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M. Hudik

WHEN *X* BECOMES *X'* : SAMENESS AND THE INTERNAL CONSISTENCY OF CHOICE

When *x* Becomes *x′*: Sameness and the Internal Consistency of Choice[*]

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Abstract: The fact that any two choices are necessarily asynchronous raises the question of whether some alternative *x* at moment *t* remains the same alternative *x* at moment *t* + 1. It is argued that this question cannot be answered without taking into account the decision-maker's perception of the choice problem. Consequently, an objective description of a choice problem is impossible for each description involves an interpretation. A definition of sameness is provided and an extension of the standard choice model is suggested. The problem of the possibility of different perceptions of the decision-maker and the observer is emphasized.

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1   Introduction

Consider a decision-maker who always chooses *x* from set $A = \{x, y\}$ and *y* from set $B = \{x, y, z\}$; this sequence of choices is inconsistent with the assumption of maximizing behaviour, provided, among other things, that both elements *x* and *y* from set *A* really are the same as *x* and *y* from set *B*. But under what conditions is the sameness of the choice alternatives preserved as we move from *A* to *B*? Choice theorists have not provided a systematic answer to this question and have been relying on their intuition and proficiency in the art of modelling. Luce and Raiffa (1989) and Sen (1993) at least provide examples illustrating that the issue of alternatives description is problematic and the latter also offers a tentative classification of situations in which one has to be especially careful in the descriptions of choice alternatives; however, his conclusion that "there is no way of determining whether a choice function is consistent or not without referring to something external to choice behaviour (such as objectives, values, or norms)" (Sen 1993, 495), is too general to offer systematic guidance to a model-maker. Sen's conclusion has been explicitly or implicitly taken up by several theorists who further developed it: these include, in particular, Bernheim and Rangel (2007), Salant and Rubinstein (2008) and Rubinstein and Salant (2012), all of whom incorporate framing into the standard model of choice. Nonetheless, their approaches do not address directly the issue of sameness of choice alternatives across different choice problems as they are built on the implicit assumption that the same/different distinction is determined outside their model and is independent of the decision-maker's perception. Framing in their models then does not affect the description of alternatives but rather distorts the decision-maker's preferences.

In fact, the question of what it means when we say that two alternatives are the same has not – despite its obvious importance for choice theory – drawn much attention in economics; there is, however, a large amount of literature on categorization within philosophy and cognitive psychology (for an overview, see e.g. Murphy and Medin (1985), Vosniadou and Ortony (1989), Smith (1993), Lamberts and Shanks (1997), Rosch (1998)). Unfortunately, only rarely is the discussion related to the problems of decision-making. Viewed from the

other side, the closest decision-making literature has got to the problem of categorization are the works on similarity (e.g. Smith and Osherson 1989; Rubinstein 1998); nonetheless, these works cannot be directly applied to the problem studied in this paper as they typically assume the same/different distinction to be unproblematic: the similarity concept applies only to cases in which alternatives are, for some (unexplained) reason, understood as different. Another related branch of literature starting with Kahneman and Tversky (1981) is concerned with framing, which, although dealing with different descriptions of a choice problem, typically assumes that the choice problem is invariant to various descriptions – i.e. it is always the same no matter how described. Perhaps the most relevant work for the purpose of this paper is Bicchieri's (2005) discussion of categorizations; however, her focus lies somewhere else: she deals with the categorization of social situations in which people choose rather than with the categorization of choice alternatives.

   The aim of this paper is to fill in a gap in choice theory literature and to examine the question of when two alternatives are considered the same and when they are considered different. One of its main findings is that the same/different distinction is always subject-dependent and that the description of the choice alternatives is thus inseparable from the beliefs and goals of an individual. In this sense, the paper is in line with 'methodological subjectivism' (represented in particular by Mises (1996) and Hayek (1952)), which is characterized by the postulate that "[s]o far as human actions are concerned the things are what the people acting think they are" (Hayek 1952, 27). In fact, part of the argument of this paper is built on Hayek's works in psychology and philosophy (Hayek 1987; 1990).

   This paper is organized as follows. Section 2 discusses problems with the same/different distinction and proposes a definition of sameness based on the Hayekian model of mind as an apparatus of classification; Section 3 suggests a simple extension of the standard choice model and supplies several examples thereof; Section 4 presents a brief discussion and concludes the paper.

