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Mental Temporal Accounting

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ABSTRACT: This paper introduces Mental Temporal Accounting – the behavioral economics application of mental accounting in the time domain. While most discounting studies are in the finance domain, social and environmental components have not gotten as much attention as appearing to require based on the novel perspectives this research grants. Theoretically we may also derive conclusions for contact theory and point at opening monetary gains focuses to social and environmental cues that may nudge people to perceive time differently and act on it accordingly. As mental accounting was successfully introduced to be extendable onto time, traditional mental accounting theory (Thaler 1999) should be revisted for attention to time discounting in the social and environmental spheres alongside the economic attention. Elucidating how contexts and experiencing critical life stages of parenthood influence temporal activity allocation choices promises to improve manifold decisions on education, health, asset management, career paths and common goods preservation throughout life for this generation and the following.

KEYWORDS: discounting, economic time, environmental time, mental temporal discounting, social time, time

Introduction

Time tacts life. While all human face the same natural constraints of 24-hours days, behavioral economics found individuals differing in discounting preference for immediate rewards over delayed gratification (Estle, Green, Myerson & Holt 2007; Kahn 2005; Rubinstein 2006; Samuelson 1937). Regarding monetary gains, individuals were also shown to hold mental accounts dependent on a reference point but also in regards as to how to allocate money to causes individuals care about.

But what if individuals also differ in mental temporal accounts, hence regarding how to spend their time? Decision makers may have natural mental temporal accounts for how to spend 24 hours a day, 720 hours a month, 8760 hours a year or 700800 hours an average life? Could it be that individuals have implicit mental accounts for how much time to spend on their own, how much time to be allocated towards working and how much time to just enjoy life in the open environment? If so, could individuals be susceptible to external cues that nudge them into certain mental timeframes that determine their mental time allocation preferences? Could this mental accounting also depend on reference points, such as the age of the individual and critical life events, such as becoming parents?

If individuals differ in time spent on their own and social time but also vary in their choices of time spent working and time in the natural environment, we could show that the classical mental accounting theory (Thaler 1999) actually describes similar processes as mental temporal accounting how to spend time but also dependent on the reference points of age and parenthood.

Research Question

The following empirical studies will test if the behavioral economics idea of mental accounting in the finance domain and hyperbolic discounting deviations from standard neoclassical discounting functions can be extended to realistically describe how individuals decide in regards to the scarce resource time, which is introduced as mental temporal discounting.

Research question 1 will investigate the existence of certain mental temporal accounting categories, for instance such as economic, social and environmental time accounts. If so, research question 2 will capture a discounting variance based on economic, social and environmental contexts. Research question 3 will test whether there are age-dependent mental temporal accounts and if critical life events of parenthood changes time allocations as well as propose *Hypothesis 1* that *the elder one*

gets, the more future-oriented and pro-social choices become, which will be introduced as the age paradox in the discussion.

Method

Study 1: *Exploratory meta-analysis of American Time Use Survey*

A qualitative exploratory meta-analysis study content-analyzed time use mentioned on the American Time Use Survey of the Bureau of Labor Statistics (https://www.bls.gov/tus/). The American Time Use Survey of the Bureau of Labor Statistics classifies life activities into the following categories: (1) Personal care, including sleep; (2) Eating and drinking; (3) Household activities; (4) Purchasing goods and services; (5) Caring for and helping household members; (6) Caring for and helping nonhousehold members; (7) Working and work-related activities; (8) Educational activities; (9) Organizational, civic, and religious activities; (10) Leisure and sports; (11) Telephone calls, mail, and e-email; (12) Other activities, not elsewhere classified.

While these categories grant insights into the general time-use categories, it remains unclear whether some of the categories are considered as social, economic or environmental activities. For instance, sports can be a social category but also be performed on one's own. Also, time bracket variant information is not retrieved. For instance, it is not clear whether individuals change their time allocations when considering different time spans.

The lack of information whether the activities are done by oneself or with others demands for an empirical investigation of time use to be categorized into social, economic and environmental time. Study 2 therefore targets at retrieving information on how much time individuals estimate to spend on social, economic and environmental tasks.

