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CONCERNS: Review of the thesis of Ms. Almara Kulieva

Brussels, January 29th, 2023

THE REVIEW

of a member of the dissertation council on the dissertation of Almara Kulieva on the topic: "Efficiency prediction and control on cognitive task solution in the learning" submitted for the degree of Candidate of Psychological Science in the specialty field 5.3.1. — General Psychology, Personality Psychology, History of Psychology

Overview of the work

The thesis submitted by Almara Kulieva, in its English translation, consists of a document of 139 pages (including bibliography and appendices). The thesis is broadly dedicated to the fascinating issue of understanding the nature of errors in cognitive tasks. Why do errors occur? Are they simply the result of noise (i.e., fatigue, lack of attention, inherent imprecision), or do they stem from specific factors? And if so, what are those factors? Here, the core hypothesis is that one of such factors is the "efficiency criterion" (~Bandura's "self-efficacy"), that is, a person's metacognitive appreciation of her ability to solve a particular problem or classes thereof. Thus for instance, if I think I cannot shoot, then my success hitting the target will be perceived and interpreted as a "lucky shot" rather than as a reflection of my true ability. This perspective also raises the further issue of the effects of learning on changing one's efficiency criterion.

The thesis is structured in three chapters buttressed by an Introduction that offers a bird's eye view of the thesis and by a "Findings" section that summarizes its main contributions and by a (very) short Conclusion. There is no substantial "Discussion" section.

The thesis develops six experimental studies that form the empirical core of the dissertation and that are described in Chapter 3.

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Chapter 1 offers an overview of the theoretical perspective that will be pursued over the thesis. This is firmly rooted in the idea, often set aside by reductionist and functionalist views of the mind, that subjective experience is central to what we do: What we feel, what we experience, and our judgments about what we feel and what we experience, drive much of what we do. Thus, the chapter rightfully begins with one of the most striking demonstrations of such phenomena: The placebo effect, which illustrates the effects that our beliefs can exert on our automatic reactions. Next, Ms. Kulieva looks at the effects of beliefs (i.e., about our own ability or about the extrinsic difficulty of a problem) on controlled reactions, as when we are solving a problem. Different very interesting phenomena are briefly overview: Targets made to be perceived to be easier than they are through visual illusions, learned helplessness, superstition, stereotype threat, false feedback. In the next subsection, core theoretical concepts that can explain such phenomena are overviewed: Bandura's self-efficacy, Kirsch's response expectancy, Allakhverdov's efficiency control. The latter importantly assumes that the main function of consciousness is ensure consistency. Thus, inconsistent incoming information is either pushed aside or restructured to be made consistent with extant conscious beliefs.

The second part of the introduction is dedicated to a review of metacognitive concepts and effects. The concept of efficiency criterion is further developed. The third part of the introduction is about learning, and changes in one's efficiency criterion. Each of these sections produces a specific hypothesis to be tested through the experimental work.

Chapter 2 details the experimental procedures and paradigms that will be used in the rest of the work. Most experiments were carried out online using the Pavlovia platform. The core paradigm involves a temporal estimation task rendered as a computer game in which players have to make a rocket land on the moon. The difficulty comes the fact that both rocket and moon become invisible shortly after the rocket is launched, leaving the participant to estimate when to stop it. The overall concept of the entire series of empirical studies is to manipulate different aspects of people's perception of the task or of the target criteria, and to measure the effects of such manipulations on performance. People's beliefs are measured either prospectively or retrospectively.

A total of 276 people were tested across six experiments. Experiment 1 is straightforward: People perform the rocket game, and are told that the computer can either help them, interfere with them, or do nothing. On each trial, the distance between the initial position of the rocket and the target moon is manipulated. People initiate and stop the trial by pressing on the space bar; their goal is to get the (now invisible) rocket entirely within the moon circle. Feedback is presented, and people are asked to judge whether the computer helped, interfered, or did nothing. The findings largely confirm the hypotheses: People learn, people attribute fewer hits to computer intervention over time. Strikingly, people report more computer interference when they miss than when they succeed. This interacts with task difficulty: Difficult hits are more often attributed to computer help than easy hits; difficult misses are less often attributed to computer interference than easy misses. Experiment 2 build on Experiment 1 and adds target size as a variable (the surface of the moon). The results largely replicate those of Experiment 1.

The results of Experiments 1 and 2 are interpreted as reflecting the self-attribution bias and are found to be consistent with the efficiency criterion framework. An interesting discussion links the empirical work with other research highlighting germane concepts: sense of agency, processing fluency, resource depletion. The discussion closes with questions about how shifts in the efficiency criterion may explain changes in metacognitive appraisal over time. The next experiments aim to explore these questions.

Experiment 3 leverages the same paradigm, but 1/ removes feedback, and 2/ structures the 100 trials in ten 'levels' differing (unknown to participants) only by the visuals. Participants move from one level to the next if they hit either 50% or 70% of the targets. On each trial, participants are asked to indicate whether they thought they hit the target or not. It is hypothesized that participants experiencing the lower success criterion will perform better, learn faster, and will judge trials to be successful more often than participants experiencing the higher success criterion. None of the hypotheses are verified: Groups do not differ in their performance, there is no learning, and there is no difference in their self-reports. These negative findings are assumed to stem from small sample size and from the overall low performance.

