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Need for closure and multitasking performance: The role of shifting ability

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ABSTRACT

The aim of the study was to test the role need for closure (NFC) plays in multitasking performance. We predicted that this specific motivation, defined as a tendency to reduce uncertainty and ambiguity via cognitively rigid information processing style, would lead to poorer multitasking performance. However, we expected that NFC is not related to this deficiency when associated with high shifting ability. The results supported these hypotheses as it turned out that NFC was related to poorer accuracy in the main task in the easy condition and poorer accuracy in additional task in the difficult condition. In both cases it was true only for participants low on shifting ability suggesting that high shifting ability might compensate worse performance on multiple tasks related to NFC. Presented study is the first one to test the role of NFC in the multitasking context.

1. Introduction

The ability to efficiently perform many tasks at the same time is necessary in everyday life (Bühner, König, Pick, & Krumm, 2006), especially in today's media saturated environment in which multitasking has become a prevalent phenomenon (Ophir, Nass, & Wagner, 2009). Multitasking has been defined as carrying out two or more tasks at the same time (e.g. Bühner et al., 2006; Ishizaka, Marshall, & Conte, 2001) or as a means to accomplish many goals within a certain period of time by switching between individual tasks (Delbridge, 2000). Multitasking thus requires divided attention (Judd, 2013) and flexibility, or the ability to efficiently shift from one task to another (Monsell, 2003). Flexibility should then aid multitasking, whereas rigidity should impair it. In this paper we focus on the role the latter plays in multitasking performance, but rather than cognitive rigidity we focus on one that is motivational in nature. One of the best described variables linked to motivational rigidity is need for closure (NFC, see Roets et al., 2015).

2. NFC as a predictor of multitasking performance

NFC has been originally defined as a desire for a definite, firm answer to a question, in contrast to uncertainty, confusion, or ambiguity (Kruglanski, 1990; Kruglanski & Webster, 1996) and refers to a motivated tendency to reduce uncertainty via simplification, structuring, reduction of information and rigid processing style, which have been demonstrated in many areas, such as hypothesis generation, decision making, creativity, and social beliefs (see Roets et al., 2015, for overview). We believe it may also affect multitasking performance. Since NFC manifests itself in desire for predictability, preference for order and structure, and discomfort with ambiguity (Webster & Kruglanski, 1994), individuals high on this disposition should feel less comfortable in multitasking (rather that mono-tasking) environment in which completing one task is not possible before moving to another. Hence, flexible shifting between ongoing tasks should not be a typical and natural tendency for high NFC individuals and they might perform worse on tasks requiring the same. Moreover, previous research suggests that individual differences in NFC might be related to differences in elementary cognitive processes. It has been shown that high NFC corresponds to limited pool of resources, which might be compensated for by heightened selective attention and better ability to shut out irrelevant distractions and noise from environment (Kossowska, 2007a, 2007b; Kruglanski & Webster, 1996). There is also neurological evidence for the relationship between motivational rigidity and selectivity of attention (Kossowska et al., 2015). This improved selectivity and focalization exhibited by high NFC individuals, as well as cognitive system limitations may imply that these individuals might be more “predisposed” to single—rather than multitasking, as the latter might be relatively more demanding for them. However, it does not mean that high NFC is related to inefficient multitasking. It might suggest, though, that certain level of cognitive control, or specifically — shifting ability, is required to compensate for the differences stemming from NFC.

3. The role of shifting ability in multitasking related to NFC

A vast number of studies show that multitasking requires executive control (e.g. Heyder, Suchan, & Daum, 2004; Logan & Gordon, 2001; Rubinstein, Meyer, & Evans, 2001; Thoma, Koch, Heyder, Schwarz, &

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Daum, 2008), which is necessary to successfully divide attention and allocate resources among concurrent tasks (Logie, Cocchini, Delia Sala, & Baddeley, 2004). However, the research on executive control shows that there are several executive functions that can be treated somewhat independently. The most frequently postulated executive functions are: shifting of mental sets (task switching), monitoring and updating of working memory representations, and inhibition of prepotent responses (Miyake et al., 2000). Also other authors agree that task shifting is one of the aspects of executive functioning (e.g., Heyder et al., 2004) and some even argue it is its key aspect (Zelazo, Craik, & Booth, 2004). Since multitasking involves constantly and rapidly shifting mental sets between tasks (Monsell, 2003), this is the shifting executive function that should contribute to multitasking performance to the greatest extent. We chose this lower-level approach rather than focusing on complex intellectual abilities, such as reasoning, as previous studies show that when simultaneous relationship of both intelligence and lower level abilities e.g., working memory capacity, is considered, it is lower level abilities that are stronger (König, Bühner, & Mürling, 2005) or only significant (Colom, Martínez-Molina, Shih, & Santacreu, 2010) predictors of multitasking performance. Hence, in this study we focus on the shifting executive function, predicting that its high level is related to better multitasking performance.

