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The impact of background category information on the creation of social cliques: The role of need for cognitive closure and decisiveness¹

This article focuses on the role of need for cognitive closure in the process of mental model creation about social relations (i.e. social cliques). We assumed that high (vs. low) need for closure participants tend to rely on background category information when forming social cliques. We predicted that this tendency to employ categorical information as a mental aid, used in order to form social cliques, would be efficient in simple task structures (where category information overlaps with the mental model structure) but would lead to increased error rates in complex task structures (where category information is inconsistent with the model structure). The results confirmed our predictions, showing especially strong effects for the decisiveness component of need for closure. The importance of individual differences in need for closure and decisiveness in social reasoning is discussed.

Keywords: social mental models, categorization, need for cognitive closure, decisiveness

After years of describing our knowledge representations as static and fixed, social cognitive research has come to focus on more dynamic and flexible aspects of our cognition, emphasizing the constructive nature of social information processing (Smith, 1998; Wyer & Radvansky, 1999; von Hecker & Sędek, 1999). In order to explain how people reason about the physical and social world and how they create meaningful cognitive representations, new theoretical ideas have been developed. One important theory that explains how we reason about novel situations centers around the mental model concept. According to this idea, knowledge representations are constructed actively and on-line in order to allow the perceiver to understand specific, real or imaginary situations (Johnson-Laird, 1983). New knowledge about the environment can be represented in the form of a mental model in which particular elements are related to each other, and can therefore be retrieved from memory using inferential processes. In the present research we focused on the role of epistemic motivation in the process of social mental model creation. We expected that the

biasing impact of background categorical knowledge on the accuracy of reasoning about social relations should be moderated by individual differences in need for cognitive closure.

Mental models in understanding patterns of social relations

Previous research has proven that mental models help perceivers to organize information and understand patterns of social relations (Hummert, Crockett, & Kemper, 1990). Hummert and colleagues (1990) also examined the idea that balance schemas (Heider, 1958) can be used during reasoning about social relationships as a means to encode, store, and retrieve information about patterns of sentiment (liking vs. disliking) relationships between people. They concluded that perceivers sort members of small groups into smaller units (known as cliques); this representation is constructed serially at the moment of acquisition but once formed it is retrieved as a whole mental model. This means that even if the perceiver did not code a particular sign of relationship between two people, this piece of

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information can be easily inferred from the constructed model, which specifies who belongs to which social clique. Further studies in this domain explored the role of logical inference rules in reasoning about sentiment relations. Von Hecker (1997) assumed that transitivity and intransitivity rules are used as cognitive tools in the process of constructing social mental models. These theoretical assumptions stem from Heider's original balance principles (1958), which state that relations within a group must have a positivity value, those between groups a negativity value. Based on this assumption, when using transitivity rules it is possible to infer that if we know person A likes B and B likes C, then a positive relation between A and C can be inferred by the perceiver. The anti-transitivity rule comes into play, for example, when A dislikes B and B dislikes C, but A likes C (thus forming two cliques). It has been shown that these inference rules are used by people in order to construct a meaningful mental model of sentiment relations in small social groups and that contextual cues can influence this process (von Hecker, 1997).

One of the important factors influencing the social clique model creation is the background knowledge of the perceiver about the type of social context in which the liking-disliking relations take place. Von Hecker and colleagues demonstrated the role of previously learned category distinctions in the process of learning sentiment relationships (von Hecker, Crockett, Hummert, & Kemper, 1996). They found that when the information contained in a mental model contradicted the previously acquired social categorization, interference processes occurred leading to an impaired learning performance of new information. This research clearly showed that the reasoning process about sentiment relationships in small groups can be affected by other sources of information that the perceiver attends to, like for example their membership in social categories.

Pursuing this line of research further, we posed the question of to what extent people differ in terms of how mental model construction processes are influenced by background categorical knowledge. In our previous research (Bukowski, von Hecker, & Kossowska, 2011) we applied nationality information (names of people belonging to a social clique) that was either a valid cue for the creation of an accurate social clique model (i.e. the mental model could be created based on a simple rule that people from one category like each other while those from different categories dislike each other) or an invalid cue (i.e. the liking and disliking relations between people were not related to their nationalities). We refer here to these two types of models as category consistent or category inconsistent models, respectively. In the research presented here, we additionally introduced multiply-categorizable targets, a condition where a second category can also be used in building up a social clique model (such as profession in addition to nationality). This condition serves

as a more complex and ambiguous categorization setting and most importantly demands flexibility – prompting the subject to change the chosen categorization rule while task performance is underway.

