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Selecting the Most Optimal Conditions for the Polygraph Examination

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Introduction

We wrote (Saldžiūnas and Kovalenko 2008, 2009a, b, c, d), just like other authors, about the conditions of the polygraph examination which enable obtaining maximally objective and reliable results. Let us remember that the stimulus (or the question) applied and the environment are among factors important for the examination. The impact of the stimulus on the responses depends on the way the question is formulated (Kniazev et al. 2012) and on the depth, timbre, and duration of the voice

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of the examiner asking the question. The element of the environment consists of external noise, distracting details on the premises of the examination, etc. (Saldžiūnas and Kovalenka 2009c). It must not be forgotten that the psychological microclimate that the examiner creates during the examination is important for the results as well. Scientists from various countries have expressed the opinion that comparison question tests (CQT) may not be applicable for polygraph examinations (Ben-Shakhar 2002; Fiedler et al. 2002; Furedy 2009; Iacono 2011; Patrick 2011). In their opinion, there are scientific grounds only for polygraph examinations using concealed information test (CIT) and the event knowledge test (EKT, a modification of the CIT). There is one more important circumstance due to which the use of CQT may be limited. Defending the results of CIT-type tests in courts is easier for the examiner in some countries (especially in Europe and Japan) (Nakayama 2002; Osugi 2011; Saldžiūnas and Kovalenka 2013). Below in the article we compare CQT and CIT also using the model of influence of various psycho-physiological factors we have suggested.

Influence of the examinee’s physical condition on polygraph examination

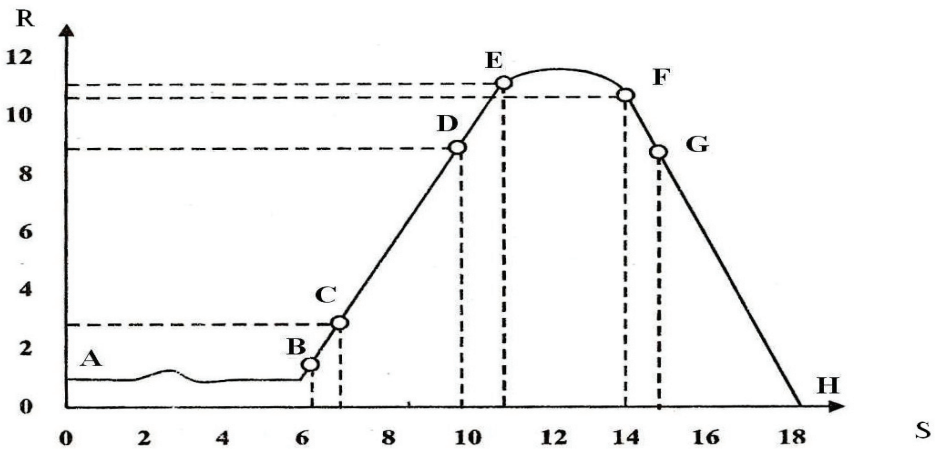


Figure 1. Dependence of the magnitude of relative response (R) in polygraph subjects on the subject's emotional stress (S) [according to Varlamov et al. 2010]]

The dependence of a person’s potential relative responses to stress is illustrated in Figure 1. If the examinee is stressed between the points A and B, he or she may be apathetic to external factors, including a polygraph examination. This may happen if the examinee is physically, psychologically and/or emotionally fatigued. Varlamov

