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▶ **To cite this version:**

André Lapidus. David Hume and Rationality in Decision-Making: A Case Study on the Economic Reading of a Philosopher. R. Ege and H. Igersheim (eds), The Individual and the Other in Economic Thought, 2019. hal-01831901

HAL Id: hal-01831901
https://paris1.hal.science/hal-01831901

Submitted on 6 Jul 2018

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DAVID HUME AND RATIONALITY IN DECISION-MAKING: A CASE STUDY ON THE ECONOMIC READING OF A PHILOSOPHER

André Lapidus*

Chapter 16 of R. Ege and H. Igersheim (eds), *The Individual and the Other in Economic Thought*, London: Routledge, 2018, pp. 270-90.

Abstract

This paper shows that Hume's theory of passion, such as elaborated mainly in book II of the *Treatise of Human Nature* (1739-40) and in the *Dissertation on the Passions* (1757), gives rise to a conception of the decision process which challenges the canonical approach to the rationality of decision, as rationality of preferences or rationality of choice. It shows that when adopting a Humean perspective, rationality is not embodied as consistency requirements of individual behaviour, but may emerge as a possible outcome of some dispositions of our mind, which make the world inhabited by our emotions.

Keywords: Hume, economic philosophy, rationality, decision, passion, emotion, desire, preference, will, choice.

JEL classification: B11, B31, B41, D01.

1 Introduction

This paper is an unintentional product of an interrogation on the reasons why, as economists, we burden ourselves with the reading of past philosophers, whereas we already have a hard job in dealing with acknowledged economists of the past. The question might seem a bit rude and, for most of us, answering it would be superfluous: as economists, we do not need to answer it to go on working on philosophers. Rude though, this question is raised hereafter concerning the works of David Hume, as a special case study. It gave rise to four typical answers, which have in common to investigate alternative ways of borrowing something from a philosopher – here, from Hume. Something that we can use as economists:

1. A transposition of a way of reasoning, which had historically made sense for economists – and sometimes, still makes sense.
2. A direct contribution to economic ideas of his time.
3. An influence on acknowledged economists.
4. A challenge to contemporary economics.

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Obviously, these four issues refer to possible approaches of the works of philosophers like Hume. Recalling their content should help emphasizing the last of them, which is retained in the following of the paper.

1. *A transposition of a way of reasoning*. The first issue echoes Karl Pribram's understanding of the history of economic reasoning, as applications of principles of reasoning elaborated elsewhere, namely in philosophy (Pribram 1983). This led him to stress the use of a nominalist method of reasoning, or of associationism, in Hume's criticism of Baconian economics (using Pribram's words) and in his contribution to the rise of utilitarianism. In the same way, Hume's careful attention to practical matters concerning economic life, his interest in the figure of the merchant, as emphasized, for instance, by M. Schabas and C. Wennerlind (2011), can be viewed as an effect of an empiricist approach to economic matters.

2. *A direct contribution to economic ideas of their time*. The second issue echoes J.A. Schumpeter's position, when he claimed that "[Hume's] economics has nothing whatever to do with either his psychology or his philosophy" (Schumpeter 1954: 474n.). This means that we would not be misleading when arguing that although a philosopher, we have good reasons to move away from Hume's *Treatise of Human Nature* (1739-40) and consider Hume to be an economist, when he deals, in some of the short texts introduced in his *Political Discourses* since 1752 onwards to be finally published as parts of the *Essays Political, Moral, and Literary* (1777), with such questions as interest, public expenditure, money, and the balance of payment. It is in this way, for instance, that J.A. Frenkel and H.G. Johnson (1976) drew on Hume's price-specie flow mechanism in order to introduce historically the monetary approach to the balance of payments, or that M. Friedman (1987) opened his review article on the quantity theory of money.

3. *An influence on economists*. Typical of this issue is the attention paid to, say, the respective influence of Hegel and Kant on Marx and Walras. Such influence might be either complex, like in the case of Marx, when considering the transformations of the Hegelian concept of alienation into the Marxian concept of exploitation, or limited to a mere transposition, like for Walras who, drawing on a popularized knowledge of Kant, uses the distinction between phenomenon and noumenon in order to view exchange as a natural fact which constitutes the object of pure economics. Obviously, this issue is also involved in the discussion of Hume's influence on Adam Smith when, for instance, looking for the roots of the latter's moral philosophy or philosophy of knowledge, we are induced to go back from Smith's *Theory of Moral Sentiments* (1759) to books II or III of Hume's *Treatise* (1739-40), to his second *Enquiry* (1751) and to the *Dissertation* (1757), or (with fewer textual evidence) from Smith's *History of Astronomy* to Hume's book I of the *Treatise* and to his first *Enquiry* (1748). Notably, such perspective focuses on a philosopher's work only insofar as it sheds special light on the work of the possibly influenced economist, which constitutes the determining stake.