The role of motivational and ability factors in the creation of social mental models

There is increasing evidence that motivational factors determine what type of information is attended to and how extensively information is processed in the course of creating new knowledge (see Kruglanski, 2004). Research on social reasoning has demonstrated that people who experience conditions of uncontrollability show a decreased ability to integrate new information into a meaningful mental model (von Hecker & Sędek, 1999). Knowing this, one could also expect that people who have a low motivation to deal with ambiguity and process information in a piecemeal fashion would also show less accuracy in the mental model creation process. One factor with a potential bearing on this issue that has not received much attention in understanding the creation of social mental models is need for cognitive closure (NFC; Kruglanski, 2004). Need for closure has been defined as a desire for a definite answer to a question, for any firm answer rather than uncertainty, confusion, or ambiguity (Kruglanski & Webster, 1996). It has been described as a dispositional variable with such facets as decisiveness, preference for order, predictability, discomfort with ambiguity, and closed mindedness, as well as a situational variable that can be manipulated by time pressure, noise, or mental fatigue (Kruglanski & Webster, 1991). According to the previous literature on the effects of need for closure on memory performance, people who score high on the need for closure scale show a preference for processing schema consistent information and tend to use more heuristic processing styles during negotiations and consumer decision making (de Dreu, Coole, & Oldersma, 2009; Dijksterhuis, van Knippenberg, Kruglanski, & Schaper, 1996; Kruglanski & Freund, 1983). However, there is not much research showing the influence of need for closure on reasoning and knowledge construction processes in the social relations domain.

In our previous research, we found that a high level of need for cognitive closure leads to difficulties in reasoning about social relations and to higher error rates in conditions where the construction of a mental model is inconsistent with the participant's expectations (Bukowski, von Hecker, & Kossowska, 2011). However, it is still not clear how people with high vs. low need for closure build mental models in a situation when the rules that allow an accurate picture of the situation to be constructed vary in complexity and change over time. We assume that people with relatively high need for closure will construct less accurate mental models of social relations within a group when the categorization rule that divides these people into subgroups or cliques changes

over time. In other words, high need for closure might help in efficient construction of a mental model when a simple categorization rule is provided, but a change of the rule or the use of a more complex logic of inference (not based on any specific social category) would require a more flexible cognitive processing strategy, to which high need for closure individuals might not be able to adapt. Further on in this article we will focus on the issue of how social mental models are constructed when the perceiver already has some contextual information (here, about sentiment relationships in groups) and is asked to learn new pieces of information that contradict the possessed schematic representation.

Thus, in this research we want to examine the role of need for closure in the dynamic process of forming a social clique model of liking or disliking relations between people in fictitious groups. Specifically, we are interested in the comparison between three types of conditions: in the first the accurate mental model of the situation overlaps with the dominant categorization cue (nationality), in the second the social clique model is based on a different categorization cue (profession), and in the third the background categorization is not a valid cue at all and the participant has to follow transitivity logic in order to build up a correct mental model of the relations presented. The three task conditions therefore impose an increasing demand on the participants to process the information more systematically in order to solve it accurately. Apart from that, the tasks are presented to all participants in a sequential way, so we can also observe how people with high vs. low NFC adapt to the change in categorization rules (from nationality to profession to non categorical rule). The sequential and dynamic aspect will enable us to observe the flexibility of reasoning during the social clique creation process.