(2010) recommends examining when the subject's level of stress is contained between the points B and D. In this section of the curve, the magnitude of the subject's psycho-physiological response may be dependent almost linearly on the increase of emotional stress, which means that as the stress increases the magnitude of the psycho-physiological response rises proportionally. If the examinee is in the EH section of the curve because of very high stress, responses measured by the polygraph may be interpreted incorrectly by the examiner (or the polygrapher may altogether fail to measure the change of the psycho-physiological response). This means that, if the functional capabilities of the suspect arrested by the police are, for example, in the section DE of the curve because of stress, the person's functional capabilities will end up in the part EH of the curve because of the additional stress caused by the relevant question and thus the measured psycho-physiological responses cannot be used when evaluating the effect of the question on the examinee. Therefore, the examiner must assess the state of the examinee before the examination. If the examinee does not participate in the pre-test conversation actively enough and demonstrates hardly any interest in the examination, it may be assumed that the examinee is tired or has taken medications suppressing physiological functions (Varlamov 2010). This may mean that the examinee's organism is between the points A and B (Figure 1) and the examination must be rescheduled. Visual assessment whether an examinee is fit for the examination is sometimes very difficult for the examiner. Which is why demonstration tests (DT) are recommended (Krapohl 2010). In EKT, we use only adaptive question (Saldžiūnas and Kovalenka 2008a). After a DT, polygraph charts allow to see whether the examinee's responses are excessively labile or highly indifferent (Krapohl 2010; Soschnikov et al. 2008). Varlamov (2011) and the authors (Saldžiūnas and Kovalenka 2014) maintain that assessing whether the examinee has consumed medications as a countermeasure is possible with regard to the magnitude of tonic electrodermal activity (EDA). When tonic EDA is equal to or exceeds 300 kilo ohms, the examinee may be believed to have consumed medications before the examination or to be a drug addict. Several computerised polygraphs can register tonic EDA. If there is an assumption that the examinee has consumed medications that can influence reaction of examinee, the examiner must decide whether further examination will be useful and whether continuation is practical.

Factors influencing the magnitude of responses recorded in polygraph charts

Scientists have tried to create a model that would explain the psycho-physiological processes taking place in the subject's organism during a polygraph examination. A few dozens of models have been created (Handler and Honts 2007; Kleiner 2002;

Kniazev and Varlamov 2012; Moltshanov and Babikov 2012; Verschuere and Ben-Shakhar 2011). The process of building models continues, as there is still no model that would fully explain the psychophysiological processes, whether in laboratory or field examinations, and whether in CQT or in CIT. What probably explains the psychophysiological processes of the examination best is a model based on the phenomena of orienting responses (OR) (Sokolov 1966). According to Verschuere et al. (2009), the defensive response is the organism's answer to an aversive event. Although OR and DR are functionally different, they are often difficult to distinguish. Both reflexes are characterised by an increase in skin conductance. One of the easiest and straightforward means to discriminate the two reflexes is to examine the heart rate response: OR is associated with heart rate deceleration, and DR – with heart rate acceleration (Verschuere et al. 2009). Verschuere et al. (2010) tried to evaluate the named patterns in field polygraph examinations of the Belgian Federal Police but, as far as the authors understood, not quite successfully. The authors reviewed the polygraph charts of the field criminal investigations performed in Lithuania in 2008–2012 and did not find in the polygraph charts any obvious patterns in the change of heart rate that would help discriminating between OR and DR. Each examinee's psyche is individual, individual resistance to stress is different, the examination conditions cannot be ideally the same in all criminal investigations, even the questions in a single test are not the same with regard to their significance for the examinee; therefore, we believe that OR or DR evidence itself for each examinee individually. The authors believe that it is too early to apply models in which OR and DR may be distinguished in field polygraph examinations.

Research of Verschuere and Ben-Shakhar (2011) suggests that emotional-motivational factors such as overt deception and motivation to avoid detection may increase CIT. The emotional-motivational factors can increase the significance of the relevant items. All told, OR theory can explain most of research findings related to the CIT. On the other hand, OR theory faces several challenges. First, significance is a very useful concept but it is also too broad and vague (Verschuere and Ben-Shakhar 2011).

After a review of the scientific articles (Handler and Honts 2007; Kleiner 2002; Kniazev and Varlamov 2012; Moltshanov and Babikov 2012; Verschuere and Ben-Shakhar 2011) and on the grounds of field polygraph examinations by conducted by us and our peers from neighbouring countries (Kniazev and Varlamov 2012; Nakayama 2002; Saldžiūnas and Kovalenka 2008, 2009a, b, c, d; Varlamov and Varlamov 2010), we tried to draw up a chart illustrating the way various psychological factors influence the magnitude of psycho-physiological reactions during a polygraph examination (Figure 2). We wish to note that we tried to model the influence of various factors to the magnitude of response during the whole examination which may continue for anything up to 1 or 2 hours. It is our first try to draw up such a model.

We are not certain whether it is complete and perfect. We hope that it will be the first step to help to understand better the requirements that must be set for the newly created tests.

