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USING SUBJECTIVE REPORT RATING SCALES TO REVEAL BASIC PROCESSES UNDERLYING INSIGHT SOLUTIONS IN ANAGRAM TASKS

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Использование субъективных шкал самоотчета для выявления механизмов, лежащих в основе инсайтных решений анаграмм

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Abstract

The research attempted to evaluate the informativeness of subjective rating scales in order to reveal the processes underlying insightful solving of anagrams. Subjects divided into two groups solved anagrams evaluating their own solutions using rating scales of subjective characteristics taken from similar insight study (Danek et al., 2014): solution happiness, solution surprise, solution suddenness, solution certainty, and experience of an impasse. The subjects in the first group (the "Insight" group) solved regular anagrams. The second group (the

Резюме

В исследовании предпринималась попытка оценить информативность субъективных шкал для понимания психологических механизмов, лежащих в основе инсайтного решения анаграмм. С этой целью испытуемые, разделенные на две группы, решали анаграммы, оценивая субъективные переживания с использованием рейтинговых шкал, взятых из аналогичного исследования инсайта (Danek et al., 2014): удовлетворенность решением, удивительность решения, внезапность решения, уверенность в решении и переживание состояния тупика. Испытуемые первой группы («Инсайтная группа») решали обычные анаграммы. Испытуемые второй груп-

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"Implicit" group) solved anagrams based on a single pattern, which led to an implicit learning effect. It was expected that the values of the subjective rating scales would make it possible to separate insightful solutions of anagrams based on the realization of implicit knowledge from ordinary insightful solutions. The obtained results confirmed the validity of the assumption. The predictors of belonging to different groups were the scales of solution happiness, solution certainty and experience of an impasse. The study has demonstrated that it is possible to use subjective rating scales to separate insightful anagram solutions on the basis of processes that caused them. This indicates that such a subjective reporting technique is an informative method. The results of this study provide new possibilities for improving the self-reporting procedure in insight research.

Keywords: insight, intuitive component, task solving, anagram

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пы («Имплицитная группа») решали анаграммы, построенные по единой закономерности, что приводило к имплицитному научению. Ожидалось, что значения субъективных шкал дадут возможность отделить инсайтные решения анаграмм, основанные на реализации имплицитного знания, от обычных инсайтных решений. Полученные результаты подтвердили справедливость предположения. Предикторами, отличающими испытуемых из двух групп, стали шкалы удовлетворенности решением, уверенности в решении и переживания состояния тупика. Результаты исследования продемонстрировали возможность использования шкал субъективной оценки для разделения инсайтных решений анаграмм в зависимости от обуславливающих их процессов. Было показано, что подобная форма субъективного опроса является информативным методом исследования. Результаты исследования открывают новые возможности для совершенствования методики самоотчета в исследования инсайта.

Ключевые слова: инсайт, интуитивный компонент, решение задач, анаграмма.

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The operational definition of insight (Aha! experiences) can be reduced to three characteristics: insight is a task solution that "appears out of nowhere" after a series of unproductive attempts to solve it; the solver is unable to give a subjective report of the way to their solution; the finding of the solution is often accompanied by an emotional reaction (Bowden et al., 2005; Sprugnoli et al., 2017). It is important to point out that an insightful decision is usually the right one (Salvi et al., 2016).

In modern psychology of thinking, much attention is paid to insight research. It is connected with the fact that the phenomenon is the result of the work of the

"intuitive component" of thinking not realized by the subject (Ponomarev, 1976) and it is the least studied at the moment (Vladimirov & Pavlishchak, 2015).

In experiments investigating insight, subjects are asked to solve tasks that should provoke them to make an insightful decision. The method for determining the presence or absence of insight is often the subject's self-report. This is often done in a binary form where subjects are asked to answer whether or not they experienced an insight (Aha! experience) (Jung-Beeman et al., 2004; Kounios et al., 2008; Aziz-Zadeh et al., 2009, etc.). In connection with the above, it is reasonable to ask how informative this method is.

