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Abstract

This article reviews and discusses the axiomatic foundations of the normative theory of experienced utility proposed by Kahneman et al. (1997). First, I emphasise some philosophical problems with the axioms of *Separability* and *Time Neutrality*, which may require to reconsider them. Second, I discuss the implications of taking *remembered utility* rather than *moment utility* as the informational basis of the theory. Third, although the theoretical discrepancy between decision utility and experienced utility is intuitively appealing, significant evidence about such a discrepancy is lacking, which may lead us back to decision utility as a welfare-relevant criterion.

Keywords. *happiness – time – utility – welfare*

JEL codes. B41, D60, D90, I31

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1 Introduction

Measuring happiness through the hedonic interpretation of Bentham (1780 [2007]) has been the subject matter of approximately twenty years of research by Kahneman and co-authors (henceforth ‘Kahneman et al.’). The bulk of this research program was to concretise a utilitarian dream left unrealised by Edgeworth (1881):

‘Let there be granted to the science of pleasure what is granted to the science of energy; to imagine an ideally perfect instrument, a psychophysical machine, continually registering the height of pleasure experienced by an individual. ... The continually indicated height is registered by photographic or other frictionless apparatus upon a uniformly moving vertical plane. Then the quantity of happiness between two epochs is represented by the area contained between the zero-line, perpendiculars thereto at the points corresponding to the epochs, and the curve traced by the index.’ (p. 101)

However, in a recent interview given to *Hareetz* (an Israeli online newspaper), Kahneman explicitly declared that he does not believe anymore in the research program he undergone for twenty years. In Kahneman’s own words,

‘I gradually became convinced that people don’t want to be happy ... They want to be satisfied with their life. People don’t want to be happy the way I’ve defined the term – what I experience here and now. In my view, it’s much more important for them to be satisfied, to experience life satisfaction, from the perspective of “what I remember”, of the story they tell about their lives. I furthered the development of tools for understanding and advancing an asset that I think is important but most people aren’t interested in.’ (Daniel Kahneman, interviewed by Amir Mandel in 2018)¹

The ‘new’ Kahneman (henceforth Kahneman-2018) recognises that he might have missed the point of what objective happiness truly is in giving *moment* utilities (what is experienced here and now) too much importance. Instead, what may fundamentally matter is not the *experienced* value of a decision but its *remembered* value: what individuals remember of their experiences. Yet maximising moment utilities for normative analysis was the ultimate goal of the experienced utility program (Kahneman 1999, 2000). In this article I provide a methodological assessment of measuring experienced utility. In particular, I aim to assess what seems to be philosophically problematic with the theory of experienced utility measurement by discussing the axiomatisation proposed by Kahneman et al. (1997).

Three main problems are discussed. First, although the assumption of cardinality is subject to some debate – particularly in the light of some insights from the literature in psychology – more concerning from a philosophical point of view seem to be the axioms of *Separability* and *Time Neutrality*, which (respectively) hold that moment utilities can be added ‘at will’ over time, and that individuals’ introspection of their experienced pain and pleasure should not be weighted by the time at which those are experienced. Second, aligned with Kahneman-2018’s reconsideration, *remembered utility* may matter more in individuals’ general assessment of their happiness than *moment utility*. Third, the discrepancy between decision utility and experienced utility is an intuitive and theoretical distinction that requires further empirical investigation. At this stage, it is actually hard to claim that there is significant evidence that experienced utility differs from decision utility. As a consequence, I emphasise two major implications of the present analysis.

¹<https://www.haaretz.com/israel-news/.premium.MAGAZINE-why-nobel-prize-winner-daniel-kahneman-gave-up-on-happiness-1.6528513>.

Either we should aim to refine the normative theory of experienced utility by taking into account the methodological problems presently discussed – mainly the two axioms of *Separability* and *Time Neutrality*, as well as considering *remembered* utility instead of *moment* utility as the informational basis for welfare aggregation – or we may be back to decision utility as a welfare-relevant criterion.

The rest of the article is organised as follows. Section 2 briefly presents the theory of experienced utility measurement. Section 3 discusses each of the ten axioms of the theory of experienced utility (Kahneman et al. 1997), which allows for aggregating individuals' moment utilities into a total utility. Section 4 is an attempt to reconsider the content of experienced utility measurement, i.e. what matters for welfare evaluation may not be *moment utility* but *remembered utility*. I then conclude in Section 5 by suggesting two implications of the present analysis for public policy.

2 Experienced Utility Measurement: Theory

The discrepancy between 'decision utility' and 'experienced utility' was initially suggested by March (1978), who made the case that decision value and experience value typically do not converge for ordinary decision makers. *Decision* utility is the weight of an outcome in a decision, as in standard models of decision-making. *Experienced* utility is the hedonic quality as in Bentham's (1780 [2007]) usage. That is, it is the experience in terms of happiness, which is not necessarily related to one's observed choice. Since decision utility is inferred from observed choices, and since observed choices are sometimes subject to cognitive biases, the idea is that individuals may not always choose the outcome that makes them better off. The conceptual appeal of experienced utility is to consider it as a more reliable proxy of well-being than decision utility and to use it as a welfare criterion for normative analysis. The main advantage of the experienced utility criterion is that it is independent of the choices individuals make, and then can be used to evaluate which choices increase well-being and which choices decrease it. In the 1990s, the separation between decision utility and experienced utility became the central interest of the research program of Kahneman et al. concerned in evaluating individuals' experiences of *pain* and *pleasure*.

The main interest of this research program was to understand the connection and gap between what individuals *experience* in real time – i.e. the way they actually lead their life – and what they *remember* of those experiences – i.e. the narrative they represent themselves about the way they lead their life. With the experienced utility criterion, normative analysis can be based on the evaluation of *total utility*: the collection of utility profiles which follows certain normative rules (that are discussed in Section 3). According to the experienced utility criterion, a state of affairs is judged to be better than another if it maximises the level of total utility. Its central ethical rule can then be formulated by the following premise.

Ethical premise. *An individual's state of affairs is better than another if it has more level of total utility than another.* Formally, let $x = (x_1, \dots, x_n) \subseteq X$ be a realisable set of an individual's states of affairs (e.g. a consumption bundle, health states, sips of tea, etc.) and X be the set of outcomes. I denote by $i = \{0, \dots, n\}$ the index of time for each

element of the vector x . For example, x_1 is one sip of tea at time 1, x_2 is another sip of tea at time 2, and so on. $W(x)$ is an individual welfare function of the form,

$$W(x) = \int_0^n u(x_i) dx$$

where $u(x_i)$ is the individual's utility profile of x at time i and \int the integral of all utility profiles, which allows to have the total utility of the individual over the time period that is being considered.² The experienced utility criterion is then satisfied under the condition that:

$$W(x) \geq W(x') \implies x \succeq x'$$

From the beginning of the 1990s until the end of the 2000s, the development of the experienced utility program can be resumed in three main phases: (i) theoretical distinctions between several kinds of utilities (*decision utility, experienced utility, predicted utility, moment utility, remembered utility and total utility*), (ii) accumulation of evidence about the way individuals perceive and remember experiences of pain and pleasure, and (iii) methodological improvements of measuring the aggregation of moment utilities.³

3 Experienced Utility Measurement: Limits⁴

The theory of experienced utility measurement is about formulating the conditions that allow to integrate utilities into a timeline so that experiences over time and among subjects can be compared. This attempt is known by the seminal contribution of Kahneman et al. (1997). In their 'back-to-Bentham' approach, they propose a formal normative theory of what they call the total experienced utility of temporally extended outcomes (TEOs): a sequence of life experiences that can include anything related to the sensation of pleasure and pain. The authors aim at measuring TEOs with the normative concept of 'total utility': an aggregation of temporal profiles of utility which is experienced instantly by individuals. With the concept of 'utility integration', the authors aim to specify 'the conditions under which the total utility of an extended outcome is the temporal integral

²Although it is not absurd to use a sum, the integral better captures the summation of utility profiles because such a summation graphically represents an 'area' of pleasure (or pain) if we consider time to be a continuous variable.

³For the individual contributions (in chronological order), see Kahneman and Snell (1990), Kahneman and Varey (1991), Kahneman and Snell (1992), Varey and Kahneman (1992), Kahneman et al. (1993), Fredrickson and Kahneman (1993), Kahneman (1994), Redelmeier and Kahneman (1996), Kahneman et al. (1997), Kahneman (1999), Kahneman (2000), Kahneman et al. (2004), Kahneman and Sugden (2005), Kahneman and Krueger (2006). Note that since the end of the 2000s the experienced utility program made, however, no more significant theoretical and empirical improvements. Other contributions document errors of hedonic forecasting and provide arguments for measuring experienced utility in the health domain (Kahneman and Thaler 2006; Dolan and Kahneman 2008), discuss its practical issues (Loewenstein and Ubel 2008), provide empirical tests of the peak-end rule (Do et al. 2008; Kemp et al. 2008; Mah and Bernstein 2019), provide empirical tests of the fundamental distinction between decision utility and experienced utility (Carter and McBride 2013; Akay et al. 2017), are made for the public reader (Kahneman 2011 [Part V]), and focus on some particular issues about measuring health states (Oliver 2017).

