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Failure to Replicate the Unconscious Thought Advantages

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***Abstract*—**In this study we tried to replicate the unconscious thought advantage (UTA), which states that complex decisions are better handled by unconscious thinking. We designed an experiment in e-prime using similar material as the original study (choosing between four different apartments, each described by 12 attributes). A total of 73 participants (52 women (71.2%); 18 to 62 age: M=24.63; SD=8.7) took part in the experiment. We did not replicate the results suggested by UTT. However, from the present study we cannot conclude whether this was the case of flaws in the theory or flaws in our experiment and we discuss several ways in which the issue of UTA could be examined further.

***Keywords*—**Decision making, unconscious thoughts, UTT.

I. Introduction

WHEN deciding about serious matters such as buying a first apartment, people usually recommend us to explore as many offers as possible, evaluate relevant criteria, estimate the most important criteria, assess their pros and cons, etc. We (and also they) feel anxious about our bad decision and about 30-year mortgage repayment for apartment which fails to meet our expectations. But the more apartments we will see, the more difficult the decision gets. Is the proximity to work the best criterion? And what happens when we change job, or when the workplace will be relocated? Or is the price what is most important and we spend half a day by commuting? It seems that the more complex the decision is, the more difficult is considering all attributes in a prescriptive, rational manner. Moreover, we are often not able to predict our affective reactions (feelings after buying an apartment), or correctly estimate the weight of each criterion (overemphasizing guest room and underestimating the daily commute). And there is also another group of people who recommend us to sleep on it. Which is the right way to decide among the possible apartments? Write pros and cons, or sleep on it?

Dijksterhuis and Nordgren [1] distinguish between conscious (writing pros and cons of apartment) and unconscious thinking (sleep on decision about apartment). Conscious thinking refers cognitive and/or affective processes that we are aware when we solve tasks, whereas unconscious thinking processes take place out of our consciousness. In addition, the conscious thinking has limited capacity – we can concentrate only on limited things at a given time.

A. Unconscious Thought Theory

For making a good decision the meaningful integration of information (thinking) is important [2]. If the large amount of information is presented to people in a relatively short time, it is likely that the information will be disorganized in memory. The pieces of information must be combined and integrated. This process is largely performed by unconscious mind, which organizes initial disorganized information into clearer, more integrated representation in memory.

Contrary to common notion, Dijksterhuis and Nordgren [1] argue that it is better to deliberate about simple decisions, while more complex decisions are better solved by unconscious thinking.

From the *Unconscious Thought Theory* (the UTT) follows principal assumption (labeled deliberation-without-attention effect): the principle of capacity dictates that conscious thought does not produce good decisions in complex conditions. On the other hand, if the capacity is not limited (a minimum of information), the conscious thought is precise and is superior to unconscious thought because of the principle of rule. In other words, deliberation-without-attention effect claims that conscious thought is superior if the task is simple; with the increasing complexity of the task its performance deteriorates. On the other hand, the quality of unconscious decision making is independent on task complexity (amount of information). This hypothesis is experimentally tested for the different types of complex tasks (such as buying an apartment, car or choosing a roommate) by supporters of the UTT.

B. Meta-Analysis and Critique of UTT

Because about half studies that tried to replicate findings concerning the unconscious thought advantages (UTA) failed to show any effect, Strick et al. [3] did a meta-analysis of possible moderators of UTA. In other words, what circumstances increase the likelihood that the finding of original authors will be replicated? They subjected to analysis categorical (outcome measure, materials, presentation format, distraction task, complexity, declared purpose and mindset) and continuous variables (best/worst ratio, best/second ratio, number of options, number of attributes for each option, time of attribute presentation and thought interval).