The relevance of the issue becomes evident in a context of the existence of so-called "false insights", wrong decisions that were experienced by the subjects as insights (Danek & Wiley, 2017). Trying to explain reasons for the existence of false insights, it has to be assumed that false and true insights result from fundamentally different psychological processes. In this case, the subject is unable to recognize them accurately (Ibid.). Therefore, the subject's self-report is not informative and using it in research would be a mistake. Nevertheless, there is an alternative assumption. Perhaps the subjective report is still informative enough to distinguish between different decision processes, but it should not be limited by a binary assessment.

From this point of view, papers where researchers have tried to complement the binary form of self-report by using scales of subjective evaluations are of interest.

In particular, such an attempt was made in the Danek and colleagues' research (Danek et al., 2014). In this study, subjects were required to solve the secret of magic tricks that were videotaped and shown to them. In addition to the binary assessment (the presence/absence of an Aha! experience while solving the trick), the subjects assessed their solutions on several scales of subjective characteristics, assigning a desired number of points to each of them. There were five such characteristics:

Solution Happiness. Subjects were asked to indicate how much satisfaction they felt when they found the solution.

Solution Surprise. They were asked to rate how surprising the answer was.

Solution Suddenness. It evaluated how quickly the solution came to mind.

Solution Certainty. It was asked how confident the subject was about the decision.

Experience of an impasse. Here it was necessary to indicate how much difficulties the person experienced before the solution was found (Ibid.). The results showed that insightful decisions are accompanied by high values on some scales. In particular, insightful decision-making is accompanied by high values of the solution happiness scale (Ibid.). A similar methodology was used in the Webb and colleagues' paper (Webb et al., 2016). In this study, the authors used similar scales to assess solutions of standard insights, non-insights, and compound remote association (CRA) tasks (Bowden et al., 2005). The results of the study also demonstrated a connection between the values of some scales and insightful decision (Webb et al., 2016). Finally, in the 2017 paper by Danek and Wiley (compared to the 2016 paper) modified scales were used in the assessment of false and true insights. It was

shown that the values of the scales Solution Suddenness, Solution Certainty, Pleasure and Relief can be predictors of true insights (Danek & Wiley, 2017). Based on the results of the study, the authors conclude that although the binary form of self-reporting cannot serve as an unambiguous criterion of decision insight, the subjective experience of an insightful decision, in itself, is not an epiphenomenon (Ibid.).

Thus, evidence from a number of studies suggests that the subjective account of the subject is an informative means of identifying the processes underlying their decision making when shifting away from binary assessment.

One type of task often used in insight research is anagram solving tasks. Anagrams are sets of letters that need to be put in a certain order to obtain a solution word. It has been shown that in addition to the analytical solution, i.e., the conscious rearrangement of letters, anagram solutions can be found as a result of sudden insight (Bowden, 1997; Novick & Sherman, 2003), which allows the researcher to obtain two types of solutions (insightful and analytical) using the same material. It makes such tasks convenient for this kind of studies. Anagrams are used in neurophysiological research (Aziz-Zadeh et al., 2009; Kounios et al., 2008, etc.). For example, Kounios and colleagues used anagrams in their research to investigate the relationship between resting brain activity and the number of insightful solutions made by subjects. It is important to mention that the authors used a binary form of self-report and asked subjects to indicate whether a decision was insightful or not. Significant conclusions are based on the results of this study about neuronal mechanisms of insight (Kounios et al., 2008). Binary insights assessments combined with the application of anagrams have been used in other studies (e.g., Aziz-Zadeh et al., 2009).

At the same time, no studies have been found in the literature where subjective report of anagram solving was carried out using subjective rating scales similar to Danek's. However, this form of self-reporting may be informative and may enable more accurate recognition of the processes leading to the solution of an anagram.

Assessing the informativeness of subjective rating scales for identifying the processes underlying anagram solving was the purpose of this study.

In order to achieve this goal, it is obvious to conduct an experiment where subjects have to subjectively evaluate their own solutions of anagrams. The solutions themselves should be the result of two types of psychological processes. The first would be processes associated with the traditional search for anagram solutions, and the second would be processes that differ from the first. The processes associated with the phenomenon of implicit learning were chosen as the second type of process in this study.