⁴A glossary of experienced utility measurement is provided in Appendix A, which explains and summarises the technical concepts for the construction of the normative theory of experienced utility. Readers who have no background in the theory can consult it before reading the present section.

of some transformation of instant utility' (p. 388). They suggest that a social planner could eventually maximise the sum of the total utility of each individual into an objective function. This section aims to discuss some limits of the theory of utility integration.

The construction of the temporal integral of moment utilities relies on six assumptions about subjects' ratings of instant utility (Kahneman 2000) and on four additional assumptions about a social planner who has a knowledge of the scale (Kahneman et al. 1997). Axioms 1, 2, 3 and 4 impose requirements on the measure of moment utility. They are epistemic judgements made for the practical usefulness of measuring total utility. Axioms 5 and 6 are normative rules which specify how total utility is constructed from moment utilities. They are required for summing moment utilities into total utility (or into an individual welfare function). As we shall see, Axioms 5 and 6 are perhaps the most problematic from a philosophical point of view. Axioms 7, 8, 9 and 10 are technical assumptions about the transformation of utility profiles. I now discuss each axiom in turn.

3.1 AXIOM 1 (Inclusiveness)

Ratings must contain all the relevant information required for its temporal integral to be a plausible measure of the total utility.

This axiom merely consists in bounding the welfare-relevant domain. The informational basis of the experienced utility criterion is *moment utility* (what is experienced here and now). Moment utility also includes the affective consequences of prior events (e.g. adaptation, fatigue) and future events (e.g. fear, hope). Disputing the informational basis of the welfare-relevant domain (here moment utility) would lead us to an external critique, according to which sensations of pleasure and pain are not relevant for normative evaluation. Such an assessment is obviously outside the scope of the present analysis.

3.2 AXIOM 2 (Ordinal Measurement across Situations)

The measurement of positive and negative deviations from zero is ordinal.

By definition, moment utility is the valence (good or bad) and the intensity (mild to extreme) of current affective or hedonic experience. This axiom states that the valence and intensity of a stubbed toe can be compared with the ones of a humiliating rebuke. For example, a pain rating of 7 in one situation (e.g. a stubbed toe) is considered of being worse than a pain rating of 6 in another situation (e.g. a humiliating rebuke), but the interval between 6 and 7 need not be psychologically equivalent with the interval between 3 and 2, although they must be measured on a common scale.⁵ Holding this axiom requires to accept that different psychological perceptions (e.g. a stubbed toe and a humiliating rebuke) are categorised under a similar hedonic feeling. Whether the two psychological phenomena of hedonic feeling (e.g. physical pain) and emotional feeling

⁵Note that the experienced utility that is integrated remains cardinal. For example, if decreasing the pain from 3 to 2 in one day is not worth an operation a day before, but the decrease of pain from 7 to 6 is, then, under *ceteris paribus*, the latter decrease is bigger than the former.

(e.g. emotional pain) are assumed to be commensurable is, however, left unclear in Kahneman et al. (1997). The authors mention the affective experience of plotless film clips of Fredrickson and Kahneman (1993) to support the observation that individuals violate monotonicity (the rule according to which adding a moment of pain should reduce individuals' total utility). Yet they make it quite explicit that their normative theory only applies to hedonic states that are naturally interpreted in terms of *physical* pleasure and pain, e.g. enjoying the taste of an ice cream or suffering a colonoscopy procedure.

Kahneman (2000) instead considers both psychological phenomena of hedonic *and* affective experiences to be commensurable, which can be seen as a natural extension of experienced utility measurement if aimed to be applied in a wide range of domains. The author advances that 'reporting the sign and intensity of current hedonic and affective experience is not essentially different from the standard psychophysical tasks of reporting color or smell' (p. 195). Here Kahneman refers to his own point in Kahneman (1999) about the large body of empirical studies in psychology on how human sensory experience works. Specifically, he refers to the analogy he makes between the human sensory system and hedonic states. The author acknowledges an important difficulty: 'it is more difficult – but not impossible – to compare the loudness of sounds that differ in pitch and in timbre than to compare sounds that share these attributes'. He then argues that 'the question of whether people can compare physical and emotional pain, or the trills of food and music is ultimately empirical' (p. 197). As there may be few doubts that empirical studies can enlighten us on this point, Kahneman's question seems also philosophical. Can evidence tell us whether the sensation of eating chocolate while being sad provides meaningful comparison between the first and the second feeling? It may be suspected that some would disagree with Kahneman's simplification, according to which almost every psychological perception can fit into a 'good-bad' scale (to be discussed below). Further empirical and philosophical assessments could perhaps enlighten us on this point, which is related to the assumption of interpersonal comparisons of utilities (to be discussed below).

3.3 AXIOM 3 (Distinctive Neutral Point)

The scale has a stable and distinctive zero point ('neither good nor bad', 'neither pleasant nor unpleasant'), which permits comparisons across outcomes and individuals.

This axiom is very familiar with the notion of a reference point, like in reference-dependent models of decision-making such as prospect theory (Tversky and Kahneman 1992). In prospect theory, the reference point generally represents the *status quo* and serves as the benchmark to distinguish gains from losses. Following the same logic, the neutral point of the normative theory of Kahneman et al. (1997) serves as the benchmark to distinguish positive from negative feelings.⁶

Some may argue that the existence of such a neutral point is not a weak assumption, since when asking an individual to evaluate her happiness, we ask her to imagine an

⁶Abstraction is made of any additional content associated with the reference point, such as loss aversion. See Kahneman (1999, p. 18) for a discussion and Carter and McBride (2013) for an empirical test of whether the value function of prospect theory is of similar S-shape than the experienced utility function of Kahneman et al. (1997). The authors found mixed evidence for loss aversion in experienced utility.

abstract state in which she evaluates her current mood from such a ‘zero point’. Yet even if this neutral point can be identified by the individual, a concerning problem is that it may not be stable. Typically, how can an individual who adapt to her life circumstances can evaluate a similar perception of pain and pleasure than before? If, for example, she becomes rich to the point that she does not derive the same level of pleasure in eating tuna than before (because she can now afford caviar), it is hard to imagine that her hedonic level would not change according to her new circumstances. Kahneman (1999, pp. 11-15) extensively discusses this point, recognising it to be difficult but not impossible to overcome. The main argument of Kahneman et al. (1997) is that ‘the stimulus that gives rise to a neutral experience may be different in different contexts, but the neutral experience itself is constant’ (p. 380). Thus, if we put individuals in an experimental setting for a short interval of time so that they do not have time to durably adapt, the evaluation of pain in relation to a neutral point may not be that problematic, e.g. as in the colonoscopy experiment of Redelmeier and Kahneman (1996) (to be discussed below). Yet experienced utility measurement would be quite restrictive if it cannot be applied to situations where these conditions are not satisfied.

Another point is that the ‘bottom-up’ construction of objective happiness (Kahneman 1999) requires that each moment can uniquely be characterised by a value on the ‘good-bad’ dimension. This technically requires the following two assumptions.

- *Assumption 1.* The brain continuously constructs an affective or hedonic commentary on the current states of affairs – an assumption judged to be fairly supported by evidence according to Kahneman (1999, 2000). In other words, any moment of time can be characterised by a particular value of the ‘good-bad’ dimension (positive, neutral or negative) but an evaluation cannot be both good and bad at the same time nor major manifestations of the ‘good-bad’ dimension can be dissociated.
- *Assumption 2.* It follows from *Assumption 1* that a commentary is adequately summarised by a single value, judged to be a ‘tolerable oversimplification’ by Kahneman (1999, p. 7).

Since *Assumption 2* cannot be empirically supported, I here restrict my comment to *Assumption 1*. *Assumption 1* is very similar to the first psychological phase in prospect theory labelled as *editing/framing* (Tversky and Kahneman 1992, p. 299). In the editing/framing phase, the decision maker constructs a representation of the acts, contingencies, and outcomes that are relevant to the decision. Tversky and Kahneman (1981) specify that ‘the frame that a decision-maker adopts is controlled partly by the formulation of the problem and partly by the *norms, habits, and personal characteristics* of the decision-maker’ (p. 453 – my emphasis). One issue is that *Assumption 1* also necessarily depends on personal and social characteristics of individuals, which can lead to very different perceptions of the good-bad scale among individuals. *Assumption 1* also rules out any mental evaluation that goes beyond a ‘good-bad’ dimension. Unsurprisingly, the experienced utility criterion is restricted to the evaluation of pain and pleasure in ‘simple cases’, e.g. a toothache, the taste of an ice cream flavour, the itch of a mosquito bite, etc.⁷

⁷The empirical support for the possibility of fitting various kinds of human sensation on a good/bad dimension is vast in psychology and is consequently outside the scope of the present discussion. I refer

3.4 AXIOM 4 (Interpersonal Comparability)

The comparisons of individuals experiencing different outcomes (e.g. a colonoscopy and the sensation of drinking tea) are ordinal, but the comparisons of individuals experiencing the same outcome (e.g. a colonoscopy or the sensation of drinking tea) are cardinal.

