Subjective Experience of Time

• Many people believe that life has sped up as they have become older
• When people indicate that they feel that time is now passing faster than it was when they were younger, they usually do not refer to how quickly seconds, minutes or hours have passed
• They tend to refer to how quickly the previous weeks, months and years have passed for them
• They generally compare the passage of present time with the passage of time from years or decades ago
• So, what do people remember from those earlier time periods?
Outline Presentation

• Autobiographical Memory: Memory retrieval and temporal distribution
• Subjective Experience of Time: Within-subjects and between-subjects comparisons
• Six explanations
Autobiographical Memory

• When researchers speak of autobiographical memory, they are referring to the memories a person has of his or her own life experiences (Robinson, 1986)

• Categories: Specific memories, repeated or generic memories, extended memories and autobiographical facts (Brewer, 1986)

• Autobiographical memories can involve seeing, hearing, smelling, tasting, and touching, and they can vary greatly in spatial, temporal, emotional and narrative content (Rubin, 2005)
Memory Retrieval

• Memories are not stable entities, but they constantly change.
• Each time a personal event is retrieved, the memory is reconstructed, causing the content, the properties, and the phenomenology of the memory to be (slightly) different (e.g., Anderson, Cohen, & Taylor, 2000).
• There are broadly four factors that influence memory retrieval: (1) age of the event, (2) mode of retrieval, (3) demand characteristics, and (4) interference.
• Memories can be disrupted by information given either before (proactive interference) or after (retroactive interference) the event.
Methods

• The temporal distribution of autobiographical memory tends to be examined.
• Either with the Galton-Crovitz cueing technique (Crovitz & Schiffman, 1974; Galton, 1879; Robinson, 1976), in which participants are given a series of cue words and asked for each cue word to describe the personal event that comes to mind first.
• Or with requests for most important events from people’s lives (Rubin & Schulkind, 1997; Thomsen & Berntsen, 2008).
Temporal Distribution of Autobiographical Memory

- Childhood amnesia
- Reminiscence bump
- Increased recall of recent events, or recency effect
Childhood Amnesia

• Whereas infants are able to recall recent past events (e.g., what they ate for breakfast or which animals they have seen at the zoo), adults hardly remember any events from the first three or four years of their life (Nelson & Fivush, 2004)
Reminiscence Bump

- People tend to recall more events from adolescence and early adulthood (10-30 years) than from other lifetime periods
Increased Recall of Recent Events

- Ebbinghaus (1885) and Rubin and Wenzel (1996)
- Many recalled events are from the 5 to 10 most recent years
- Remote events are more likely to be forgotten than recent events, causing a high proportion of recent events
- Recent events might also have a higher level of activation, causing a higher likelihood of retrieval
Methods and Temporal Distribution

• The method used for gathering memories affects the location and size of the reminiscence bump (Rubin & Schulkind, 1997)
• There is a smaller and earlier reminiscence bump for word-cued memories than for important events
• Furthermore, there is a large increased recall of recent events for word-cued memories
Subjective Experience of Time

• Many people believe that time is now passing faster for them than time in the past
• The phenomenon was already reported in the nineteenth century (Guyau, 1890; James, 1890; Janet, 1877)
• The phenomenon is known for at least 135 years and therefore probably not the result of any recent societal changes or technological advancements
• The phenomenon tend to examined with retrospective timing tasks (within-subjects and between-subjects comparisons)
Within-Subjects

- Within-subjects comparisons are often used (e.g., Baum, Boxley, & Sokolowski, 1984; Gallant, Fidler, & Dawson, 1990; Joubert, 1983, 1984, 1990; Lemlich, 1975; Tuckman, 1965; Walker, 1977)
- Participants are asked how much slower or faster time seems to pass in the present compared with when they were approximately one-half or one-quarter of their present age
- For example, a participant who is currently 40 years old will be asked to indicate how much slower or faster present time is passing compared to time when he or she was 20 and 10 years old
Memory Retrieval

• In those within-subject comparisons, middle-aged adults are asked to recall subjective experiences from 20 and 30 years ago.
• Many events and many details of events from these time periods have been forgotten.
• Events from these periods have also been subject to retroactive interference.
• The memories of subjective experiences of 20 and 30 years ago might therefore not be completely accurate.
Within-Subjects