Webster and Kruglanski (1994) suggest that Need for Cognitive Closure is a unitary latent variable manifested in five different facets: Need for Order, Need for Predictability, Tolerance of Ambiguity, Closed-Mindedness, and Decisiveness. However, later findings have shown that Decisiveness is a separate dimension, differing from the other factors contained in Need for Closure in that it represents the ability to achieve cognitive closure (Kossowska, Van Hiel, Chun, & Kruglanski, 2002; Roets, Van Hiel, & Cornelis, 2006; Roets & Van Hiel, 2007). For example, Roets and Van Hiel (2007) argue that the items of the Decisiveness scale largely tap into ability-related characteristics. For example, the items 'When faced with a problem I usually see the one best solution very quickly' and 'When I go shopping I have difficulty deciding exactly what it is I want' (reversed item) do not seem to measure solely the wish to make quick decisions but also the perceived ability to make these decisions. Items for a need scale should refer only to motivation and preferences, not to habitual behaviors, which represent a mix of ability and

needs. Mannetti, Pierro, Kruglanski, Taris, & Bezinovic (2002) conclude that 'the specific wording of Decisiveness items described the ability (or lack of ability) to reach a decision quickly rather than the need to find an answer as soon as possible without too much worry about its validity (i.e., seizing upon the first available answer)' (p. 153).

In line with recent developments in the study of need for cognitive closure, we sought to examine two distinctive aspects of closure, one related to the preference for simple knowledge structures (related also to conservative beliefs; see Kossowska & van Hiel, 2003) and the other related to the ability to make quick decisions (represented by the decisiveness scale; Roets, van Hiel, & Cornelis, 2006). In the context of a social clique formation task that involves integrative, systematic processing (when no categorization rule is provided), the distinction between decisiveness and the motivation to achieve closure might be very relevant. By measuring these two aspects we sought to be able to distinguish better whether the performance level of our participants can be explained entirely by the differences in closure motivation or whether the decisiveness, ability-related component plays an important role in the clique formation process as well.

Main predictions

We expected high NFC participants to exhibit lower performance in the condition where the liking distribution is not related to any categorization provided and overall the model is inconsistent with either of the two categorizations. At the same time we assumed that high NFC participants should show an initial benefit in performance (in relation to low NFC participants) in the condition where the categorization rule is consistent with the nationality of presented names. However, when the rule switches to the use of a different categorization principle, the advantage of high NFC participants should disappear.

Furthermore, we assumed that participants who score high on the decisiveness dimension should freeze quickly on the first available solution for the task, without considering other possible alternatives. This strategy should lead to an even more strongly pronounced effect of categorical cue use in task conditions where social cliques can be formed based solely on one simple nationality or profession categorization. In conditions where such a cue is not valid and a social clique cannot be correctly formed based thereon, high (vs. low) decisiveness participants should show an increased error rate, due to the application of simple decision strategies to solving a complex reasoning task. In sum, we expected not a qualitative but a quantitative difference between the results for the need vs. ability measures of the cognitive closure process. Specifically, apart from the motivational component, the aspect of cognitive resources (related to an increased demand on working memory functions; von Hecker & Dutke, 2004) should be very important in the

type of reasoning task to be provided to the participants and this aspect should be more precisely assessed by the Decisiveness scale.

Method

Participants

The sample consisted of 58 participants, including 43 women and 15 men with a mean age of 20.82 (SD = 2.11). All of them were students of the Warsaw School of Social Sciences and Humanities.

The study had a 3 (categorization rule type: nationality, profession or none; within participants) x 2 (need for closure: high vs. low; between participants) experimental design.

Procedure and materials

Participants were asked, after signing an agreement to participate in the study, to fill out a Polish version of the 32 item Need for Closure Scale (Kossowska, 2003; Webster & Kruglanski, 1994). The scale consists of five sub-scales: 1) Preference for order and structure in the environment; 2) Predictability of future contexts; 3) Affective discomfort occasioned by ambiguity; 4) Decisiveness, and 5) Closed-mindedness. We analyzed the items from the Decisiveness scale separately because it has been seen as tapping not so much into the motivational aspects as into a general ability to achieve cognitive closure (Bar-Tal & Kossowska, 2010; Roets & Van Hiel, 2007). Mean scores were calculated for the 27 need for closure items and for the 5 items of the Decisiveness scale (Cronbach Alpha = .721 and .651, respectively).

Background category information

Participants were seated in front of a computer and were presented with a cover story telling them about an international company that consisted of Polish and German engineers and doctors of biology who were given the common goal of inventing and developing a new flu vaccine. Each person could be therefore classified into one of four categories: Polish doctor, Polish engineer, German doctor or German engineer; such category membership was indicated by the name and title in front of it (e.g., Dr. Sławomir or Eng. Klaus). At the same time it was stated that when the workers were distributed into teams, some team members would come to cooperate with one another, others to rival one another. As a consequence, subgroups of people who liked each other would form spontaneously. Moreover, participants were told that the ensuing tasks they would be asked to perform on the computer were designed to understand how they would, in their minds, divide these people up into smaller subgroups according to the information provided on pairwise liking, whereby

the subgroups could consist of at least two people. As mentioned above, people who formed a given relation were distinguishable as to their nationality and profession by their names and titles (e.g., Dr. Bogdan + Dr. Wolfgang means a liking relation between two people belonging to two different nationality categories, Polish and German, but to the same professional category).

