



Paieška

NAUJIENOS

KNYGOS

MOKSLO ŽURNALAI

APIE LEIDYBOS DIREKCIJA

E – KNYGYNAS

NAUJAUSIOS KNYGOS

Visos knygos

Pavadinimai A – Z

Autoriai A – Z

Tik spausdinta versija

Tik elektroninė versija



Pavadinimas arba pavadinimas ir toks ir toks

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Pavadinimas arba



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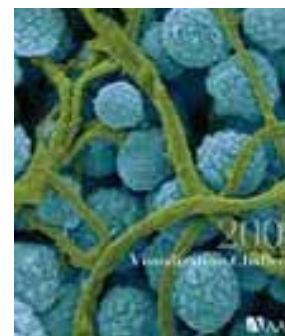
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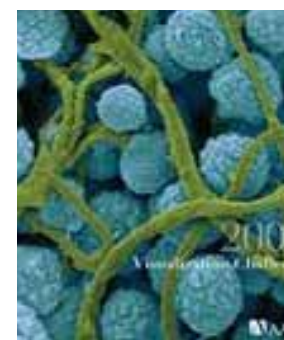
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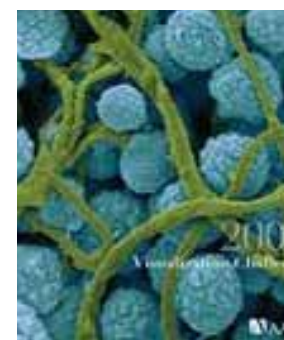
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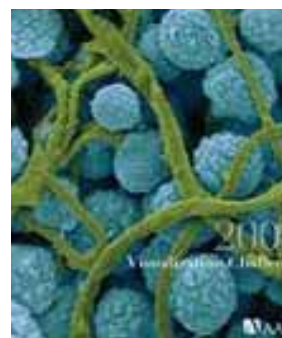
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and the shortest will be provided by the one who was occupied by the difficult arithmetic. This is a powerful finding: remember, if the duration estimation was done retrospectively – if the three participants were not told in advance that they would have to estimate the duration – the inverse effect would be obtained (Block & Zakay, 1997).

These findings indicate that retrospective and prospective timing are based on different cognitive processes. Whereas retrospective timing is based on memory processes as explained earlier, prospective timing is based on attentional processes. This conclusion was further supported by Zakay et al. (1994), who showed that level of segmentation of an interval only has an impact on retrospective duration estimation, not on prospective ones.

The attentional gate model (Zakay, 2000) provides an explanation for prospective timing. It is based on the scalar expectancy theory (SET) model, which is an internal clock model that successfully predicts and explains time-based behaviours (e.g. time conditioning) in animals. In this model, the internal clock consists of some sort of a pacemaker that emits signals continuously and with a constant, steady tempo. The signals emitted in a given interval are read and counted by a component called an accumulator. The count of signals during a target interval is stored in memory and can be used to represent the duration of that interval. An organism can repeat certain durations by counting the signals until there is a match between the new count and a former one. This does not require any awareness of the passage of time.

Humans, on the other hand, are aware of the passage of time and are highly influenced by attentional demands during a target interval. Thus, another component should be added to the SET model in order to fit the human prospective duration estimation. This component is called the 'attentional gate', which regulates the amount of signals emitted by a pacemaker and subsequently counted by an accumulator during a given interval. The gate can become 'wide' or 'narrow' depending on the amount of attentional resources allocated for timing. The more attentional resources allocated for timing (like in cases in which the passage of time is very important, such as waiting for an important meeting) the wider the opening of the gate, the higher the count in the accumulator in comparison to a case in which time is not important (such as

relaxing during a long vacation). In these cases only few attentional resources are allocated for time and the gate becomes narrow, allowing for a low number of signals to be accumulated by the accumulator during a given interval. Assuming that the feeling of an interval duration is a function of the count in the accumulator, the same objective interval (say, 30 seconds) will be perceived as longer while waiting than while relaxing.

There are two major factors that determine the amount of attentional resources allocated for prospective time.

"In many situations it is advantageous to cause people to experience durations as short"

The first is 'temporal relevance', which indicates how important it is in a specific situation to be aware of the passage of time. The higher the temporal relevance, the more attentional resources will be allocated, the wider the opening of the gate and therefore the longer the estimate of duration. The second factor is the amount of attentional resources required for performing a concurrent nontemporal activity. Attentional resources are limited and have to be divided between all the activities taking place simultaneously. Therefore when facing a demanding nontemporal task, more attention is consumed by the task and less attention is allocated for timing.

Now we can explain why prospective duration judgement produces a mirror effect to retrospective judgement. Take, for example, the Ornstein study (1975). In retrospect, the exposure duration of a complex geometrical figure is longer than the exposure duration of a simple figure because in the complex figure more information was processed, sorted and later on retrieved from memory than in the simple figure case. However, if exposure duration estimation is done *prospectively*, then memorising the complex figure demanded more attentional resources than memorising a simple figure. The result is that in the first case fewer attentional resources are left for timing than in the second case. This will lead to a narrow gate and low count of signals in the first case and a wider gate, leading to a high count of signals in the second case.