Study 2: *Quantifying time use in the domains of social, economic and environmental time*

Design

Since the American Time Use Survey of the Bureau of Labor Statistics does not indicate the time categories social, economic and environmental time; an exploratory study gave quantitative indications of the time use in those specific domains. Social time is defined as time spent with other people and engaging in social interaction, communication or activities with others. Economic time is defined as time spent using one's labor power and productive capacity, likely to earn money and be or prospectively be a productive part of the labor force. Environmental time is defined as time spent ourdoors in the open environment. Overlaps may exist, for instance if spending time in the environment with others or working outside. Then respondents are advised to indicate both categories as overlapping times. So for instance, a person could indicate to spend 10% of a day for economic, 65% of a day for social and 45% of a day for environmental time, which adds up to 120% time use as for overlapping categories.

Study 2 was conducted over the Internet using the website Amazon Mechanical Turk (MTurk). MTurk is an online labor market in which employers can advertise jobs (typically taking less than 10 minutes and paying less than $1), and employees can accept posted jobs that are attractive to them. Workers are incentivized based on their performance, which makes MTurk an attractive tool for conducting experiments and surveys (Puaschunder & Schwarz 2012). Online labor markets allow to conduct behavioral experiments in the international arena. Online labor markets use the internet to connect researchers with potential subjects drawn from an international sample (Rand 2012). The entire process of meeting subjects, the survey and experiment as well as payment of subjects by the researcher occurs over the internet and computer simulations. The experience is quite similar to performing a set of computer simulations. In literature overviews and replication studies, MTurk has been proven to provide valid and reliable results (Horton, Rand & Zeckhauser 2011; Rand, 2012; Suri & Watts 2011). With the advent of online markets, many laboratory experiment barriers, such as limited samples and location biases, have been removed. MTurk workers draw samples from all over the world, with the majority of workers being either in the United States or India (Rand 2012). The international sample character with an US and Asian sample population makes MTurk an interesting resource pool for conducting experiments on the global validity of time use decision making.

Sample

In total, 110 individuals (female=32 [29.09 percent], male=77 [70 percent], M_{age}=31, SD_{age}=8.55, Range=[18,64]) from around the world participated in the study online. After an informed consent, the online questionnaire investigated time use of men and women. Of the entire sample, 54 individuals (49.1 percent) indicated to have children and 56 (50.9 percent) reported that they do not have children. Of the sample with children, 33 respondents had one child (61.11 percent of the parents sample, 30 percent of the total sample), 17 respondents had two children (31.48 percent of the parents sample, 16 percent of the total sample), 3 subjects had 3 children (5.56 percent of the parents sample, 2.7 percent of the total sample) and only 1 survey taker had 4 children (1.85 percent of the parents sample, .9 percent of the total sample).

General time-use questions were presented to subjects on Amazon Mechanical Turk in a Qualtrics questionnaire solution. After consenting to a standard informed consent form, all subjects were asked to make an assumption how much time they spend on (1) Social time defined as time spent with other people and engaging in social interaction, communication or activities with others. (2) Economic time defined as time spent using one's labor power and productive capacity, likely to earn money and be or prospectively be a productive part of the labor force. (3) Environmental time defined as time spent ourdoors in the open environment. The specific question read: 'Please make an assumption how much time you spend for: (1) Social time defined as time spent with other people and engaging in social interaction, communication or activities with others. (2) Economic time defined as time spent using one's labor power and productive capacity, likely to earn money and be or prospectively be a productive part of the labor force. (3) Environmental time defined as time spent outdoors in the open environment on average over a day. The scale below indicates percentages of a day.'

