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Laypeople's Beliefs affect their Reports about the Subjective Experience of Time

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Abstract

Because the general population may be familiar with the phenomenon that life appears to speed up as people become older, participants' preconceptions may affect how they answer questionnaires about the subjective experience of time. To be able to account for these preconceptions in future research, we assessed laypeople's beliefs about the phenomenon. Participants (N = 313) were asked whether they were familiar with the phenomenon, whether they experienced the phenomenon themselves, and what they thought that the cause or causes of the phenomenon may be. More than 80% of the participants had read or heard about the phenomenon prior to the study, suggesting that the phenomenon is well-known among the general population. Furthermore, although most participants experienced the phenomenon themselves, familiarity with the phenomenon affected whether they felt that life appeared to speeding up and whether time passed fast for them. Familiarity also affected whether participants attributed the phenomenon to changes in objective or subjective time but not the endorsement of the phenomenon's causes. Finally, participants also had preconceptions about what time periods represent 'the present' and 'the past'. Whereas nearly all participants considered the past to have lasted more than one year, two-third of the participants felt that the present represented a period less than one year.

Key words: Time perception, time experience, laypeople, beliefs, preconceptions.

1. Introduction

When people are asked to compare time passage in the present with time passage in the past, they tend to indicate that there has been a large increase, suggesting that life has speed up as they have become older (i.e., Baum, Boxley, & Sokolowski, 1984; Gallant, Fidler, & Dawson, 1991; Joubert, 1983, 1984, 1990; Lemlich, 1975; Tuckman, 1965; Walker, 1977). However, when time passage in the present is compared across groups of young, middle-aged and older adults on intervals, like the previous week, month or year, there are hardly any age differences (Friedman & Janssen, 2010; Janssen, Naka, & Friedman, 2013; Winkler et al., 2017; Wittmann & Lehnhoff, 2005). Only when the passage of time is compared on extremely long intervals, such as the previous 10 years, age differences are observed.

Because the general population may be familiar with the phenomenon that life appears to speed up as people become older, participants' preconceptions may affect how they answer questionnaires about the subjective experience of time. To be able to account for these preconceptions in future research, we assessed in the current study laypeople's beliefs about the phenomenon. Participants were asked whether they had prior to the study heard or read about the phenomenon, whether they experienced the phenomenon themselves, and what they thought that the cause or causes of the phenomenon may be.

Many theories have been proposed in the literature to explain the phenomenon (see Table 1), with several accounts relating the phenomenon to age and aging. First, a decrease in the number of memorable events in older age has been proposed as an explanation (Fraisse, 1963, 1984; Guyau, 1890; James, 1890; Landau, Arndt, Swanson, & Bultmann, 2018; Winkler et al., 2017). For instance, James (1890) suggested that life in late adulthood has more routines and fewer unique events as compared to childhood. Time perception is therefore based on the number of specific events that can be recalled from different lifetime

periods, with more specific events from childhood and fewer specific events from late adulthood. Second, ratio models are explanations whereby there is an implicit comparison of an interval with the total length of one's life (Janet, 1877, cited in Fraisse, 1963; Lemlich, 1975). In this comparison, the same interval time will have a smaller ratio for older than younger adults. A five-year period represents a fourth of a twenty-year-old person's life but only a tenth of a fifty-year-old person's life. Third, biological clock theories propose that ageing causes a slowing down in the ability to process time internally. Because this internal clock slows down in older age, the experience of external time as indicated by clocks and calendars will increase (Craik & Hay, 1999; Draaisma, 2004; Whitrow, 1972). Fourth, a similar theory has proposed that the decrease in attentional resources in older age limits the ability to process time internally (Gruber, Wagner, & Block, 2004), causing a similar slowing down of internal time in comparison to external time.

In addition to these four theories that relate the phenomenon to age and ageing, there are also three theories that provide more general explanations for the phenomenon. First, when people are asked to date events, they tend to underestimate the age of the events (i.e., the events appear to be closer in time) and make errors forward in time (e.g., Janssen, Chessa, & Murre, 2006; Rubin & Baddeley, 1989). The forward telescoping explanation argues that, when people realize that they have underestimated the age of an event, they would then feel that time has passed quickly in the time between the event and the recollection (Crawley & Pring, 2000; Draaisma, 2004). Second, the difficulty of recalling experiences from an interval may lead to the impression that time passed quickly during that interval (e.g., Block, 1989; Ornstein, 1969; Poynter, 1989). For example, when a person cannot recall any events from the last month, they might have the feeling that the month passed quickly. Third, time pressure explanation argues that feelings of being busy and not having enough time to complete tasks are related to the experience of time (Friedman & Janssen, 2010; Janssen et

al., 2013; Winkler et al., 2017). People are able to recall many instances of recent time pressure but fewer instances of time pressure in the past, which leads to the feeling that time is passing faster in the present than in the past (Janssen, 2017).