They found that UTA is greater when verbal and image information are combined, when word search puzzle is used as a distraction task, when information are presented in block for each option, when the problem is complex, when central-general aim and configural mindset is induced. Effect size was

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also greater when there were higher number of decision options (more apartments, etc.), shorter time of information presentation and shorter (un)conscious thought interval. Authors of meta-analysis recommended to researchers wanted to replicate effect of unconscious thought, to comply with the following tips:

1) Use sufficiently complex task, for example, it seems that increasing the number of attributes for each option works well. Complexity could be increased by variation of nature of attributes (do not use the same attributes in all options).
2) In instruction, underline the objective to make overall impression.
3) Induce configural mindset by requesting participants to make configural representation of options and not focus too much to specific positive or negative aspects of options. It is also possible to manipulate the value of specific attributes – the most important attribute could be constant and value of minor attributes could be changed. Similarly, combination of verbal and imagine information leads to more holistic processing.
4) Present information in block for each decision option. In this case it is important to have problem complex enough, or to shorten the time of attribute presentation to participant.
5) Increase ecological validity by using real materials (such as choosing art posters which could participants take home). Like another aims-oriented processes, unconscious thought needs sufficient interest from participants.
6) Create your own materials and verify them in pilot study.

Overall, it can be concluded, that unconscious thought is better observable when the problem is complex enough, when participants are least somewhat motivated, and have some relevant expertise in domain (but not too much, that the task would not be too easy for them). Compliance with those conditions depends on the interaction among various parameters of the study, participant's characteristics (for example, their interests, expertise), and situation factors (whether are decisions made in group or alone, in loud shopping center or silent laboratory, etc.). Therefore, it makes sense to adapt decision tasks and procedural characteristics of study to the specific sample of participants and situational circumstances. Authors recommended rather taking the main idea of tested paradigm and adapting it to their specific situation, than trying to replicate original experiments from different cultures and in different languages. This is the main reason why we decided to design own experiment in the UTT paradigm.

On the other hand, several new studies [4] did not conform significant UTA even after following recommendations resulting from metananalysis of Strick et al. [3]. Furthermore, Niewinstein and van Rijn [4] identified several other factors that can affect UTA, such as time interval for deliberation phase in conscious thought condition. They aso figured that even mental fatigue did not lead to increased UTA and that increased complexity did not lead to UTA, but quite the contrary – it lead to conscious thought advantage (CTA).

C. Aims and Rationale of Our Study of UTT

Because of inconclusive results of many studies concerning UTT [2]-[4], we wanted to verify UTA on complex tasks designed in the manner recommended by original authors [1], as well as their replicators [3], [4].

For pilot study we designed Apartment task, as this was used most often in UTT studies. Our main aim was to gain some insights about UTA from the analysis of the difference between conditions, as well as from informal verbal accounts after experiments that could lead to identification some crucial factors and improving the task for the next study. We employed mixed sample of participants (students vs. adults) to see whether these factors could lead to some differences in performance. The main outcome variable was, similar as in Dijksterhuis´s [2] study, the difference in evaluation of the most desirable and the most undesirable apartment. We followed Dijksterhuis´s rationale that recognizing and rejecting a particular unattractive alternative is in many cases as important as choosing the right one. Another practical reason was enhancing statistical power. However, as we measured attitudes towards all alternatives (apartments), the secondary outcome variable was actual evaluation of the most desirable and undesirable alternative.

II. Methods

A. Participants

A total of 73 participants (52 women (71.2%); 18 to 62 age: M=24.63; SD=8.7) took part in the experiment. 56 were undergraduate students from the Constantine the Philosopher University at Nitra, who received either money (2€) or course credit for their participation.17 were self-selected volunteers who received 2€ for their participation. The non-student sample differed significantly from student sample only in terms of age (21.5 vs 34.9 years, t=-4.150, p=.001) and education (in adult sample there were 6 participants with high school, 11 had college degree); there were no differences in gender composition ($\chi 2$=.004, p=.585). The significant part of non-student sample also had some experience with buying an apartment.

B. Procedure

Participants were asked to take part in the experiment described as examining how people decide in complex tasks. The student sample was invited at the introductory lecture by lecturers (authors of the study) and was offered either financial incentive (2€) or course credit (worth one question from the final test). The adult sample was recruited from the local community and was offered financial incentive (2€).

The whole experiment took from 20 to 30 minutes (according to an assigned condition). The students willing to take part in the experiment were assigned time slots and performed the al tasks in the lecturer´s office either alone or in pairs (each working on his or her notebook[1]). The adults sample performed the experiment usually at some familiar

[1] Both notebooks on which the experiment was ran were of the same type, LENOVO IdeaPad U410.

place (flat of acquaintance, etc.), but sometimes other persons were around.