This axiom refers to the classical interpersonal comparisons of utility assumption that has been subject to a long controversy in the history of welfare economics. Although it did not play a role in Kahneman et al. (1997), it is made explicit in Kahneman (2000) in order to make comparisons between individuals and groups. Because of the vast background on this historical controversy, I restrict my discussion to the arguments advanced by Kahneman et al.⁸

Kahneman and Varey (1991) argue that *adaptation* is one important reason which permits interpersonal comparisons of utilities. According to the authors, when two individuals are fully adapted to different levels of stimulation, they can be said to be matched in their absence of response to their states. The other reason they bring about is if individuals' responses to stimuli differ in the same direction from their respective adaptation levels, those can be matched in signs, if not in magnitude. The main argument advanced by Kahneman et al. (1997) is that the functions that relate subjective intensity to physical variables are qualitatively similar for different individuals. This refers to what has been said previously about the non-impossibility of individuals to perceive the loudness of a sound similarly when it is of different pitch and timbre. Because the cardinal measurement of deviations in sign or in magnitude may not perfectly reflect adequate perception of feelings between individuals, it may explain why Kahneman et al. (1997) restrict cardinality between individuals experiencing the *same* thing (e.g. a colonoscopy) but not between individuals experiencing different things (e.g. a colonoscopy and carrying a heavy suit case).

Others may, however, find the assumption of interpersonal comparisons of utilities unsatisfying, even for individuals experiencing the same thing (e.g. a colonoscopy). The reason is that although the empirical arguments provided by Kahneman (2000) – according to which the sign and intensity of current hedonic and affective experience is not essentially different from the standard psychophysical tasks of reporting colour or smell – some would still believe that individuals may have incommensurable perceptions of pains, while they can react about the exact same pain in a very different manner than others. As Kahneman et al. (1997) put it,

'Of course, not all human pleasures and pains are biologically programmed in detail. Prior consumption experiences and various cultural and social influences can alter the hedonic value of stimuli, as when people learn to like coffee or chili peppers, develop a dislike for rich desserts, or acquire a passion for opera.' (p. 379)

The difference between proponents and opponents of interpersonal comparisons of utilities would then be a matter of degree in terms of how far can we accept – biologically and sociologically speaking – individuals to perceive things similarly.

the reader to Kahneman (1999, pp. 7-9), who reviews the literature on this area of research, and who is enthusiastic about using the good-bad dimension for many situations – e.g. for the experiences of a straining runner and of a spectator watching a tragedy.

⁸See Fleurbaey and Hammond (2004) for a synthesis of this historical controversy.

3.5 AXIOM 5 (Separability)

The order in which moment utilities are experienced does not affect total utility. That is, the contribution of an element to the total utility of the episode (or TEO) is independent of the elements that are preceded and followed it.

This axiom is fundamental. Without it, the concept of total utility can simply not result from the summation of moment utilities, as total utility does not preserve the order in which moment utilities are experienced. Indeed, this axiom is needed to sum ‘at will’ all moment utilities of an episode of a TEO. Philosophically speaking, it is perhaps also the most problematic.

Taking an illustration, the axiom states that the sum of the experiences of playing a football game and having a beer is not affected by the order in which these two events are experienced. While it may appear obvious that having a beer after a football game is more enjoyable than the other way round, Kahneman et al. (1997, p. 391) and Kahneman (2000, p. 192) reply to this kind of objection by emphasising that the episodes of a TEO that are to be evaluated are not *outcomes (or events)*, but *moment utilities associated with outcomes (or events)*.

Recall that under Axiom 1 (*Inclusiveness*), *all* the effects of the order of outcomes (or events) are already incorporated into moment utility. This means that when all moment utilities are summed, the social planner should not worry about the order in which those moment utilities are experienced because the information related to past and future events is already contained in the individual’s moment utilities. The issue is that by incorporating all previous and anticipated information in moment utility, one has specifically good reason to think that a total hedonic experience *will* be affected by the order in which these two moment utilities associated with events are experienced. In other words, it seems that physical events can be rearranged at will in time but once they are associated with a psychological affect, subjective experiences associated with events necessarily change.

As an example, consider the following two scenarios. Anticipating the enjoyment of having a beer after his football game (incorporation of information about anticipated utility), John attributes 6 hedonic state to the football game and 7 hedonic state to the beer he is now enjoying as a reward after decent effort (incorporation of information about past utility). *Scenario 1* therefore yields to a total utility of 13 hedonic states. Consider now a second scenario. Anticipating the episode of playing a football game while enjoying his beer, John attributes 5 hedonic state to the beer and -3 hedonic state to the unpleasant feeling of running on the pitch with a non-empty stomach. *Scenario 2* therefore yields to a total utility of 2 hedonic states. Table 1 below summarises the outcome of each hedonic scenario in terms of total utility.

Table 1: Hypothetical evaluation of hedonic scenarios

	$u(\text{football})$	$u(\text{beer})$	Total utility
<i>Scenario 1:</i> football then beer	6	7	13
<i>Scenario 2:</i> beer then football	-3	5	2

Having these two counterfactual events which yield to different total utilities, how can the order of these two episodes not affect the value of John’s total utility? The counter-intuitive aspect of the *Separability* axiom requires to discuss some of its underlying assumptions. In order to grasp the intuition of this axiom, Kahneman (2000, p. 192) proposes the following thought experiment. Assume an individual wins two unexpected prizes in a row: 500\$ and 10 000\$, then suddenly dies (or loses his memory). In evaluating the total utilities of both scenarios (*Scenario 1*’: receiving 500\$ then 10 000\$; *Scenario 2*’: receiving 10 000\$ then 500\$), *Scenario 1*’ would surely be preferable to him because the enjoyment of a smaller prize is greater when it comes first (equivalently, the enjoyment of the bigger prize is greater when it comes second). Now let us imagine that all we know is that just before his sudden death (or amnesia), an individual had two pleasurable experiences, respectively $u(a)$ and $u(b)$, where $u(a) \gg u(b)$. Kahneman asks, ‘would we still think that their order matters?’, to which he replies that ‘when outcomes are moment-utilities, there is no compelling reason to reject separability’ (p. 192). Two points are worth being discussed.

First, with this thought experiment it is unclear to perceive the relevance of the social planner’s role in evaluating the individual’s total utility. Those moment utilities experienced by the individual must matter to *the individual*, not to an external observer. But if the difference in total utility ultimately matters to the individual (and not to the social planner), the difference between the value of the individual welfare function (or total utility) of *Scenario 1*’ and the one of *Scenario 2*’ should have reflected enough information to observe a salient magnitude between both individual welfare functions, just before the individual died. As Kahneman (2000) seems to acknowledge it, as long as *Scenario 1*’ provides more total utility than *Scenario 2*’, the first should be preferred to the second. This is true even if the difference in magnitude between the two total utilities is extremely small. Shall the order of moment utilities slightly disrupt the value of total utility, recall that the ethical premise of experienced utility states that the aim of the social planner is to maximise one’s total utility (Section 2). Under this maximisation principle, it would then be sufficient to hold that the order does matter.

Second, it is left unclear what the introduction of death (or amnesia) brings more to the argument if the evaluation of total utility of the individual is relevant *before* he dies (or get amnesic). Imagine you go to the restaurant. There is one scenario in which the order of the course goes normally, starting with the starter and ending with the desert. There is another scenario where the waiter brings you the desert at the beginning and the starter at the end. What does your death bring up more to the evaluation of your concatenation of episodes at the restaurant from the social planner’s viewpoint? In fact, *Separability* seems to be relevant when the evaluation of one’s total utility is made *after*

the individual gets amnesic. For example, assume the lottery winner receives 500\$, gets amnesic, then receives 10 000\$. Would his total utility change, had he received 10 000\$, got amnesic, then received 500\$? Presumably not. For the sake of practical appeal (it is rather uncommon that people get amnesic from one moment to another), let us take back the football-beer example. Assume ‘football game’ and ‘beer’ are not experienced on the same day but at two separate days (or even at two separate weeks). In this case, it seems reasonable to hold that the order in which moment utilities are experienced does not affect total utility, simply because the distance in time between these two experiences is ‘big enough’ so that these experiences can be considered to be independent one from another.

The *Separability* Axiom thus holds under the condition that the distance between two temporally finite disjoint episodes/events is sufficiently big so that the subjective evaluation of one moment utility associated to an event does not affect the subjective evaluation of the other moment utility associated to another event. In other terms, the higher the distance in time between two episodes is, the more plausible it is to have two equal total utilities for both scenarios. In Kahneman et al. (1997), there is, however, no imposed condition on the distance between two finite disjoint episodes in the definition of a TEO to construct total utility. If the present argument holds, a notion of ‘*Time Distance*’ may be needed to the normative theory of experienced utility.

3.6 AXIOM 6 (Time Neutrality)

All moments are weighted alike in total utility. That is, the temporal distance between an outcome and its retrospective assessment is entirely irrelevant to its evaluation.

