



# Time perception and time perspective differences between adolescents and adults



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## ABSTRACT

The present experiment aimed to investigate the differences in time perception and time perspective between subjects representing two developmental stages, namely adolescence and middle adulthood. Twenty Chinese adolescents aged 15–25 and twenty Chinese adults aged 35–55 participated in the study. A time discrimination task and a time reproduction task were implemented to measure the accuracy of their time perception. The Zimbardo Time Perspective Inventory (Short-Form) was adopted to assess their time orientation. It was found that adolescents performed better than adults in both the time discrimination task and the time reproduction task. Adolescents were able to differentiate different time intervals with greater accuracy and reproduce the target duration more precisely. For the time reproduction task, it was also found that adults tended to overestimate the duration of the target stimuli while adolescents were more likely to underestimate it. As regards time perspective, adults were more future-oriented than adolescents, whereas adolescents were more present-oriented than adults. No significant relationship was found between time perspective and time perception.

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## 1. Introduction

Time is a kind of resource that is allocated according to our plans, needs, goals, and values, therefore, considering its limited nature, time management and time planning have always been the core of success in life and career. From the evolutionary perspective, accurate perception and estimation of time would be a critical adaptive skill for survival (Diedrichsen, Ivry, & Pressing, 2003; Ivry & Richardson, 2002; Spencer, Zelaznik, Diedrichsen, & Ivry, 2003). Our motor control and cognitive functions require time estimation accuracy in milliseconds (Justus & Ivry, 2001; Meck & Benson, 2002; Schirmer, 2004) while making predictions and scheduling work needs to be done within seconds to minutes (Bateson, 2003; Gallistel & Gibbon, 2000). Various mental processes and behaviors rely on our perception of time, in the physical environment as well as in the social context. For example, we estimate the speed of objects moving towards us to avoid being hit. We plan our schedule on the basis of previous experience of time, deciding how much time is needed for a particular task. We feel bored when we spend a long time alone and feel embarrassed when there is a long pause in the conversation.

Undoubtedly, our time perception is highly related to our cognitive functions in everyday experience (Block, Hancock, & Zakay, 2010).

On a daily basis, it is common to see adolescents assess movements quicker, react better in all kinds of sports, and respond to video games more accurately than adults. As time perception is related to attention (Brown, 1985), working memory (Brown, 1997), motor activity (Surnina & Lebedeva, 2008), physiological and emotional arousal (Gil, Niedenthal, & Droit-Volet, 2007), perceiving contextual cues, social interaction, etc., it is possible that, with the effect of age on the above aspects, time perception changes with age too (Brotchie, Brennan, & Wyke, 1985; Coelho et al., 2004). Research on time perception shows that age may diversify the ability to assess time adequately (e.g., Block, Zakay, & Hancock, 1998) and that attitude towards time changes across the lifespan. According to Carstensen, Isaacowitz, and Charles (1999), the perception of time has an important role in the selection and pursuit of social goals and social goals can be related to either acquisition of knowledge or regulation of emotion. Older people, who perceive time as limited, may focus more on emotional goals, while younger people perceive time as open-ended and give priority to knowledge-related goals. Other studies also found a positive association between age and subjective time perception (McGrath & O'Hanlon, 1968). For example, an individual's unit of subjective time shortens and the interval of real time appears to grow longer as one grows older. Considering the importance of time perception in our daily lives

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and the inconsistencies in research on time perception across different age groups, it would be worthwhile to investigate whether there is a difference in time perception between adolescents and middle-aged adults. It is hypothesized that there will be a greater error in the perception of time in middle-aged adults than in adolescents because of the deterioration of cognitive ability with age (e.g. Andres & van der Linden, 2001; Hedden & Gabrieli, 2004; Lyketsos, Chen, & Anthony, 1999). In our study, we also focused on the comparison of these two groups in terms of time perspective. Considering that time perspective serves as a framework for organizing our events, experiences, and goals (see *Zimbardo & Boyd, 1999*), it may be an influential factor affecting the perception of time. As has been indicated in previous research, attitude towards time is related to intelligence (*Zajenkowski, Stolarski, & Ledzińska, 2014*), to cognitive tasks such as a relatedness judgment task (*Nowack, Milfont, & van der Meer, 2013*), or to cognitive processes such as mental construal (*Liberman, Sagristano, & Trope, 2002*). From research on time perspective that goes in that direction, very little is actually known about how the preference of a particular temporal frame is related to time duration judgments.

## 2. Changes of time perception and time perspective over the lifespan

Time perception refers to the sense of time and is defined as the subjective aspect of objective time (*Hornik, 1984*). Within the general area of time perception, there are three main aspects of psychological time, namely succession, duration, and temporal perspective (*Block, 1990*). Succession allows us to use our time perception to recognize the temporal order of events. Duration allows us to perceive the period of time that an event lasts (*Wittmann, 1999*). Temporal perspective is the cognitive conception of the past, the present, and the future (*Block, 1990*). Research shows that actual time and perceived time differ from each other. The results of the experiment done by *Hornik (1984)* show that subjects tended to overestimate the duration of waiting time. The subjective estimation of time requires the use of an “internal clock” to measure the objective time without any cues from “external clocks.” Although the “internal clock” has not yet been localized in the brain, the brain’s mechanisms specialized in the encoding of stimulus duration have already been identified (*Harrington, Lee, Boyd, Rapsak, & Knight, 2004; Leon & Shadlen, 2003; Lustig, Matell, & Meck, 2005; Meck, 2005*). According to other approaches, such as the memory-based model, time judgment depends on the amount of information to be processed (*Schäfer, Smukalla, & Oelker, 2013*). Events and contextual changes are encoded. The more such information there is, the longer the duration of the event seems to be.