4. *A challenge to contemporary economics*. The question is no more this of knowing how a philosopher – again, David Hume – did contribute to the shaping of the economic knowledge of his time, but how he might contribute to the shaping of the economic knowledge of our time. This means that when Hume writes as a philosopher, explicitly on those questions which Schumpeter, in the above quoted passage, regarded as irrelevant from an economic point of view, he challenges what we know in economics, analytically and methodologically. This claim was at least indirectly supported by such authors like Ken Binmore through the specific part he granted to David Hume in the history of ideas. Since the 1980's, he tried to explain that various passages from the *Treatise on Human Nature*, book III, like the one about the "[t]wo men, who pull the oars of a boat, [and] do it by an agreement or convention, though they have never given promises to one another" (Hume 1739-40: 3.2.2.10[1]; see also 3.2.5.9. The same ideas are repeated, more than ten years later, in the second *Enquiry*; see Hume 1751: App. 3.8.) provide a solution to some well-known difficulties in game theory concerning such topics like the selection of an equilibrium, or the implementation of a sustainable cooperation as equilibrium in repeated games (see Binmore 1994: 27-34; 2005: 4). Whatever our doubts about the question of knowing whether Hume did, or did not, have a firm enough intuition of a line of answers to these difficulties, I'd like to focus on the fact that Binmore's argument rests on the idea that Hume considered differently the relation between the self and the other, and that he aimed at investigating the consequences of such difference upon the interaction between individuals. From a methodological viewpoint, this paper might be considered in line with Binmore's approach to Hume. But analytically, it focuses not on interactions between individuals, but on decision-making in relation to rationality. Relying chiefly on books I and II of Hume's *Treatise*, it will be shown that he induces us to view rationality of both preferences and choices not as embedded in the axiomatic basis of decision-making, but as a possible outcome of a decision process.

This will lead to proceed in the following way. The first step consists in recalling the characteristics of what can be regarded as a canonical understanding of rationality in decision-making – *i.e.*, rationality of preferences and rationality of choice (section 2). This allows, in a second time, to assess the type of modifications of this canonical view, which comes along with a Humean approach of decision-making, as modifications regarding the premises and properties of preferences and choice, giving birth to rationality as a possible outcome (section 3). Keeping this objective in mind explains that in the following, emphasis is laid on the consequences of a specific reading of Hume, rather than on the way such consequences are obtained (see, on this issue Diaye and Lapidus 2005a). The conclusion (section 4) allows showing the precise scope of Hume's challenge to the canonical theory of decision – a

[1] Reference to Hume's works published by Oxford University Press are given according to the divisions of the edition: for the *Treatise*, book, part, section and paragraph numbers; for the *Abstract*, paragraph numbers; and for the two *Enquiries*, section and paragraph numbers.

challenge which regards the way we address the issue as economists, and our philosophical implicit assumptions.

2 A canonical approach: rationality assumed

The canonical way of considering rationality in the simplest framework of decision (that is, leaving aside time, risk or uncertainty) follows a representation of the tastes of a decision-maker through a *preference relation* and a *choice function* which respectively satisfy some meaningful properties. The preference oriented side is now quite common, and rests on comparisons within pairs of alternatives, whereas the choice function side is a bit less familiar, and amounts to the selection of one or some alternatives among subsets of the set of choices. Preference and choice might be viewed as either simultaneous or mutually exclusive primitives in the canonical approach. But in each case, the relations between the conditions of rationality of preferences and of choice (comparatively, the second might be viewed as the looser) constitutes a crucial issue.