• Many of the previously mentioned within-subjects comparisons used young adults
• For example, participants who are currently 20 years old are asked to indicate how much slower or faster the present time is passing compared to when they were 10 and 5 years old
• Recalling subjective experiences from the period when participants were 5 years old: Childhood amnesia
• Young adults also feel that time is now passing faster for them
• These results seem to suggest that people of all ages feel that time is now passing faster than it used to do
Within-Subjects

- Regardless of age: 70% faster, 20% no difference, 10% slower
- Ratio model: Janet (1877) and Lemlich (1975)
- The subjective duration of an interval varies inversely with age or the square root of age
- Present time passes 1.41 times faster (i.e., square root of 2) than time at one-half of present age and 2 times faster (i.e., square root of 4) than time at one-quarter of present age
Between-Subjects

• There are no major age effects between subjects when cross-sectional comparisons are made (Friedman & Janssen, 2010; Janssen, Naka, & Friedman, 2013; Wittmann & Lehnhoff, 2005)

• In Friedman and Janssen (2010, Exp. 2), participants \( N = 1766 \), between 16 and 80 years old) rated the passage of six time intervals (usually, next hour, previous week, previous month, previous year, previous 10 years) on five-point scales that ranged from -2 to 2 (very slowly, slowly, neither fast nor slow, fast, very fast)
Between-Subjects

- Nearly all participants indicated that time was passing quickly for them ($M = 0.96, \ SE = 0.01$)
- Most responses were ‘fast’ or ‘very fast’ (78.7%), only a few were ‘slow’ or ‘very slow’ (3.2%). The remaining responses were ‘neither fast nor slow’ (18.1%)
- Age correlated well with the passage of the previous 10 years but poorly with other intervals
- The correlations on those shorter intervals only reached significance due to the number of participants ($N = 1766$)
How fast does time usually pass for you?

$r = .11, p < .01$
How fast do you expect the next hour to pass?

$r = .06, p < .01$
How fast did the previous week pass for you?

$r = .06, p < .01$
How fast did the previous month pass for you?

$r = .02, p = .51$
How fast did the previous year pass for you?

$r = 0.04, \ p = 0.13$
How fast did the previous 10 years pass for you?

$r = .21, p < .01$
Subjective Age

- There are also no substantial age effects when examining subjective age (e.g., Rubin & Berntsen, 2006)
- People of all ages feel “inside” about 20% younger than they actually are
- A person who is actually 40 years old might feel that he or she is 32 years “inside”, whereas a person who is actually 60 years old might feel that he or she is 48 years “inside”
Subjective Experience of Time

• The subjective experience of time seems to be a within-subjects effect rather than a between-subjects effect
• People of all ages report that time is now passing faster for them than it did in the past
• There are hardly any differences between age groups
Six Explanations

• Slowing Down Internal Biological Clock
• Decrease Attentional Resources
• Telescoping Effect
• Difficulty of Recall
• Lower Number of Memorable Events
• Time Pressure
(1) Internal Biological Clock

• External time, as measured by clocks and calendars, is compared to an internal biological clock or pacemaker.
• If the rate of this internal biological clock or pacemaker slows down with aging, external time will appear to pass more quickly.
• The model is often examined with prospective timing tasks: estimations, productions and reproductions.
Estimations and Productions

- Estimation tasks: Participants are first presented a stimulus interval and are then required to estimate the duration of this interval.
- Production tasks: Participants are given a description of an interval. After a stimulus that indicates the start of this interval has been given, participants are required to indicate when the interval has ended.
- Reproduction tasks: Participants are first presented a stimulus interval and are then asked to reproduce this interval. After a stimulus that indicates the start of this interval has been given, participants are required to indicate when the interval has ended.
(1) Internal Biological Clock

• The internal biological clock model explains the interval timing process by three interrelated stages: counting, memory, and decision (Gibbon, Church, & Meck, 1984)
(1) Internal Biological Clock

- In the counting stage, objective time is translated to subjective time by a mechanism with three components: A pacemaker emitting pulses, an accumulator storing these pulses, and a switch connecting the pacemaker and the accumulator.
- After the switch is turned on, the number of pulses in the accumulator increases as objective time passes.
- In the memory stage, critical temporal information from previous experiences is retrieved from the reference memory (e.g., 10 pulses is 10 seconds).
- In the decision stage, a comparator determines whether the number of pulses in the accumulator is equal to the number of pulses retrieved from the reference memory or vice versa.
(1) Internal Biological Clock

- If the internal biological clock (or pacemaker) slows down as people become older (and if the information in the reference memory does not change with age), then older adults should give **shorter estimates** and **longer productions** than young adults.