2   A definition of sameness

2.1 Problems with defining sameness

I start with the following tentative definition of sameness: let each choice alternative (e.g. consumption good) be a vector of its objective characteristics (such as colour, size, shape etc.); any two alternatives are the same when they are equal in all their characteristics.

Several objections can be raised against this definition: first, human beings presumably do not have access to all characteristic of choice alternatives: they are only able to perceive some of them with their senses and register several others thanks to devices they were able to construct (Chomsky 1995); second, no two alternatives are the same under our tentative definition, as they always differ at least in their spatiotemporal characteristic; and third, there are factors influencing the same/different distinction which can hardly be regarded as 'characteristics' of an object. To see this, consider two identical paintings; one of them is believed to be genuine, while the other counterfeit; based on these beliefs (whether true or not), they will have to be treated as different choice alternatives in most decision problems. These objections imply that the definition of sameness cannot be based on the objective characteristics of things; it has to take into account the decision-maker's perception.

Our first tentative definition thus fails and an alternative must be looked for. A convenient starting point seems to be the insight that people always compare mental representations of things and not things themselves (Medin and Ortony 1989). In addition, let us accept as a fact that people believe (irrespective of whether such a belief is justifiable or not) that things have 'essences', i.e. some invariable characteristic or set of characteristics that are perhaps unknown. To use a term advanced by Medin and Ortony (1989), people are 'psychological essentialists'. To give an example, people believe that the lamp on their desk will remain the same lamp after an hour passes; it will also remain the same if they move it somewhere else or even change a light bulb. Can 'psychological essentialism' be the basis for the definition of sameness?

Although 'psychological essentialism' is a plausible hypothesis, it does not help to answer the question: "When are two alternatives considered as the same by the decision-maker?" The reasons are as follows: first, 'psychological essentialism' does not provide a workable definition of sameness. Second, even if true, 'psychological essentialism' is irrelevant for decision making according to the following two arguments: (i) a cube of butter one day before the expiry date and one day after the expiry date may be thought to be 'essentially' the same cube of butter, yet a decision-maker will probably treat the two as different things. To put it in

Aristotelian terms, as far as decision making is concerned, 'accidents' matter. The second argument (originating with Sen (1993)) suggests that the context matters as well: (ii) an apple in a basket on a dinner table will be perceived (without changing its 'essence') differently if there are other apples in the basket or if it is the only one.

In the next section I first introduce assumptions about the mind as a classificatory apparatus and then I suggest a definition of sameness which evades the above-mentioned problems.

2.2 A Model of the Mind and the Definition of Sameness

In dealing with the same/different distinction I adopt the 'primacy of the abstract' hypothesis, advanced by Hayek (1987; 1990). According to this hypothesis "all the conscious experience that we regard as relatively concrete and primary, in particular all sensations, perceptions and images, are the product of a superimposition of many 'classifications'" (Hayek 1990, 36).[3] My approach avoids naïve realism or inductivism: together with Hayek, I do not assume that there exists 'raw experience' consisting of concrete events which are only afterwards categorized into an abstract classification structure; on the contrary: it is assumed that the mind possesses abstract categories (forms) which make the experience of the concrete possible.

Formally, we may think of categories as sets C_i, $i = 1, \ldots, k$. For the sake of simplicity, categories are assumed to be independent, i.e. hierarchical and other relationships between categories (such as, for instance, $C_s \subset C_u$ or $C_u \cap C_v = \varnothing$) are ignored. Although the number of categories is finite, it does not mean that this number is fixed: people constantly engage in

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[3] Apart from the references that Hayek himself provides in support of his primacy of the abstract hypothesis, it may be pointed out that this hypothesis is principally in line with Treisman-Gelade's 'feature integration theory' (Treisman and Gelade 1980) and also with experimental (although as yet inconclusive) evidence which suggests that abstract relationships are mastered already by three-year old children (Bovet, Vauclair, and Blaye 2005), chimpanzees (Oden, et al. 1988), baboons (Bovet and Vauclair 2001; Vauclair and Fagot 1996), rhesus monkeys (Katz, Wright, and Bachevalier 2002), pigeons (Santiago and Wright 1984; Holmes 1979; Zentall and Hogan 1978) and even honey bees (Giurfa et al. 2001). For an overview see e.g. Hernnstein (1990) and Thomson and Oden (2000).