Implicit learning can be defined as the unintended and largely unconscious acquisition of knowledge, in which the individual is unable to verbalize its content (Moroshkina et al., 2017). The most cited work related to this phenomenon is Reber's study of subjects' acquisition of "artificial grammars" which are certain patterns in the construction of letter sequences. In this study, subjects were presented two groups of incentives: letter strings constructed according to certain patterns, and strings constructed at random. It was shown that subjects were able to separate

the two groups of incentives. However, they were unable to explicate the rules of "artificial grammar" (Reber, 1967). The mechanisms underlying implicit learning are still unclear. The phenomenon of implicit learning can result either in subjects involuntarily forming some abstract rules, or in learning a sequence of specific incentives (Moroshkina et al., 2017). However, it seems clear that the processes involved in learning and implementing implicit knowledge are different from the processes of searching for the solution to a task.

A number of studies have also shown that, under certain conditions, the implicit learning factor can influence the efficiency of anagram solving. For example, in the Fomicheva and Burmistrov's study (Fomicheva & Burmistrov, 2019) subjects were divided into two groups: the first group solved anagrams constructed according to a single hidden sequence (a specific algorithm for arranging letters in the anagram), while the second group solved ordinary anagrams. The results of the study demonstrated that anagrams with a hidden sequence were the fastest to be solved (Ibid.). Thus, both ordinary solving and the implementation of implicit learning equally lead to successful solution of anagrams.

Since insights (Metcalfe & Wiebe, 1987) and implicit learning processes are equally inaccessible to the subject's consciousness, it would be expected that using a binary self-report form, a subject who solves an anagram following an implicitly-learned sequence might mistakenly classify the decision as an insightful one. However, the values of subjective rating scales (in particular, the solution surprise scale and the solution certainty scale) would make it possible to distinguish between true insight solutions and "insights" based on the realization of implicit knowledge. This is the hypothesis of the present study.

It was the task of this study to investigate whether the subjective rating scales proposed by Danek and colleagues (Danek et al., 2014) could be used to distinguish insightful anagram solutions based on the processes that caused them.

Method

In order to perform the task, an experiment was conducted. The subjects were randomly allocated between two groups.

In the first group (hereinafter referred to as "Insight Group"), subjects solved "ordinary" anagrams obtained by a random permutation of letters. Each subject in this group was presented with the same set of anagrams.

In the second group (hereinafter referred to as "Implicit") subjects mostly solved anagrams obtained by the permutation of letters according to the same pattern ("false anagrams"). The subjects were not informed of the existence of the pattern. Each subject in the group was also presented with the same set of anagrams.

All subjects solved the same number of anagrams under the same conditions. After solving the anagram, they made binary evaluations of their own solutions (they were asked to respond whether the solution was insightful or analytical) and also assessed it using subjective rating scales. The Danek and colleagues' scales were used in the present study (Danek et al., 2014).

Subjects

A total of 105 subjects took part in the study. 51 subjects were placed in the Insight Group and 54 subjects were placed in the Implicit Group.

At the end of the study, subjects in both groups were selected depending on their effectiveness in performing the task. A subject who solved at least 40% of the anagrams was considered to be satisfactorily efficient. After the selection, the Insight Group had 33 respondents left (12 men, 21 women, and the average age of 21.5), and the Implicit Group had 36 respondents left (14 men, 22 women, and the average age of 21). Data collected from these subjects was included in further analysis.

When calculating the proportion of insightful solutions, it was found that two subjects in the Implicit Group and three in the Insight Group did not rate any of the solutions as insightful. Therefore, the analysis of insightful and non-insightful solutions was carried out based on data from 34 subjects in the Implicit Group and 30 in the Insight Group.

Incentives

All anagrams for the subjects in both groups consisted of six letters with the anagram solution words being nouns equalized by incidence per million. The Frequency Dictionary of Russian Vocabulary (Lyashevskaya & Sharov, 2009) was chosen as the source of the solution words.

The subjects of the Insight Group were presented with ordinary anagrams. Anagrams were formed by randomly permuting the letters.

The subjects of the Implicit Group were presented with anagrams formed by rearranging the letters according to the same pattern: the first letter of the solution word was the fifth in the anagram, the second was the fourth, the third was the first, the fourth was the last, the fifth was the third and the sixth was the second (For example: anagram — ETIRCD, solution word — CREDIT).

Equipment

The study was remotely conducted. Each subject was asked to choose a time and a place where distractions (extraneous noises, conversations, etc.) could be kept to a minimum during the experiment. A computer with a high-quality video connection and a computer mouse with left and right buttons were obligatory requirements for participation in the study.