- Block et al. (1998) conducted a meta-analysis and found that older adults actually tended to give **longer estimates** and **shorter productions**.

- Information in the reference memory can be relearned by providing false feedback after prospective timing tasks (Ryan & Fritz, 2007; Ryan & Robey, 2002).
(2) Attentional Resources

- The perceived duration of an interval depends on how attention is allocated during that interval (Craik & Hay, 1999)
- Intervals in which attention is divided appear shorter, because less attention is available to notice time passage
- This account is examined with prospective timing tasks during which participants have to do a second, non-temporal task (e.g., perceptual judgments)
- There are less attentional resources available to older adults and they will therefore fail to notice time passage sooner
- Older adults, as expected by the account, tend to give shorter estimates and longer productions when they have to do a second task while making temporal judgments
(2) Attentional Resources

- It is difficult to establish causality because estimation and production tasks use short intervals (seconds, minutes), whereas the experience of time is measured on much longer intervals (weeks, months, years, decades).
- Individual differences: Do people who give shorter estimations or longer productions also report that time is passing faster?
- So far, no study has even reported a correlation between the performance on prospective tasks (with short intervals) and retrospective ratings of the subjective experience of time (on much longer intervals).
- Furthermore, it is difficult to relate the account to findings that young adults also report that time is now passing faster.
(3) Telescoping Effect

• Forward telescoping: Remote events tend to appear to be closer in time than they actually have.

• If a person thinks that an event happened 5 years ago but finds out that the event actually happened 10 years ago, then time might appear to have passed quickly (e.g., Shimojima, 2002).

• Older adults might experience these dating errors more frequently and their errors might be larger (Crawley & Pring, 2000).
(3) Telescoping Effect

- There are three problems with the account
  - First, it is not clear whether the telescoping effect is the cause or the effect of the acceleration of the subjective experience of time
  - Second, research has shown that all age groups display forward telescoping and that the size of the errors depends on the length of the period from which events are drawn (Lee & Brown, 2004)
(3) Telescoping Effect

- What about backward telescoping?
- Recent events tend to appear to be further away in time than they actually have (e.g., Janssen, Chessa, & Murre, 2006; Lee & Brown, 2004)
- If a person would think that an event happened 2 months ago but would find out that the event actually happened only 1 month ago, then time might appear to have passed slowly for them
- Subjective time does not appear to pass slowly on relatively short intervals (i.e., weeks or months)
(3) Telescoping Effect

- Participants \( (N = 99) \) were given 12 news events that happened 3-4 years ago and rated how well they remembered the events (Friedman & Janssen, 2010, Exp. 1)
- The 6 highest-rated events were selected and participants indicated how long ago (in years and months) these 6 events happened
- Participants then received false feedback on how well they did
- They were told that events had happened either more recently (~33%) than they thought (forward telescoping) or more remotely (~33%) than they thought (backward telescoping)
- Finally, participants rated the passage of time on five-point scales and three items about experiencing telescoping in daily life on seven-point scales
(3) Telescoping Effect

• The experimental manipulation seemed to work well
• Participants who were told that the events had happened more recently than they had thought reported experiencing more telescoping in daily life ($M = 5.25$, $SE = 0.14$) than participants who were told that the events had happened more remotely than they had thought ($M = 3.71$, $SE = 0.17$)
• There were, however, no differences on the ratings of the passage of time between the two groups
• There was also no correlation between the actual dating errors and the passage of time
(4) Difficulty of Recall

• People estimate the duration of an interval by the number of events or changes that can be recalled from this interval (e.g., Block, 1989; Ornstein, 1969; Poynter, 1989)

• When a person recalls many events from a period, it will seem to have had a long duration and thus appear to have passed slowly, whereas, when a person recalls only a few events from a similar period, it will seem to have had a short duration and thus appear to have passed quickly

• Laboratory studies have shown this for short intervals, but what about much longer intervals?
(4) Difficulty of Recall

- This account is not compatible with the increased recall of recent events.
- People have no difficulties recalling specific events from recent periods, which should make present time seem to pass slowly.
- People, however, experience difficulties recalling specific events from the period when they were about half their present age, which should make time in the past seem to have passed quickly.
Participants (N = 1766) rated the passage of six time intervals (Friedman & Janssen, 2010, Exp. 2). Participants answered either before or after rating these intervals 10 open-ended and 20 multiple-choice questions about news events that had occurred in the last 2 years. These questions included the dates of the news events. Reminding people about recent events did not affect the perceived passage of time. Participants who were given the news questions before rating the passage of time (M = 0.98, SE = 0.02) did not differ from participants who were given the news questions after rating the passage of time (M = 0.94, SE = 0.02), t(1764) = 1.77, p = .08, Cohen’s d = 0.07.
(5) Number of Memorable Events