the processes of reclassifying and creating new categories.[4] As far as the character of categories is concerned, it may be pragmatic ('edible', 'dangerous', 'weapon', etc.), normative ('just', 'right', 'beautiful', etc.), cultural ('money', 'gift', 'award', etc.) or ontological ('mammal', 'metal', 'white', etc.).[5]

A concrete choice alternative (or, in general, event) x is then an intersection of some of these categories (and perhaps also of complements of others, as the information that a certain category does not apply may be important for determining what an event is). For instance, if the brain possessed only two distinct categories, say 'white' (C_1) and 'round' (C_2), it would be able to distinguish at most among four different events: 'white and round' ($C_1 \cap C_2$), 'non-white and round' ($C_1' \cap C_2$), 'white and non-round' ($C_1 \cap C_2'$), and 'non-white and non-round' ($C_1' \cap C_2'$). It is not assumed that this process of classification is necessarily conscious (Hayek (1990) talks about a 'super-conscious' process) or that an individual is always aware of the fact that a certain event belongs to a certain category (cf. Treisman and Gelade 1980; Greenwald and Banaji 1995).

One way to think about the classification process in which the mind is engaged is to treat it as a question-asking procedure, consisting of the following k questions: "Does a category C_i apply?" (e.g. "Is it white?", "Is it round?", "Is it moral?", etc.).[6] These questions can be answered "Yes", "No" or "No answer". This question-asking procedure will bring us to something like the characteristics approach adopted in the first tentative definition, since x can now be defined as a k-dimensional vector $(c_1,...,c_k)$, where $c_i \in \{\text{Yes, No, No answer}\}$ is the answer to the question about the applicability of the category C_i. The similarity becomes even closer if we replace the questions "Is it white?", "Is it round?", etc. with the questions "What

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[4] Quine (1969) talks about revisions of 'natural kinds' and the creation of 'theoretical kinds'; likewise, Hayek (1952) describes the task of natural sciences as the revision of pragmatic concepts that people naturally use to guide their actions.

[5] Cf. Engliš (1930), who distinguishes among only three different 'orders of thought': teleological, normological and ontological (causal). These 'orders of thought' involve not only categories but also relationships among them. For a contemporary elaboration of Engliš's theory of orders of thought, see Pavlík (2005; 2006).

[6] This view has been familiar at least since Kant, who famously wrote that reason must "compel nature to answer its questions".

colour does it have?", "What shape does it have?", etc. There is, however, an important difference in interpretation between the category membership approach and the characteristic approach: in the category membership approach we do not deal with the objective characteristics of an object but rather its *perceived* characteristics, as we deal not with the object itself but rather with its mental representation.

Keeping this in mind, we may finally proceed to the definition of sameness. Let X be a set of all alternatives and let each alternative $x \in X \subset \mathbb{R}^n$ be a row vector of perceived characteristics (or category memberships). Sameness cannot be defined as the equality of these perceived characteristics because one of the objections raised earlier could be, mutatis mutandis, raised again: the perceived spatiotemporal characteristic of two choice alternatives is never the same.

To deal with this objection I will define sameness as the equality of the perceived characteristics (or category memberships) to which the decision-maker pays attention. For this purpose I define an $n \times n$ diagonal matrix R (*attention matrix*), where, for all $i = 1,\ldots, n$, $r_{ii} = 1$ if the i-th category is taken into account by the decision-maker and $r_{ii} = 0$ if it is not. This way of modelling attention is formally similar to the standard approach (e.g. Fehr and Rangel 2011). An important difference, however, is that, in these standard models, attention is modelled as a vector of weights attached to various characteristics, which blurs the distinction between the perception of the choice problem on one hand and the decision procedure on the other. The approach adopted here is capable of distinguishing the two. I now formally define the sameness of two alternatives for a decision-maker as follows.