A few minutes prior to the study, the experimenter identified the subject group (using random value generator in Excel) and connected with him/her through the ZOOM video service. Then the subject downloaded an incentives presentation program to the computer. After listening to the instructions, the subject switched on the desktop demonstration mode and started the program.

The experimenter was in video conference with the subject and monitored the subject's performance throughout the study.

Procedure

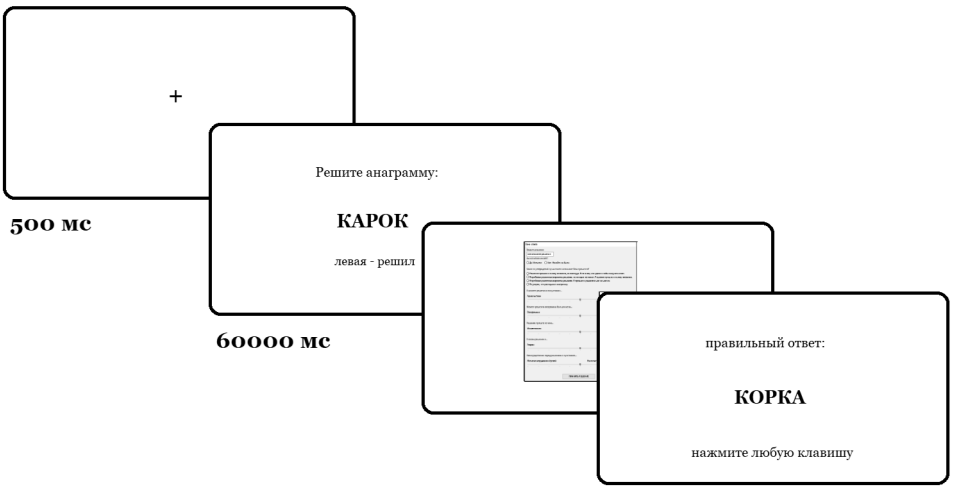
At start the incentives presentation program was unfolded to the full screen (see Figure 1). Before the anagram was demonstrated, the subjects were presented with a 500ms fixation cross. After the cross disappeared, an anagram written in large font in white letters on a black background (Arial, 60) was presented on the screen. The time for presenting the anagram was limited to one minute. The task for both groups was to solve the anagram as quickly as possible and then press the left mouse button. If the examinee did not manage to solve the anagram within one minute, it disappeared and was replaced by the demonstration of the solution word. If the subject managed to solve the anagram by pressing the left mouse button before the time runs out, the answer window was displayed in front of them, where the subject had to:

- type the solution word in the special line;
- indicate whether the subject had an insight in solving or no insight at all;
- choose one of the four statements which, in the respondent's opinion, would best describe the process of searching for a solution;
- using the suggested subjective rating scales, evaluate the subject's own decision.

The subjects were instructed on what should be considered an insight before the start of the study. In characterizing insight, the focus was on the inability to provide a subjective report of how the solution was found. From our point of view, this characteristic of an insightful solution is more significant than the others.

Figure 1

Experimental Procedure



Note. Правильный ответ – Right answer, мс – ms (millisecond).

Moreover, it is mentioned in one way or another in all such instructions (Bowden et al., 2005; Ellis et al., 2011; Sprugnoli et al., 2017). The instruction had the following:

You should mark that you experienced insight if the solution came to you unexpectedly and you cannot describe how you found it.

You should mark no insight if you can talk about how the solution was found (what exactly you did to find it).

The four statements describing the search for a solution were taken from the Ellis' study (Ellis et al., 2011) and translated into Russian. The statements were as follows.

1. My solution came to me suddenly, out of nowhere. I don't know what I did to get the answer.

2. I tried different solutions, but no one was helpful. The solution came to me suddenly.

3. I tried different solutions. I came up with the solution step by step.

4. I am not sure I solved the anagram correctly.

The subjective report rating scales were in compliance with the scales used by Danek and colleagues (Danek et al., 2014). These scales were Solution Happiness, Solution Surprise, Solution Suddenness, Solution Certainty, and Experience of an Impasse. Each of the scales consisted of 11 points: 0 points, +5 points, and −5 points. To rate each of the scales, the subject had to use the mouse to move the slider underneath the scale to the negative or positive side, or to leave it at zero.