- Lower number of memorable events in older age (Guyau, 1890; James, 1890)
- James (p. 625) argued that childhood experiences are varied and distinct, but in adulthood “each passing year converts some of this experience into automatic routine which we hardly note at all, the days and weeks smooth themselves out in recollection, and the years grow hollow and collapse”

James
(5) Number of Memorable Events

• This account is compatible with the distribution of highly important personal events, which has no recency effect but a strong reminiscence bump.

• Participants \((N = 99)\) rated the passage of time and whether they had many new experiences and experienced many life changes in the last couple of years (Friedman & Janssen, 2010, Exp. 1).

• There was, however, no correlation between these two variables.
The phenomenon that life appears to speed up as people become older seems to be similar to the fading affect bias (Walker, Skowronski, & Thompson, 2003).

Although the ratio of positive and negative experiences does not change across the lifespan (e.g., Janssen & Murre, 2008), the intensity of negative events decreases faster than the intensity of positive events, causing the past to seem more positive than the present.

A similar memory bias may be causing time to appear to be passing faster as people become older.
(6) Time Pressure

- The belief that life speeds up as one becomes older seems to be caused (a) by the relation between perceived time pressure and the subjective experience of time and (b) by the difference in how well people remember recent and remote instances of time pressure.
- People recall more recent than remote events and more details about recent than about remote events (Ebbinghaus, 1885; Rubin & Wenzel, 1996; Kristo, Janssen, Murre, 2009).
- People are similarly able to recall many recent instances of time pressure, but have difficulties recalling many instances of past time pressure.
- This memory bias causes them to underestimate past time pressure.
(6) Time Pressure

- In Janssen, Naka and Friedman (2013), Japanese participants ($N = 868$, between 16 and 80 years) rated the passage of time on six intervals (usually, next hour, previous week, previous month, previous year, or previous 10 years).
- They then rated how busy they were presently and how busy they had been 10 years ago.
- Nearly all participants indicated that time was passing quickly for them ($M = 0.89, \ SE = 0.02$).
- Most responses were ‘fast’ or ‘very fast’ (72.7%), only a few were ‘slow’ or ‘very slow’ (5.4%). The remaining responses were ‘neither fast nor slow’ (21.9%).
- Age correlated with the 10-year interval ($r = .178$) but not with the other intervals.
(6) Time Pressure

- Present time pressure correlated negatively with age \((r = -.201)\) and positively with the shorter intervals \((r = .178-.325)\).
- Past time pressure correlated positively with age \((r = .420)\) and the 10-year scale \((r = .185)\).
- Present and past time pressure did not correlate with each other \((r = -.011)\).
- Participants indicated that they presently experienced more time pressure \((M = 0.91, SE = 0.04)\) than they had 10 years ago \((M = 0.23, SE = 0.04)\).
- When comparing the present time pressure of participants to the past time pressure of participants who are 10 years older, participants seemed to underestimate past time pressure.
(6) Time Pressure

• There was support for the time pressure account
• The passage of short intervals (present time passage) was related to present time pressure, whereas the passage of the 10-year interval (past time passage) was related to past time pressure
• Furthermore, participants tended to underestimate past time pressure, suggesting that they might also underestimate past time passage
Conclusions

• The phenomenon that life appears to speed up as people become older seems to be a within-subjects rather than a between-subjects effect
• Cross-sectional studies only report age differences on extremely long intervals (i.e., 10 years) and with large samples
• Accounts, such as a decrease in attentional resources, might explain timing on short intervals (seconds, minutes) but that does not mean that they explain timing on longer intervals (weeks, months, years)
• This could be similar to the observation that the timing of sub-second intervals requires an automatic system, whereas the timing of supra-second intervals requires a cognitively controlled system (Lewis & Miall, 2003)
Conclusions

• Recent research has found no support for the explanations that looked at forward telescoping, the difficulty of recall or the number of memorable events
• It has, however, found some support for the time-pressure explanation
• Results suggested (a) that present time passage was related to present time pressure, whereas past time passage was related past time pressure and (b) that participants tended to underestimate past time pressure, suggesting that people might also underestimate time passage at younger ages
• The effect sizes are small, so other factors may also play a role
Thank you for your attention!

Questions?

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