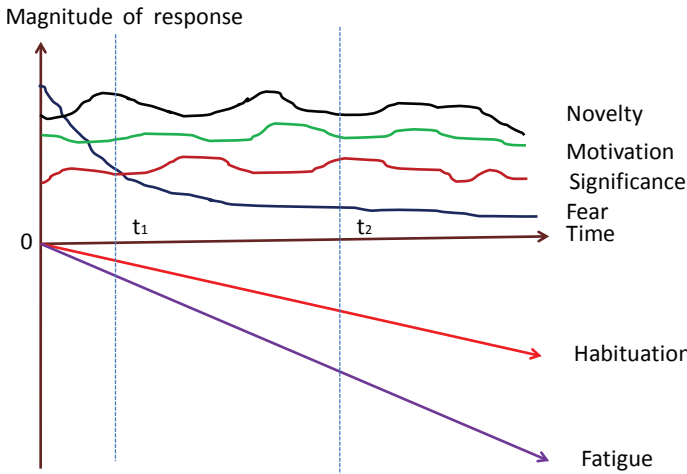


Figure 2. The model of a change in the examinee’s magnitude of relative response during a polygraph examination

We included the factors of novelty, motivation, significance, fear of waiting, habituation, and fatigue during the polygraph examination (Figure 2). Our following estimates are based on the results of Gati and Ben-Shakhar (Gati and Ben-Shakhar 1990) who revealed there is no evidence for interaction between factors.

Novelty. The idea that phenomena of orienting responses (OR) are evidenced in psycho-physiological measurement by a polygraph is suggested in all academic papers discussing the model of polygraph examination (Verschuere and Ben-Shakhar 2011). Pavlov (1927) sometimes called it the “what is it” response. Bradley (2009) demonstrated the importance of OR phenomenon in his laboratory research as well. Bradley in turn uses the concept of “novelty” which we found suitable for our model. Certainly, novelty will not be steadily the same throughout the whole polygraph examination. The novelty-produced response may increase or decrease during the actual examination. Overall, the way novelty impacts the magnitude of the produced response requires additional research (Ben-Shakhar 2000).

Motivation. When reviewing the methodologies of the examination, some authors (Handler and Honts 2007) take almost no heed of the motivation factor. Varlamov (2010) considers motivation to be one of the most important factors ensuring a use-

ful examination. Probably, all professional examiners have experienced that registering a response is more difficult when investigating a case of a theft of 100 dollars than when investigating a case of a murder. Examinees have major stress in case of a murder. Bradley (2009) suggested that emotion is fundamentally organised around two motivational systems, one defensive and one appetitive. Elaad (2009) does not contradict this idea either. Obviously, defensive motivation suits loyalty and field criminal examinations; appetitive motivation influences the responses during laboratory and demonstrative examinations. When creating an efficiency formula for polygraph examination, we have already taken the importance of motivation factor into account (Saldžiūnas and Kovalenka 2011). It is difficult to say theoretically whether the influence of a motivation factor will change at all during a polygraph examination. Obviously, the magnitude of the motivation of the guilty and innocent suspects will be different in the same criminal investigation. We believe (on the basis of our field examinations) that the motivation of the guilty examinee will be stronger and thus it will determine stronger recorded responses.

Significance. An attempt to account for the cases where stimulus change failed to produce an orientation was based on the notion that stimulus novelty in itself is insufficient for OR elicitation, and some level of significance is necessary (Ben-Shakar et al. 2000). Ben-Shakar notes that the definition of stimulus significance is relativistic for an individual. Suzuki et al. (2004) writes 'for each subject, a binary classification was applied to the questions terms of whether their relation to the crime was close or high (*Hi*), or less close or low (*Lo*). The *Hi* questions were directly related to the crime, and dealt with such issues as the nature of the crime, tools used in the crime, and the general locale where the crime was committed. The *Lo* questions were not closely related to the crime, and dealt with such issues as precise amounts of money involved, precise time when the crime was committed, colour of the robber's bag, and precise words that the victim spoke (Suzuki et al. 2004). Bradley (2009) also noted that stimulus significance may influence the magnitude of the recorded response. Significance may change in various ways during the examination depending on the test used; the magnitude of the recorded response will change respectively.