2.1 Rational preferences

The preference side of the canonical representation was introduced in economic literature through successive attempts to identify the axiomatic basis which allows a binary relation of preference to be represented by a utility function – what G. Debreu achieved in 1954. Such was the case for R. Frisch (1926; 1933), F. Alt (1936), and H. Wold (1943). Though N. Georgescu-Roegen (1954: 119) traced back to Frisch's first published paper what he called the 'modern' (*i.e.* post-Paretian) approach to choice, as distinct from preferences, he seems to have been more interested in the expression of preferences and of their relative intensity in order to build a function of utility. Frisch gave them the presumably first axiomatisation (see Bjerkholt and Dupont-Kieffer 2007, and Dupont-Kieffer 2013: 27-35), consisting in completeness (Frisch's "axiome de choix"), transitivity ("axiome de coordination"), and in an axiom on the effect of infinitesimal variations ("axiome d'addition"). This allowed him to accomplish what he called "le rêve de Jevons" (the dream of Jevons) (Frisch 1926: 79), that is, presenting a formal statement of the representation of preferences and of their intensities by a utility (cardinal) function. Yet, the influence of Frisch's paper, written in French in 1923 during a stay in Paris and published in a Norwegian journal, was rather poor. Although more available to the scientific community at the end of the 1950's thanks to its republishing in *Metroeconomica* (1957), it was not translated into English before 1971, together with the translation from German of the paper of his continuator Franz Alt (1936)[2]. Frisch seems to

[2] Alt's paper in 1936 was directed against Oskar Lange's contribution from 1934, in which the latter established a link between what was to be later known as "cardinal utility" (the "determinateness" of the utility function, in the words of O. Lange), and the ranking of differences between allocations. The last paragraphs of Alt's paper, where he discussed solutions from his predecessors, shows that he was familiar with Frisch's works, especially with his book from 1932 (where his previous axiomatic approach was only briefly recalled at the very beginning of the book; Frisch 1932: 2-3), but also with "some short articles by the same author" (*einige*

have revisited this topic only once, again in Paris, for the Poincaré Lectures he gave in 1933 – that is, for an audience mostly composed with mathematicians or physicists, not with economists – where he proposed an extension of the axiomatic basis from 1926. Again, these lectures weren't translated into English before their recent publication by O. Bjerkholt and A. Dupont-Kieffer in 2009. The second of the three-parts study that H. Wold devoted to the theory of demand in 1943-44 also contained an axiomatisation of preferences which consisted in completeness, transitivity, monotony, continuity and some other axioms, with the objective of building a utility function which represents preferences (Wold 1943). Since its recognition by Debreu as "the only rigorous one" in the topic (Debreu 1954: 159), Wold's paper is today widely acknowledged for providing a proof of a representation theorem. Nonetheless, though written in English, it was published in a Scandinavian actuarial journal and its immediate influence, again, seems to have been limited.

Two decades separate Frisch's first attempt and the more familiar representations of, now, both preferences and choice by K. Arrow. Concerning the preference side, Arrow seems to have been quasi-ignorant of his above mentioned predecessors, with (like for Debreu) the exception of Wold's contribution, which he discovered when returning to Columbia after World War II. He rendered justice to Wold's 1943 paper on the occasion of an interview published in *Social Choice and Welfare* (Kelly 1987: 46). However, his concern with preference as a binary relation which could be a substitute for utility was far more anterior. It can be traced back to his undergraduate studies. K. Arrow attended the lectures given by Alfred Tarski in 1940, at the department of philosophy of City College of New-York, and became the proofreader of Olaf Helmer's translation into English of his *Introduction to Logic* (Kelly 1987: 44). So that, as Arrow put it, "whenever I saw a U for a utility function I translated to a preference ordering" (Kelly 1987: 46). The consequence was a most impressive Rand Corporation's working paper (Arrow 1948), presented at the December 1948 meeting of the Econometric Society in Cleveland: this paper introduced not only a first exposition of the impossibility theorem, but also the main ideas of the canonical approach to decision making (Arrow 1948: 3-9) – a binary relation of preference with the properties of a complete preorder, and a choice function which satisfies consistency requirements, like already in the revealed preference approach pioneered by P.A. Samuelson in 1938. It therefore announced Arrow's following works: his article (Arrow 1950: 331-3) and his book (Arrow 1951: 11-7) on social choice and, some years later, his article on individual choice and preferences (Arrow 1959).

Rationality of preferences fits Arrow's early statement of the preference relation as a complete preorder[3]. It first depends on a double premise, this of the definition of the set of

kürzere Artikel desselben Verfassers) (Alt 1936: 167). On Alt's contribution, see T. Ellingsen 1994 (pp. 121-2) and I. Moscati 2013 (pp. 925-7).

3 A "weak ordering", in the terminology of Arrow 1948: 4; 1959: 122.

objects to which preferences are applied (the set of reference of choice), and after that, this of the relation of preference itself, expressed by a binary relation over the set of reference of choice:

X (set of reference of choice) [1]

$R \subseteq X^2$ (relation of preference) [2]

According to [2], preference of x on y is noted $(x, y) \in R$. The alternative and more commonly used notation is xRy, which reads "x is preferred to y" (which does not exclude the possibility that yRx, in which case x and y are said "indifferent"). In the canonical approach, the double premise [1] and [2] characterizes an individual, from a decision theory point of view. It concerns this part of the external world, pre-existing to him or to her, potentially subjected to his or her tastes, and these tastes, embodied in a given structure of preference[4] At this point, nothing has been said about the properties of the preference relation, except that it exists, at least for some, if not all, x and y belonging to X.