Social clique model construction task

Relations between six fictitious persons were presented as individual pairs, with a plus or minus sign between two male names, indicating the type of sentiment relations between them (liking or disliking). The participant decided when the next pair should appear. After the presentation of each pair the sign indicating the type of relation between two people (“+” for mutual liking, “-” for mutual disliking) disappeared but the name pair remained on the screen. Eight relations were successively shown, allowing for a partitioning of the six persons into either 2 or 3 subgroups (cliques).

Two main dependent variables were considered – sorting decisions (how many subgroups / social cliques were formed) and decisions about the sign (positive or negative) of relations previously presented. The first variable can be treated as an indicator of how accurately the social clique model was formed (von Hecker & Sędek, 1999), whereas the second variable can tell us how precisely particular pieces of information (i.e. signs of relations between specific pairs of names) were coded and retrieved from memory.

Results

Before starting the analysis all the continuous variables were centred. A simple contrast schema was used for the dichotomous independent variables (auxiliary variable coding: -0.5 and 0.5) and an orthogonal reverted Helmert contrast was used for the experimental condition variable. The model tested for a difference between the 1st condition and 2nd condition (contrast 1; comparison between two conditions with clique structure consistent with categorical knowledge) and between the average of 1st and 2nd conditions on the one hand and the 3rd condition on the other (contrast 2; comparison between condition inconsistent with categorical knowledge and average from two consistent conditions). Interaction terms were computed on the basis of centred variables and orthogonal contrasts to ensure that there would be no multicollinearity in the data.

Due to the dichotomous character of the dependent variables (response accuracy), a multilevel logistic regression was chosen to compute estimates of the hypothesized model (Gelman & Hill, 2007; Jiang, 2007). R package *glm* (Bates, 2010; R Development Core Team, 2008) was used for both models: accuracy of decisions

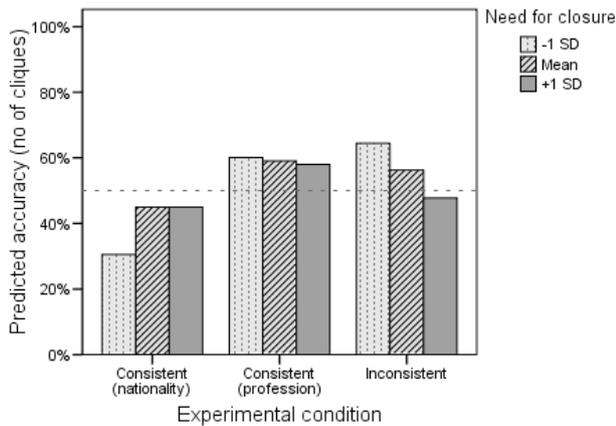


Figure 1. Accuracy of decisions regarding the number of social cliques that were formed as a function of task condition and the level of need for closure.

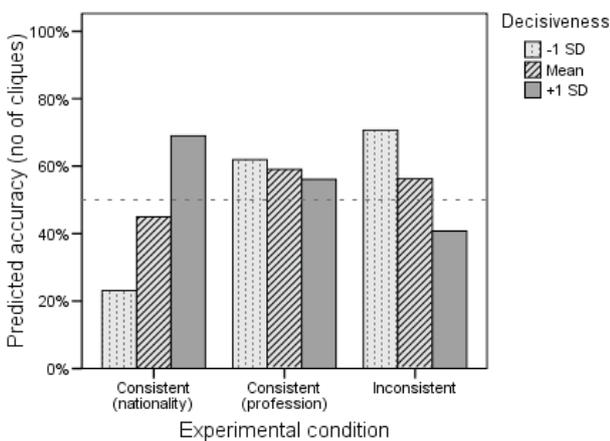


Figure 2. Accuracy of decisions regarding the number of social cliques that were formed as a function of task condition and the level of decisiveness.

