



Age differences in delay discounting in Chinese adults



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ABSTRACT

Delay discounting is the decrease in subjective value of a reward as the interval of receiving it is increased. Previous studies have found inconsistent results on the relationship between age and delay discounting, and few studies have been conducted using Chinese participants. The current study aimed to clarify this relationship using a relatively large sample of Chinese adults with a wide age range (viz., 18 to 86 years old). A total of 1288 individuals completed the Monetary Choice Questionnaire. Results showed that the rate of delay discounting increased with age across adulthood, with younger participants (18–30 years) discounting less than both middle-aged participants (31–60 years) and older participants (over 60 years); and middle-aged participants discounting less than older participants. Furthermore, when the reward magnitude was large, participants were more likely to wait for delayed rewards. The increase in delay discounting rate from middle-aged adults to older adults might be explained by the life-cycle theory. The increase in delay discounting rate from young adults to middle-aged adults may reflect that young adults expect much time and a variety of future positive life events in the rest of their lives.

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1. Introduction

As humans, we face many decisions regarding matters such as whether to spend time to do exercises which may sacrifice immediate time for rest but have delayed benefits. These decisions involve choices between small immediate rewards versus large delayed rewards, for example, the short-term comfort of relaxing at home compared with the long-term benefit of keeping healthy. When faced with such “inter-temporal” choices, most people show a preference for immediate rewards to delayed ones (Lockenhoff, O’Donoghue, & Dunning, 2011). This phenomenon of valuing future outcomes less than immediate outcomes is called “delay discounting” or “temporal discounting” (Banich et al., 2013). Delay discounting involves the decrease in subjective value for a reward as the interval of delay increased, that is to say, the longer a person has to wait before he/she can receive a future reward, the lower his/her present subjective value towards the reward (Green, Myerson, Lichtman, Rosen, & Fry, 1996).

Given the ubiquitous nature of delay discounting, a broad variety of studies have been conducted to examine this construct, including the

effect of pathological behavior such as substance abuse and gambling on delay discounting (Albein-Urios, Martinez-Gonzalez, Lozano, & Verdejo-Garcia, 2014; Imhoff, Harris, Weiser, & Reynolds, 2014; Secades-Villa, Weidberg, Garcia-Rodriguez, Fernandez-Hermida, & Yoon, 2014; Wing, Moss, Rabin, & George, 2012; Wray, Simons, & Maisto, 2015). In addition, researchers also explored factors that may affect delay discounting, including gender (Shibata, 2013), personality traits (Manning et al., 2014) and time perspective (Lin & Epstein, 2014). While the relationship between age, an important developmental factor, and delay discounting has been studied, results obtained are inconclusive. For example, de Water, Cillessen, and Scheres (2014) examined age-related differences in delay discounting of real monetary reward in adolescents and young adults ($n = 337$, 12–27 years), and found that delay discounting rate declined linearly with age. Jimura et al. (2011) studied the discounting of hypothetical money in younger ($n = 23$) and older adults ($n = 27$), and found that young adults discounted monetary rewards at a steeper rate than older adults. In contrast, Chao, Szrek, Pereira, and Pauly (2009) explored the relationship between delay discounting rate for hypothetical reward and age across the adult life span ($n = 175$, age range: 18–91 years) and found that discounting rate was stable across adulthood.

Whelan and McHugh (2009) suggested direct parallels in human delay discounting rate of hypothetical and real consequences, thus the

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different types of reward (hypothetical vs. real monetary reward) cannot explain the discrepancy of previous findings. One reason for these conflicting findings might be because the age range of the participants included in most previous studies was relatively narrow. For example, the age of the samples included only adolescents and emerging adults (Olson et al., 2008; Steinberg et al., 2009; de Water et al., 2014). Only a few studies recruited participants with a wider age range and included older adults. However, the results of these studies did not allow a firm conclusion about the relationship between age and delay discounting to be drawn. For example, Green, Fry, and Myerson (1994) studied three age groups: sixth graders ($n = 12$, $M = 12.1$ years), college students ($n = 12$, $M = 20.3$ years) and older adults ($n = 12$, $M = 67.9$ years) and found that delay discounting rate of hypothetical monetary reward decreased with age. Eppinger, Nystrom, and Cohen (2012) found similar results in their study that compared delay discounting rate of real monetary reward in younger and older adults ($n = 32$). However, Whelan and McHugh (2009) found that delay discounting rate of real monetary reward decreased from adolescents ($n = 12$, mean age 14 years) to adulthood but was stable from middle adulthood ($n = 16$, mean age 46 years) to older adulthood ($n = 10$, mean age 73 years). A third profile of relationship between age and delay discounting was shown by Harrison, Lau, and Williams (2002) and Read and Read (2004) though they used different forms of monetary reward (hypothetical and real respectively). These two studies investigated delay discounting in relatively larger samples of individuals (aged 19–75 years [$n = 268$] and 19–89 [$n = 123$] respectively) and found a U-shaped relationship between age and delay discounting rate, that is, the discounting rate decreased from young adults to middle adults, and then increased from middle adults to old adults. Another reason might be these studies used different measures, different magnitude of rewards and delay periods for delay discounting, these factors may affect the rate of discounting (Weatherly, 2014), particularly for old adults. A third reason for the conflicting results reported might be the small sample size included in some of these studies. Studies that use a small sample size may yield results that are unduly influenced by unique characteristics of the participants, such as years of education or socioeconomic status.