Rationality comes along with the two following properties of the relation of preference, which make it a complete preorder and constitute the well-known axiomatic basis of the standard theory of consumer behaviour:

$\forall x, y \in X, (x, y) \in R$ or $(y, x) \in R$ (completeness) [3]

$\forall x, y, z \in X, (x, y) \in R$ and $(y, z) \in R \Rightarrow (x, z) \in R$ (transitivity) [4]

Our preferences are said to be "rational" when R is a complete preorder, that is, when they satisfy [3] and [4]. Both completeness and transitivity provide possible and not exclusive interpretations for rationality. On the one hand, completeness [3] refers to some kind of cognitive ability, in the sense where the comparability between any elements of X is independent of its dimension. This seems rather demanding, since it dismisses any answer of the kind: "Well, I really don't know. If I were indifferent, it would mean that I could toss a coin to decide. But here, it's not that I don't mind having x or y. I really don't know how to compare x and y. I just can't answer…"[5]. Lack of completeness thus appears less as non-

[4] Though intuitive, the idea that X in [1] and in [2], as support of the preference relation, is typically constituted by goods or services, like in ordinary consumer theory, is not that obvious: underlying the notion of value function in D. Kahneman and A. Tversky (1979) for instance, and more generally in reference-dependent models, preferences are not defined on a state, figured by goods and services, but on a difference to a state of references, that is, on gains and losses. There is, of course, no objection to the representation of gains and losses by X.

[5] In a paper rather critical on the rationality assumptions concerning preferences, H. Putnam (1996) illustrated the case of incomparability with the example of an individual, called Theresa, who is torn between an "ascetic" (y) and a "sensual" way of life but, in case she chooses the sensual way of life, who prefers as a lover x to z.

rationality than as a limitation to rationality, as what H. Simon called "bounded rationality" – which amounts to regard "mind as the scarce resource" (Simon 1978: 9). On the other hand, transitivity [4] refers to a consistency requirement, at least when strict preferences are at issue. When such is not the case, we can easily adhere to the idea that, because of an insufficient ability to discriminate between close elements of X, non-transitivity might occur when indifference is involved. Such restriction amounts to substitute quasi-transitivity for transitivity in [4], so that R becomes what R.D. Luce (1956) called a "semi-order". At least quasi-transitivity, therefore expresses this necessity of the mind, which can hardly be ruled out since it contains the core of the idea of the rationality of preferences.

2.2 Rational choice

Understanding the rationality of preferences nonetheless allows bypassing an external feature of the characterization of the individual, this of the subset of the set of reference of choice, illustrated by the budget in the theory of consumer behaviour, over which some elements can be chosen. Now, focusing on choices over alternative non-empty subsets of the set of reference of choice, named "contexts of choice" (or "opportunity set", or "budget", or "menus", according to alternative terminologies), rather than on preferences on a set of reference of choice, continues an intuition drawn from Samuelson's path-breaking article on revealed preferences (Samuelson 1938), systematized by Arrow as soon as 1948 (Arrow 1948: 4-5; 1951: 15-7; 1959: 122-3). In this approach, the primitive of decision moves from the binary relation of preferences over X (what Sen 1987 called "binariness") to the function of choice. Here again, the analysis rests on given premises – the identification of the set of reference of choice, the set of alternative contexts (the "domain of choice") which are made available to the individual, and this of the choice function which is defined over it:

X (set of reference of choice) [1]

$F \subseteq \mathcal{P}(X)\backslash\emptyset$ (domain of choice) [5]

$C: F \to \mathcal{P}(X), S \longmapsto C(S)$ (choice function) [6]

Like in the preference approach, the set of reference of choice X is given by [1]. Denoting $\mathcal{P}(X)$ the power set of X, [5] makes explicit the possible restrictions on the various contexts of choice S on which a choice can be made. When all non-empty parts of X are possible contexts – that is, when $F = \mathcal{P}(X)\backslash\emptyset$ – the domain of choice F is said to be "abstract" or "non-restricted". Otherwise, when $F \subset \mathcal{P}(X)\backslash\emptyset$, the domain F is "restricted". Note, for instance, that assuming that choices are submitted to an income constraint, like in elementary