A total of five series of ten anagrams in each were presented to the subjects.

In the Insight Group, ordinary anagrams were presented in all five series. In the Implicit Group, 40 false anagrams were presented in Series 1–4. In Series 5 they were presented with ordinary anagrams.

This feature of the experimental design was motivated by the necessity of proving the presence of implicit learning. It is known that when an implicit rule is taught from series to series, motor response time decreases. At the same time, changing this rule during an experiment leads to a sharp increase in response time (Berns et al., 1997). In accordance with the above, it was expected that subjects in the Implicit Group would show a decrease in anagram solution time from Series 1 to 4 and an increase in Series 5. These dynamics would be a consequence of implicit learning and would indicate the presence of implicit learning in the group.

After completing the study, the Implicit Group was asked the question "Have you noticed any pattern in the construction of anagrams? If you have noticed a pattern, reproduce it."

Analyzed indicators

As indicators of the subjects' behavior, the following were used.

• Anagram solving time (based on the data from Series 1–5 of the two groups). The time elapsed between the appearance of the anagram and the click of the left mouse button, provided that the anagram was solved correctly.

• Proportion of insightful and non-insightful solutions (based on data from Series 1–4 of two groups). The ratio of the type of solution to the total number of correctly solved anagrams was estimated for the calculation.

The solutions were considered to be insightful if:

- the subject rated them as insightful;
- when choosing one of the four statements, the subject chose either the first or the second statement;
- the solution was correct.

This double control helped to minimize the impact of the subjects' mistakes in answering.

The proportion of "false insights" was assessed separately (based on data from Series 1–4 of the two groups). False insights were solutions that the subject considered to be insightful, but the solutions were not correct (Danek & Wiley, 2017).

For true insightful solutions, the mean values of the subjective scales were estimated (based on data from Series 1–4 of the two groups).

The experimental design of the present study assumed that the insightful solutions of the Implicit Group subjects would be caused entirely by processes related to the acquisition and use of implicit knowledge. At the same time, the insightful solutions of subjects in the Insight Group would not be related to implicit learning. Thus, belonging to the different groups a priori implies different processes underlying the solution of the anagrams.

In this case, the research task can be reduced to answering the following question: is it possible to determine whether a person belongs to the Implicit Group or the Insight Group relying only on the values of the subjective rating scales of an insightful solution provided by the subject? Based on this, we chose binary logistic regression as a statistical model best suited to linear classification tasks and selected it as the most appropriate tool to analyze the data.

Results

None of the subjects noticed or were able to reproduce the pattern of false anagrams.

On average, subjects in both groups solved 55% of the anagrams, with 27% solved by insight. The average correct solution time was 17.800 ms (see Table 1).

Insightful solutions in the two groups

In the Insight Group, false insights were observed among 22 subjects. The average value of false insights was 17%. In the Implicit Group false insights were observed among 14 subjects. On average, 14% of insights were false.

A comparison of regular (true) insightful and non-insightful solutions showed differences between the two groups.

Table 1

Anagram Solving Performance of the Two Groups

Group	Number of solutions	Solution time (ms)	Number of insights
Implicit	56%	18.310	29%
Insight	54%	17.248	26%

The Implicit Group made insightful solutions faster than the non-insightful ones, $t(66) = 2.03$, $p = .004$. In the Insight Group such differences also occurred (see Table 2), but the differences were not reliable, $t(61) = 2.04$, $p = .354$.

Dynamics of the Anagram Solution Time in the Two Groups

The analysis of the successful solution time of both groups in different series demonstrated a difference in its dynamics. Thus, the Insight Group (see Figure 2) showed an increase from Series 1 to 5, $F(4,160) = 3.24$, $p = .014$, $\omega^2 = 0.05$. Scheffe's multiple comparison method revealed significant differences between Series 1 and 5, $p = .025$.

A different dynamic was observed in the Implicit Group. From Series 1 to Series 4, there was a decrease in the mean decision time, followed by an increase in Series 5 (see Figure 3). However, the observed differences between the series were not reliable.