Fear. What is meant here is the examinee's pre-test fear. Ekman (1992) named five reasons why the examinee may feel fear before a polygraph examination. In their experiments Bradley et al. (2008) demonstrated that fear of pain is evidenced in psycho-physiological responses. We observed that in most field examinations.

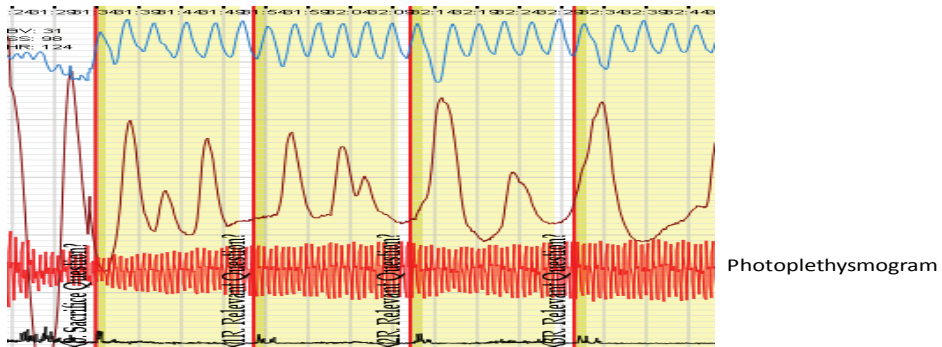


Figure 3. Field examination chart

It can be seen in Figure 3 that the response is reduced in the photoplethysmogram in the beginning of the test. Response magnitude of photoplethysmogram signal grows with time. This means (Krapohl 2010; Varlamov et al. 2010) that the examinee experiences higher stress in the beginning of the examination. The examinee's stress may change later depending on the situation.

It is one of the reasons why making the first question in CQT or the first item in CIT (first answer in EKT) relevant is not recommended (Varlamov et al. 2010). It may be thought that the initial fear of the polygraph examination and a response to it may decrease as shown in Figure 2. But that may be a very individual process which has not been well investigated yet.

Habituation. Ben-Shakar et al. (2000) wrote: the definition of the OR as a response to a change in stimulation implies that repeated presentation of the same stimulus would result in a gradual decline in response magnitude. Such a pattern was defined as habituation. In their experiments, Nakayama (2002) and Varlamov et al. (2010) demonstrated the way habituation reduces response magnitude during polygraph examinations. It is shown in Figure 2 that habituation reduces response magnitude as the duration of the examination is prolonged.

Fatigue. Fatigue may be physical, psychological or emotional. When the examinee fatigued during the examination, his or her state changes and the response magnitude decreases (E–F in Figure 1). Therefore, it is shown in Figure 2 that, as fatigue increases during the examination, the response magnitude decreases due to the fatigue factor.

The dependence of the relative response magnitude on the duration of the examination may be assessed in Figure 2. If we add the response magnitudes of all factors at the point t_1 , we will obtain response magnitude $R(t_1)$:

$$R(t_1) = R(\text{novelty}, t_1) + R(\text{motivation}, t_1) + R(\text{significance}, t_1) + R(\text{fear}, t_1) + R(\text{habituation}, t_1) + R(\text{fatigue}, t_1)$$

If we add up all response magnitudes in the point t_2 ($t_2 > t_1$), we will obtain response magnitude $R(t_2)$:

$$R(t_2) = R(\text{novelty}, t_2) + R(\text{motivation}, t_2) + R(\text{significance}, t_2) + R(\text{fear}, t_2) + R(\text{habituation}, t_2) + R(\text{fatigue}, t_2).$$

In accordance with our model, when $t_2 > t_1$, it is $R(t_2) < R(t_1)$. This means that the longer the polygraph examination, the weaker responses are registered. This conclusion coincides with the conclusions of experimental works and our experience in field work.

Discussion

We will further review the way the magnitude of response changes when examining using Comparison Question Test, Concealed Information Test and Event Knowledge Test.

Comparison question test

Novelty. Assessing whether novelty influences the magnitude of relative response is very difficult. We believe that the influence of novelty will be minimal. The reasons thereof:

- The examiner introduces the questions to the examinee before the tests and discusses all nuances of each question with the examinee.
- The test is repeated from 3 to 5 times during the examination.