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Putnam showed that here, this lack of completeness would also violate *negative transitivity* ($\forall x, y, z \in X, (x, y) \notin R$ and $(y, z) \notin R \Rightarrow (x, z) \notin R$), otherwise Theresa could not prefer x to z.

consumer theory, means that the domain of choice is restricted to the set of well-known triangles representing the expenses possibilities of the consumer. According to [6], $\{x\} = C(S)$ reads "x is chosen over S". Note that this is a quite general formulation since, instead of the singleton $\{x\}$, we may have, for instance, $\{x, y\}$ or even, if C is non-selective, $\emptyset$. In the same way as in a preference-oriented approach, the choice-oriented approach acknowledges as its starting point something given in order to characterize an individual: the way external objects are made available to him or to her, and his or her possible choice among these alternative sets of objects. And here again, the question of the rationality of choices is raised when adding supplementary properties to the function of choice so simply defined as in [6].

On first view, these properties can be introduced without explicit reference to pre-existent preferences. Such was the case since Arrow (1948), with H. Uzawa (1956), and with Arrow (1959), who defined a rational choice function by choice-consistency conditions.

Reference to choice-consistency conditions deserves special attention. In his contribution from 1959, Arrow set out five alternative "definitions" of a rational choice function, labelled from C1 to C5, and explored their logical relations, showing the equivalence between C2 and C3, between C1, C4 and C5, and the implication of the first group of equivalent definitions by the second. This puts an end to an elaboration which started in 1948, when he gave one single definition of a rational choice function, which amounted to C4 (later known as Arrow's axiom), and continued with Uzawa (1959) who gave two definitions which amounted to C1 and C2. All these definitions regarded choice (and not preferences) as a primitive, so that whereas the way a rational choice was defined might have been different, it always amounted to internal consistency. Yet, the vocabulary in use concerning the definition of rational choice functions might be misleading. Again in Arrow (1959), definition C5 corresponds to the so-called Weak Axiom of Revealed Preferences (WARP) (Arrow 1959: 123), whose initial statement comes from Samuelson (1938). But in spite of its name, it didn't involve any pre-existent preferences (see Richter's reservation to Samuelson's terminology using the word "preference" (Richter 1971: 32, n. 4)). Its formulation in Arrow's article means that when I choose x on a context S where y was available and not chosen, there is no other context T in which x and y are available, and where y would be chosen. This amounts to the following statement, which clearly contains no reference to preferences:

$$\forall S \in F, \forall x, y \in S, x \in C(S) \text{ and } y \notin C(S) \Rightarrow \nexists T \in F : x, y \in T \text{ and } y \in C(T) \quad \text{(WARP)}$$

Yet, since M. Richter (1966, 1971), it has become difficult to make a so complete abstraction of preferences in the definition of a rational choice function, though the binary relation is now a property associated to the choice function, and not a representation of the tastes of an individual. We are indebted to Richter for a definition of the rationality of the choice function as the existence of a specific compatibility between our choices and a hypothetical underlying

relation of preference – the *rationalizability* of a choice function by such hypothetical relation of preference (Richter 1971: 31). This does not imply any comeback from choice to preferences as a primitive; but it requires the introduction of the possibility of a preference relation as a criterion for rationality. A mere possibility: it does not mean that we do have preferences, but that this relation stands for those that we could have. And if such was the case, our choices on each context S, when rational, would have been in accordance with our preferences on this context. Following Richter, rationalizability hence amounts to:

$$\exists R \subseteq X^2 : \forall S \in F, C(S) = \{x \in S : \forall y \in S, (x, y) \in R\} \text{ (rationalizability)} \qquad [7]$$

According to [7], a choice function C defined on F is said rational when we can imagine a preference relation R with support X such that on each context of choice S, what is chosen over this context is also what would have been preferred, according to R. Numerous examples illustrate cases where a consistency condition is unsatisfied, so that no preference relation could, like in [7], rationalize the choice (see, for instance, A. Sen 1993: 500-3). But even when the choice is rational according to [7], it is clear that since nothing is said concerning the properties of the preferences R which rationalize the choice, they might be non-complete (not satisfying [3]) or non-transitive (not satisfying [4]), therefore non-rational[6].

This explains that a significant part of the literature has been devoted to the search for conditions under which both choice and underlying preferences are rational. For instance, when the domain of choice is unrestricted (resp., restricted), the Weak Axiom of Revealed Preferences (resp., the Houthakker Axiom of Revealed Preferences) is a necessary and sufficient condition to the rationality of choice, the underlying preference relation being also rational. But generally speaking, rationality of choice is less demanding than rationality of preferences.