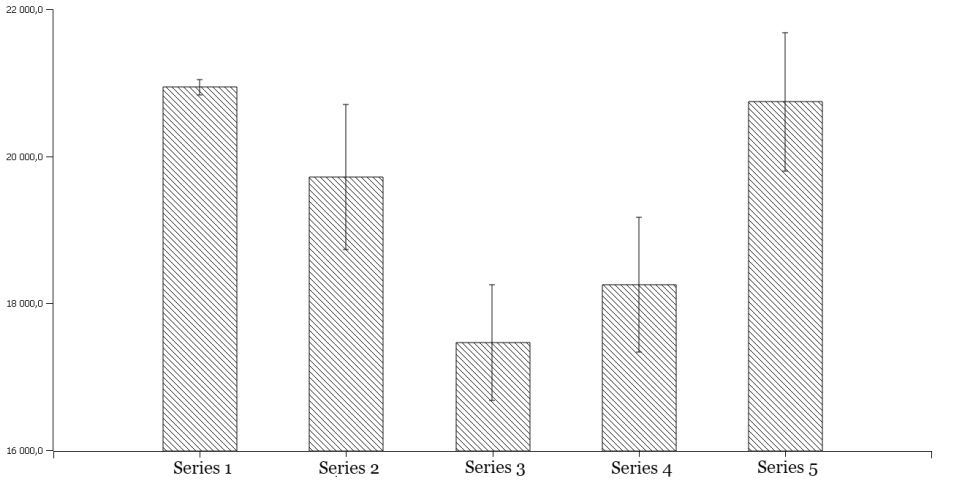
Table 2

Insightful and Non-Insightful Solution Times (ms)

Group	Insight		Non-insight	
	M	SD	M	SD
Implicit	16.777	10.651	18.325	7.522
Insight	16.562	10.087	21.268	9.089

Figure 2

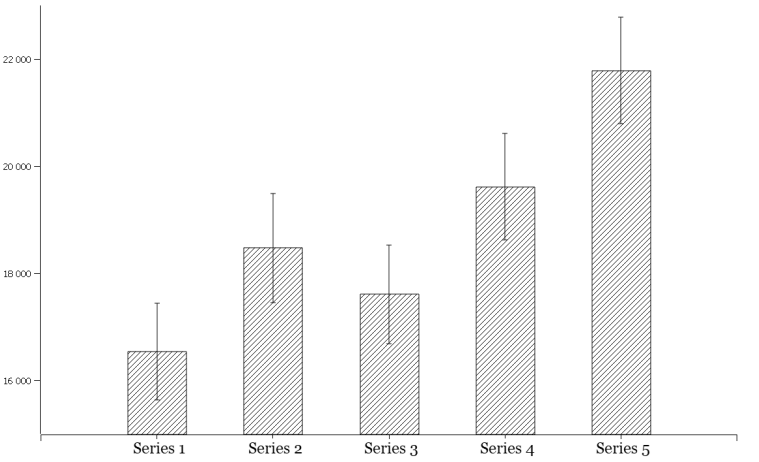
Anagram Solution Times of the Insight Group (N = 33) in Series 1–5



Note. Solution time is presented in ms. Vertical bars indicate confidence interval.

Figure 3

Anagram Solution Times of the Implicit Group (N = 36) in Series 1–5



Note. Solution time is presented in ms. Vertical bars indicate confidence interval.

Subjective Ratings of Insightful Solutions

A correlation analysis of the Implicit and Insight Groups' subjective rating scales demonstrates a different picture of interrelations. In the Insight Group, there were reliable correlations between Solution Happiness and Solution Certainty, and a negative relationship between Solution Certainty and Experience of an Impasse (see Tables 3 and 4).

In the Implicit Group, there was also a relationship between Solution Happiness and Solution Certainty. However, there is no negative relationship with the Experience of an Impasse (see Tables 3 and 5).