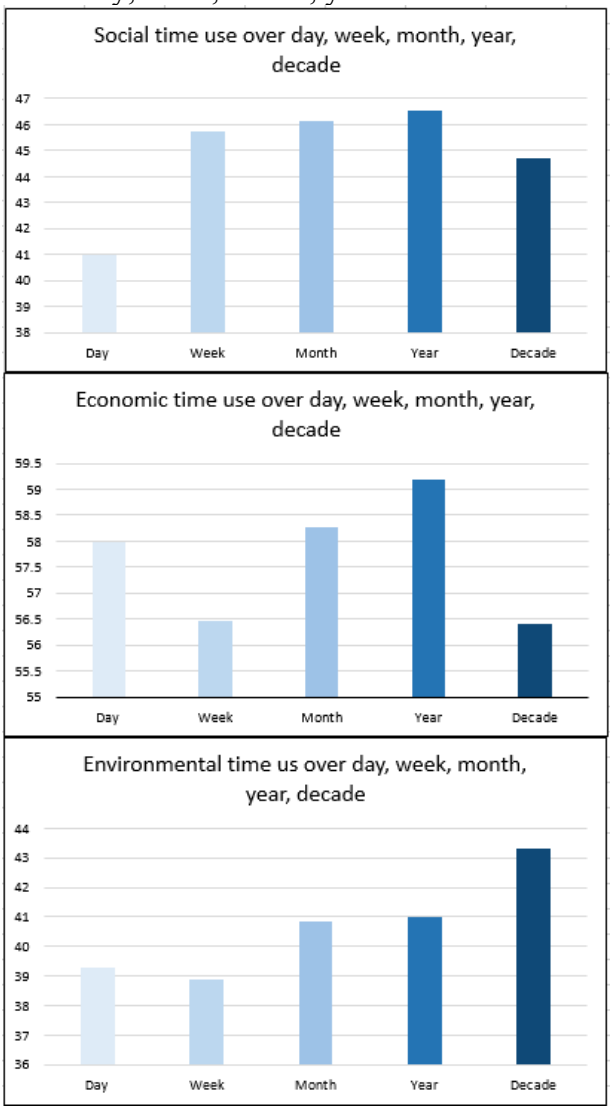
The time use categories were scrambled. All subjects had questions about all time horizons of a day, week, month, year and a decade. Time frames and time use categories' display was scrambled between subjects. Study 2 thereby quantitatively depicted the percentage of time use estimates between categories per day, week, month, year and over a decade. The influence of age-varying time use differences as well as the critical life event of parenthood were studied.

Results

Over all subjects, time is reported to be used differently for social, economic and environmental time use over a day ($t_{S(107)}$=17.050, df=106, p<0.000; $t_{Ec(108)}$=28.832, df=107, p<0.000; $t_{En(107)}$=39.271, df=106, p<0.000); a week ($t_{S(106)}$=19.011, df=105, p<0.000; $t_{Ec(106)}$=29.025, df=105, p<0.000; $t_{En(106)}$=14.019, df=105, p<0.000); a month ($t_{S(104)}$=19.219, df=103, p<0.000; $t_{Ec(105)}$=27.927, df=104, p<0.000; $t_{En(105)}$=14.404, df=104, p<0.000); a year ($t_{S(104)}$=19.752, df=103, p<0.000; $t_{Ec(104)}$=28.339, df=103, p<0.000; $t_{En(104)}$=14.443, df=103, p<0.000); and a decade ($t_{S(108)}$=20.600, df=107, p<0.000; $t_{Ec(108)}$=28.455, df=107, p<0.000; $t_{En(107)}$=15.937, df=106, p<0.000).

Over different time horizons, all subjects report different social, economic and environmental time use. Social time use perception differs over a day ($t_{S(107)}$=17.050, df=106, p<0.000), week ($t_{S(106)}$=19.011, df=105, p<0.000), month ($t_{S(104)}$=19.219, df=103, p<0.000), year ($t_{S(104)}$=19.752, df=103, p<0.000) and a decade ($t_{S(108)}$=20.600, df=107, p<0.000). Economic time use perception differs over a day ($t_{Ec(108)}$=28.832, df=107, p<0.000), week ($t_{Ec(106)}$=29.025, df=105, p<0.000), month ($t_{Ec(105)}$=27.927, df=104, p<0.000), year ($t_{Ec(104)}$=28.339, df=103, p<0.000) and a decade ($t_{Ec(108)}$=28.455, df=107, p<0.000). Environmental time use perception differs over a day ($t_{En(107)}$=12.979, df=106, p<0.000), week ($t_{En(106)}$=14.019, df=105, p<0.000), month ($t_{En(105)}$=14.404, df=104, p<0.000), year ($t_{En(104)}$=14.443, df=103, p<0.000) and a decade ($t_{En(107)}$=15.937, df=106, p<0.000). All mean distributions for social, economic and environmental time use perception over day, week, month, year and decade are displayed in Graph 1.