The canonical approach produced formal statements about both *rationality of preferences* and *rationality of choice*. Each of them is now as widely known as it is widely threatened, from about the middle of the twentieth century onward. Calling this approach "canonical" doesn't mean that it should be regarded as the most accepted to decision-making (see Zouboulakis 2014): it is "canonical" only because it conveys a reference against which alternative approaches can be, and use to be, assessed. In a sense, it plays the same role as, say, perfect competition, when the issue is the understanding of imperfect competition. In the following, it will therefore constitute the appropriate starting point to account for the importance of the challenge to which we are invited by the works of David Hume.

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6 In his 1966 paper, Richter still held that R should be itself rational, that is, that preferences are complete and transitive. However, he noted in a footnote the possibility of a more general conception of rationality, where R would be non-complete and non-transitive (Richter 1966: 636, n. 4).

3 A Humean perspective: Rationality as a possible outcome

Let us turn back to Hume. The decision process inferred from Hume's theory of passions, developed mainly in book II of the *Treatise* and in the *Dissertation*, has been formally described in Diaye and Lapidus (2005a). Whereas this paper does not conclude with the incompatibility between Hume's conception of a decision process and the rationality of preferences and choice (for an opposite view, see Sugden 2005 and the answer of Diaye and Lapidus 2005b), it nonetheless challenges the canonical conception, in their premises ([1], [2], [5], [6]) and in the part played by rationality ([3], [4], [7]). This shows that a concern, as economists, about a possible change in our understanding of the individual as a decision-maker is far from being analytically neutral: such change, carried on by David Hume, comes along with a modification in the representation of decision–making.

3.1 Which premises for preferences and choices?

What David Hume called "passions" or "impressions of reflection" can be conveniently approached by what we would name today "emotions", but restricted to the modalities of – that is, to the ways to live – the sensations of pleasure and of pain. At the very beginning of book II of the *Treatise*, they are presented "as arising either from the original impressions [of pleasure and pain; A.L.] or from their ideas" (Hume 1739-40: 2.1.1.3). Round-trips between Hume's teaching on the passions and canonical decision theory allow showing the possible consequences of a Humean approach 1) on the nature of the primitive for decision-making, 2) on the stability of the preference structure, and 3) on the respective places of preferences and choice as well as this of the sets over which they are defined.

3.1.1 The nature of the primitive for decision-making

An often quoted passage from the *Treatise* emphasizes the asymmetry between reason and passions, presenting the first as the "slave" of the second (Hume 1739-40: 2.3.3.4). A result of this asymmetry is the picture of emotion-driven individuals (see Lapidus 2011), drawn all along Hume's philosophical works. The relevant emotions here belong to what he called the "direct" (by opposition to "indirect") passions, which "arise immediately from good or evil, from pain or pleasure" (Hume 1739-40: 2.1.1.4) and converge toward "desire" (or its opposite, "aversion") and "will" – the latter coming immediately before action (see part 3 of book 2 of Hume 1739-40, and section 1 of Hume 1757)[7]. A comparison between this picture and the current one, drawn from canonical decision theory, rests on a transposition from Hume's desire and aversion to preferences, and from will to choice. Diaye and Lapidus (2005a: 94-6) give textual evidence which corroborates such transposition.

[7] The direct passions presented in the *Treatise* and in the *Dissertation* are joy and grief, hope and fear, desire and aversion, and volition or will. On Hume's theory of passions, P.S. Árdal's book from 1966 still remains an impassable introduction.

An immediate conclusion is that whereas canonical decision theory does not really settle the question of the primitive for decision-making – either preferences or choice –, or even avoids asking it in such terms, the coexistence, within Hume's theory of passions, of both desire and will (though, as will be seen hereafter, Hume seems to hesitate counting the will among the passions), shows that both preferences (desire) and choice (will) can be regarded as the primitives for decision-making.