Table 3

Subjective Ratings of Insightful Solutions in the Two Groups

Groups	Scales	Min	Max	M	SD
Insight	Solution Happiness	0	10	2.26	2.00
	Solution Surprise	0	10	5.80	2.60
	Solution Suddenness	0	7	3.00	1.75
	Solution Certainty	0	10	2.00	2.30
	Experience of an Impasse	0	10	5.40	2.50
Implicit	Solution Happiness	0.6	4.6	2.50	1.00
	Solution Surprise	1.8	9.6	6.80	1.80
	Solution Suddenness	0.7	7	3.00	1.70
	Solution Certainty	0	4.7	1.40	1.37
	Experience of an Impasse	0.6	8	4.48	1.90

Table 4

Correlations of Insightful Solutions Ratings. Insight Group (N = 30)

	Solution Happiness	Solution Surprise	Solution Suddenness	Solution Certainty
Solution Happiness	1.00			
Solution Surprise	0.048	1.00		
Solution Suddenness	−0.149	0.127	1.00	
Solution Certainty	0.698*	0.051	−0.174	1.00
Experience of an impasse	−0.290	−0.130	−0.353	−0.583*

Table 5

Correlations of Insightful Solutions Ratings. Implicit Group (N = 34)

	Solution Happiness	Solution Surprise	Solution Suddenness	Solution Certainty
Solution Happiness	1.00			
Solution Surprise	0.039	1.00		
Solution Suddenness	0.099	−0.235	1.00	
Solution Certainty	0.380*	0.007	0.208	1.00
Experience of an impasse	0.148	−0.243	−0.047	−0.197

* $p < 0.05$, p-value is two-tailed.

Binary logistic regression with subjective scores as predictors of the Implicit or Insight Groups' participation resulted in a robust model (see Table 6), in which subjective scores such as Solution Happiness, Solution Certainty and Experience of an Impasse were significant predictors (see Table 7).

Table 6

Model Classifier

	Predicted false	Predicted real	Total
Observed implicit	27	7	34
Observed insight	12	18	30
Total	39	25	64

Table 7

Regression Variables

	B	SE	*p*
Solution Happiness	−0.485	0.240	0.044
Solution Surprise	−0.158	0.134	0.239
Solution Suddenness	0.098	0.185	0.595
Solution Certainty	0.657	0.234	0.005
Experience of an Impasse	0.385	0.164	0.018
Constant	−1.318		

Discussion

For the task of the study, the analysis of the data can be reduced to a proof of two statements:

- The solution behavior characteristics of the Insight and Implicit Group subjects differ, which is evidence of qualitatively different processes of their solution search;
- The values of some subjective rating scales of insightful solutions can be used as predictors for assigning subjects to the Insight and Implicit Groups.

Differences in Behavioral Characteristics between the Two Groups

The presence of implicit learning in the Implicit Group suggested that the total number of anagrams solved in this group would be higher, and the total solution time would be lower than in the Insight Group. It was also expected that the time to solve anagrams in the Implicit Group would decrease from Series 1 to Series 4 and increase sharply in Series 5, since there the basis of successful "solving", the hidden pattern, would disappear.

These hypotheses were partially confirmed. The results obtained show no difference between the Implicit and Insight Groups in both the proportion of anagrams solved and in the average solution times. Both groups showed a rather low percentage of solutions (55%). Could this be an indication that the implicit pattern was not learned by subjects in the Implicit Group? From our point of view, it could not.

First of all, it should be noted that a low percentage of solved anagrams is also found in other studies related to implicit learning. For example, in the Deeva and Kozlov's study, subjects were asked to solve anagrams with the letters put together in a certain sequence. Anagrams were presented in four consecutive blocks of ten each. The time for solving anagrams was limited to 8 seconds. One group (called "EG1") solved anagrams with the same sequence, while the second group ("EG2") had the sequence changed in the middle of the test. The results obtained in the EG1 group show that the number of anagrams solved in each block did not exceed 65%. In addition, subjects in the EG1 group had no significant improvement in the number of anagrams solved from block to block (Deeva & Kozlov, 2021). The authors explain such results by the organization of their study, in particular by the strict time limit for solving anagrams (Ibid.). Obviously, in our study, the time for solving anagrams was also limited. But, in our opinion, the reasons for the obtained results are not the same.

It is known that, besides other things, the time and efficiency of solving anagrams strongly depend on the factor of the subject's individual experience. For example, it is very difficult to solve an anagram if the solution word in it is rare. And while this point can be neutralized by equalizing the solution words of anagrams according to their incidence, it is more difficult to deal with other forms of this factor. For example, solving an anagram is known to be difficult if some of its letters are put together into a familiar word (Ellis & Reingold, 2014). Moreover, a similar difficulty is also caused by the incidence of syllables that form an anagram. So, in Lapteva's study, subjects were asked to find solutions to five-letter anagrams,

which were presented with a sixth "distractor" letter (a letter unrelated to the solution). The solution involved separating the distractor from the letters of the anagram and solving it. The study showed that a distractor that formed high-frequency letter combinations with the letters of the anagram made its solution less possible compared to a distractor that formed low-frequency letter combinations (Lapteva, 2016).