Graph 1: Mean distributions for social, economic and environmental time use perception over day, week, month, year and decade



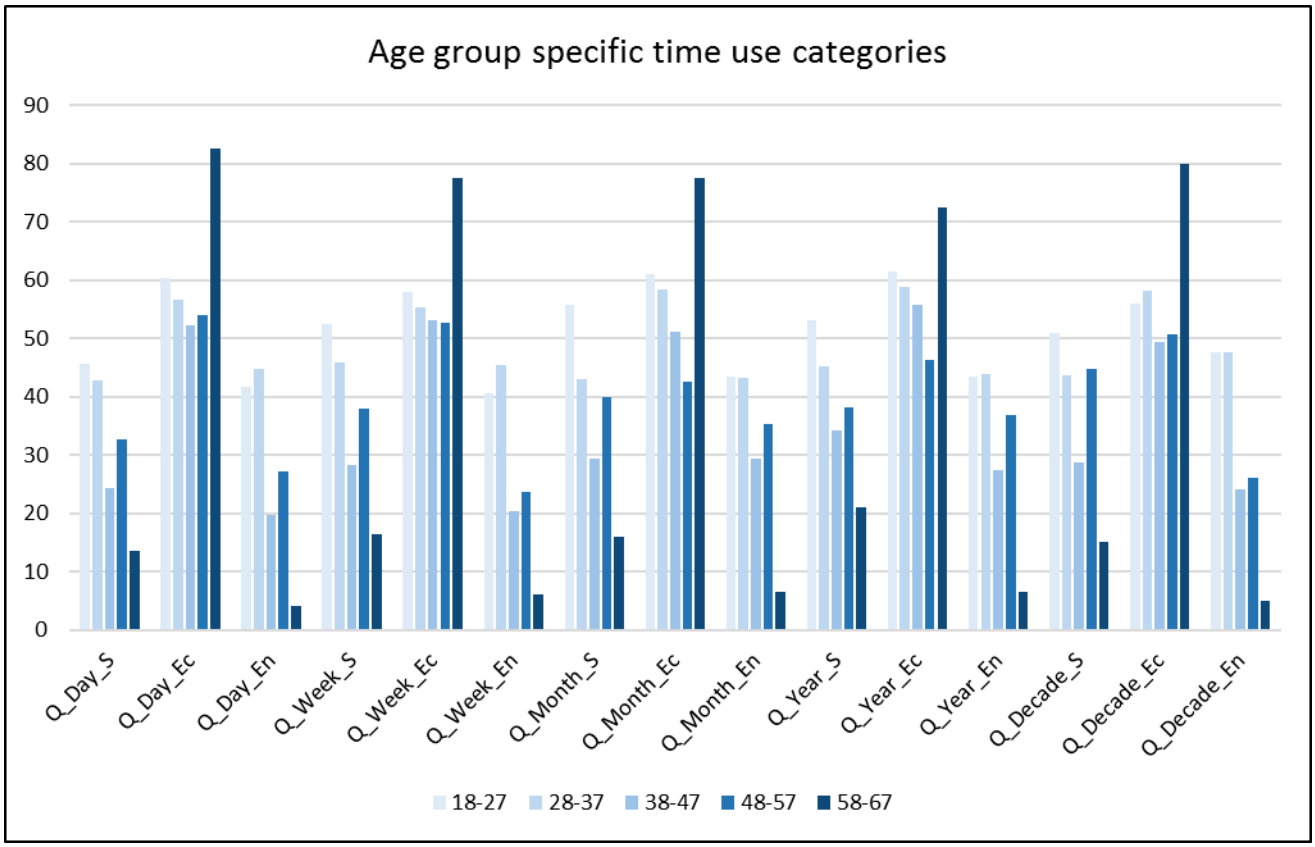
Social time use perception differs over a day ($Mean_{(107)}$=40.99; SD=24.890), week ($Mean_{(106)}$=45.76; SD=24.784), month ($Mean_{(104)}$=46.13; SD=24.480), year ($Mean_{(104)}$=46.54; SD=24.028), and decade ($Mean_{(104)}$=46.54; SD=24.028). Economic time use perception differs over a day ($Mean_{(108)}$=57.99; SD=20.902), week ($Mean_{(106)}$=56.45; SD=20.025), month ($Mean_{(105)}$=58.26; SD=21.376), year ($Mean_{(104)}$=59.18; SD=21.297), and decade ($Mean_{(108)}$=56.40; SD=20.598). Environmental time use perception differs over a day ($Mean_{(107)}$=39.27; SD=31.298), week ($Mean_{(106)}$=38.91; SD=28.572), month ($Mean_{(105)}$=40.83; SD=29.046), year ($Mean_{(104)}$=40.98; SD=28.936), and decade ($Mean_{(107)}$=43.34; SD=28.128).