Motivation. Motivation does not depend on the type of the test.

Significance. There are no clear requirements regarding significance of relevant and comparison questions in the CQT. Significant and less significant questions may be freely administered in the tests. In accordance with the CQT concept, relevant questions must be more significant to the 'guilty' examinee, whereas comparison questions – to the 'innocent' one. As the tests are repeated from 3 to 5 times, significant and less significant questions are repeated throughout the examination.

Fear. Ex ante fear of the examination does not depend on the type of the test. As demonstration tests are also used in the examinations with CQT, it should reduce the magnitude of response of 'innocent' examinees, whereas it should increase the magnitude of response of the 'guilty' ones (Krapohl 2010).

Habituation. This should have a major influence to the magnitude of response, as the questions are introduced to the subject before the examination and the tests are repeated several times.

Fatigue. As the conversation, whose duration may last from one to several hours depending on the polygrapher's style, takes places before the test, the examinee may become tired still before the polygraph tests. In CQT, fatigue strongly reduces the magnitude of response.

The model assessing the influence of all factors on the relative magnitude of response in COT is shown in Figure 4.

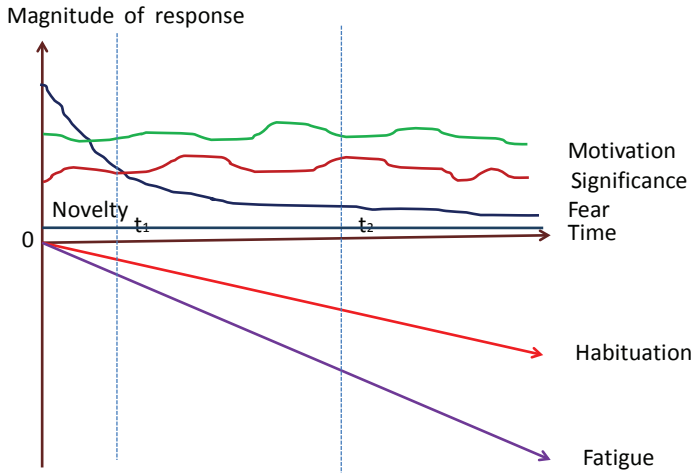


Figure 4. The model of the change of the examinee's magnitude of relative response during the polygraph examination for the CQT

Concealed information test

To clarify, the US (Krapohl et al. 2009), Japanese (Osugi 2011) and Russian (Kni-azev et al. 2012) versions of the CIT are used.

The authors have examined all the factors and have found hardly any big differences, as all named factors influence the magnitude of response. Although the examiners from the Japanese police (Osugi 2011) note that the questions may be more and less relevant, we did not find their recommendations on how the questions of different relevance must be asked during an examination. The examiners of the Japanese police (Nakayama 2002; Osugi 2011) repeat the tests several times during the examination as well; therefore, the magnitude of response influenced by *significance* should decrease. It may be considered that the pre-test conversation before the CIT takes place for a shorter time than before the CQT. For this reason, the examinee's fatigue will have less impact on the magnitude of response. This means that the model of the change of the magnitude of response during the examination in case of the CIT will be very similar to the CQT model (Figure 4).

Event knowledge test

Novelty. The impact is great as:

- The question options are not introduced to the examinee before the examination (Saldžiūnas and Kovalenka 2008, 2009a, b, c, d).
- The questions are usually not repeated during the examination (Saldžiūnas and Kovalenka 2008, 2009a, b, c, d). Some answer options are repeated in exceptional cases.

Motivation. Motivation does not depend on the type of the test.

Significance. One of the main requirements in EKT tactics is that the questions are arranged from the least to the most significant one. It is only a trend in actual examinations, as the examiner's opinion that a certain question is the most significant may not coincide with the examinee's assessment.

Fear. Ex ante fear of the examination does not depend on the type of the test.

Habituation. It should reduce the magnitude of response significantly, as the questions are not introduced to the examinees before the tests and the questions are not repeated during the examination.

Fatigue. The procedure of the examination is briefly introduced to the examinee before the examination. This, in our opinion, does not increase fatigue strongly. Having assessed the influence of all factors on the magnitude of relative response in the EKT, we present the relevant model in Figure 5.