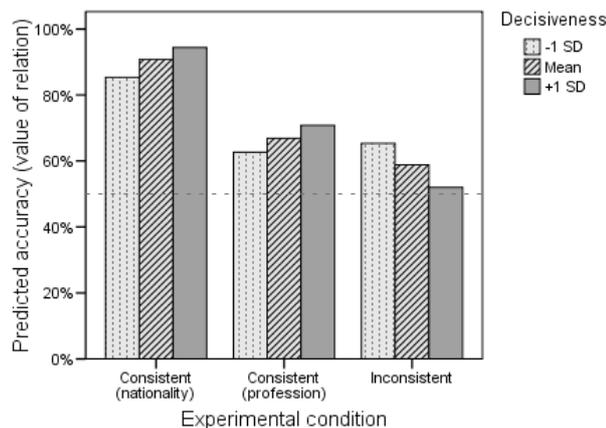


Figure 3. Accuracy of correct relation sign decisions for presented relations as a function of task condition and level of NFC.

about the number of cliques and accuracy of relation sign (positive or negative). As concerns the model for the type of relation sign (positive or negative) an improvement was achieved by taking individual variability into account (AIC changed from 1289.6 to 1259.1). Surprisingly, allowing effects for experimental conditions to vary between subjects also strongly improved model fit (AIC changed from 1259.1

to 1246.9, $chi-square = 22.16$, $df = 5$, $p < 0.001$). Therefore, the experimental condition effect has also been specified as a random effect. Variability in effect size proved to be more related to contrast 1, which refers to a comparison between the 1st and 2nd condition (two conditions consistent with categorical knowledge).

The results for the group sorting variable revealed an interaction effect close to statistical significance but only when the two category consistent conditions were pooled together and compared against the category inconsistent condition (contrast 2: $t = 1.83$, $p = 0.06$; contrast 1: $t = 1.643$, $p = 0.1$) between need for closure and task condition. Participants who scored low on NFC (vs. moderate and high) made less accurate sorting decisions only in the nationality category consistent task condition. This pattern was reversed in the category inconsistent condition: low NFC participants were the most accurate while high NFC participants scored the lowest levels of accuracy. In the profession categorization condition no differences regarding the need for closure level were observed. The results are presented on Figure 1.

We also performed similar analyses for sorting decisions with decisiveness as the main independent variable. Results showed a very similar pattern as for the need for closure scale but the effects were even stronger (decisiveness interaction with contrast 1: $t = 2.58$, $p = 0.01$; contrast 2: $t = 2.91$, $p = 0.004$) (see Figure 2). People who scored high on decisiveness outperformed those who scored low in the nationality based categorization condition, but underperformed in the condition in which social categorization could not be used as an inference rule.

Results for the accuracy of decisions about the sign of presented relations between two fictitious people revealed that participants who scored high on decisiveness performed better than the low decisiveness participants in category consistent conditions but performed worse in the category inconsistent conditions ($t = 3.21$, $p = 0.001$) (see Figure 3).

Discussion

These results confirm our main prediction that a high level of need for cognitive closure facilitates the construction of correct social cliques when there is a simple categorization rule that can be used by people in order to solve the task (nationality or profession). However, when the rule changes to a different one the advantage of high NFC participants disappears. Importantly, in task conditions where there is no clear and simple categorization rule (most of the relation signs are inconsistent with either the nationality or the profession categorization), the advantage of low need for closure participants grows. This result is

consistent with our previous findings that showed that only for the most complex mental model structures do low need for closure participants outperform those who show high need for closure (Bukowski et al., 2011). It seems also that low motivation to achieve closure can act both ways – in task settings where decisions about relations between people can be made based on simple categorical rules, using simple heuristics can help to make a better decision, therefore people who score high in NFC perform better than low NFC participants. Still, more complex structures of relations between people are better recalled by low NFC participants. This might be due to a more analytical, systematic processing style applied by such participants. Therefore, what seems important for performance level in the social clique creation process is the fit between the task complexity and the strength of the epistemic motivation.

