertainty were always high NFC individuals, followed and supported by the second highest NFC individual of each group respectively. Firstly, this demonstrates that the established environment chosen to test the hypotheses was indeed effective, and secondly that the predictive validity may be higher than initially assumed at the start of this thesis. However, the actual predictive validity remains open, but encourages more research into theme 4, perhaps employing a more quantitative approach in the future.

Theme 5: Consensus Striving and Pressure Toward Uniformity in High NFC Individuals

Finally, high NFC participants demonstrated a drive for group consensus, pushing for uniform agreement to reduce ambiguity. For example, TB187 and JBZ12 frequently sought explicit confirmation from group members, promoting coordinated strategies but sometimes stifling alternative perspectives. This behavior underscores the trade-off between achieving closure and fostering creative, divergent thinking in group settings (Leary & Hoyle, 2013). This theme was difficult to access using the framework that was employed. This is because the transcripts do not accurately reflect and address the tone and sense of urgency that was often present with high NFC individuals. For example, the excerpt from EVM19 (Group 1) saying: *Yeah, that'd be cool. I think I'm gonna do that. Does anyone object?* Potentially reveals a subtle attempt by a lower NFC member to ensure group alignment by inviting objections. However, when placed in the

context of the game - minute 34, when the team chasing Mr. X relies heavily on coordinated teamwork; EVM's statement takes on a different meaning and tone. It actually underscores a more individualistic approach that contrasts with the collective effort crucial to the team's success at this critical juncture. This was a clear limitation of this thesis, that NFC tendencies to reduce uncertainties were often reliant on tone, subtleties and heavily relied on the games contextual position.

Limitations

To outline more limitations, with Participant TB187, it became evident that they often prioritized group cohesion and sentiment, even in situations outside the game's inherent uncertainty. This observation suggests that, alongside NFC, other factors such as a personality structure leaning towards agreeableness may significantly influence behaviors, and in some cases, even outweigh the variable in question within the testing environment. This shows how the personality differences among individuals may have contributed to variance within the participants.

Additionally, the sample size was relatively small, which limits the generalizability of the results to a broader population. A larger sample could have provided greater variability in behaviors and reduced the influence of individual outliers. The sample size remained small due to time constraint and emphasis on validity which meant that data on smaller groups with smaller samples was omitted from this research. This was compounded by the nature of the game itself, which requires one player to act as a 'spy' which changes their respective role in the game considerably.

Additionally, a considerable limitation pertained to participant-specific biases, which became evident during the analysis. For example, JSK06 appeared to prioritize interpersonal

dynamics over task-oriented behavior, likely due to a lack of engagement with the game itself. This was evident not only in their actions but also in the tone of their speech, which often conveyed disinterest or detachment. These observations suggest that JSK06's behavior may not align with NFC-related patterns, highlighting their role as an outlier. This detachment and disinterest were observed in the tone and style regarding the audio version of the data collection, which was not the primary focus of this research, which relied on the transcripts.

The qualitative nature of the study introduced potential researcher bias. As this was the researcher's first experience conducting qualitative analysis, challenges arose in systematically interpreting extensive transcripts and identifying consistent patterns. The task of correctly assessing transcripts and excerpts and not falling prey to innumerable number of biases was challenging. These biases were exacerbated by using previously established themes as guidelines as this meant that the initially normally less biased view of the transcripts was already influenced by the researcher's former research about themes regarding uncertainty management styles. This was however less impactful given that the names were pseudonymized into codes, which means abstracts and phrases could be coded without forming too many impressions.

The mainly qualitative focus posed an additional limitation, it became clear that some themes could have benefited from a quantitative approach to the analysis. For instance, the first theme of "Reducing Uncertainty" could have been explored by examining the percentage of utterances reflecting this tendency. This would not only help to account for how frequently individuals expressed such behaviors but would also provide a proportionate representation of this pattern relative to their overall contributions. Such an approach would mitigate the potential overemphasis and research biases on participants who spoke more frequently, ensuring a more balanced and accurate depiction of the theme.

Finally, the use of convenience sampling introduced additional limitations. Some participants were familiar with one another, including siblings, which may have influenced their interactions during the game. Preexisting relationships and familial roles could have obscured participants' individual dispositions, resulting in behaviors that were not entirely representative of their natural tendencies within our setting. Players may have shown higher preference for socio-economic discussion given their history.

Conclusion

The NFC is a stable dispositional construct, but it has failed to receive as much attention as other concepts and constructs such as the Big Five personality traits or the locus of control and optimism vs. pessimism. This became evident in relation to and when researching prior literature regarding NFC and uncertainty management. The thesis set out to show that, even though NFC does not feature as prominently in the social psychological research literature, it still has a profound impact on outcomes and posed clear gaps and potential for further research.