While there are no gender differences to report; age groups make a difference when it comes to time allocation perceptions during a day in the social sphere [F(4, 102)=2.483, p=0.048] and the environmental domain [F(4, 102)=2.414, p=0.054]; during a week in the social sphere [F(4, 101)=3.142, p=0.018] and the environmental domain [F(4, 101)=3.065, p=0.020]; during a month in the social sphere [F(4, 99)=4.356, p=0.003]; during a year in the social sphere [F(4, 99)=2.397, p=0.055]; and during a decade in the social sphere [F(4, 103)=3.203, p=0.016] and the environmental domain [F(4, 102)=3.438, p=0.011].

Over different time horizons, the different age groups report different social and environmental time use. Social time use perception differs over a day [F(4, 102)=2.483, p=0.048], week [F(4, 101)=3.142, p=0.018], month [F(4, 99)=4.356, p=0.003], year [F(4, 99)=2.397, p=0.055] and a decade [F(4, 103)=3.203, p=0.016]. Environmental time use perception differs over a day [F(4, 102)=2.414,

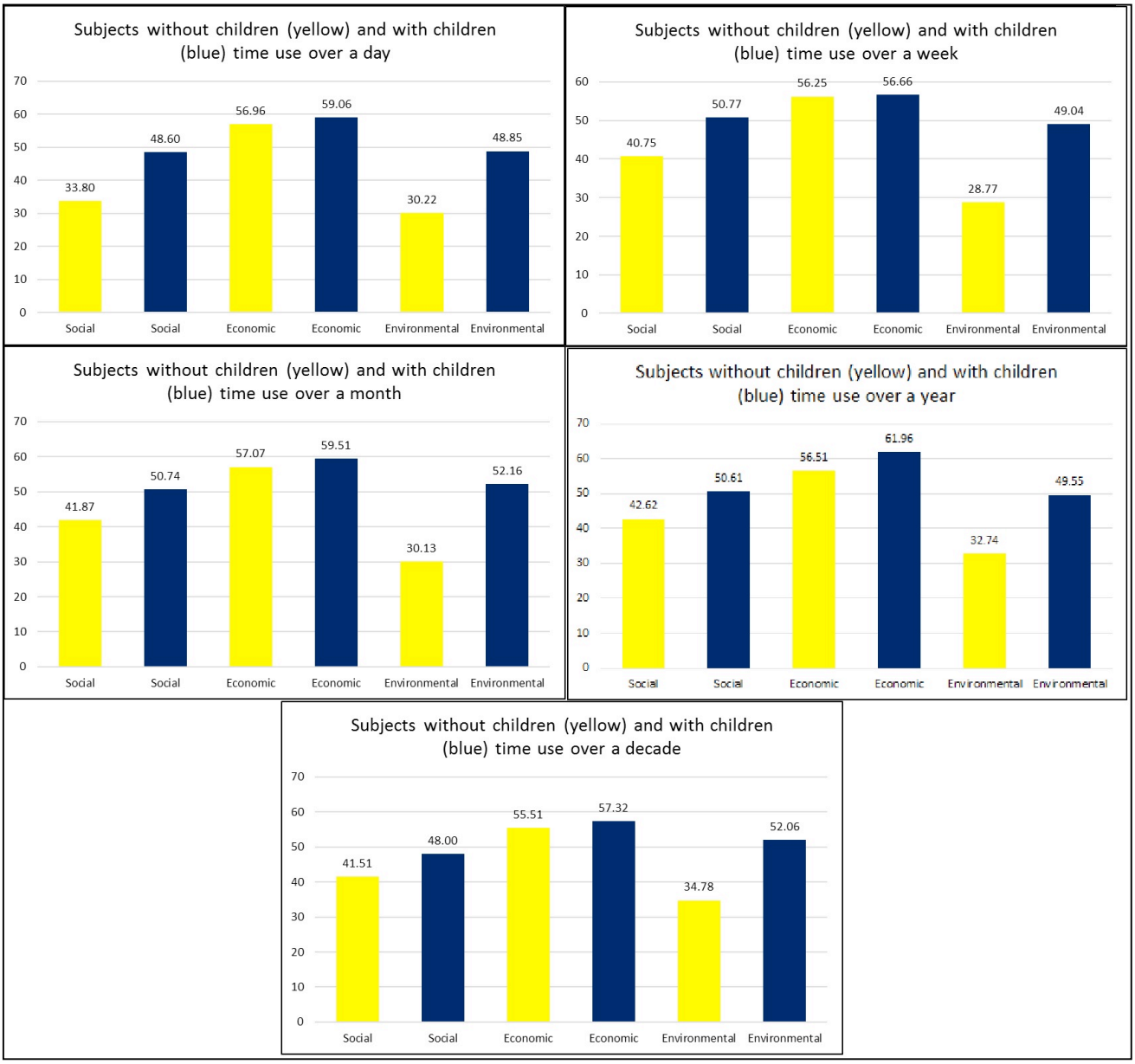
p=0.054], week [F(4, 101)=3.065, p=0.020], and a decade [F(4, 102)=3.438, p=0.011]. Economic time use perception does not differ over age groups. Table 1 exhibits the means of time use per social, economic and environmental category for the different age groups.