It is important to notice that the accuracy of decisions regarding the number of social cliques, as well as the overall accuracy for the relation sign decisions in the recall task phase, were more strongly related to the results on the decisiveness scale than to the general need for closure score. Decisiveness is defined as a tendency to make decisions quickly, regardless of their importance, in order to simplify the decision making process and be able to achieve certainty faster (Webster & Kruglanski, 1994). According to more recent findings, decisiveness can be considered a separate factor loosely correlated with other need for closure facets (Kossowska, Van Hiel, Chun, & Kruglanski, 2002) and it also might reflect efficacy in quick decision making. Previous research on the relation between decisiveness and preferences for various decision making strategies shows that high decisiveness is associated with greater tendency to simplify the decision process and to use non-compensatory decision making strategies (based on the value of one attribute and not the integration of information from different dimensions) (Wichary, Kossowska, Orzechowski, Ślifierz, & Markovic, 2008). Our results that relate decisiveness to the accuracy of clique formation are consistent with those previous findings. People who score high on decisiveness terminate the mental model creation process earlier and stick to the first simple structure that could serve as a solution for the task provided. In task conditions where the clique structure overlaps with the simple, category based distribution of people into cliques, high decisiveness participants perform better than low decisiveness ones.

This finding is in line with the argument presented by Gigerenzer, Todd, & the ABC Group (1999), who claim that fast and frugal decisions based on simple decision making heuristics are often also the accurate and therefore adaptive ones as well. However, the efficacy of these strategies might be limited to conditions in which the environment is relatively stable and no changes in the social clique structures are introduced. In task conditions in which multiple social

categorizations can serve as a candidate for a correct clique structure solution, the difference between high and low decisiveness people disappears, and in conditions where no categorization can serve as a solution, high decisiveness impedes piecemeal processing of the participants (required in order to solve the task properly) and consequently affects the overall performance level. At the same time low decisiveness participants gain an advantage in this situation and elevate their level of performance.

The cognitive mechanism underlying these results can be better understood when we take into account that high decisiveness might narrow one's working memory capacities related to integration of information. From previous decision making research we know that lower working memory capacity is related to the use of simple decision making strategies (Wichary, Orzechowski, Kossowska, Ślifierz, Markovic, & Bukowski, 2005). At the same time it has been shown that low working memory resources are an important factor in the integrative perception of relations in a social clique learning task and individuals low in working memory benefit more from external representations (von Hecker & Dutke, 2004). In the case of our task, background social categorizations can be considered external, socially shared representations. In the absence of such external cues, high decisiveness participants, due to their lowered working memory capacities, might have limited abilities to apply more complex processing strategies and simplify a task in which social categorization is no longer a valid cue.

General Conclusions

This research has shown that people who tend to make decisions quickly and do not think about alternative choices more than absolutely necessary also tend to “freeze” their reasoning process more quickly and rely heavily on the available categorical information about social targets. This tendency importantly influences their accuracy of reasoning about the type of social relations in groups. In contexts that provide a clear categorical distribution of the social world, such a fast decision making strategy also proves to be the accurate one, since additional rumination about alternative solutions does not make one's decision more correct but only consumes time and mental effort. However, in contexts where categorical rules cannot be applied in order to build an accurate representation of relations between people, then high decisiveness reveals its disadvantages. Those individuals seem to process information in a highly selective way, relying almost entirely on the categorical background information. Interestingly, it seems that the relation between need for closure and reasoning accuracy is not so straightforward, since it depends strongly on the type of the structure of the social environment. Therefore, high need for closure (and especially high decisiveness) may be

related to facilitation or impairment of reasoning process accuracy, depending on the fit between the complexity level of the environment and the particular cognitive processing strategy applied in building a mental representation.