We used between participant design with three conditions: 1) immediate decision (participants had to decide and evaluate immediately after presentation of information); 2) conscious decision (participants were given few minutes to thing about information before they decide); and 3) unconscious decision (participants were distracted for a few minutes before they decided). In the conscious decision conditions we did not use forced time for deliberation (as did Dijksterhuis [2]), we let participants think as long as they needed (but 3 minutes at maximum).

C. Materials

1. Apartment Selection

The experiment was prepared in a program E-prime, so the whole process and randomization were computerized. Participants were randomly assigned to one of the three conditions by the E-prime: immediate decision condition (ID, N= 31), a conscious decision condition (CT, N= 20), and an unconscious decision condition (UT, N= 22). Participants then received an instruction that they would be presented with information about four hypothetical apartments (Amethyst, Topaz, Emerald, and Ruby). Each apartment was described by 12 attributes, for a total 48 pieces of information. Information were presented about each apartment individually (but in block per apartment), apartments were presented in each trial in a random order. Each attribute was presented for 5 seconds in the center of the screen, but participants were allowed to click spacebar to move faster, if they needed. To visually differentiate between apartments, but to control unwanted noise, the background color was changed with each apartment. Apartment Topaz (yellow) was the most attractive apartment (with 8 positive and 4 negative attributes) and Apartment Amethyst (white)was the worst apartment (with 8 negative and 4 positive attributes). The two other apartments (Ruby – turquoise, Emerald – grey) served as fillers with neutral attractiveness (6 positive and 6 negative attributes). A specific description of attributes was designed so that the most important attributes identified in short survey (prize, locality and apartment´s dispositions) were not extremely negative or extremely positive. Each of the apartment was described by same 12 dimensions (energies, locality, apartment´s dispositions, green, price, condition, distance to work/center, size, surrounding, physical properties, additional spaces, parking; a detailed description is presented in Table II in Appendix)[2], but the specific content of the dimension was different for every apartment. Valence of the dimensions was assigned randomly (the best apartment had one of three most important dimensions negative and the worst apartment had two of three most important dimensions negative).

Participants were asked to choose the best apartment for young childless couple. We decided for this instruction to control individual preferences in apartment selection and we also designed the content of individual attribute so they would be positive for someone looking for his or her apartment. After participants read all the information, those in ID were asked to evaluate each apartment on the 10-point scale ranging from 1 (*absolutely unsuitable*) to 10 (*absolutely suitable*). Those in CT were instructed to decide after they take as long time as they needed for decision. And finally, those in UT had to solve distraction task (multiplication task) for three minutes before rating the apartments.

2. Rational-Experiential Inventory

After rating the apartments the participants were asked to fill in self-report questionnaire (REI, [5]) about their preferred cognitive style (rational or experiential). REI-R is based on Need for Cognition Scale (REF) and REI-E is based on Faith in Intuition scale. The REI was employed for secondary analysis of the experimental results – namely, to check the assumption that participants higher in REI-R would perform better in CT and participants high in REI-E would perform better in UT. REI was also presented as a part of E-prime experiment.

3. Dimension Importance Ratings

Subsequently, participants had to sort dimensions by which apartments have been described from 1 (the most important for me) to 12 (least important for me). The subjective evaluation was also employed for secondary analysis to check, whether subjective importance had effect on the rating of apartments.

III. Results

There were no significant differences between the conditions in terms of participant´s age ($F=2.189$, $p=.120$) and gender ($\chi^2=1.034$, $p=.596$).

First, we checked whether the most attractive apartment was judged as more attractive than an unattractive apartment. The most attractive apartment (Topaz) received, indeed, the highest evaluation ($M=6.14$, $SD=2.4$), while the least attractive apartment (Amethyst) received lowest evaluation (5.49, $SD=2.2$), with two neutral apartments scoring in between with almost identical evaluation (Ruby: $M=5.62$, $SD=2.1$, Emerald: $M=5.63$, $SD=2.4$).