Graph 2 holds the means of time use per social, economic and environmental category for all age groups. Graph 2: Age-group dependent time use per social, economic and environmental category



Children make a difference when it comes to social ($t_{S(106)}$=-3.208, df=105, p<0.002) and environmental time use during a day ($t_{En(106)}$=-3.209, df=105, p<0.002); during a week in the social sphere ($t_{S(105)}$=-2.115, df=104, p<0.037) and the environmental domain ($t_{En(105)}$=-3.889, df=104, p<0.000); during a month in the environmental sphere ($t_{En(104)}$=-4.180, df=103, p<0.000); during a year in the environmental sphere ($t_{En(103)}$=-3.082, df=102, p<0.003); and during a decade in the environmental domain ($t_{En(106)}$=-3.324, df=105, p<0.001). Graph 3 holds the means of time use per social, economic and environmental category for the group of individuals with children and without children.

Graph 3: Groups of parents or not-parents' time use per social, economic and environmental category



Over different time horizons and different parent or non-parent groups, social time use perception differs over a day ($t_{S(106)}$=-3.208, df=105, p<0.002) and a week ($t_{S(105)}$=-2.2115, df=104, p<0.037). Environmental time use perception differs over a day ($t_{En(106)}$=-3.209, df=105, p<0.002), week ($t_{En(105)}$=-3.889, df=104, p<0.000), a month ($t_{En(104)}$=-4.180, df=103, p<0.000), a year ($t_{En(103)}$=-3.082, df=102, p<0.003) and a decade ($t_{En(106)}$=-3.324, df=105, p<0.001). Economic time use perception does not differ between parents and non-parents.

Overall, time is reported to be used differently for social, economic and environmental time use over all different time horizons. Over different time horizons, all subjects report different social, economic and environmental time use differently. Social time is rated highest over a year, month and week. Economic time is assumed to be the highest over a year, month and day. Environmental time is assumed to be highest over a decade, year and month. While there are no gender differences to report; the in-between study of age differences reveals whether age serves as a reference point for changed time use throughout life. The in-between subject measurement of parenthood serves as evidence for the importance of critical life events, in particular parenthood, for time use variation. Different age groups report different social and environmental time use over different time horizons. While self-reported time use tends to drop in the age bracket from 18 to 47, from 48 to 67 time use seems to rise,

particularly in the economic domain – although these results have to be seen with a caveat of the sample of 58-67 age group only being comprised of two individuals. In general, parents report more time use than non-parents. Children make a significant difference when it comes to social and environmental time use.

Study 3: *Survey study of external influences on time use preferences and age-dependent reference points*

Design

An experimental survey study was operationalized by Qualtrics and administered via Amazon Mechanical Turk. Four groups of participants will be exposed to either (1) Social cues (Test group 1), (2) Economic cues (Test group 2), (3) Environmental cues (Test group 3) or (4) No cues (Control group).

Participants were recruited via Amazon Mechanical Turk. After having been exposed to an informed consent disclaimer, the respondents who agreed to participate were asked to answer an open-ended free-association writing task on either one of the following 3 conditions in a between subjects design: (1) 'Describe your friends (social cue)' (Test condition 1 for Test group 1) or (2) 'Describe your paid work (economic cue)' (Test condition 2 for Test group 2) or (3) 'Describe a place in nature (environmental cue)' (Test condition 3 for Test group 3). The questions elicited a writing task, in which the respondents were meant to write down free-associations after exposure to the cues. The writing task was meant to prime respondents into a *social* (Test group 1), *economic* (Test group 2), *environmental* (Test group 3) or *neutral* (Control group) condition. The subjects were split evenly among the 3 Test conditions (between subjects design). The sample from study 2 served as neutral control condition, which did not have any priming of any cues and writing task questions.