We believe that, as, in general, multitasking constitutes a challenge for our cognitive system (Miyake et al., 2000; Monsell, 2003), it can be more difficult for some people than for other. Multitasking can be especially demanding for people high on NFC. Thus, for those individuals more shifting ability should be required to effectively perform several concurrent tasks, especially when the tasks given are difficult. So, we expected that NFC would lead to poorer multitasking performance for participants with low shifting ability, whereas high motivational rigidity individuals whose shifting ability is sufficient to overcome rigidity, should not exhibit impairments in performance on concurrent tasks. In other words, high shifting ability should play a compensatory role. We expected that this effect would be pronounced when the task demands are high, for it has been shown that motivational factors are important predictors of multitasking performance but only when the task is difficult enough (Goonetilleke & Luximon, 2010; Ishizaka et al., 2001).

4. Overview of the study

To test our predictions we presented participants with a task (herein referred to as main task) (single task condition) and with the same task accompanied by an additional task in another (dual-task condition). There were two difficulty levels for both single- and dual-task conditions (difficulty was manipulated with the presence of distractors). We were interested in how people handle two concurrent tasks, so indicators of performance in dual-task condition served as our dependent variables. We separately analyzed two aspects of performance on the main task (i.e., its speed and accuracy), as well as accuracy in the additional task for both easy and difficult task conditions. Thanks to this approach (instead of one general score as used in Miyake et al., 2000), we could have a more detailed insight in the dual-task performance of our participants. Need for closure was measured by a scale.

5. Method

5.1. Participants

The sample comprised one hundred and seventeen young adults with at least secondary education ($N = 117$). They were recruited by announcement via local social portal and given a monetary compensation (about 3.5 EUR) in exchange for participation in the study. Four cases were removed due to missing data and three cases were removed based on the results in a single-task block, which served as a baseline condition (accuracy below 50%). Finally, 110 cases were included in the analysis (77 women, 33 men) aged between 18 and 44 ($M = 22.53$, $SD = 4.40$). The study was carried out in accordance with the recommendations of the local Commission of Research Ethics with written informed consent from all subjects.

5.2. Measures

To measure NFC, we used the short version of the Need for Cognitive Closure Scale (Webster & Kruglanski, 1994). Specifically, we used its three subscales that tap onto the rigidity aspect of NFC, that is 1) preference for order and structure, 2) predictability of future contexts, and 3) affective discomfort occasioned by ambiguity. The original scale comprises also a closed-mindedness[1] and decisiveness subscales but both have been argued to measure other constructs (e.g., Neuberg & Newsom, 1993, argue that the closed-mindedness subscale captures a different phenomenon and Roets & Van Hiel, 2007, postulate that the decisiveness subscale measures ability rather than motivation). Thus, they were not included in the analyses. A sample item is: *I find that establishing a consistent routine enables me to enjoy life more*. A global score of NFC was calculated by averaging responses to all items (Cronbach's $\alpha = .84$).

Dual-tasking performance was measured with a procedure based on the DIVA task (Szymura & Nęcka, 1998). The task consists of four conditions 2 (single vs. dual-task) × 2 (easy vs. difficult). In single task conditions a person is required to press the space button once a letter identical with a probe letter appears on the screen. Letters are displayed every 850 ms. There are from 3 to 5 letters presented at the same time. For each probe there are 20 letters presented (4 targets and 16 non-targets). There are 15 probe letters in each block. Accuracy and reaction times are recorded.

In dual-task conditions a person is additionally required to monitor two bars placed in the middle of rectangles on two sides of the main task frame (see Fig. 1). At any moment during the task one of the bars starts dropping and participant's task is to correct its position, so that the bar does not leave the designated area. To correct the bars' position the “Z” and “M” keys are used for left and right rectangle, respectively. The bars drop in a fixed randomized order. Each time a bar goes beyond the designated area, respective rectangle turns red and an error is recorded. The number of errors was inversed, so that higher scores indicate better performance. Participants were told their aim was to perform *both* tasks as best as possible. The difficulty level was manipulated by adding distraction letters in the frame external of the main task frame (see Fig. 1). The person is required to ignore the distraction letters and react only when a letter identical with the probe appears in the middle (but not external) frame. There were training blocks before the single task and the dual-task blocks. The entire procedure took approximately 20 min to complete.

To measure shifting executive function we used a task-set switching task (Oberauer, Süß, Schulze, Wilhelm, & Wittmann, 2000). In this task two geometrical figures appear on the screen side by side (see Fig. 2). Participant's task is to respond “left” (by pressing “Z”) or “right” (by pressing “M” key on the keyboard) to indicate on which side a sharp-edged or round-edged figure appeared. The response stimulus interval was 300 ms. After 24 practice trials, 160 experimental trials were presented. There were 80 sharp-edged and 80 round-edged figures. Since previous studies show that costs might be reduced for predictable switches (e.g. Monsell, 2003; Monsell, Sumner, & Waters, 2003), we decided to present the stimuli in an alternating AABBAABB design. We thus wanted to be sure that participants we label “low shifting ability” are in fact low on this ability — as they score low in the easier version of this task. A one-word reminder to the next decision criterion was included in the top part of each display. The side of target shape presentation (left vs. right) was randomized, so that participants could not predict on which side it would Appear prior to analysis all RTs

[1] We reran all analyses with the closed-mindedness scale included and obtained similar results (see Supplementary Material for more details).