The measure of interest was how well could participants differentiate between the attractive and unattractive alternative. Hence, difference scores were calculated by subtracting the evaluation of unattractive apartment from the evaluation of attractive apartment. However, we found no differences between conditions in their evaluation of apartments neither difference between conditions in actual evaluation of the best apartment (Table I). However, our results showed that participants in UT actually evaluated the most attractive apartment better ($M=6.95$ vs. 6.10 in CT and 5.58 in ID conditions) and they discriminated between the best

[2]These 12 dimensions were identified as the most important in the pilot study on the sample of 15participants, who were asked to list at least 12 attributes they considered when buying the flat. All the participants in the pilot study preceding the study reported here were chosen because of their recent (within 5 years) experience with purchasing the flat or house. The dimensions that occurred most often on the upper positions were chosen for the current study.

and worst apartment better (mean difference between the worst and best was 1.9 vs. 0.1 and 0.09 in CT and ID conditions, respectively).

TABLE I
DIFFERENCES BETWEEN INSTANT DECISION CONDITION, CONSCIOUS THOUGHT CONDITION AND UNCONSCIOUS THOUGH CONDITION IN EVALUATING APARTMENTS

		Sum of Squares	df	Mean Square	F	Sig.
evaluation	Between Groups	50.412	2	25.206	2.110	.129
	Within Groups	836.328	70	11.948		
	Total	886.740	72			
best apart.	Between Groups	24.327	2	12.164	2.159	.123
	Within Groups	394.303	70	5.633		
	Total	418.630	72			

evaluation: differences between conditions in their evaluation of apartments

best apart.: difference between conditions in actual evaluation of the best apartment

We were also interested whether there are differences in sample of students and sample of adults in their evaluation of apartment. The results for students sample showed that there was difference between conditions approaching the level of statistical significance in their evaluation of the most attractive apartment (F=2.735, p=.074), but not in the differentiating between the worst and the best. On the other hand, adult sample showed quite opposite pattern: there was no difference between conditions in their evaluation of the best apartment, but their differentiating ability approached the level of significance (F=3.217, p=.071). However, these results should be interpreted with caution not only due to their significance levels, but also because there was only 1 participant from the adult sample in CT condition, (7 were in ID condition and 9 in UT condition). Generally, the biggest differences between conditions were not between CT and UT groups, but between UT and ID groups.

Participants also sorted dimensions by which apartments have been described. The most important dimensions according to participants were price (M=2.66; Mode=1), condition (M=4.44; Mode=2) and locality (M=4.86; Mode=2), then followed size, energies and rent, dispositions, distance to work/school, other externalities, parking, green, physical properties, and additional spaces.

IV. DISCUSSION

Our main aim was to construct the same task as was typically used in UTT paradigms and replicate findings of Dijksterhuis and his colleagues [1]-[3].

We did not succeed in replicating UTA effect, but it seems that we were able to construct the task that was complex enough for participants, yet it was still possible to identify the best and worst alternative. However, it still seems that the apartments were not different enough from each other and the task could be improved either by adding the number of dimensions per alternative or by adding more alternatives. This solution was also suggested by [3]. Most study replicating UTA used the original format of four alternatives each described by 12 attributes (resulting in 48 pieces of information in general) but with mixed results. For example, Bos, Dijksterhuis, ad Van Baaren [6] Dijksterhuis [1], Queen and Hess [7], Usher, Russo, Weyers, Brauner, and Zakay [8] found evidence for UTA, while Acker [9], Lassiter, Lindberg, Gonzalez-Vallejo, Belleza, and Phillips [10], Rey, Goldstein, and Perruchet [11], Thorsteinson and Withrow [12], Van De Wiel, Boshuizen, Meeuwesen, and Wiers [13], and Waroquier, Marchiori, Klein, and Cleeremans [14], [15] did not find any evidence of UTA.

It is possible that participants were choosing according to some other strategy than WADD (either conscious or unconscious), probably using only one (or only few) criterion (e.g. Take the best). It is necessary to analyze the current results in regards with participants´ evaluation of their personal weight of each dimension. We found that the current sample attributed different weight to some dimensions (prize, condition, and locality) than our pilot sample (prize, locality and apartment´s dispositions). It could have some effects on the results, because when designing the task we assigned positive and negative values to individual alternatives (apartments) randomly, which resulted in distribution where the most attractive apartment had 1 negative value out of the three most important and the least attractive apartment had two out of three most important attributes formulated negatively. However, when we analyzed the content of dimensions from the perspective of personal importance of the current sample, exactly opposite pattern emerged: The most attractive apartment had now 2 negative descriptions of the personally most important dimensions and the least attractive had only one. This may suggest the need of "fixating" the most important dimensions by describing all alternatives either positively or negatively in these particularly important dimensions [16]. However, Van De Wiel et al. [13] "fixed" the most important dimensions (price, location, and condition) by not including them to the task and they did not find evidence of UTA. This was probably caused by the fact that without the most important and distinguishing dimensions participants could choose randomly or they had no motivation to distinguish between slight nuances of the individual alternatives. We assume that this version of the task in fact decreases the difficulty and complexity of the task.