Although these explanations might not be known to the general audience, it is likely that participants in studies examining the subjective experience of time are familiar with the phenomenon and that they may have explanations for the phenomenon themselves. These preconceptions may influence their responses in studies examining the subjective experience of time (i.e., demand characteristics). It is therefore important to assess whether participants are familiar with the phenomenon and what they think the cause or causes of the phenomenon may be.

Furthermore, two ways of phrasing the question whether participants experience the phenomenon have been used in the literature. Some studies have asked whether life appeared to be speeding up as participants became older (e.g., Gallant et al., 1991), whereas other studies have asked how slow or fast time usually passes for participants (e.g., Baum et al., 1984; Wittmann & Lehnhoff, 2005). Although it is assumed that these two questions measure the same construct, it is not clear if they do; both phrasings have been used but never within the same study. We therefore asked participants both questions; whether it felt like life appeared to speed up for them as they became older and how slow or fast time usually passed for them. Similarly, because research into the phenomenon sometimes uses poorly defined time periods (e.g., 'the present' and 'the past'), we also asked participants how they defined these time periods when answering whether time in the present is passing slower or faster for them than time in the past.

2. Method

2.1. Participants

The study was conducted online, and participants were recruited by using the snowballing technique (e.g., advertised on social media and sharing links with friends, family, and colleagues). Participation was voluntary, and no compensation was provided. There were five exclusion criteria: Not signing the consent form, being younger than 18 years old, indicating that 'the past' ended at a later age than their current age, not answering the questions 'honestly and accurately', and taking longer than 15 minutes to complete the survey.

After applying the exclusion criteria, a group of 313 participants remained, of which 191 classified themselves as female (61.0%), 120 as male (38.3%), 1 as other (0.3%), and 1 preferred not to indicate their gender (0.3%). The participants had a mean age of 29.52 years (SD = 11.47), and their ages ranged between 18 to 77 years. Most participants were young adults (N = 261; 18-37 years), and only a few were middle-aged (N = 38; 38-57 years) or older adults (N = 14; 58-77 years).

Participants tended to come from three regions: 154 came from the United Kingdom or other English-speaking Western, Educated, Industrialized, Rich and Democratic (WEIRD; Henrich, Heine, & Norenzayan, 2010) countries (United States, Canada, Australia, and New Zealand), 88 from Southeast Asia (Malaysia, Indonesia, Singapore, and Brunei), and 59 from Continental Europe (Germany, Netherlands, Italy, Sweden, etc.). The remaining 12 participants came from countries outside these regions.

2.2. Materials and Procedure

The survey was approved by the Science and Engineering Research Ethics Committee of the University of Nottingham – Malaysia Campus. Qualtrics was used to administer the

survey. Before starting, information regarding the survey was given to participants and they were asked to sign the consent form. They were then asked to provide demographic information (e.g., age, gender, nationality, and country of residence).

We subsequently asked participants whether they were familiar with the phenomenon: "Some people have said (or written) that life (for them) appeared to speed up as they became older. Have you ever heard (or read) about this phenomenon (i.e., life appears to speed up as people become older)?" to which they could answer 'yes', 'no', or 'maybe'. We also asked participants to indicate whether they felt that life appeared to be speeding up as they became older on a five-point scale ('definitely not', 'probably not', 'might or might not', 'probably yes', and 'definitely yes') and how slow or fast time usually passed for them also on a five-point scale ('very slow', 'slow', 'neither slow nor fast', 'fast', and 'very fast').[1]

Because research into the phenomenon sometimes uses poorly defined time periods, such as 'the present' and 'the past', participants were also asked how they defined these time periods when answering whether time in the present was passing slower or faster for them than time in the past. For 'the present', participants indicated the number and the time unit to which they were referring (i.e., seconds, minutes, hours, days, weeks, months, years, or decades), whereas they indicated the ages at which it began and ended for 'the past'.

In the last section of the survey, participants were asked whether they thought that the phenomenon was caused by changes in objective or subjective time. We clarified that changes in objective time refers to time actually moving faster (i.e., the earth revolving around the sun, the earth spinning around its axis) and subjective time refers to the way that people experience time. We also asked what they thought the cause of the phenomenon was.