This research has also shown that decisiveness is an important aspect of epistemic motivation which should be considered separately from the whole need for closure construct. Decisiveness can be treated as a form of ability or at least perceived efficacy in decision making, in contrast to the motivational aspect. When decisiveness is conceptualized in this way, our results seem to be consistent with the predictions stemming from the distinction between need and ability to achieve cognitive structure (Bar-Tal, 1994; Bar-Tal & Kossowska, 2010). It has been previously shown that when need for cognitive structure is high and the ability to achieve it is high as well, then an increase in stereotyping can be observed, whereas stereotyping decreases in low ability conditions (Bar-Tal & Guinote, 2002; Kossowska, 2010). In the current research we have demonstrated that low decisiveness (thus low ability or tendency to make quick and spontaneous decisions) can reduce the tendency to rely on the first mentally available social categorization. Therefore we believe that not only need for closure but also decisiveness might have important consequences for social information processing. Previous research has shown that the Decisiveness scale and the other NFC facet scales correlate with conservatism and racism (Roets & Van Hiel, 2006). Dechesne, Schultz, Kruglanski, Orehek, & Fishman (2008) found that individuals high in need for closure prefer groups with impermeable (vs. permeable) boundaries and had more negative attitudes toward immigration. In the light of these findings and our results, it seems plausible that the need for urgency (reflected in the decisiveness aspect of the NFC construct) may also influence the creation of relatively simple (vs. complex) cognitive representations of social relations between people or groups. Specifically, the ability to build relatively complex and flexible forms of social knowledge should be affected by an elevated level of decisiveness.

We believe that further research should examine the relation between decisiveness as a relatively stable individual difference, task complexity, and working memory capacities in order to provide a more precise picture of how these constructs are interrelated. Another interesting aspect that could be developed based on this study is the dynamics of the social clique learning process. In this study we provided a task sequence in which an initially learned social categorization, which could serve as a rule to solve the clique division task, was not valid for subsequent social clique distributions. This shifting of categorization rules could be a promising measure of cognitive flexibility in the domain of social cognition. The relation between epistemic motivation and flexibility in rule change conditions appears to be an inspiring field for future research.

References

- Bar-Tal, Y. (1994). The effect on mundane decision-making of need and ability to achieve cognitive structure. *European Journal of Personality*, 8, 45-58.
- Bar-Tal, Y., & Guinote, A. (2002). Who exhibits more stereotypical thinking? The effect of need and ability to achieve cognitive structure on stereotyping. *European Journal of Personality*, 16, 313-331.
- Bar-Tal, Y., & Kossowska, M. (2010). The efficacy at fulfilling need for closure: The concept and its measurement. In John P. Villanueva (Ed.), *Personality Traits: Classification, Effects and Changes* (pp. 47-64). New York: Nova Publishers.
- Bates, D. M. (2010). *lme4: Mixed-effects modelling with R*. Book available at: <http://lme4.r-forge.r-project.org/book/>
- Bukowski, M., von Hecker, U., & Kossowska, M. (2011). The role of need for cognitive closure in the construction of social mental models. Unpublished manuscript, Jagiellonian University, Poland.
- Dechesne, M., Schultz, J. M., Kruglanski, A. W., Orehek, E., & Fishman, S. (2008). A psychology of borders: Need for closure and the allure of group impermeability. Unpublished Manuscript, University of Maryland, MD, USA.
- de Dreu, K., Koole, S., & Oldersma, F. (1999). On the seizing and freezing of negotiator inferences: Need for cognitive closure moderates the use of heuristics in negotiation. *Personality and Social Psychology Bulletin*, 25, 348-362.
- Dijksterhuis, A. P., Van Knippenberg, A. D., Kruglanski, A. W., & Schaper, C. (1996). Motivated social cognition: Need for closure effects on memory and judgment. *Journal of Experimental Social Psychology*, 32, 254-270.
- Gelman, A., & Hill, J. (2007). *Data Analysis Using Regression and Multilevel/Hierarchical Models*. New York: Cambridge University Press.
- Gigerenzer, G., Todd, P.M. and the ABC Research Group (1999). *Simple Heuristics that Make Us Smart*. Oxford: Oxford University Press.
- Heider, F. (1958). *The psychology of interpersonal relations*. New York: Wiley.
- Hummert, M. L., Crockett, W. H., & Kemper, S. (1990). Processing mechanisms underlying use of the balance schema. *Journal of Personality and Social Psychology*, 58, 5-21.
- Jiang, J. (2007). *Linear and generalized linear mixed models and their applications*. Springer Series in Statistics. New York: Springer.
- Johnson-Laird, P. N. (1983). *Mental models. Towards a cognitive science of language, inference and consciousness*. Cambridge: Harvard University Press.
- Kossowska, M. (2003). Różnice indywidualne w motywacji poznawczej (Individual differences in cognitive motivation). *Przegląd Psychologiczny*, 46, 355-375.
- Kossowska, M. (2010). Poznawcze i motywacyjne źródła nabywania wiedzy. (Cognitive and motivational sources of knowledge formation). In: A. Kolańczyk & B. Wojciszke (red.). *Motywacje umysłu (Motivations of the mind)* (pp. 15-28). Sopot: Smak Słowa.
- Kossowska, M. & Van Hiel, A. (2003). The relationship between need for closure and conservatism in Western and Eastern Europe. *Political Psychology*, 24, 501-518.
- Kossowska, M., Van Hiel, A., Chun, W.Y. & Kruglanski, A. (2002). The need for cognitive closure scale: structure, cross-cultural invariance, and comparison of mean ratings between European-American and East Asian Samples. *Psychologica Belgica*, 42, 267-286.
- Kruglanski, A. W. (2004). *The psychology of closed mindedness*. New York: Psychology Press.
- Kruglanski, A., & Freund, T. (1983). The freezing and un-freezing of lay-inferences: Effects on impression primacy, ethnic stereotyping and numerical anchoring. *Journal of Experimental Social Psychology*, 19, 448-468.
- Kruglanski, A. W., & Webster, D. M. (1991). Group members' reactions to