Time neutrality is the thesis, according to which individuals should attribute no normative significance to the temporal location of their pleasure and pain (all else being equal). It is important to emphasise that total utility is always assessed *after* the moment at which the outcome is experienced. The idea is if the social planner takes a ‘neutral’ stance in summing all utility profiles, there is no apparent reason that he attributes more weight to one time at which one experience is evaluated by the individual instead of another.

To understand why Kahneman et al. (1997) and Kahneman (2000) make this normative judgement, consider first how individuals tend to weight time in decision utility and remembered utility. In decision-making, temporality *does* matter: economists assign to each intertemporal choice a discount factor, which captures the individual’s patience. The more the outcome occurs late in time, the heavily the outcome is discounted. Remembered utility works the other way round: individuals’ retrospective judgement tend to give more weight to the time at which the peak of pain is experienced and the final time at which the last intensity of pain is experienced (according to peak-end rule). Kahneman (2000) however judges both decision utility and remembered utility to have a ‘dubious normative status’ (p. 193). According to the former, he brings up the classic argument in the literature of self-control failures that myopic preferences are normatively irrelevant (Thaler and Shefrin 1981; Laibson 1997) because they do not maximise total utility. According to the latter, the author judges that ‘an experience that ended very badly could still have positive utility overall, if it was sufficiently good for a sufficiently

long time' (p. 193).

One objection we can make to this axiom is that attributing a 'neutral' value to time is far from being obvious. Indeed, individuals may simply like to attribute different weightings of time during the day because they have personal reasons to do so. For example, an individual who wakes up every morning to go to work may rationally think that his hedonic state of -2 does not have the same weight than his hedonic state of 7 when he goes back home. This is because the time associated with the negative feeling of making something unpleasant may not be perceived equivalently with the time associated with the positive feeling of playing with his cat after he gets back home. The individual values the second activity much more than the former, and accordingly, cares less about the time of the day at which he makes something unpleasant. He may also have the opposite reasoning, which is also consistent with time weighting. Consider that the pain he experiences by waking up every morning affects him more than the enjoyment of playing with his cat when he gets back home. This individual may have a negative remembered utility about his past TEO. Even if his total utility is positive, he may provide good reason not to want to repeat this TEO because he weights pain-time more than pleasure-time, to the point that he has a negative retrospective value of that TEO.⁹ In this example, the individual values time in a TEO where both pain *and* pleasure are experienced. But how about in a TEO where either pain *or* pleasure is experienced?

Philosophically speaking, this leads us to a more general question: *is it irrational not to consider time as being neutral?* Kahneman's normative stance about the relationship between time and rationality is in fact very similar to the one of Parfit (1984), who holds the time-neutrality thesis.¹⁰ In our example, the individual values more to play with his cat when he gets back home rather than going to work because he *desires* one action more than the other. And it is because he desires one action more than the other that he has *reason* to weight time differently. Parfit, however, disputes the Humean view, according to which rationality is only grounded on reasons to believe, and since a desire cannot be false (according to Hume), it cannot be open to rational criticism. Parfit disagrees with this, arguing that rationality is not only grounded on reasons for *believing*, but also on reasons for *acting* (p. 120). According to Parfit (1984, p. 124), for temporal biases to be considered as normatively relevant (e.g. hyperbolic discounting), one must provide *reasons* for such a behaviour:

'Someone is not irrational simply because he finds one experience more painful than another. But he may be irrational if, when he has to undergo one of these two experiences, he prefers the one that will be more painful. This person may be able to defend this preference. He may believe that he ought to suffer the worse pain as some form of penance. Or he may want to make himself tougher, better able to endure later pains. Or he may believe that by deliberately choosing now to undergo the worse of two pains, and sticking to this choice, he will be strengthening the power of his will. Or he may believe that greater suffering will bring wisdom. In these and other ways, someone's desire to suffer the worse of two pains may not be irrational.' (p. 123)

With this first point in mind, we can provide some reasons to question time neutrality in the construction of total utility, and Parfit would perfectly agree with it. In the colonoscopy experiment (discussed below) an individual may prefer, for the reasons

⁹This thought experiment implies that remembered utility has normative significance, which is the matter of discussion in Section 4.

¹⁰By rationality, I mean here 'what someone has reason to do'.

Parfit mentions (e.g. strengthening the power of one's will), to repeat the procedure which is more painful than the other, even if he actually remembers this experience to be more painful. Now the point is, what if the individual does not have reason to do so but simply has a desire for it?

Parfit answers this argument with another thought experiment of an individual who has '*future-Tuesday-indifference*' (p. 124 – his emphasis). Imagine an individual who cares in a perfectly equal manner about the pain (or pleasure) that occurs to him in the future, except on Tuesday, where he does not care at all about the pain (or pleasure) he endures by then. Keeping only one kind of hedonic state (pain), this means that 'he would choose a painful operation on the following Tuesday rather than a much less painful operation on the following Wednesday' (p. 124). Parfit argues that preferring more pain to less simply because the agony will be on Tuesday '*is no reason*' (p. 124 – his emphasis). He then extends his argument, asking what would be the difference in principle with an individual who cares equally for everything that will happen to him within a year, but once a full year has passed, discounts by half the rest of his future. That is to say, this individual would rather choose e.g. two days of pain twelve months and one day from now rather than one day of pain twelve months from now. Parfit judges this kind of psychological rule to be simply arbitrary – along with the ones which discriminate between equal pleasures or pains:

'It is irrational to care less about future pains because they will be felt either on Tuesday, or more than a year in the future.' (pp. 125-126)

With Parfit's (1984) defence of time neutrality, we can first complete Kahneman's (2000) implicit argument that shall the individual have no reason about having this kind of preference, there is no point in considering each of her moment utilities extended in time as being non-neutral. Second, if one agrees with Parfit (1984), one may need to justify this reason on something more than a belief. For example, to say that 'I prefer to give more value to the evening rather than the morning because I desire more what I do in the evening rather than what I do in the morning, even if I enjoy both equally' would be irrational according to Parfit if there is no *reason* associated with such a desire ('I simply desire so but I cannot tell you why'). Yet do we always need to provide reasons for acting rationally or not? Further assessment is perhaps worth being considered.¹¹

Another point is that discriminating between the values of different times in one period is not more demanding in terms of ethical judgements than not discriminating. It seems that Kahneman et al. (1997) and Kahneman (2000) assume time neutrality not only for practical appeal – this assumption refrains the social planner from invoking arbitrary criteria to discriminate between different times in one period – but also in order to conform to the social planner assumption in standard welfare economics, who only aims at maximising individual welfare without adding extra ethical judgements such as why individuals should weight time. Indeed, discussing why (and how) time should be weighted inevitably leads us to some philosophical assessments, as previously discussed.

I now consider the last four axioms of experienced utility measurement. The external observer (or social planner) in the normative theory of Kahneman et al. (1997) has a knowledge about the use of the scale (because he is omnipotent). His task is to make

¹¹See Parfit (1984, pp. 170-177) and Brink (2011) for an extensive discussion of time neutrality.

comparative judgements about utility profiles. Those judgements must satisfy the following axioms in order to determine an equivalent relation between the original utility scale and duration.

3.7 AXIOM 7 (Concatenation of Neutral Utility Profiles)

The global utility of a utility profile is not affected by concatenation with a neutral utility profile.

This axiom considers neutral utility profiles, defined as profiles in which instant utilities are hedonically neutral (i.e. ‘neither good nor bad’). Discussing this axiom would lead us back to Axiom 3 (*Distinctive Neutral Point*).

3.8 AXIOM 8 (Monotonicity in Instant Utility)

Increases of instant utility do not decrease the global utility of a utility profile.

(See comment below).

3.9 AXIOM 9 (Monotonicity in Total Utility)

Replacing one profile by another with a higher global utility increases the global utility of the concatenation of two utility profiles.¹²

Axioms 8 and 9 impose the requirement that a measure of instant utility should comprise all the information required for the determination of total utilities. That is to say, all the information that is needed to evaluate the goodness or badness of an episode must be incorporated in its utility profile. This means that any effect of previous or anticipated consumption on the utility of present consumption must be incorporated in the measure of instant utility. This refers to what has been said about Axiom 1 (*Inclusiveness*).

3.10 AXIOM 10 (Cardinality of Instant Utility)

The ordering of total utility of two utility profiles does not change if for both the instant utility level is increased by the same constant over an equally long period.

This last axiom is necessary for making cardinal measurement. As Kahneman et al. (1997) put it, ‘the analysis becomes simpler if cardinal measurement of instant utility can be assumed, so that differences of instant utility are meaningful’ (p. 392). Once cardinality is assumed, the social planner can rescale moment utility by its relation to duration. For example, if the social planner judges that one minute of pain at the hedonic state of -5 is equivalent with two minutes of pain at the hedonic state of -3, the social planner can rescale this original hedonic report by considering that -5 of the transformed scale is equivalent to the double of the original hedonic state of -3. The properties of the

¹²Note that Axioms 7, 8 and 9 hold under the theorem which states that there exists a non-decreasing (‘value’) transformation function of moment-utilities, assigning value 0 to 0, such that global utility orders utility profiles according to the integral of the value of moment utility over time (Kahneman et al. 1997, p. 391). For the proof of this theorem, see Kahneman et al. (1997, pp. 400-402).

original scale (Axioms 2 and 3) and the possibility of making interpersonal comparisons of utilities with cardinal measurement (Axiom 4) have already been discussed. We can now move on to the main point emphasised by Kahneman-2018 as a self-critique of the experienced utility criterion: it exclusively takes *moment utility* as its informational basis.