Subsequently, all respondents were asked to make an assumption how much time they spend as '(1) Social time defined as time spent with other people and engaging in social interaction, communication or activities with others. (2) Economic time defined as time spent using one's labor power and productive capacity, likely to earn money and be or prospectively be a productive part of the labor force. (3) Environmental time defined as time spent ourdoors in the open environment.' All subjects then had to provide an estimate of how much time in relation to each other they spend on the outlined categories social, economic and environmental time. Social, economic and environmental time use of an average over an entire day, an entire week, an entire month, an entire year and in the last decade of one's life were asked for being estimated.

The questionnaire measured the influence of cues on time allocation preferences and perceptions. The cues served to put the respondents into different social, economic and environmental mindsets. These external frames were tested for influencing the respondents' time allocation perceptions.

In order to study the impact of situational cues on time allocation choices, the different groups were compared in their general time-use description after having been exposed to a writing task cue. The differences in the time use description were generated by quantitative responses to the question to estimate their time use per category social, economic and environmental times. A quantification of contents in relation to each other were pursued in order to derive information on the relative percentage of time use categories to each other.

After a writing task, general time-use questions were presented to subjects on Amazon Mechanical Turk in a Qualtrics questionnaire solution. After consenting to a standard informed consent form, all subjects were asked to make an assumption how much time they spend on (1) Social time defined as time spent with other people and engaging in social interaction, communication or activities with others. (2) Economic time defined as time spent using one's labor power and productive capacity, likely to earn money and be or prospectively be a productive part of the labor force. (3) Environmental time defined as time spent ourdoors in the open environment. The specific question read: 'Please make an assumption how much time you spend for: (1) Social time defined as time spent with other people and engaging in social interaction, communication or activities with

others. (2) Economic time defined as time spent using one's labor power and productive capacity, likely to earn money and be or prospectively be a productive part of the labor force. (3) Environmental time defined as time spent outdoors in the open environment on average over a day. The scale below indicates percentages of a day.'

The time use categories were scrambled. All subjects had questions about all time horizons of a day, week, month, year and a decade. Time frames and time use categories' display was scrambled between subjects. Study 2 thereby quantitatively depicted the percentage of time use estimates between categories per day, week, month, year and over a decade. The influence of age-varying time use differences as well as the critical life event of parenthood were studied.

The mindframes of social, economic and environmental factors allowed to draw inferences whether social, economic or environmental context are prone to elicit certain discounting anomalies. The prospective results elucidate whether social, economic or environmental cues can manipulate time use preferences. The category priming followed by a free-association writing task will also reveal if a certain mindframe either enhances or depletes continuous use of time for the same category.

In addition, the survey asked for the age of the respondent and if they have children and if so, how many children. The time use of different age groups and groups with or without children were compared in order to test for discounting differences and pro-social behavior variations during different time periods throughout life. Children's influence as critical life event in parents' lives on time allocation preferences was examined.

Sample

In total, 262 respondents were included in Study 3. The subjects (female=75 [28.07 percent], male=186 [71.3 percent], M_{age}=30, SD_{age}=8.21, Range=[18,65]) from around the world participated in the study online. After an informed consent, the online questionnaire investigated time use of men and women. Of the entire sample, 130 individuals (49.6 percent) indicated to have children and 132 (50.4 percent) reported that they do not have children. Of the sample with children, 47 respondents had one child (63.15 percent of the parents sample, 17.9 percent of the total sample), 46 respondents had two children (35.38 percent of the parents sample, 17.6 percent of the total sample), 16 subjects had 3 children (12.31 percent of the parents sample, 6.1 percent of the total sample), 5 survey takers had 4 children (3.85 percent of the parents sample, 1.9 percent of the total sample) and 16 survey takers had 5 children (12.31 percent of the parents sample, 6.1 percent of the total sample).