Experiment 4 attempts to manipulate the nature of the feedback. Participants again judge whether the computer helped, interfered, or did nothing. A first phase of the experiment involves feedback, a second, no feedback. In the first phase, feedback is manipulated as follows: Feeback could be correct, incorrect, of mixed. When incorrect, the actual deviation from the target was either made smaller (positive incorrect feedback) or larger (negative incorrect feedback). Mixed feedback involved positive incorrect feedback on some trials and negative incorrect feedback on others. It is hypothesized that incorrect positive feedback will be most beneficial and will more likely lead participants to judge they hit the target (in the second phase). Again, no difference between groups obtains.

Experiments 5 and 6 abandon the idea of changing participants' efficiency criterion through manipulating people's perception of success or the feedback they receive, and are instead focused on changing people's perception of the task difficulty. Experiment 5 involves a complex design in which task difficulty (target distance), report mode (no report, predictive report, postdictive report) and target type (illusory vs actual small or big surface) are manipulated. Differences are found in hit rate between illusory larger and smaller targets, but no difference obtains between actual and illusory targets. Overall, this experiment is not inconsistent with prior findings, but fails to achieve its core objective. It does demonstrate, however, that people are more successful with a larger vs. smaller illusory target.

Experiment 6 attempts to manipulate perceived difficulty by manipulating the time given to participants to prepare at the beginning of each trial. All groups begin with three seconds, during which they can observe the rocket and the moon and launch the rocket when they choose. Importantly, this preparation time cannot objectively influence the temporal estimation required to be successful. During a second phase, one group sees this preparation time reduced to 0.5 seconds while the other receives two seconds. All participants receive one second during a third phase. Thus, for half of the participants, the third stage is easier whereas for the other half, it is harder. Participants again judge the involvement of the computer on each trial. The results are in line with the hypotheses: Despite the fact that the third phase is identical for the two groups, people who experience it to be easier are more successful.

The thesis closes with a synthetic summary of the core findings and with a one-page conclusion.

Review and appraisal

Overall, this a very good thesis in Experimental Psychology. It demonstrates that the candidate is able to develop theory and discuss it in the context of the wider literature, to design experiments in the domain of cognitive psychology, and to analyse and report the results. The thesis contains some very good, well-informed discussion (though it lacks a General Discussion — a shortcoming as this is often the place where the most interesting speculations and ideas come forward). Further, Ms. Kulieva has already published multiple scientific articles, including at least one that reports on some of the thesis' findings.

The thesis leaves many questions open, however. While the experimental work is interesting, competently carried out, and structured around key hypotheses, one would have liked a better framing of the overall theory. The idea that our behaviour is shaped by our subjective experience is a very important idea, — an idea that in fact tends to be denied today, with many philosophers claiming that consciousness is an epiphenomenon, with many psychologists claiming that whatever we can with consciousness we can do better without, and with AI research showing how much we can do with (obviously) non-conscious algorithms. It would have been interesting to develop the original concept of the "efficiency criterion" further, in particular by comparing it more systematically with existing notions such as sense of agency, placebo, ego depletion, and so on.

Empirically, a general comment about the different experiments is that they are perhaps somewhat too focused on a single paradigm. In this sense, the entire thesis is more a single study than a collection of studies. One question about the experiments is why the candidate never actually attempted to have the computer control some of the trials — this would have offered sometimes lacking control conditions, but would also have brought the research in contact with the phenomenon of "illusion of control".

A further point is that interval estimation is often used as a proxy for sense of agency. But typical studies in that domain rely on intentional binding, which manifests itself only through subjective reports of duration. Would it not have been interesting to ask participants to also report how long they thought the rocket had taken?

There is also a question about how people estimate the speed at which the rocket "moves". Do they see an initial movement, or (as I understand it) is it the case that the rocket always moves at the same speed and that people have to guess the speed during the first few trials? Why was speed not manipulated?

The self-serving bias found in Experiments 1 and 2 would have been worthy to further explore. What would be possible designs to do that?

Despite these critical comments, overall, Ms. Almara Kulieva is to be congratulated for her solid work exploring a very interesting theory and the associated empirical phenomena. The work, as is often the case for Ph.D. theses, is not flawless and tends to leave the reader with more questions than answers, but overall, it clearly demonstrates skill in developing theory, in carrying out empirical work, and in analyzing and reporting the results. It shows sufficient scholarship to deserve a Ph.D.

Thus, the dissertation by Almara Kulieva on the topic *"Efficiency prediction and control on cognitive task solution in the learning"* meets the basic requirements established by Order No.11181/1 dd. 19.11.2021, "On the Procedure for Awarding Academic Degrees at St Petersburg State University," the applicant Almara Kulieva deserves to be awarded the degree of Candidate of Psychological Science in the specialty field 5.3.1. — General Psychology, Personality Psychology, History of Psychology. No violations of paragraphs 9 and 11 of the specified Order have been detected.

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