### 2.1. Time perception in a lifespan

Behavioral and neurophysiological studies have suggested that human develop the ability to time temporal intervals from the stage of infancy. Infants are able to register the temporal interval between two events, as demonstrated by the temporal conditioning of the pupillary reflex and the decreased heart rates recorded when the stimulus was omitted in a sequence of repetitive stimuli (*Clifton, 1974; Colombo & Richman, 2002*). Studies on brain activation have also found that infants’ and adults’ brains react in similar ways to temporal deviation in a repetitive sequence of auditory stimuli (*Brannon, Rousel, Meck, & Woldorff, 2004*). They suggest that infants can automatically detect temporal differences in a repetitive sequence of stimuli. Timing is actually an instinctive ability of human beings that is indispensable for learning and adaptation to the environment. Humans generally possess a primitive sense of time from an early age and it is possible that the corresponding neural mechanism for the sense of time matures early in life as well.

Researchers have long been studying the effect of the developmental trajectory of time perception. Although infants have exhibited a primitive sense of time only, numerous studies report an improvement in time judgment throughout childhood (*Allman, Pelphrey, & Meck,*

*2012; Block, Zakay, & Hancock, 1999; Droit-Volet, 2011*). Generally, there is an age-related increase in time estimation accuracy and a decrease in the variability of the estimation. Older children have been found to be more sensitive to temporal differences in a habituation paradigm (*Droit-Volet et al., 2013*). Yet, the results on whether children tend to overestimate or underestimate the temporal interval have been inconsistent (*Chelonis, Flake, Baldwin, Blake, & Paule, 2004; Droit-Volet, 1999; Droit-Volet & Rattat, 1999; Espinosa-Fernandez, Dela Torre Vacas, del Rosario Garcia-Viedman, Garcia-Gutierrez, & Torres Colmenero, 2004; Espinosa-Fernandez, Miro, Cano, & Buela-Casal, 2003; Szelag, Kowalska, Rymarczyk, & Poppel, 2002*). Some other studies have found that the overestimation or underestimation of time duration is related to the “internal clock” of human beings. Compared to young adults, both children and older adults were found to have a faster “internal clock” and hence they tend to underestimate the temporal intervals (*Coelho et al., 2004; Shannon, 1976*). However, the average relative error of time reproduction and estimation was the greatest in elderly people and the smallest in young adults (*Surnina & Lebedeva, 2008*). This suggests that different age groups show different abilities in the sphere of time perception.

### 2.2. Time perspective in different life stages

Time perspective reflects the role that time plays in our lives. It concerns our attitudes and thoughts towards time. Not only can time perspective define our personality traits, our judgments, and our style of decision making (*Zimbardo & Boyd, 1999*), but it also plays an important role in motivation and goal-setting (*Lens & Tsuzuki, 2007*) as well as academic achievements (*de Volder & Lens, 1982*), and generally contributes to our behaviors, too (*Lewin, 1939, 1942*). Research by *Zimbardo, Keough, and Boyd (1997)* showed how individual variation in time perspective acts as a strong predictor of positive and negative behaviors. For instance, future-oriented adolescents spend more time at school while present-oriented ones are more likely to be involved in risky behaviors such as drunk driving or unsafe sex. Since time perspective is an important indicator of lifestyle, it may be linked to our perception of time. Time perception is based not only on objective indicators (physiological and neurological processes) but also on subjective ones (psychological processes). In a cross-cultural study, productive time was perceived as shorter than idle time in Native Americans but not in Anglo-Americans, which correlated with a higher need for achievement in the former (*Shannon, 1976*). This reflects the fact that in cultures which appreciate achievement idle time is perceived as longer, being thought of as meaningless and wasted. Research pertaining to time perspective in different age groups brought some inconsistent results. *Zimbardo and Boyd (1999)* stated that with age the hedonistic present orientation decreases, whereas the future orientation prevails. In the study by *Fingerman and Perlmutter (1995)* there were generally no significant differences in terms of the future period that the participants thought about most frequently, but younger adults (aged 20–37) tended to think more about the distant future than older adults (aged 60–81) did. The fact that the sample consisted of healthy, highly educated, and active participants may have had an impact on the results. A different study revealed that younger adults (17–25 years) did show a stronger future time perspective in the abstract cognitive task and that they approached the task with holistic processing (*Thomas et al., 2007*). In contrast, older adults (aged 60–75) have a less future-oriented time perspective. According to socioemotional selectivity theory, older adults perceive the future as limited and therefore they focus on present emotional goals rather than the goals optimizing the future (*Fung & Carstensen, 2003*). According to the results obtained by *Ortuño, Janeiro, and Paixão (2011)* the youngest group (16–20 years) scored the highest on hedonic present in comparison with other age groups and the middle age group (21–34 years) scored higher on future time perspective. The differences in the results between studies regarding the changes in future time perspective with age can be accounted for by

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