[1] We also asked participants why they chose the option for the previous question about how slow or fast time usually passed for them. We attempted to clarify that we were asking about the information that they used to make their choice. We were expecting that participants would indicate that they compared the present with the past, but, because we tried to avoid leading the participants, we gave no examples. As a result of the vagueness of the question or the absence of examples, participants either did not answer this question or gave an explanation for the phenomenon. Because the explanation for the phenomenon was assessed in a later question, the answers to this question are not analysed further.

We provided short descriptions of the seven theories that have been mentioned in the Introduction and are taken from the literature (see Table 1), one additional option (i.e., the phenomenon is caused by societal changes and technological advances), and a ninth option, called 'others', in which they could enter an explanation themselves.

The survey took on average 5 minutes and 57 seconds to complete. At the end of the survey, participants were asked whether they had answered the questions 'honestly and accurately', thanked for their contribution, debriefed, and given the opportunity to give comments.

3. Results

3.1. Familiarity with the Phenomenon

We first examined with three questions whether participants had heard or read about the phenomenon of life appearing to speed up as people become older and whether it mattered how the phenomenon was assessed. The first question measured whether participants had heard or read about the phenomenon prior to the study. A large majority (80.8%) responded 'yes' to this question, and only a few participants answered 'maybe' (8.6%) or 'no' (10.5%), suggesting that the phenomenon is well-known among the general population.

The second question asked whether the participants felt that life appeared to be speeding up for them as they became older. A large majority of the participants responded affirmative, with 43.5% of the participants answering 'definitely yes' and 34.3% answering 'probably yes'. Some participants were unsure (9.6%) and answered 'might or might not'. The remaining participants did not feel that life was speeding up for them; 8.0% answered 'probably not' and 4.5% 'definitely not'. The mean value of the responses ($M = 4.04$, $SD = 1.12$) was above the midpoint, $t(312) = 16.50$, $p < .001$. Although these responses, consistent with previous research, did not correlate with age, $r(311) = .096$, $p = .089$, they were affected

by familiarity with the phenomenon, $\chi^2(2) = 46.96$, $p < .001$. Those who had heard or read about the phenomenon responded more often 'definitely yes' or 'probably yes' (85.8%) than those who had maybe or never heard or read about the phenomenon (45.0%).

The third question assessed how slow or fast time usually passed for participants. Whereas only a few participants (8.6%) answered 'very fast', more than half of the participants (53.7%) answered 'fast'. Less than a third of the participants (30.7%) felt that time usually passed 'neither slow nor fast' for them, and hardly any participants felt that time was usually passing for them; 6.7% answered 'slow', and 0.3% answered 'very slow'. The mean value of the responses ($M = 3.64$, $SD = 0.75$) was above the midpoint, $t(312) = 15.04$, $p < .001$. Again, these responses did not correlate with age, $r(311) = .109$, $p = .054$, but they were affected by familiarity with the phenomenon, $\chi^2(2) = 8.95$, $p = .011$. Participants who had heard or read about the phenomenon (65.6%) responded more often 'very fast' or 'fast' than participants who had maybe or never heard or read about the phenomenon (48.3%).

When we compared the answers to the second and third question, we found that, although the answers on these two questions were related [$r(311) = .372$, $p < .001$], they did not seem to measure the same construct. A person who indicated that life definitely appeared to speeding up for them did not necessarily feel that time passed very fast for them (11.8%). Most of the people who indicated that life definitely appeared to speeding up for them reported that time passed 'fast' for them (66.9%). Although these questions are meant to measure the same construct, it does matter how the phenomenon is assessed.

3.2. The Present and the Past

When answering the question about how slow or fast time usually passes for them, people might compare time passage in the present to time passage in the past. However, to what time periods 'the present' and 'the past' refer could differ between people. We therefore

investigated to what time period participants were referring as 'the present' when they thought about time passage in the present. Participants could choose among eight time units. Although the participants were not equally distributed across these categories [$\chi^2(7) = 126.64$, $p < .001$], there was little agreement across participants regarding what time period represents the present. For 28.1%, the present represented a period of less than a day (seconds: 9.9%; minutes: 8.6%; hours: 9.6%). However, for 40.3%, the present represented a period of more than a day but less a year (days: 17.6%; weeks: 10.2%; months: 12.5%). For the remaining 31.7%, the present represented a period of a year or more (years: 30.4%; decades: 1.3%). There was medium-sized correlation between the duration of the present and the age of the participants ($\rho = .294$, $p < .001$), with older participants choosing longer time periods.