4 Moment Utility *versus* Remembered Utility

As previously mentioned, Kahneman is perhaps the author who contributed the most to the experienced utility research program but he said to have abandoned it because he might have failed to characterise what happiness is, in overall, about. Kahneman et al. initially considered that subjects in the experiments of Kahneman et al. (1993), Fredrickson and Kahneman (1993), Redelmeier and Kahneman (1996) and Schreiber and Kahneman (2000) made mistakes because they failed to accurately remember the moment utilities experienced during the episodes, which made them preferred the worst experience according to the logic of utility integration. Accordingly, Kahneman et al. took utility integration as a normative standard and considered failures of maximising moment utilities as *mistakes* (i.e. something that make individuals worse off).

But as Kahneman-2018 acknowledges it, the logical rule of utility integration may fail to represent individuals' overall happiness. In fact, if we think what matters is not happiness as 'living in the moment' but happiness as a durable mental state, then we may have better interest in defining happiness in terms of *remembered utility* rather than in terms of *experienced utility*. Kahneman-2018 is sympathetic with the idea that what matters is not the utility experienced at the moment (as in Benthamian utilitarianism) but the *memory* individuals have about those experienced utilities – disregarding whether they reflect the highest intensity of pleasure (or the lowest intensity of displeasure) experienced during those episodes. The idea is that, contrary to an experience which is enjoyed at the present moment, memory is a durable mental state, which stays in one's mind for a long period of time. In this sense, individuals choose their next vacation not as a *present experience* but as a *future memory*. This could explain why individuals typically like to buy souvenirs or to take pictures of their vacation. In doing so, they can enjoy their vacation not only at the moment they experience it but also for the rest of their life. This point relates to one of the objections Kahneman and Sugden (2005) early stated towards the experienced utility criterion:

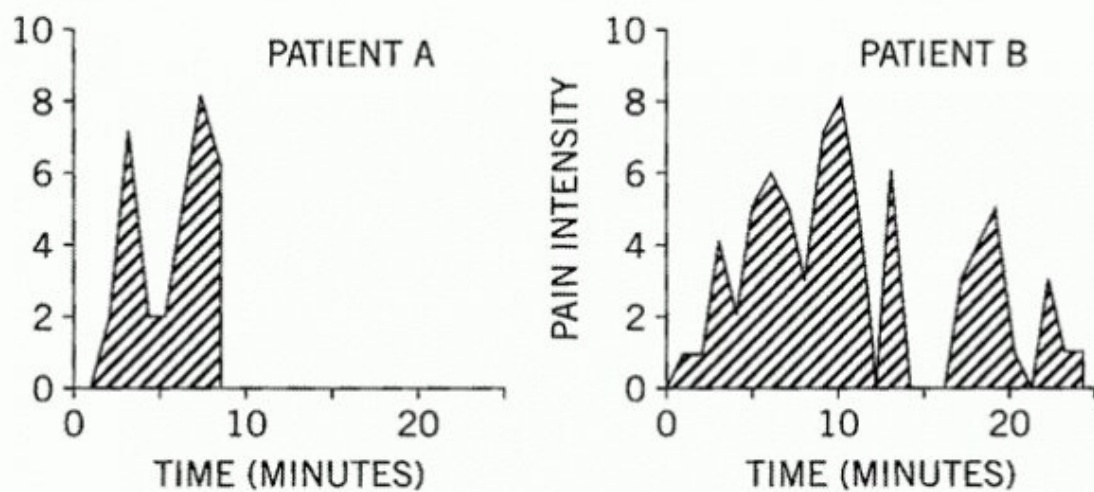
'It is possible to view life, not as a flow of pleasurable and painful experiences, but as the accumulation of a stock of good and bad memories. Because the mental representation of memory is more like a photograph album than a home movie – it is made up of discrete snapshots of "representative" moments – the life plan that maximises the integral of a person's happiness over time may not be the one that maximises the value of her accumulated stock of memories.' (p. 177)

If the logical rule of utility integration is considered to be unwarranted (given the way individuals represent the experience of their life taken as a whole), then the ethical premise of experienced utility seems no more convincing. Considering that moment utility may not have more normative value than remembered utility, what are the implications for happiness measurement?

4.1 Remembered Utility Matters

First, we may need to take *remembered* utility instead of *moment* utility as the informational basis of experienced utility measurement. That is, even if one's total utility is more painful than another – as in the cold-water experiment of Kahneman et al. (1993) or in the colonoscopy experiment of Redelmeier and Kahneman (1996)) – the second one should prevail if most subjects hold the memory that it is less painful than the first one, *even if they actually experienced more total pain during the second experiment*. As an example, consider the colonoscopy experiment.

Figure 1: Real-time recordings from two patients undergoing a colonoscopy. *Source:* Redelmeier and Kahneman (1996).



The figure above displays the intensity of pain (y -axis) recorded each minute (x -axis) by two patients undergoing a colonoscopy. The intensity of pain is measured by $\Psi = \{0, \dots, 10\}$ and the outcome X (colonoscopy) associated with time $N = \{0, \dots, 25\}$ is measured by the vector $x = \{x_1, \dots, x_{25}\}$. Patient A experienced the short procedure (8 minutes) and Patient B experienced the long procedure (24 minutes). According to peak-end rule, the total utility of the experiment with the added extra pain is remembered as less unpleasant than when no extra pain was added (specifically because this extra pain was *less unpleasant*). It is however clear that the total utility of the experiment with the extra pain is more unpleasant in terms of total utility than the short experiment.

Imagine, as in the experiment of hands submerged in cold water of Kahneman et al. (1993) that we, as social planners, have to choose for a patient C who has undergone both types of colonoscopies one of the two colonoscopy to repeat. We have two alternatives: repeat the short experiment or repeat the long experiment. If Axiom 5 (*Time Neutrality*) and Axiom 6 (*Separability*) hold, we can sum the three colonoscopy episodes in order to have two TEOs (temporally extended outcome) of the possible alternatives to evaluate: (i) the concatenation of ‘short + long + short colonoscopies’ episodes and (ii) the concatenation of ‘short + long + long colonoscopies’ episodes. Assigning a utility level of instant utility to each time point, we have the total utility profile of a TEO,

$$\sum_1^3 \int_0^N u(x_i) dx$$

In terms of *experienced utility* (or utility profiles), we have,

$$\int_0^n u(x_i) dx + \int_0^{n+m} u(x_i) dx + \int_0^n u(x_i) dx > \int_0^n u(x_i) dx + \int_0^{n+m} u(x_i) dx + \int_0^{n+m} u(x_i) dx$$

where $m \in N$ represents the extra added pain (which equals to 16 minutes in the example above). According to the logic of utility integration, the concatenation of ‘short + long + short colonoscopies’ episodes dominates the concatenation of ‘short + long + long colonoscopies’ episodes. However, in terms of *remembered utilities*, it is the concatenation of ‘short + long + long colonoscopies’ episodes which dominates the concatenation of ‘short + long + short colonoscopies’ episodes (under the assumption that the extra added pain is *less unpleasant* than the short procedure, as in the example above). That is,

$$\int_0^n u^r(x_i) dx + \int_0^{n+m} u^r(x_i) dx + \int_0^n u^r(x_i) dx < \int_0^n u^r(x_i) dx + \int_0^{n+m} u^r(x_i) dx + \int_0^{n+m} u^r(x_i) dx$$

Here $u^r(x_i)$ is the *remembered* utility of the patient at time i . The possibility of considering remembered utility as being more valuable than moment utility was, in fact, already suggested by Redelmeier and Kahneman (1996), who concluded with the following words:

‘For procedures where some pain is unavoidable, clinicians may need to decide whether it is more important to optimize patients’ experiences or memories.’ (p. 7)

In our example, patient C has a *false belief* that the total utility of ‘short + long + long colonoscopies’ is less unpleasant than the total utility of ‘short + long + short colonoscopies’. With respect to the discussion about Parfit’s (1984) reasons for acting (Section 3.6), we have two possible schools of thoughts. One would argue that any acting based on a false belief is necessarily an irrational behaviour (Kahneman et al.’s viewpoint), while the other would argue that the individual’s self-report is not irrational in the sense that his belief about having less pain in the long experiment is *true to him* (perhaps Kahneman-2018’s viewpoint). Since the aim of the experienced utility criterion is not to maximise the social planner’s well-being but the individual’s well-being, we may judge that it is preferable to give normative value to *remembered* utility because the individual’s memory is what matters *to him*.