Another way to gain better insight into conscious and unconscious processing in decision making in complex task is concentrating more on the process of decision making. For example, Strick et al. [3] and Waroquier et al. [15] were asking participants to indicate the procise moment at which they decided and they identified "online" decision-makers (about 60 % of the sample) who made decisions while reading the attributes and then just remembered their choice. We have similar experience with some participants in our sample who spontaneously gave account of their thinking processes after finishing the experiment.

It would be also good idea to include the check question, whether participants have any experience with buying an apartment or house, as our preliminary comparison of our two subsamples suggest that they might decide differently, or at

least, that they attributed different way to some dimensions. It is possible that more experienced people should be able to decide more effectively in shorter time or perform better under UT condition. This assumption is consistent with other findings that experts allocate more importance to the most predictive clues [16].

Therefore, we think that probably more fruitful way of getting insight into which thinking is better suited for complex decisions is to study, whether unconscious thinking uses different decision strategies than conscious thinking. In other words, does the unconscious rely more on heuristics such as Take the Best or uses some kind of WADD strategy as suggested by Glöckner and Witteman[17].

In conclusion, we did not replicate the results suggested by UTT. However, from the present study we cannot conclude whether this was the case of flaws in the theory or flaws in our experiment. To set this issue, further detailed analysis of intervening conditions into un/conscious decision making is needed.

Appendix

Best apartment (Topaz, yellow) was described by following attributes: apartment is somewhat more expensive than you intended to invest; apartment is located in the quiet district; dispositions of the apartment are satisfactory; apartment is sunny; it has lower costs for energies (sunny); original condition and requires further expenses for reconstruction; it is hard to find parking place near; it is somewhat smaller than you hoped for; loggia and small cellar are part of the apartment; it is located within a block of similar apartments with its own yard; there is playground in the yard and shops are in close vicinity; you have close to work from the apartment.

Worst apartment (Amethyst, white) was described by following attributes: price is at your upper range, but it is possible to negotiate with the owner; it is located in the busy district; it is not possible to change any dispositions of the apartment; situated in the corner of the building; higher expenses for energies; partly reconstructed; few parking places in front of the house; apartment is small; there is no cellar nor larder; there is no green; nice view on the town; it is far from your work.

Neutral apartment 1 (Ruby, turquoise) was described by following attributes: price is within your planned range; apartment is in the center of the town; it has separate rooms with own entrance; windows are orientated to the East and West; air-conditioning is needed because of the constant sunshine; windows are new, as well as electric circuits in the apartment; parking is not beside the house; apartment has rather small rooms; it is without a balcony; not a lot of green spots in the center and it is quite far to the park; on the neighboring street resides a famous disco club; everything is close.

Neutral apartment 2 (Emerald, green) was described by following attributes: it is more expensive than the apartments in the similar category; apartment is located on the large housing development; it has "goldfish" rooms; apartment is rather dark; smaller expenses for energies; it is reconstructed, but you do not like it so it will be necessary to re-decorate; no problem with the parking outside the house; it is satisfactorily spacious; apartment comes with large cellar; it is situated on the housing development, but close to the nearby forest; without nice view from the windows (other houses around); close to the shopping center.

TABLE II
Dimensions and concrete items

Dimensions	Best apartm.	Neutral apartm. 1	Neutral apartm. 2	Worst apartm.
Price	-	+	-	+
Locality	+	+	-	-
Dispositions of the apartment	+	+	-	-
Physical properties	+	+	-	+
Energies and rent	+	-	+	-
Condition	-	+	-	+
Parking	-	-	+	-
Size of the apartment	-	-	+	-
Additional spaces	+	-	+	-
Green	+	-	+	-
Other externalities	+	-	-	+
Distance to work/center	+	+	+	-

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