We also investigated to what time period participants were referring as 'the past' when they thought about time passage in the past. Participants indicated their age when the past started and ended. Although there was a large range in the ages (1-35), participants on average felt that the past started in childhood ($M = 6.29$, $SD = 6.80$). However, the age at the start correlated with current age, $r(311) = .298$, $p < .001$. Whereas participants on average felt that the past ended in early adulthood ($M = 24.10$, $SD = 9.81$), the age range was larger (5-68) and it strongly correlated with current age, $r(311) = .802$, $p < .001$. The total number of years that represented the past ranged between 1 and 60 years ($M = 17.81$, $SD = 10.32$).

Although the method to establish 'the present' and 'the past' was different, it seems that, when these concepts are not defined by the experiment, the present represents a shorter time period than the past. Whereas 68.4% of the participants felt that the present represented a period of less than a year, only 1.6% gave an age range of 1 year for the past.

3.3. Causes of the Phenomenon

Finally, we examined laypeople's beliefs about the cause or causes of the phenomenon. We first asked participants whether the phenomenon was caused by objective or subjective time either slowing down or speeding up. Results revealed that 90.1% of participants responded 'subjective' and only 9.9% responded 'objective'. These responses were affected by familiarity with the phenomenon, $\chi^2(1) = 11.51$, $p = .001$, with participants who had heard or read about the phenomenon attributing the phenomenon more often to changes in subjective time (92.9% vs. 78.3%).

There are many different causes of the phenomenon mentioned in the literature, but, because all of them approach the phenomenon as a change in how time is perceived, we asked only participants who thought that the phenomenon is caused by changes in subjective time what they thought the cause or causes of the phenomenon were. These participants endorsed on average 2.20 existing explanations ($SD = 1.29$), and the most popular explanations were fewer memorable events in older age, ratio models, and time pressure (see Table 1).

Of the eight explanations, only one explanation was affected by familiarity with the phenomenon (after applying a Bonferroni correction to address family-wise errors), with ratio models being more often endorsed by participants who had heard or read about the phenomenon, $\chi^2(1) = 21.37$, $p < .001$. We also conducted 16 chi-square tests to examine whether feelings that life appeared to be speeding up or that time was passing fast affected the support for each explanation. Only one analysis seemed significant (i.e., ratio models were more often endorsed by participants who felt that life appeared to be speeding up for them), but this finding did not remain significant after applying a Bonferroni correction.

Table 1. Laypeople's beliefs about the causes for the phenomenon that life appears to speed up as people become older. The numbers indicate the order of appearance in the survey.

Cause	Percentage
6. Life becomes more routine, and there are fewer memorable events in older age.	53.5%
2. One year represents 5% of the life of a 20-year-old person but 1% of the life of a 100-year-old person.	43.3%
8. People remember many recent events in which they were very busy, but these events are forgotten from remote time periods.	32.6%
1. The phenomenon is caused by recent societal changes and technological advances.	29.4%
7. People often feel that remote events have happened more recent than they actually had.	24.8%
4. As people become older, they have more difficulties keeping track of time.	14.9%
5. Older people have difficulties recalling recent events, and the recall of events is related to the experience of time.	14.2%
3. Objective time is compared with an internal clock, and this clock slows down in older age.	7.4%

In addition, 34 participants (10.9%) offered their own beliefs about the cause of the phenomenon. Although four alternative explanations seemed to be highly similar to explanations that had already been offered, there were several new suggestions. Whereas four participants simply stated that time is relative, the most frequently mentioned alternative explanation was that life truly becomes busier as people become older, because, as an adult,

one will have more and more responsibilities. Whereas the time pressure explanation argues that retrospective judgments of time pressure are inaccurate, this explanation that was mentioned by 13 participants seems to argue that retrospective judgments of time pressure are accurate.

Whereas researchers often focus on the recall of (past) time passage, participants who offered alternative explanations had a stronger emphasis on the experience of (present) time passage. Four participants suggested that time passes more quickly when you spend your time doing activities you like or that people lose track of time when they do things they enjoy. Another participant suggested that young adults have more excitement for upcoming events and the anticipation for these upcoming events makes time for them appear to pass slowly. Older adults, on the other hand, look less forward to upcoming events and the lack of anticipation makes time for them appear to pass more quickly. A related suggestion that was mentioned twice argued that novel experiences pass slower than routine experiences and young adults have more novel experiences than older adults.