It appears that the example above also echoes to a philosophical argument against the maximisation of instant pleasure. Consider Nozick’s (1974) ‘pleasure machine’ thought experiment, which consists in asking if we would prefer to be connected to a machine that would maximise pleasure rather than living the real life. Nozick (1974) provides three arguments why it may not be desirable to do so: (i) we want to *do* certain things, not just have the experience of doing them; (ii) (in relation to the first point), this is because we want to be a certain kind of person and not ‘an indeterminate blob floating in a tank’ (p. 43); (iii) plugging into an experience machine limits us to man-made reality,

where there is no contact with a ‘deep reality’. According to Nozick’s (1974) argument, it is then not absurd to assume that proponents of the experienced utility criterion would say that what matters is not the individual’s *true* beliefs about what he experiences, but what he *thinks he experiences*.

Shall the individual’s brain being constantly manipulated by a benevolent scientist whose purpose is to maximise the individual’s level of dopamine and to stimulate more regions in the brain where dopamine is active, it does not matter whether the individual’s beliefs about experiencing this virtual world is false. In the same way, why should the individual’s self-report in the real world not be taken as a false belief, which is, in the same logic, normatively relevant to the social planner? The point of Kahneman et al. is that maximising remembered utility cannot be normatively relevant because it is considered to be ‘biased’: it gives more weight to the peak-time and the end-time of the procedure. However, the concept of remembered utility is, after all, only a matter of interpretation of the observer. Is remembered utility not a form of moment utility, which, as the definition of moment utility holds, incorporates the information of past and anticipated feelings in its evaluation (see Appendix A, *Remark. 5*)? The integration of experienced utility can be justified if experienced utility is taken in an all-encompassing manner. If remembered utility plays a role, then one can say that it contributes to the experienced utility of all the moments at which it played a role.¹³ Ultimately, the ethical premise of a normative approach that would give importance to individuals’ remembered utility could be reformulated in terms of *negative utilitarianism* of remembered utilities: it is good to *minimise* the remembered disutility of one’s suffering.

Ethical premise (bis). *An individual’s state of affairs is better than another if it has less remembered disutility than another.* Formally, let $x = (x_1, \dots, x_n) \subseteq X$ be a realisable set of an individual’s states of affairs (e.g. a consumption bundle, health states, sips of tea, etc.) and X be the set of outcomes. I denote by $i = \{0, \dots, n\}$ the index of time for each element of the vector x . For example, x_1 is one physical pain at time 1, x_2 another physical pain at time 2, and so on. $W(x)$ is an individual welfare function of the form,

$$W(x) = \int_0^n -u^r(x_i)dx$$

where $-u^r(x_i)$ is the individual’s remembered disutility experienced at time $i = \{0, \dots, n\}$ and \int the integral of all utility profiles, which allows to have the total utility of this individual (here the total disutility of suffering). The remembered utility criterion is satisfied under the condition that,

$$W(x) \geq W(x') \implies x \succeq x'$$

4.2 Back to Decision Utility?

Second, if decision utility is mostly driven by remembered utility of a past episode – i.e. decision utility is an expression of an individual’s preference for repeating one event over another – we may simply be back to *decision utility* as the relevant welfare criterion for

¹³One may however argue that this way, experienced utility is hardly operational. Taken in this sense, a reformulation of Axiom 1 would need to consider a way to make welfare evaluation based on remembered utility. I thank Peter Wakker for this remark.

normative analysis. In fact, that decision utility diverges from experienced utility is – strictly speaking – more a theoretical assumption than an observation supported by evidence. That subjects in Kahneman et al.’s experiments can prefer addition of suffering in their decisions (rather than neutrality during a period, leading to a violation of monotonicity of experienced utility), is taken as important evidence to support the claimed difference. Yet it must be emphasised that Kahneman et al. assume their subjects to make mistakes either because of retrospective judgement about their past experience, which showed that decision utility does not maximise experienced utility, or because of failure to predict their future (or anticipated) utility. That is, they are assumed to make a mistake because of *fallible memory* and incorrect evaluation of *past experiences* or because of *wrong anticipation*. But if this observation is not at hand, we need a counterfactual: what they would have done had they been able to maximise their experienced utility. In the many situations where a counterfactual preference is required to justify the experienced utility criterion (for lack of evidence about the effect of another normative recommendation), it is actually difficult to assume that individuals’ decision utility does not reflect their own well-being.¹⁴

Some evidence disputes the common assumption that decision utility is fundamentally different than experienced utility (although we may accept the conceptual difference). Carter and McBride (2013) propose an empirical test of the similarity of shape and behaviour between the value function of prospect theory (which depicts individuals’ choice), and the experienced utility function that is theoretically assumed in the normative theory of Kahneman et al. (1997). Their empirical result can essentially be resumed as follows. Experienced utility is S-shaped (like the value function of prospect theory) when using the expectations and social comparison as the reference point, but is not always S-shaped when using past outcomes as the reference point. The result of their study leads them to suggest that decision utility and experienced utility are fundamentally related, although conceptually different.¹⁵ Another empirical test is the one of Akay et al. (2017) in their paper provokingly entitled ‘Back to Bentham, Should We?’. Comparing British households’ observed preferences with their reported subjective well-being, the authors found striking similarities on average between decision utility and experienced utility. Their empirical study concludes that a majority of individuals made decisions that are actually consistent with the maximisation of their subjective well-being.

Eventually, subjects’ self-reports that violate monotonicity may, in fact, be the ones to be considered as normatively relevant. Does Kahneman-2018’s acknowledgement about utility integration being a dubious normative standard leads to reject the fundamental ground on what Kahneman et al.’s approach is based on: that individuals who deviate from the norms of rational choice make *mistakes*?¹⁶ According to Kahneman et al. (1997, pp. 377, 395) and Kahneman (1999, p. 20), evidence showed that individuals already

¹⁴See also Kahneman et al. (1997, p. 376), who justify the intuitive appeal of differentiating the two concepts of decision utility and experienced utility with the help of a thought experiment but not an actual experiment.

¹⁵Note that Carter and McBride (2013) acknowledge that the S-shape of both decision utility and experienced utility should be understood as one of the various possible shapes observed in a heterogeneous population (p. 14).

¹⁶Note that this normative stance can be generally associated with the literature of behavioural welfare economics (Bernheim and Rangel 2007, 2009), and even more generally, with the heuristics-and-biases program (Kahneman and Tversky 1996).

have the ability to maximise the utility they store in their memory (i.e. individuals maximise their remembered utility). When this evidence is combined with Kahneman-2018's stance that remembered utility may actually be what matters, we may simply be back to *decision utility* (and thus observed choice) as a relevant welfare criterion for normative analysis.

5 Conclusion

In this article, my aim is to provide a methodological assessment of experienced utility measurement after the reconsideration of Kahneman-2018. I provide a philosophical discussion of all the axioms of experienced utility measurement formulated in Kahneman et al. (1997), discuss the importance of remembered utility (instead of moment utility) as a better indicator of objective happiness, as well as the lack of evidence which should support the theoretical assumption that decision utility and experienced utility actually diverge. This methodological assessment implies at least two directions for further research: either we should aim to refine the axiomatisation proposed by Kahneman et al. (1997), such as adding a notion of '*Time Distance*' in the *Separability Axiom*, or we may be back to decision utility as a relevant welfare criterion for normative analysis. In what follows, I suggest two implications for public policy.

First, it may be considered that the philosophical problems of experienced utility measurement presently discussed can provide policymakers reasons for endorsing alternative measures of happiness that do not aim at maximising pleasure, but which are grounded on perhaps better objective conceptions of what makes the good life. As an illustration of what those alternative measures might be, consider Kahneman-2018's distinction of two concepts of happiness: (i) the feeling of enjoyment an individual has at the moment, which is related to the experiences she has at the moment (*moment utility*), and (ii) the feeling related to social yardsticks such as achieving goals and meeting expectations, which is based on comparisons with other people (*life satisfaction*). In Kahneman-2018's terms, objective happiness seems to be rather about life satisfaction in terms of social life, i.e. the relationship with the company of others (partner, friends, family and colleagues) rather than the maximisation of pleasurable moments. Accordingly, it seems not absurd to consider that Kahneman-2018 has switched from Benthamian hedonism to Aristotelian eudaimonism. In contrast with hedonism (in Greek, *hedone* for pleasure), eudaimonism (in Greek, *eudaimonia* for happiness) does not put the satisfaction of pleasure at its central ethical principle. It instead considers a broader perspective of what makes the good life, typically friendship and the participation in civil or political life (Aristotle -350 [2009]). In other words, according to Bentham pleasure is identical with happiness (and the goal of life is to produce the greatest happiness for the greatest number), while according to Aristotle, pleasure is not identical with happiness but can be either a component, a process or a by-product of it.¹⁷

¹⁷See Nussbaum (2007) for a philosophical comparison between the ethics of Aristotle and Bentham. Nussbaum particularly studies the case of J.S. Mill, who, (according to Nussbaum) aims at combining Benthamian and Aristotelian conceptions of happiness. The thesis of Nussbaum is that 'despite Mill's unfortunate lack of clarity about how he is combining the two conceptions, he really does have a more or less coherent idea of how to combine them, giving richness of life and complexity of activity a place they do not have in Bentham, but giving pleasure and the absence of pain and depression a role that Aristotle never sufficiently maps out' (p. 172).