Nonetheless, it is obvious that this way of replacing desire and will in a decision-theory framework overlooks a typical feature of Hume's explanation of action, the role of "belief", as a transitional device which gives to an idea a part of the "force and vivacity" (Hume 1739-40: 1.3.7.5) of the original impression of pleasure or pain, thus allowing desire or aversion. Yet, the relation between belief and desire and their respective parts in the determination of action constitute a classical philosophical issue. From a Humean viewpoint, this issue typically opposes those who, like M. Smith (1987) or E. Radcliffe (1999), claimed each in his or her own way that belief alone couldn't give rise to action because it has a mind to world direction-of-fit, and those who, like B. Stroud (1977), considered belief as somehow similar to a passion, thus liable to be at the origin of action; or like A. Baier (1991) for whom reason has some kind of access to the determination of action through belief; or like R. Cohon (2008: 30-62), who stressed the role of belief in expected pleasures, which cause motivating passions. I do not intend to underestimate the importance of this question (see Lapidus 2010, Diaye and Lapidus 2012), but whatever the answer, my purpose here is to focus on some of its consequences which might be taken up disregarding the explicit link to belief and pleasure. And indeed, it remains that desire is related to the will and to decision. It is only this limited aspect of Hume's contribution which constitutes the subject matter of the discussion favoured in this paper.

3.1.2 A changing structure of preferences

In contrast with the implicit assumptions of canonical decision theory, but in accordance with the intuitive view of any one who is not a professional decision-theorist or economist, a second difference between the canonical view on rational decision and Hume's conception is that for the latter, the individual is changing in his or her emotional state. Hume finds in the so-called "rule of double relation" – relation of ideas, and relation of impressions (Hume 1739-40: 2.1.4; Hume 1757: 144-5) – the principle which explains such changes from one emotional state (one passion) to another, from one configuration of desire and choice to another. The "relation of ideas" leads from the object of the first passion to the object of the second. It follows the "natural relations" (resemblance, contiguity, and causality; Hume 1739-40: 1.1.4.1-4) which Hume regarded as the elementary components which allow the working

of our mind[8]. For instance, when discussing the case of pride associated to the organization of a feast, Hume draws on contiguity and causality in order to explain that the "feast" – the object of the initial direct passion of joy – is related to the "self" – the object of pride, the indirect passion which follows joy – for the one who is "the master of the feast" (Hume 1739-40: 2.1.6.2). The second element of the double relation is the "relation of impressions", based on the natural relation of resemblance. In the example of the feast, the pleasure which is at the origin of the direct passion of joy is associated to the one that arouses the indirect passion of pride: the pleasure which I feel in participating in a feast meets the one of organizing it. The working of the double relation is explicitly referred to when Hume tries to explain the transformation of our desire and will:

> "[A] suit of fine cloaths produces pleasure from their beauty; and this pleasure produces the direct passions, or the impressions of volition and desire. Again, when these cloaths are consider'd as belonging to ourself, the double relation conveys to us the sentiment of pride, which is an indirect passion; and the pleasure, which attends that passion, returns back to the direct affections, and gives new force to our desire or volition, joy or hope" (Hume 1739-40: 2.3.9.4).

An individual, moved by this engine constituted by the double relation, can no more be represented both through given and unchanging preferences, and through a given and unchanging choice function, defined over a given and unchanging domain of choice. This does not lead to conclude that preferences [2] and choice [6] have become meaningless, but rather that they are fleeting, following the changes in our emotional state – which each of us already knows, especially if he or she has forgotten to be an economist or a decision-theorist.

3.1.3 The respective places of preferences and choice, and of the sets over which they are defined

The third difference between Hume's perspective and the canonical approach is less intuitive. In the latter, the set of reference of choice is given first; and then only a binary preference relation is defined, or a domain of choice and a choice function. Now, with Hume, this order (the set of reference first, then the primitives, preferences or choice) becomes irrelevant. In keeping with Hume, objects cannot be considered, in our minds, pre-existent data: rather, they are constructed by our desires and, more generally, by our emotions. So that the objects possibly submitted to our preferences and choice are not objects that would exist independently of our impressions, as pointed to us by our reason, but the only objects the existence of which we acknowledge through our emotions:

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[8] In the enthusiasm of the *Abstract*, Hume concludes that the natural relations "are really, to us, the cement of the universe, and all the operations of the mind must, in a great measure, depend on them" (Hume 1740: 35).

> "Where the objects themselves do not affect us, their connexion can never give them any influence; and 'tis plain, that as reason is nothing but the discovery of this connexion, it cannot be by its means that the objects are able to affect us" (Hume 1739-40: 2.3.3.3).