Finally, several alternative explanations focused on the experiences of older adults. One explanation that is sometimes mentioned in the literature (Joubert, 1983; Quinn & Reznikoff, 1985; Winkler et al., 2017) and twice in the survey was that older adults feel that they are running out of time. Another belief about the cause of the phenomenon was that older adults focus more on the past and reflecting upon the past makes time feel like it has passed quickly. This explanation was also mentioned twice. A last suggestion that was mentioned twice as well was that older adults are better at regulating their emotions and emotions affect how people perceive time.

4. Discussion

The aim of this study was assessing whether laypeople's beliefs affected their reports about the subjective experience of time. Participants were asked whether they had heard or read about the phenomenon that life appears to speed up as people become older, whether they experienced the phenomenon themselves, and what they thought that the cause or causes of the phenomenon may be.

More than 80% of the participants had read or heard about the phenomenon prior to the study, suggesting that the phenomenon is well-known among the general population. Familiarity with the phenomenon might be problematic for research examining the subjective experience of time, because it may lead to the unwanted effects of demand characteristics (Orne, 1962) influencing the outcomes of these studies. We found that participants who had heard or read about the phenomenon gave higher ratings on the items measuring whether they felt that life appeared to be speeding up for them and whether time passed fast for them than participants who had maybe or never heard about the phenomenon.

Not only was the phenomenon well-known, most participants indicated that they believed that phenomenon was not caused by objective time speeding up (or slowing down) but the way that people perceive time (i.e., subjective experience of time), agreeing with the explanations given in the literature. Of these explanations, the account that life becomes more routine in late adulthood (e.g., James, 1890) received the most support, followed by ratio models (e.g., Lemlich, 1975) and the time pressure account (e.g., Janssen et al., 2013). Whereas the time pressure explanation argues that retrospective judgments of time pressure are inaccurate (Janssen, 2017), the belief about the cause of the phenomenon that was most often put forward by the participants themselves argues that judgments of time pressure are accurate and that life truly becomes busier as people become older. Although familiarity with the phenomenon affected whether participants attributed the phenomenon to changes in

objective or subjective time, it did in most cases not affect whether explanations were endorsed. Only ratio models were more often endorsed by participants who had heard or read about the phenomenon prior to the study.

Furthermore, participants also had preconceptions about what time periods represent 'the present' and 'the past'. Not only did the age of the participants affect the beginning and end of these time periods, but the ranges of the present and the past were also different. Whereas nearly all participants considered the past to have lasted more than one year, two-third of the participants felt that the present represented a period less than one year. It is possible that, even if researchers would specify the time periods that represent the present and the past, some participants in their studies might still use time periods with different durations when comparing time passage in the present to time passage in the past. It would therefore be fruitful to examine whether defining time periods for the present and the past would change participants' responses when answering questions about the subjective experience of time.

Finally, the phenomenon that life appears to speed up as people become older can be assessed by two questions. Both phrasings are considered passage of time judgements (Droit-Volet & Wearden, 2016; Wearden, 2015), and it is assumed that participants for whom life appears to be speeding up would indicate that time usually passes fast for them. Whereas the two phrasings tend to be used separately, we asked participants in the current study to answer both questions. We asked them to indicate whether they felt that life appeared to be speeding up as they became older and how slow or fast time usually passed for them. Although the two items correlated significantly, the correlation was not strong, suggesting that they do not measure the same but probably related constructs. Whereas the first item requires a comparison of the past and the present, the second item focuses on the subjective experience of time in the present. Future research should aim to clarify what each item assesses.

Although it was not a study goal, we found that the two different ratings of time passage did not correlate with age. The low number of middle-aged and older adults ($N = 52$) makes this finding unreliable, but it is important to note that it is consistent with the literature that has shown with both WEIRD (Friedman & Janssen, 2010; Winkler et al., 2017; Wittmann & Lehnhoff, 2005) and non-WEIRD (Janssen et al., 2013) samples that, unless one uses ten-year intervals, there is no relation between age and the subjective experience of time in cross-sectional comparisons.

Like any study, the current study had some limitations. One limitation is that only people who had some time answered the survey. People who did not have time to participate did not, which may have caused the average values of the two measures of the phenomenon to be underestimated. Another limitation is that we asked participants whether they were (prior to the study) familiar with the phenomenon at the beginning of the survey. However, beginning with this question may have affected their subsequent answers. Future studies should ask half the participants the question at the end of the survey to see whether answering the other questions affected whether people responded that they were familiar with the phenomenon prior to the study.

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