(S) ***Sameness***. *Any two alternatives $x', x'' \in X$ are the same for an individual, iff $x'R = x''R$*

Note that that the concept of sameness replaces the concept of indifference: indeed, the following two statements are identical: "I consider x' and x'' the same" (therefore, they are both either x' or x'') and "I am indifferent between x' and x''." To be indifferent means to see two alternatives as the same even though these two alternatives can be seen as different in some other context or by the observer. The implication of the identity between sameness and indifference is that the preference relation underlying a choice must therefore always be strict

since indifference is already contained in the very description of the choice alternatives (Hudík 2011).

In the next section it will be shown how the above definition of sameness modifies the standard model of choice; several examples of the modified model are provided.

3   A model of choice and examples

The standard approach defines a choice problem as a non-empty subset of the set of all alternatives. My approach enriches this model in two ways: first, it treats choice alternatives as bundles of perceived characteristics (or category memberships); second, it explicitly models attention with the attention matrix. More formally, in my approach a choice problem consists of $D \subseteq X$ and R; each alternative of the choice problem is given by xR. A choice function c assigns one element of D to every pair (D, R).

I now provide an interpretation of several familiar examples within the framework of the (D, R) model.

Example 1. Consider an increase in price for a certain good, x, which changes the budget set from D' to D''; x may be considered by a consumer as a different good in D' and D'' (say, x' and x'', respectively), if the increase in price signals quality to the consumer or if it enhances snob appeal (Scitovszky 1944; Alcaly and Klevorick 1970; Pollak 1977). Alternatively, the higher price may involve a number which is for some reason symbolic.[7]

Let x_p stand for the 'price characteristic' of x and set $x_p' \neq x_p''$ and $r_{pp} = 1$. x will then be considered by the decision-maker as a different good in D' and D''.

Example 2. The epistemic value of the menu (Sen 1993; Luce and Raiffa 1989): A patient chooses to buy services from Physician 1 rather than from Physician 2, but may reverse her choice if she learns that Physician 1 also offers homeopathic treatment.

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[7] For example, in China the number "four" is considered unlucky (because the word "si" meaning "four" is phonetically similar to the word meaning "death"), and some Chinese are reluctant to trade at prices involving this number.

Let the perceived quality, x_q, taking on values either high (h) or low (l), be one of the characteristics taken into account by the patient; let $p(h_1)$ be the prior probability that the quality of Physician 1 is h, and let $p(h_1|s)$ be the updated probability after receiving the signal s that Physician 1 is also a homeopath; the inequality $p(h_1) > p(h_1|s)$ makes treatments by Physician 1-non-homeopath and Physician 1-homeopath, respectively, different alternatives and, together with the assumption $r_{qq} = 1$, rationalizes the choice.

Example 3. Positional choice (Sen 1993). A person at a dinner table takes an apple when the basket contains at least two apples but refrains from taking an apple when the apple is the only remaining one in the basket.

Let x_a be a characteristic representing the social appropriateness of x, i.e. of the extent to which the choice of x is in line with the prevailing social norms. If the norm is "never take the last piece", then the last apple in the basket (x') differs in its appropriateness characteristic from an apple in the basket with two or more apples (x''); if $r_{aa} = 1$, then the decision-maker considers x' and x'' as different alternatives.

Example 4. Status quo bias (Samuelson and Zeckhauser 1988; Masatlioglu and Ok 2005).

Let each alternative x of a choice problem have two perceived characteristics (x_d, x_{-d}), where x_d is equal to 1 if x is the default alternative and where it is equal to 0 otherwise; x_{-d} is the composite characteristic representing all characteristics except for defaultness. There is a status quo bias if $r_{dd} = 1$, and for some x' and x'' we have $c(\{(0, x'_{-d}), (0, x''_{-d})\}) = (0, x'_{-d})$ and $c(\{(0, x'_{-d}), (1, x''_{-d})\}) = (1, x''_{-d})$.

Example 5. Intransitivity of indifference (Georgescu-Roegen 1936; Armstrong 1939; Luce 1956; Fishburn 1970; Aleskerov, Bouyssou, and Monjardet 2007). A person is indifferent between 100g and 101g of sugar and between 101g and 102g but he prefers 102g to 100g.