We can suggest that in our study two factors influenced the speed and efficiency of solving anagrams in the Implicit Group: the implicitly learned pattern and the frequency of the letter combinations of which the anagram is composed. In the case of some anagrams, the frequency factor interfered with implicit learning, increasing the time required to solve an anagram, or even preventing it from being solved effectively. This led to a wide variation in the time and frequency of correct solutions, which was reflected in the results of the study.

The hypothesis of changes in the anagram solution time in different series was yet confirmed. As the graph (see Figure 3) shows, the time to solve anagrams in the Implicit Group actually decreases from Series 1 to 4, and expectantly increases in Series 5. However, the observed dynamics is not statistically reliable. From our point of view, this can also be explained by the variation in the data caused by the influence of the letter combinations frequency.

When discussing the differences between the groups, we cannot avoid mentioning the increase in anagram solving time in the Insight Group from Series 1 to 5. No such increase was observed in the Implicit Group. Considering the low percentage of solved anagrams in both groups, which is an indicator of task difficulty in general, we may assume that the increase was caused by the tiredness associated with the necessity to search for solutions to difficult tasks. According to this interpretation, the absence of a similar increase in the Implicit Group with the same results in the number of solved anagrams suggests that the subjects in this group were solving anagrams in a way that did not cause such a strong tiredness.

Consequently, despite the absence of differences in the total number of anagrams solved and the average solution time, we can still claim that two different processes underlie the search for solutions in the Insight and Implicit Groups. The reason for this claim is the different intragroup dynamics of anagram solution time changes from series to series. From our point of view, the performance of anagram solving in the two groups was influenced by two factors: the frequency factor and the factor of presence/absence of an implicitly learned pattern. While the frequency factor had an equal effect on the subjects in both groups, the implicit pattern factor influenced only those in the Implicit Group. Therefore, the different dynamics in the groups can only be associated with this factor.

Predictors of Group Participation

Analysis of the subjective report rating scales revealed three predictors that enabled a group-based classification of subjects: Solution Happiness, Solution Certainty and Experience of an Impasse. Correlation analysis indicated that the Insight Group had a negative correlation between the Solution Certainty and Experience of an Impasse scales while the Implicit Group showed no such correla-

tion. At the same time, the Solution Certainty and Solution Happiness scales were found to correlate in both groups.

The results are partially consistent with similar studies. For example, in the previously mentioned Danek's study, Solution Happiness and Solution Certainty, among others, appeared to be predictors of true insights (Danek & Wiley, 2017). The authors' correlation analysis also showed significant correlations between Solution Certainty and Solution Happiness for both false and true insights (Ibid.).

Yet, the Experience of an Impasse scale was not used in the above-mentioned study. In a 2014 study, it was shown that insightful solutions were accompanied by the lowest values of this scale. The authors report: "The Experience of an Impasse indicator appears to be less important than previously thought, which calls into question the theoretical assumption that being in a state of impasse is a necessary condition for the consequent experience of insight." (Danek et al., 2014, p. 7). For this reason, the Experience of an Impasse scale was excluded from the 2017 study.

However, in our work, the Experience of an Impasse scale appeared to be a significant predictor. This may have been caused by the specifity of the tasks to be solved. In Danek's 2014 study, the authors suggested that the low values of this scale were related to the fact that when solving a trick secret, the subject is confused initially and no longer experiences anything similar when searching for a solution (Danek et al., 2014). Obviously, in the situation of solving an anagram, the experience of an impasse does not occur immediately, but sometime after the beginning of the solving process, and this explains the significance of this indicator.

Generally speaking, this study has demonstrated that it is possible to use subjective rating scales to separate insightful anagram solutions on the basis of processes that caused them. This indicates that such a subjective reporting technique is an informative method.

The results of this study provide new possibilities for improving the self-reporting procedure in insight research.

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