Second, the main issue of experienced utility measurement seems to be that utility integration invokes a conception of objective happiness that is based on an extremely *subjective* informational basis of happiness, i.e. moment utility. Recall that under Axiom 1 (Section 3.2), only hedonic states are normatively relevant. But considering Kahneman-2018's statement that what matters is life satisfaction rather than moment utility, policy-makers may want to promote measures of happiness that do not depend on individuals' subjective perception. Instead, they may want to promote 'authentic' objective features about what makes the good life such as health or friendship (as in Aristotelian terms). By 'authentic' I mean that the content of such an objective measure would not be a subjective feeling that is sensitive to strong variations among individuals. On the contrary, it would be something more stable on which individuals could perhaps consensually agree upon, e.g. the opportunity to live a life where basic human needs such as health, education and friendship are fulfilled.

The capability approach (Sen 1985; Nussbaum and Sen 1993; Nussbaum 2000) offers an interesting alternative for this direction. Capability is defined as what people are capable of achieving based on the opportunities and living conditions afforded then. In this normative approach, what makes the good life is not merely defined in terms of a subjective perception like pleasure, but in terms of essential human needs. Ten 'central human functional capabilities' are proposed by Nussbaum (2000, pp. 78-80): life; bodily health; bodily integrity; senses, imagination and thought; emotions; practical reason; affiliation; other species; play; control over one's environment. All these criteria of what makes the good life can be understood as *opportunities* to live a decent life. These criteria are potentially far more likely to reach a consensus about what makes the good life among all living populations than subjective rankings in terms of pain and pleasure. The reason is that subjective rankings in terms of pain and pleasure are likely to be more sensitive to personal/social norms and personal/social comparisons. Consequently, human capabilities have perhaps more appealing characteristics to define what *objective* happiness actually is. We may have then a slogan for those willing to take this alternative direction: 'Back to Aristotle? Explorations of objective happiness'.

A Glossary of Experienced Utility Measurement

Decision utility is the weight of a decision inferred from choice, which is in turn used to explain choice. For any given alternative, e.g. ‘drinking your tea’ or ‘reading this paper’, you have an assigned numerical value (either positive or negative) that represents your decision utility. Formally, let $X = \{x, y\}$ be the set of alternatives, where $x = (x_1, \dots, x_n)$ is the vector that corresponds to the activity of drinking your tea. For example, x_1 is ‘one sip of tea’, x_2 is ‘another sip of tea’, and so on. Let also $y = (y_1, \dots, y_n)$ be the vector that corresponds to the activity of reading this paper, e.g. y_1 is ‘reading one piece of this paper’, y_2 is ‘reading another piece of this paper’, and so on. Let $u : X \mapsto \mathbb{R}$ be a utility function. If $u(x) = 4$ then the numerical value of 4 is your decision utility of choosing x . If $u(y) = 3$, then the numerical value of 3 is your decision utility of choosing y . This numerical value has, however, no psychological meaning in terms of hedonic state.

Remark 1. Like in standard microeconomic theory, the utility function $u : X \mapsto \mathbb{R}$ is a way of assigning a number to realisable alternatives such that more preferred alternatives get assigned a larger numerical value than less preferred alternatives. But the numerical value is here only relevant to allow for an ordinal ranking of decision utilities. It does not express the *psychological intensity* of the alternative chosen – contrary to experienced utility defined below.

Experienced utility is the hedonic state experienced in doing (or choosing) something. For any given alternative, e.g. ‘drinking your tea’ or ‘reading this paper’, you have an assigned hedonic state (expressed in a numerical value), which describes your psychological intensity. Your experienced utility is high if it pleases you and low if it bothers you. Formally, let X be the set of alternatives and $u : X \mapsto \Psi$ a utility function, where $\Psi = \{-10, \dots, 10\}$ is the set of hedonic states (-10 for the less pleasant feeling, 10 for the most pleasant feeling). Assume $u(x) = 8$, then the numerical value of 8 represents the experienced utility of choosing x . If alternatives are of similar nature, e.g. ‘one sip of tea’ and ‘another sip of tea’, then cardinality applies (Axiom 4, Section 3.4). That is, let x_1 be ‘one sip of tea’ and x_2 be ‘another sip of tea’. If $u(x_1) = 6$ and $u(x_2) = -3$, it means that the first sip of tea has exactly 9 more hedonic intensity than the other sip of tea.

Moment (or instant) utility is an attribute of experience formulated into a hedonic value, which is experienced at the present moment. It is the valence (good or bad) and the intensity (mild to extreme) of current affective or hedonic experience. For example, the enjoyment (or suffering) you are having right now in reading this paper is of a given intensity, which only depends on your personal evaluation that you can report in a given scale (e.g. you really like it, like it, are being indifferent, do not like it, do not like it at all). Moment utility is measured by asking subjects to evaluate their happiness on a hedonic scale (e.g. -10 the lowest hedonic state, 10 the highest). The set of moment utility (or hedonic states) is denoted by $\Psi = \{-10, \dots, 10\}$.

Remark 2. As Kahneman et al. (1997, p. 398) put it, the set of moment utility Ψ should include the neutral value 0. This is because negative feelings should be distinguished from positive feelings and to allow for cardinal measurement of moment utility on a ratio scale (Axiom 10, Section 3.10).

An episode is a connected time interval described by its temporal coordinates. For example, from the time you started reading this paper until the time you are currently reading these words, one episode has passed. Formally, let $[B, E[\in \mathcal{N}$ be a time interval that contains all time points relevant to the analysis and let X be the set of outcomes. An episode is a function $f : [b, e[\mapsto X$, for $B \leq b$ and $e \leq E$.

Remark 3. All time intervals are assumed left-closed and right-open because the union of episodes should not include two slice times of different episodes (see below).

A temporally extended outcome (TEO) is a group of one or more temporally finite disjoint episodes. For example, from the time you started reading this paper until the time you reached the previous definition and now this other definition, *two* episodes have passed. A TEO is simply the union of two (or more) separated episodes. Formally, a TEO is a mapping from a finite disjoint union of subintervals of the time interval $[B, E[$ to the set of outcomes X . That is, $f : [b, e[\cup [b', e'[\mapsto X$ is one TEO, $f : [b, e[\cup [b', e'[\cup [b'', e''[\mapsto X$ is another TEO, and so on. We can denote the general definition of a TEO by $f : 2^{[B, E[} \mapsto X$, where $2^{[B, E[}$ is the set of all possible collections of subintervals in $[B, E[$.

A utility profile of a TEO (or simply utility profile) is a function which assigns a level of moment (or instant) utility to each time point. Informally, we can interpret it as an extensive definition of moment (or instant) utility by introducing time as an explicit variable, thus allowing moment utility to fit in any temporality (either a time slice, an episode, or a TEO). For example, the enjoyment (or suffering) you have in reading this paper (in a given intensity) can be represented at time 1, time 2, etc. Formally, a utility profile is a function $u : 2^{[B, E[} \mapsto \Psi$, with $[B, E[$ the set of slices in time.

Remark 4.1. In order to keep the standard notation ' $u(x)$ ', I however consider the summation of *experienced utility* (and not of utility profiles) to be the informational basis of total utility. This is far from absurd, since we only have to index experienced utility with time to have an equivalent notion with utility profile (although both mathematical objects are obviously different). That is, we can denote a utility profile by $u(x_i)$, where $i = \{0, \dots, n\}$ is the index of time. I judge this simplification to be useful in order to avoid entering into technical details that are not fundamentally important to the global discussion of the axiomatisation of Kahneman et al. (1997).

Remark 4.2. Kahneman et al. (1997, p. 398) precisely distinguish a *dated utility profile* from a *neutral utility profile*. The former defines the general concept of utility profile. The latter allows for a technical transformation so that some specific level of instant utility experienced at a given slice of time yields the same amount of instant utility at another slice of time, *independent of when it happens in history* (Axiom 5, Section 3.5).

Total utility is the addition of all utility profiles of an episode or TEO under the assumption that Axioms 1, 2, 5 and 6 of utility integration hold (Section 3). For example, from the time you started reading this paper until the time you are currently reading this, you had two sips of your tea. The addition of the two utility profiles 'first sip of tea' and 'second sip of tea' is described by the total utility of the time interval in which you made these two things separately. Formally, let $u(x_1)$ be one utility profile at time 1 and

$u(x_2)$ another utility profile at time 2. $W(x) = u(x_1) + u(x_2)$ represents the total utility of experiencing x_1 at time 1 and x_2 at time 2. From a welfarist point of view, total utility is nothing more than an objective function a benevolent social planner aims at maximising. With the simplified notation I propose, total utility can be denoted as $W(x) = \int_0^n u(x_i) dx$.

Remembered utility is an individual's own global retrospective evaluation of a past experience, either represented in an episode or a TEO. For example, what you previously read of this paper is a memory of a past experience. The evaluation you have about this past experience (either positive or negative) is your remembered utility of that experience. Formally, let X be the set of alternatives and $u^r : X \mapsto \Psi$ a remembered utility function, where $\Psi = \{-10, \dots, 10\}$ is the set of hedonic states. If we observe (through your self-report) that $u^r(x) = 8$, then the numeral value 8 represents the remembered utility of thinking about the past experience of x . If we observe (through your self-report) that $u^r(y) = 1$, then the numeral value 1 represents the remembered utility of thinking about the past experience of y . We can denote remembered utility by $u^r(x_i)$, where the superscript r stands for 'remembered' and where the subscript $i = \{0, \dots, n\}$ stands for the time at which the individual thinks of her past experience.