High NFC individuals indeed shape group behavior by actively reducing uncertainty through strategies such as narrowing hypotheses, driving rapid consensus, and prioritizing task efficiency over socioemotional engagement. In contrast, lower NFC individuals embraced were more comfortable with uncertainty, were able to explore diverse possibilities, and had higher emphasis on socioemotional connections, bringing a more dynamic balance to group interactions

A compelling and intriguing observation arises when viewing disposition constructs in practice. To illustrate an example of this can be seen in disgust sensitivity, which would help to predict, for instance, who might take the lead in cleaning a shared apartment. Between two people living together, the individual with higher disgust sensitivity will almost always reach

their threshold for tolerating mess and initiate cleaning, even if the difference is minimal. In a similar way, this thesis demonstrates that NFC has the potential to predict certain group behaviors such as who starts reading instructions first. This underscores the fact that it is not necessarily the magnitude of individual differences but the consistent predictability of dispositional traits that provide actionable insights into behavior within shared environments. The combination of the collaborative setting used in this thesis and the uncertainty management disposition of NFC proved to be an effective framework for exploring these dynamics.

Uncertainty should be understood through a contextual lens, studying individuals within groups is crucial for this because it allows us to observe how external factors, such as the collaborative setting, the competitive nature of the task, time constraints, and the evolving dynamics of group roles shape the expression of dispositional traits such as NFC and showcase the evolving uncertainty management over time. This research revealed clear patterns in how high and low NFC participants navigate uncertainty, offering insights into the trade-offs between striving for closure and maintaining adaptability. These patterns contribute to the broader understanding of how uncertainty can be effectively managed outside of the contexts of this thesis, perhaps effective in addressing some of today's rapidly evolving challenges.

Ultimately, this thesis underscores the relevance of NFC as a framework for understanding uncertainty management in group settings. it contributes to the growing need for research that bridges individual differences in uncertainty management with collaborative contexts. This thesis showed that NFC has a clear impact on how individuals within groups manage uncertainty, even with present limitations, valuable insights and NFC themes were explored thoroughly and hoped to add to an exciting field in educational psychology.

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Appendices

Appendix A:

Use of Artificial Intelligence Tools During the preparation of this work; the author used ChatGPT in order to brainstorm ideas, clarify complex concepts, and receive feedback on the structure and flow of the text. After using this tool, the author reviewed and edited the content as needed and takes full responsibility for the content of the work.

Appendix B: Excerpt transcripted Session Nov 13, 2024 (Group 1)

Speakers: *IBV10 TB187 EVM19 RMM30 CNT31*

0:00:29 *CNT31*: CN, T 31, okay, let's go.

0:00:33 *CNT31*: Does it sound weird if you block?

0:00:35 *IBV10*: Let's make some space.

0:00:42 *IBV10*: Okay?

0:00:47 *IBV10*: I definitely will have to go through the rules again, but...

0:00:54 *IBV10*: We can.

0:00:57 *IBV10*: So, just so you guys know, the basic idea is that one of us is going to be Mr. X. I don't know what he did, but he's trying to escape from the detectives.

0:01:26 *IBV10*: Sometimes you get hints on where he is, but then he disappears again. The only information you get is that every turn he moves somewhere else. You have different means of moving. You can take a taxi (white lines), a bus (blue lines), or the underground (red lines). There are also boat lines or borderlines. Everyone gets tickets, and you move.

0:02:34 *RMM30*: How do I know that I'm on the correct spot if I can't see?

0:02:38 *IBV10*: One of us is going to play Mr. X, and they will have this board.

0:02:45 *IBV10*: They take notes on where they are moving. You start on one spot, and then each spot has a number. On turns 3, 8, 13, and 18, you reveal your position. Cool.

0:03:16 *EVM19*: Do you want to play as Mr. X? I can because I think you're in the best position to not show where you are based on your eye movements.

0:03:24 *TB187*: Yeah, fair. Or one of you two, because you can see the field upright.

0:03:30 *IBV10*: You can see the field a bit closer, but yeah, I can be Mr. X. I don't really know the moving rules and stuff, so I have to read into it real quick.

0:03:42 *IBV10*: Let's go.

0:03:45 *IBV10*: This is the German version; I'll get the English one.

0:03:53 *IBV10*: Does it exist...?

0:04:00 *RMM30*: Yeah, these Italian circles will be...

Appendix C: Excerpt transcripted session Nov 23, 2024 (Group2)

SPEAKERS: JRD29, JBZ12, JSK07, CSA25, JSK06

JSK06 [00:59]: Maybe you and you can refresh.

JSK07 [01:01]: She hasn't played the game.

JBZ12 [01:02]: I can also do it.

CSA25 [01:03]: For I think I have to be.

JSK07 [01:07]: I'll see about transport.

JSK06 [01:15]: Is this Ticket to Ride?

CSA25 [01:16]: I think I know it.