### Explaining daily time-dependent experiences

So let's summarise the principles that determine the perception of durations:

- 1 If awareness to time is not important, duration estimation will be retrospective. As such, it will be longer for intervals in which high information-

processing load was required, when compared to intervals for which the information-processing load was low.

- 1 Whenever the relevance and importance of time is high, timing automatically becomes prospective. In such situations the more attention that is allocated directly for time, the longer the duration will be experienced.
- 1 When duration judgement is prospective and is accompanying a concurrent nontemporal task, the more demanding the concurrent task is the shorter the duration estimation of the interval during which the task was performed will be.

So how can we apply these principles to some common situations?

A 'watched pot' never boils, and earthquakes feel longer than they are. When one is watching a pot waiting for the water to boil, time is of the utmost relevance – the person is occupied with the question 'When will the water boil?'. This means that timing will be prospective, the gate will be widely open and the count of signals in the accumulator will be high. This will cause the ongoing experience of the passage of time to become very long. Similarly, when waiting for a friend to join us, for a traffic light to turn green or a call centre to answer us, we focus our attention on when it will happen: there's high temporal relevance.

Similarly, some studies indicate that people experience the duration of earthquakes in the range of minutes, as compared with its actual range of 30–40 seconds (Loftus et al., 1987). The passage of time during an earthquake is highly relevant: it is a threatening event and people want it to terminate as soon as possible. They focus on 'When will it be over?', the attentional gate is wide open and the duration estimation becomes longer.

The 'return trip' feels shorter. When we have to be somewhere at a certain time for an important event, on the way there time relevance is high. That is why prospectively we experience the duration as being longer. Returning to the starting point, although it is exactly the same distance, feels in many cases shorter than going there because time is not that important and so our attention is diverted or distracted by events occurring around us (Roy, 2011).

Time flies when we are having fun, but a boring lecture never ends. When we focus our attention on a good

book, a movie or that special someone, and we don't have any obligations, the time relevance is low. The gate will be narrow and the signal count low. We may feel that time is not passing, but if we look at our watch we will be amazed to see how much clock time has elapsed without our noticing.

Attending a boring lecture is like being in 'empty' time, because the information seems to be not useful for us so we are not processing it. Most of our attentional resources will be allocated to prospective timing, and again the gate model provides an explanation for the experience of duration in such cases.

Time slows when we are in pain. When we are in pain, temporal relevance becomes high, leading to the feeling that the pain is going on and on. Emotions in general are known to influence and sometimes distort time perception. For example, Droit-Volet et al. (2004) found that exposure duration of pictures of emotional faces were overestimated compared to neutral ones. The attentional gate model might explain why we are relatively inaccurate in making timing judgements during emotional

experiences. In some cases emotions demand attentional resources for coping with them, and then duration estimations will be underestimated. In other cases, especially when emotions have a threatening meaning like in the case of fear or pain, time relevance will be high. In such cases the duration estimation will be overestimated.

### Conclusions

What are the implications of all this? Well, in many situations it is advantageous to cause people to experience durations as short. Think of shops, call centres or in amusement parks. If people experience boring, long waits they might leave, taking their money with them. So such venues might attempt to shorten duration experiences by, for example, diverting attention from time to nontemporal, interesting attractive events. In amusement parks there are usually activities such as TV screens showing cartoons distributed along the queue, or clowns going around; in a call centre, background music will be used. Such activities divert people's attention away from time.

The nature of the cognitive processes involved in duration estimation causes the experience of time to be relativistic: in psychological time, the same clock interval may be over- or underestimated depending on the factors we have explored. Retrospective time-duration estimations are based on the amount of information about changes retrieved from memory, while prospective time-duration estimations are based on the 'reading' of the internal clock. As a result, our sense of time is not accurate, though in most cases it is sufficient for our needs. The contextual change model and the attentional gate model provide explanations for most of our daily experiences of duration, but there are so many important dimensions of time that further research will continue to deepen our understanding of the field for many years to come.



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## Extra time

In addition to four more pieces in this issue, we also have two online-only articles.

For Clare Allely (University of Glasgow) on how emotions cloud our sense of time and Luke Jones (University of Manchester) on time and information processing, see [www.thepsychologist.org.uk](http://www.thepsychologist.org.uk)







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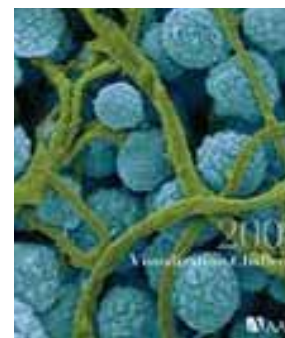
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