Predicted (or anticipated) utility is a belief about future experienced utility. For example, the activity you are thinking of doing after you will be done reading this paper is your predicted utility, also quantified in terms of hedonic states. Formally, the representation of predicted utility is exactly the same as remembered utility, except that since evaluation are not about *past* but *future* events, we can denote $u^p(x_i)$ for 'predicted'.

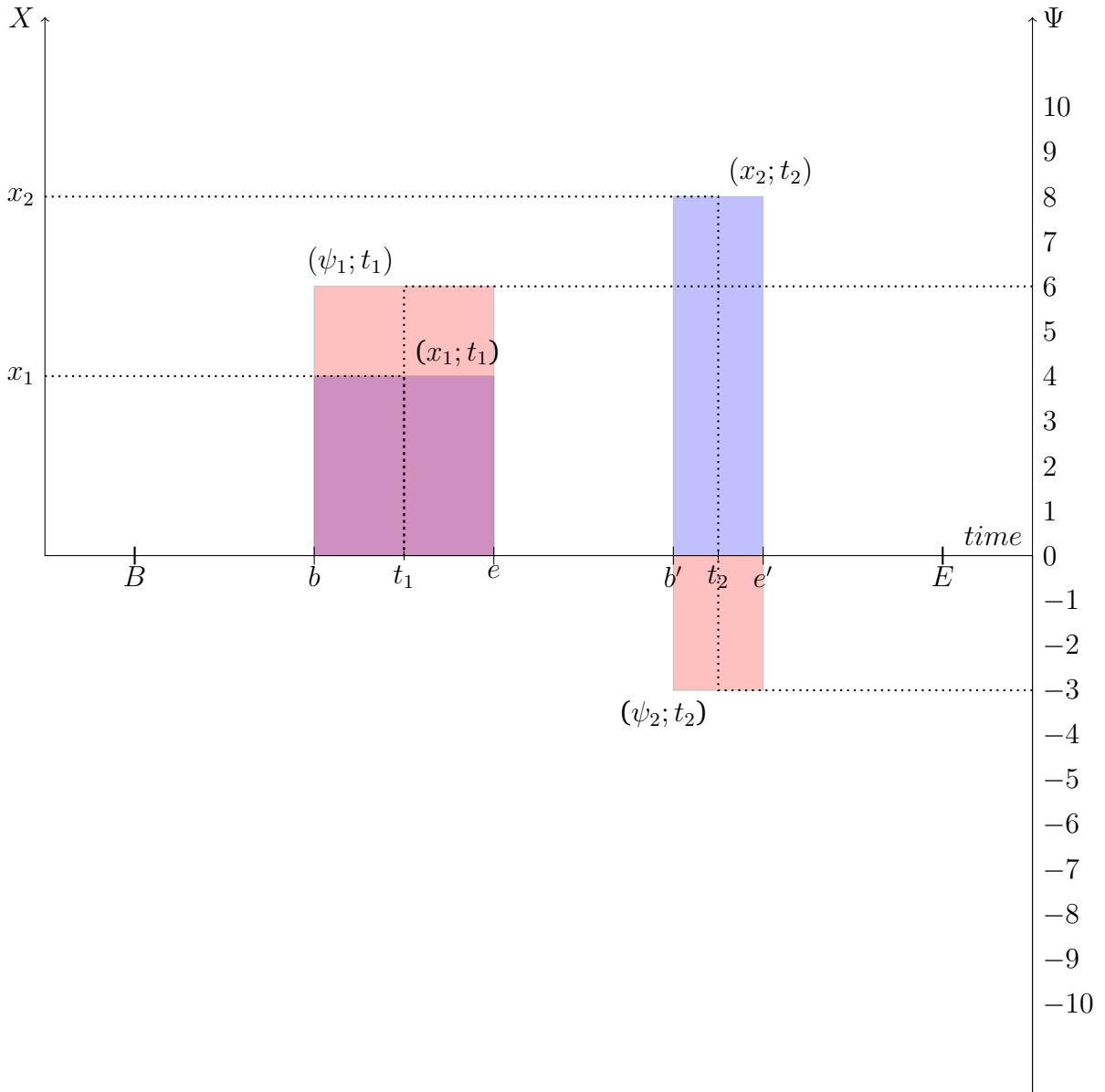
Figure 2 below provides a visual representation of the relation between time (N), outcome (X) and hedonic state (Ψ). 'Time' and 'hedonic state' are quantitative variables, while 'outcome' is a qualitative variable (which means that it does not have a numerical value).

The x -axis represents the time variable N , to which each slice of time or interval belongs to. The time interval $[B, E[$ contains all time points relevant to the analysis, e.g. the evaluation of your evening. The intervals $[b, e[$ and $[b', e'[$ contained in $[B, E[$ are two distinct episodes, e.g. $[b, e[$ represents one hour and $[b', e'[$ represents thirty minutes. The finite disjoint union of $[b, e[$ and $[b', e'[$ which maps to a set of outcome X is a TEO. Visually, it is represented by the blue area, where $\{x_1, x_2\} \in X$.

The y -axis on the left represents outcomes (a qualitative variable), where x_1 and x_2 are two outcomes, e.g. 'first sip of tea' and 'second sip of tea'.

The y -axis on the right represents the hedonic scale $\Psi = \{-10, \dots, 10\}$. The highest the value, the more enjoyable the experience is and conversely. The experience of one or several outcomes (e.g. drinking one or several sips of tea) is represented by a utility profile. A utility profile is a function $u : 2^{[B, E[} \mapsto \Psi$. In the present illustration, we have two utility profiles: $f : [b, e[\mapsto \Psi$ and $f : [b', e'[\mapsto \Psi$. Visually, a utility profile is represented by the red area, where $\{\psi_1, \psi_2\} \in \Psi$. For the sake of illustration, the outcome x_1 gives you a hedonic feeling of 6 (because the tea is warm), while the outcome x_2 gives you a hedonic feeling of -3 (because the tea is now cold).

Figure 2: Graphical representation of experienced utility measurement



On the assumption that Axiom 5 (*Separability*, Section 3.5) and Axiom 6 (*Time Neutrality*, Section 3.6) hold, we can represent the sum of two utility profiles into a total utility function of the form $f : [b, e] \cup [b', e'] \rightarrow \Psi$, or with the simplified notation I suggest, $W(x) = \int_0^n u(x_i) dx$. Since there are here only two experienced outcomes at two different slices of time, we have $W(x) = u(x_1) + u(x_2)$. The goal of the social planner is to maximise $W(x)$.

Remark 5. Again, representing total utility in terms of utility profiles would have required to write $W(n) = \int_B^E u(2^{[B, E]}) dx$. This notation is avoided for two reasons. First, and as previously said, the notation $u(x_i)$ simplifies things. That is, I simply consider that x is an element included in the two nested sets X and $[B, E]$. To make things even simpler, I use the set of time N instead of $[B, E]$, where i is the index which captures each time slice. Second, Ψ actually depends on X , as in the definition of experienced utility. But the relationship between N, X and Ψ is quite peculiar. As Kahneman et al. (1997, p. 398) put it, ‘the instant utility at a time point depends on the outcome associated with

that time point, but also on outcomes associated with other time points.’ Under Axiom 1 (*Inclusiveness*, Section 3.2), not only a moment utility includes the present hedonic feeling ψ_i of doing x_i , but also of thinking about x_{i-1} being done and of anticipating doing x_{i+1} . In other words, all the information about experienced and anticipated outcomes are already included in ψ_i . This psychological phenomenon is, however, hard to represent graphically. It cannot be represented in a three-dimensional graph because the relation between variables N , X and Ψ is not a one-to-one mapping. That is to say, one element of X at time i maps to one element of Ψ at time i , but one element of Ψ at time i maps to several elements of X at different times, e.g. $i - 1$ and $i + 1$. Mathematically, it would also require to specify the particular relation between X and Ψ . Since ψ_i not only depends on x_i but also on x_{i-1} , x_{i+1} , and so on, we should technically denote $\Psi_i = f(X_i, X_{i'}), \forall i' \in 2^{[B, E]} \neq i$.

Remark 6. The graph provides a visual representation of the theoretical discrepancy between decision utility and experienced utility. However, since the set of outcomes X is a qualitative variable, the distance between $(x_1; t_1)$ and $(\psi_1; t_1)$, and the distance between $(x_2; t_2)$ and $(\psi_2; t_2)$ are meaningless. I say ‘theoretical’ because the empirical studies of Kahneman et al. only show a discrepancy between predicted utility and experienced utility (Kahneman and Snell 1990, 1992) and between remembered utility and experienced utility (Kahneman et al. 1993; Fredrickson and Kahneman 1993; Redelmeier and Kahneman 1996; Schreiber and Kahneman 2000). But whether decision utility and experienced utility are fundamentally distinct is yet another question (see Section 4.2).

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