JSK07 [01:17]: Do you know the game?

JSK06 [01:18]: Is this Ticket to Ride?

JRD29 [01:20]: I also know.

JSK07 [01:21]: Ahh, okay.

[01:23]: *All laughing.*

JRD29 [01:36]: Lena, can you smile?

JSK06 [01:42]: *Laughing.* You look like Oma Dele, Oma Dele!

CSA25 [01:55]: I don't think that's funny.

JSK07 [01:59]: *Laughing.*

JRD29 [01:59]: So remember correctly. One is Mr. X, and he is hunted through London.

JBZ12 [02:17]: Play a word if I read the rules.

JRD29 [02:20]: Do you know Butterc?

JSK07 [02:26]: Is it on the map?

JRD29 [02:27]: I was about to ask.

JSK06 [02:31]: Okay, Johannes is reading the rules and will convey, right?

Appendix D: Excerpt Transcripted Session Nov 24, 2024 (Group3)

Speakers: KMZ08, OCS 25, DPK22, LMS17

DPK22 [03:21]: The playing piece. Mr. X takes the playing piece. In the classic design, is this supposed to be like a or the cardboard playing piece with the...

KMZ08 [03:30]: Paper?

DPK22 [03:36]: Yeah, what's the playing piece? Let's see.

KMZ08 [03:39]: This one here. This one here? Well, it's just these normal...

DPK22 [03:41]: Cases. That's you.

KMZ08 [03:42]: Thank you very much. Yeah, you gotta thank you. Yes, sir. I need...

OCS25 [03:50]: Some explanation.

KMZ08 [03:52]: Look, Mr. X also takes their...

DPK22 [03:54]: Player. Give him the travel lock. Okay with paper.

KMZ08 [03:59]: Got the paper. He has his little paper. What's the paper? Do you think he has this paper? This, this thing, this...

DPK22 [04:08]: Card? No, I think it comes with the paper.

KMZ08 [04:11]: No, it's fine. Yeah.

LMS17 [04:12]: There's some kind of paper here in the back. Arbiter, like, either paper.

DPK22 [04:16]: Should we have paper with this?

KMZ08 [04:18]: Yes, we got paper. Okay, here's a pen.

LMS17 [04:22]: You don't need to argue.

DPK22 [04:27]: Arbitrary pencil is also needed.

KMZ08 [04:30]: Yeah, done. Mr. X also takes the player board along with five black tickets and two double move tickets.

DPK22 [04:39]: What are double tickets? Michael takes their player board. Double move. I have double move tickets.

Appendix E: R Code

R Code

```
library(readr)
install.packages("psych")
install.packages("rlang")
update.packages(ask = FALSE)
library("psych")
library(tidyverse)
library(broom)
library(dplyr)
update.packages("vctrs")
install.packages("readr")
install.packages("tidyverse")
install.packages("broom")
install.packages("vctrs")
```

Import dataset

```
project <- read_csv("project5.csv")
view(project)
```

Cleaning Dataset

```
project1 <- na.omit(project1)
Descriptive2 <- na.omit(Descriptive)
Descriptive <- subset(Descriptive, select = -c(5))
Descriptive4 <- subset(Descriptive3, select = -c(1, 2, 4))
project1 <- project5
```

Descriptive statistics

```
names(Descriptive2) <- c("Identification", "Gender", "Age", "Nationality")
Descriptive3 <- lapply(Descriptive2, function(x) x[-c(1)])
Descriptive3 <- as.data.frame(Descriptive3)
Descriptive4 <- as.data.frame(Descriptive4)
describe(Descriptive4)
summary(Descriptive3)
psych::describe(Descriptive3$Nationality)
Descriptive3 <- lapply(Descriptive3, as.numeric)
project1 <- subset(project1, select = -c(1:23))
project1 <- subset(project1, select = -c(6:42))
Descriptive <- subset(project1, select = -c(6:20))
project1 <- subset(project1, select = -c(1:5))
project1 <- as.data.frame(project1)
Descriptive3 <- as.data.frame(Descriptive3)
```

Add nfcc sum

```
CC <- project1 %>% dplyr::select(1:15)
str(CC)
CC <- sapply(CC, as.numeric)
sumCC <- rowSums(CC, na.rm = TRUE)
project1$CC <- sumCC
Descriptive2$CC <- project1$CC
psych::describe(Descriptive3$CC)
```

Export summary to Excel

```
library(openxlsx)
install.packages("openxlsx")
write.xlsx(Descriptive2, file = "CCSummary.xlsx")
```

Visualization

```
library(ggplot2)
ggplot(data = Descriptive3, aes(x = CC)) +
geom_histogram(fill = "skyblue", color = "black", bins = 20) +
labs(title = "Histogram of Need for Cognitive Closure", x = "NFCC Score", y = "Frequency")
```