While the majority of the above studies were conducted using participants from western culture or societies, only a few studies in this research area have been conducted in Chinese culture, even less developmental studies. Some studies showed that people from Asian cultures were more patient than westerners. For example, Chen, Ng, and Rao (2005) manipulated the cultural priming in their experiment, participants from Singapore were primed with Singapore culture or American culture, results showed that participants primed with American culture were less patient and discount the future to a greater degree than participants primed with Singapore culture, thus western culture values immediate consumptions relatively more. Therefore people in different cultures or societies may have different cognitive styles, motivations or values that may lead to different decision making styles (Gaenslen, 1986; Weber & Hsee, 2000). Compared to participants from western culture or societies, Chinese people might show a different rate or pattern of delay discounting. Dai (2011) found that Chinese (mean age = 31.2) showed greater delay discounting rate than Caucasians (mean age = 25.2), but Du, Green, and Myerson (2002) found no significant difference of delay discounting rate between Chinese (mean age = 26.2) and Americans (mean age = 26.8). Besides the eastern/western culture divide, socioeconomic factors may also played a role in delay discounting (Trostel & Taylor, 2001). Although previous studies have compared the difference of delay discounting between Chinese and westerners, they did not take the developmental trend of delay discounting into consideration. Thus further research on the relationship between age and delay discounting in China is clearly warranted.

Taken together, there is a clear need for studies in this research area to include a wider age range and larger sample size to obtain a more reliable, accurate and comprehensive knowledge about delay discounting

across the life span. Therefore, the current study aimed to examine the relationship between age and delay discounting in a relatively large Chinese adult sample with a wide age range by including participants aged from 18 to 86 years. Moreover, we also aimed to explore the relationship between demographic information (e.g., gender, years of education, economic condition) and delay discounting.

2. Method

2.1. Participants

The participants were recruited from universities and communities in Beijing, Jiaozuo and Wuhan. In total, 1383 participants were recruited, and 95 of the participants were discarded from analysis because their questionnaires contained missing data and not able to calculate delay discounting rate or they did not meet the study criteria. Finally, a total of 1288 individuals (576 men, 666 women and 46 individuals who did not report their gender) aged from 18 to 86 years were included in the analysis. Participants over 60 years were screened by the Mini Mental State Examination (MMSE) (Wang, Zhang, Zhai, Chen, & Zhao, 1989). None of the participants reported a history of psychiatric illness, neurological illness, drug abuse/dependence, or brain injury. The participants completed a set of questionnaires on mental health. It takes about half an hour to finish all the questionnaires. Participants were compensated RMB 10 yuan. Other measures were not included in the present analysis except for the Monetary Choice Questionnaire (MCQ).

2.2. Materials

2.2.1. The Monetary Choice Questionnaire (MCQ)

The Monetary Choice Questionnaire (MCQ) (Kirby & Marakovic, 1996; Myerson, Baumann, & Green, 2014) was used to assess delay discounting rate for monetary rewards. The MCQ contained 27 items. Participants need to make a two-choice decision between an earlier (today) but smaller monetary reward (¥11–80) and a later but larger monetary reward (¥25–85) for each item (e.g. "Would you prefer ¥28 today or ¥30 in 179 days?"). The delayed time varied between one week and six months. The 27 items were grouped into three magnitudes according to the delayed rewards: small (¥25–¥35), medium (¥50–¥60), and large (¥75–¥85). The questionnaire has good internal consistency and adequate test–retest reliability of discounting rates for the three reward magnitudes (Kirby, Petry, & Bickel, 1999). Hypothetical monetary reward was used in this study since participants were compensated irrespective of their choice on the questionnaire.

2.2.2. Demographic questionnaire information

The demographic information was provided by participants regarding their age, gender, years of education, and their perception of current economic condition. The question on economic condition was "How do you think about your current family economic condition?" It was rated on a 5-point scale from 1 (very good) to 5 (very bad).

2.3. Procedure

The study was approved by the ethics committee of the corresponding author's institution and written informed consent was obtained from all participants before data collection. The participants were informed that there were no standard answers for the questions and they were required to complete the questions based on their own thoughts and behaviors. This study was conducted during July and December, 2013. Several experimenters from different regions were recruited and asked to distribute the questionnaires to undergraduates, postgraduates and community residents.

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