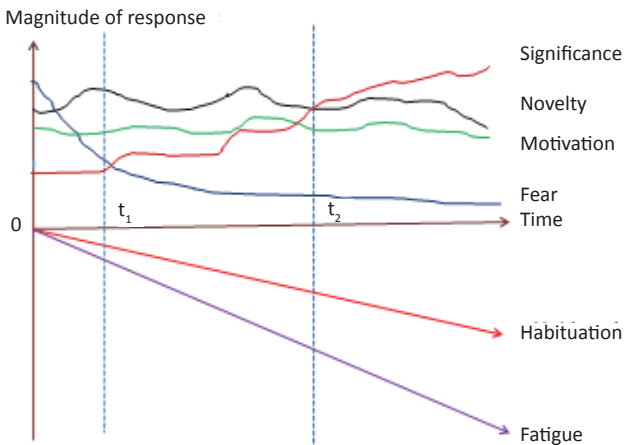


Figure 5. The model of the change of the examinee's magnitude of relative response during a polygraph examination for the EKT

It is now possible to compare the magnitude of response in the EKT and the magnitude of relative response in the CQT at a chosen time of t_2 on the basis of the model $R(t_2, \text{EKT}) > R(t_2, \text{CQT})$ presented here. On the basis of the model showing the change in the examinee's magnitude of relative response during the examination presented herein, it may be maintained that the magnitude of response in the EKT is higher than in the CQT and CIT. This assumption is confirmed by the field studies of the authors who have observed that general stress usually decreases in innocent subjects when examined according to the EKT. The stress of a guilty subject during the examination remains high or very high when resorting to the EKT (Saldžiūnas and Kovalenka 2008; 2009a, b, c, d). A potential problem of the EKT is that the very high level of the subject's stress, which makes interpreting the charts very difficult.

Laboratory examination

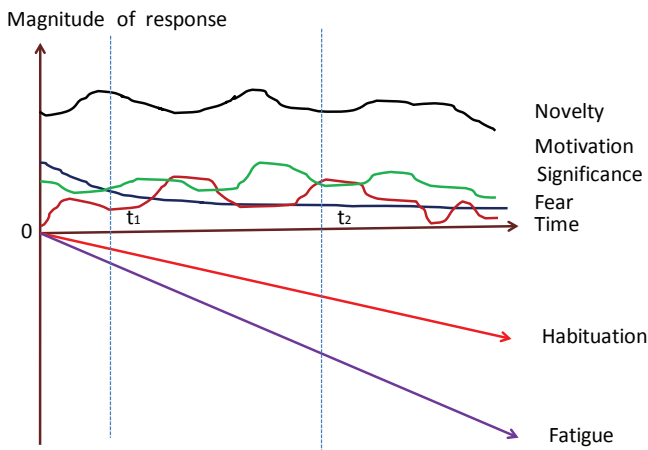


Figure 6. The model of the change of the examinee's magnitude of relative response during the laboratory polygraph examination

During a laboratory polygraph examination, the novelty factor will probably affect psychophysiological reactions much like in the field examination (Figure 6). We have already mentioned that effect of the motivation factor will be minimal during the laboratory examination. The examinee perceives laboratory examination as the gamble. Most likely, the effect of the significance factor will also be minimal during the laboratory examination. Before a polygraph examination, a subject may feel some agitation, but such a feeling will be significantly less intense than during a field examination. The authors are not aware of such scientific research, but we believe that habituation process should be more accelerated. The effect of the fatigue factor will probably only depend on physical characteristics of examinee.

To summarise, it may be said that the magnitude of relative response during laboratory examinations will be smaller than during field examinations. This model verifies our conclusions from earlier articles (Saldžiūnas and Kovalenka 2010).

Concluding remarks

1. Because novelty and significance factors increase psychophysiological reactions, we do not recommend repeating questions and we suggest selecting only the questions most important for the subject.
2. Polygraph examination should be organised rationally, and it should last as short as possible.
3. The model provided verifies that responses of examinees, who are not aware of details of the crime, are less intense than the responses of the guilty ones.
4. This model is suitable for field polygraph examinations (CQT, CIT, and EKT) and mock-crime examinations.
5. It could happen that after a re-examination (second or repeated examination) the results obtained by other examiners using the same questions for the same subject are not the same.

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