Results

Over all subjects and condition and control groups, time is reported to be used differently for social, economic and environmental time use over a day [$F_S(3, 256)=9.238$, $p=0.000$; $F_{EC}(3, 256)=8.362$, $p=0.000$; $F_{EN}(3, 256)=9.442$, $p=0.000$]; a week [$F_S(3, 254)=7.421$, $p=0.000$; $F_{EC}(3, 254)=10.423$, $p=0.000$; $F_{EN}(3, 254)=10.433$, $p=0.000$]; a month [$F_S(3, 253)=6.725$, $p=0.000$; $F_{EC}(3, 253)=6.402$, $p=0.000$; $F_{EN}(3, 253)=6.247$, $p=0.000$]; a year [$F_S(3, 252)=7.832$, $p=0.000$; $F_{EC}(3, 252)=8.397$, $p=0.000$; $F_{EN}(3, 252)=6.810$, $p=0.000$]; and a decade [$F_S(3, 256)=8.576$, $p=0.000$; $F_{EC}(3, 256)=8.472$, $p=0.000$; $F_{EN}(3, 256)=7.655$, $p=0.000$].

Discussion

Behavioral economics found individuals to hold mental accounts dependent on a reference point but also in regards as to how to allocate money to causes individuals care about. This paper presents that individuals also differ in mental temporal accounts, hence regarding how to spend their time. Over all subjects we find people perceiving time use differently in different time brackets. Individuals tend to have compartments, in which they discount and allocate social, economic and environmental time use differently. Decision makers have natural mental temporal accounts for how to spend social, economic and environmental parts of their lives throughout a day, week, month, year or decade of an average life. We have implicit mental accounts for how much time to spend on their own, how much time to be allocated towards working and how much time to just enjoy in the open environment. We can be nudged into different time use perception by external cues. But also the critical life event of parenthood sets us into a

different path of spending time in the social, economic and environmental spheres. It is not a trade off between categories but rather granting people mental time or more efficient use of time when they become parents.

As a limitation and future research prospect, the found differences of social, economic and environmental cues impacting on temporal discounting but not public policy choices in the social, economic and environment sphere demand for future investigations of the relation of mental temporal discounting and financial allocation preferences. Mental accounting theory may not easily be extendable on the untested domain of time insofar as the mental cues manipulated time perception but not monetary allocation preferences to the domains of social, economic and environmental causes. So while we have context-dependent temporal accounting strategies for time, this may not hold for monetary allocation preferences. Time is not money.

The found age-dependency of time use categories demands for additional attention. A clear limitation of the study is the narrow sample with a relatively young population. Future research may focus on testing concrete age differences in the time use preferences with a focus on a more harmoniously stratified sampling. Specific age categories hold invaluable insights on age groups' specific use of time, which hold precious market implications for very many different industries ranging from consumption goods to service industry, health care and insurance industries that could serve different age groups more efficiently.

Lastly, the results of environmental cues bestowing with a higher perception of time use in all other domains as well serve as a beautiful case for environmental recreation preservation. Sustainability may bestow us with a long-term view but also with a meaning of using our time more efficiently in all domains, the environmental but also social and economic spheres as well. In this regard, the results have ample applications, ranging from improving individual's day-to-day decision making up to intergenerational leadership in light of climate justice demands (Puaschunder 2015b, 2016a, e, f, 2017c, d, f, g, i, j, 2018a, c, forthcoming a, b). The findings hold invaluable insights for improving future-oriented and socially responsible decision making nudges (Puaschunder, 2011, 2015a, 2016b, c, 2018d). The research therefore holds direct applicability for improving the lives of current and future generations in private and public domains (Puaschunder 2015c, 2016d, 2017b, d, e, h, 2018b, e, f, g, forthcoming c, d).

Overall, pointing at the necessity to include past individual points in life into neoclassic economics and hyperbolic discounting spearheads heterodox economics by opening a detected black box of forward-looking discounting paradigms (Heidegger 1929/1963; Puaschunder 2015c; Puaschunder & Schwarz 2012). Outlining fundamental differences of temporal discounting throughout different ages allows retrieving multi-faceted decision making influences as well as generating wide-ranging nudges to improve choices over the entire life cycle (Thaler & Sunstein 2008). The prospective findings also promise to add to contemporary contract theory, which is primarily focused on monetary incentives an attention for non-monetary gratification nudges that may imbue motivation to act beyond financial gains-driven ones (Puaschunder 2018c). Contrasting orthodox temporal discounting with heterodox multi-faceted decision making approaches that elucidate more exactly how individuals choose to spend time in the course of their lives but also shedding light on the importance of integrating backward looking aspects in discounting sets the stage for improving future social care beyond one's own existence in a real-world relevant way granting opportunities to imbue eternal equity in humankind.

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