- opinion deviates and conformists at varying degrees of proximity to decision deadline and of environmental noise. *Journal of Personality and Social Psychology*, 61, 212–225.
- Kruglanski, A. W., & Webster, D. M. (1996). Motivated closing of the mind: “Seizing” and “freezing”. *Psychological Review*, 103, 263–283.
- Mannetti, L., Pierro, A., Kruglanski, A., Taris, T., & Bezinovic, P. (2002). A cross-cultural study of the Need for Cognitive Closure Scale: Comparing its structure in Croatia, Italy, USA and The Netherlands. *British Journal of Social Psychology*, 41, 139-156.
- R Development Core Team (2008). R: *A language and environment for statistical computing*. R Foundation for Statistical Computing, Vienna, Austria. Available from <http://www.R-project.org>
- Roets, A., & Van Hiel, A. (2006). Need for closure relations with authoritarianism, conservative beliefs and racism: The impact of urgency and permanence tendencies. *Psychologica Belgica*, 46, 235–252.
- Roets, A., & Van Hiel, A. (2007). Separating ability from need: Clarifying the dimensional structure of the need for closure scale. *Personality and Social Psychology Bulletin*, 33, 266-280.
- Roets, A., Van Hiel, A., & Cornelis, I. (2006). The dimensional structure of the Need for Cognitive Closure Scale: Relationships with ‘seizing’ and ‘freezing’ processes. *Social Cognition*, 24, 22-45.
- Smith, E. R. (1998). Mental representation and memory. In: D.T. Gilbert, S.T. Fiske, G. Lindzey (Eds.), *The Handbook of Social Psychology*. (pp. 391-445). New York, Oxford: The McGraw-Hill Companies, Inc.
- von Hecker, U. (1997). How do logical rules help to construct social mental models? *Journal of Experimental Social Psychology*, 33, 367-400.
- von Hecker, U., Crockett, W., Hummert, M. L., & Kemper, S. (1996). Social cliques as mental models. *European Journal of Social Psychology*, 26, 741-749.
- von Hecker, U., & Dutke, S. (2004). Integrative social perception: Individuals low in working memory benefit more from external representations. *Social Cognition*, 22, 336-365.
- von Hecker, U., & Sędek, G. (1999). Uncontrollability, depression and the construction of mental models. *Journal of Personality and Social Psychology*, 77, 833-850.
- Wichary, S., Kossowska, M., Orzechowski, J., Ślifierz, S, Marković, J. (2008). Individual differences in decisiveness: Pre-decisional information search and decision strategy use. *Polish Psychological Bulletin*, 39, 47-53.
- Wichary, S., Orzechowski, J, Kossowska, M., Ślifierz, S, Marković, J., & Bukowski, M. (2005). Strategie decyzyjne a funkcjonowanie pamięci roboczej (Decision making strategies and working memory). *Studia Psychologiczne*, 43, 97-102.
- Webster, D. & Kruglanski, A. (1994). Individual differences in need for cognitive closure. *Journal of Personality and Social Psychology*, 65, 261-271.
- Wyer, R. S. Jr., & Radvansky, G. A. (1999). The comprehension and validation of social information. *Psychological Review*, 106, 89-118.