Let x_s be a perceived size of an object. Within the (D, R) approach, the choice between 100g and 101g (or 101g and 102g) is a choice from the set $\{x', x'\}$ because the decision-maker places the two objects in the same size category and hence $x'_s = x'_s$; the fact that the observer sees the problem as $\{x', x''\}$ is irrelevant.

Example 6. *Ownership effect (Plott and Zeiler 2007; Morewedge et al. 2009). An agent prefers a chocolate bar to a mug when neither of them is in his ownership, but prefers the mug to the chocolate bar when he owns the mug and the chocolate bar remains unowned.*

Let x_o be one of the perceived characteristics of an object equal either to 1 when the object is owned or 0 if it is not. Let x_{-o} be the composite characteristic representing all characteristics except for ownership. Let x' denote the chocolate bar and x'' the mug. Given that $r_{oo} = 1$, we have $c(\{(0, x'_{-o}), (0, x''_{-o})\}) = (0, x'_{-o})$ and $c(\{(1, x''_{-o}), (0, x'_{-o}), (1, x''_{-o})\}) = (1, x''_{-o})$.[8]

4   Discussion and conclusion

The (D, R) model introduced in this paper is formally a special case of the 'extended choice problem' of Salant and Rubinstein (2008) and the 'generalized choice situation' in the sense of Bernheim and Rangel (2007). Nonetheless, there is an important difference best illustrated with an example: assume an observer who only sees the decision-maker's choices without any additional information. Assume further that x is always observed to be chosen from $D_1 = \{x, y\}$ and y is always observed to be chosen from $D_2 = \{x, y, z\}$; if the observer does not take into account that what appears the same to him does not have to appear the same to the decision-maker (as is the case in the above-mentioned models), he is led to the conclusion that this sequence of choices is inconsistent with the maximization of a preference scale. My approach, by contrast, allows for an additional interpretation: this observation might suggest that the observer's description of choice alternatives differs from that of the decision-maker. For instance, the observer may pay attention to different categories than the decision-maker: he may see the choice problem as (D_i, R'), while the decision-maker sees it as (D_i, R''), where $i = 1, 2$ and $R' \neq R''$. Alternatively, although paying attention to the same categories, the observer may categorize the choice alternatives differently, i.e. he may see the problem as (D'_i, R'), while the decision-maker sees it as (D'_i, R'_i). Without any information about the decision-maker's plans, beliefs, desires etc., the observer uses his own description of the

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[8] This formalization is in line with Plott and Zeiler's (2007, 1453) claim, according to which the ownership effect theories "describe owner-ship as being associated with phenomena that transform the features of goods so that the good to be given up is not the same as the good that was acquired."

choice alternatives, which may differ from the decision-maker's description.[9] The observed data are thus always insufficient to reject the maximization hypothesis, and seemingly non-maximizing behaviour may be a result of a different (and sometimes perhaps innovative) perception of the choice problem on the side of the decision-maker (McKenzie 2003).

Just like the standard choice model, the (D, R) model does not provide an explanation but rather a description of choice. The interesting question not discussed in this paper is whether there is a predictable pattern in shifts of categorization (e.g. morality/immorality of selling organs) and attention, respectively. At least as far as the latter is concerned, literature is already available (e.g. Fischer et al. 1999; Carmon and Ariely 2000).

Another important question that has not been addressed in the paper is: "How is it ever possible that descriptions of different people are the same, given that choice alternatives are mental rather than real objects?" A substantial part of the answer is that people share most of the categories – one may talk about 'human universals' (Brown 1991) or a common structure of the human mind (Mises 1996; Hayek 1952). However, two caveats are in place here: first, some categories are shared only within certain groups (e.g. it takes an entomologist to distinguish between similar species of butterfly); second, the same categories can be applied in different situations by different people (e.g. two people, although both endowed with the concept of justice, may differ in classifying a certain course of action as just or unjust). It follows that although the common structure of the human mind makes the actions of other people intelligible to us most of the time, there is no guarantee that we can establish the particular classification that the decision-maker applies in each individual case. Nonetheless, further elaboration on this complex issue would lead us too far from the main question of this paper and must, therefore, be left for some other occasion.

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[9] Taking this into account, the (D, R) model is also relevant to the vast literature stressing the possibility of a difference between the observer's and decision-maker's perception (for an overview see e. g. Stanovich and West (2000)).

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