Other objects could exist for other individuals or for an external observer, but for the agent who does not desire them, they simply do not exist. This is a way to say that what is given first is not something as general as a set of reference of choice, but a contextual preference relation R_S. And if so, the context of choice S can be easily identified as its support[9]:

$$S = \{x, y : (x, y) \in R_S \text{ or } (y, x) \in R_S\} \text{ (generation of the context of choice)} \quad [8]$$

And as our desires change along with our emotional state, our contextual preferences also change, therefore changing the context of choice:

$$R_{S1}, R_{S2}, \dots, R_{Si} \rightarrow S_1, S_2, \dots, S_i \text{ (contextual preferences change)} \quad [9]$$

As a result, when the context of choice changes according to [9], the general set of choice also changes, by union to the successive contexts:

$$X_i = X_{i-1} \cup S_i \text{ (set of reference of choice)} \quad [10]$$

The result of this first investigation might seem a bit disappointing. The simple and elegant presentation of the canonical approach seems to have vanished: instead of a given set of reference of choice on which preferences and choice are built, we are facing the immediate emergence of contextual preferences, which come along with a corresponding context of choice and, therefore, with a revised set of reference of choice. But all that is constantly submitted to transformations due to emotional change, so that the provisional conclusion would be: we have preferences, but they are always moving; they are not submitted to any control, so that their greatest elements on the moving contexts of choice might be anything, and can be explained by no regularity depending on the properties of the preference relation.

3.2 Rationality as an outcome

Nonetheless, the picture of such an unstable individual, left as it is, would be most unfaithful to Hume's analysis. What we can understand from Hume's decision process shows three types of regulating devices, whose effect is to stabilize it into a resulting configuration of preferences and choice. These devices consist 1) in a mental device which makes our

[9] Rigorously speaking, regarding R_S as a binary relation would require the precondition of a universal set of objects on which it is defined (see Diaye and Lapidus 2005a: 97), so that it is by abuse of notation that we keep on using R_S to denote a binary relation defined on S.

contextual preferences complete, 2) in a special link between preferences and choice, and 3) in a stabilizing property.

3.2.1 Completeness of contextual preferences

The above discussion of the "connexion" between objects (Hume 1739-40, 2.3.3.3) concluded an analysis developed in the *Treatise* of the possibility for reason, through the natural relation of causality, to make that some objects exist in our mind on its sole basis – which Hume denied. But the way the argument was developed before this conclusion is worth being quoted more extensively. Hume was talking about the aversion attached to an object:

> "'Tis also obvious, that this emotion rests not here, but making us cast our view on every side, comprehends whatever objects are connected with its original one by the relation of cause and effect. […] Tis from the prospect of pain or pleasure that the aversion or propensity arises towards any object: And these emotions extend themselves to the causes and effects of that object, as they are pointed out to us by reason and experience" (Hume 1739-40: 2.3.3.3).

This amounts to saying that the contextual preferences R_S are connected (see Diaye and Lapidus 2005a: 96-7), in the sense that each element of S is linked to any other element through a chain of theses preferences, built by the natural relations of the mind.

Interestingly, this property of *connection* doesn't come alone. It takes place within an analysis of natural relations, introduced in book 1 of the *Treatise*, which provides also a rule of extension of the natural relation in the imagination and, therefore, of our desire or preferences:

> "That we may understand the full extent of these relations, we must consider, that two objects are connected together in the imagination, not only when the one is immediately resembling, contiguous to, or the cause of the other, but also when there is interposed betwixt them a third object, which bears to both of them any of these relations" (Hume 1739-40: 1.1.4.3).

This is a way of saying that where three elements x, y and z of S are such that x and y, on the one hand, y and z, on the other hand, are related by contextual preferences R_S, x and z also are linked by R_S. Now (Diaye and Lapidus 2005a: 97), it can be shown that when connection and extension both prevail as properties of the contextual preferences R_S, this means that they are also *complete*:

$$\forall x, y \in S, (x, y) \in R_S \text{ or } (y, x) \in R_S \quad \text{(contextual completeness)} \qquad [11]$$

Considering completeness, even when it is contextual, as the result of the natural working of the mind contrasts not only with canonical decision theory, but also with Simon's view, as recalled above: since our cognitive ability is supported by our emotions and their movements,

claiming with H. Simon (1978) that the occurrence of completeness is prevented by the limits of this cognitive ability, would become meaningless.

3.2.2 Contextual compatibility between preferences and choice

The question of knowing whether the will is to be considered among direct passions is far from completely solved. On first view, some important textual evidence favours the idea that the will should be included among direct passions: this is explicitly the case at the end of the third part of Book II of the *Treatise* on the will and the direct passions, in the section dedicated to the direct passions (Hume 1739-40: 2.3.9.2), as well as in that of the *Dissertation* (Hume 1757: 139). On the contrary, other passages suggest that the will does not belong to the direct passions. It was included neither in the list which appears at the beginning of the first part of book II of the *Treatise* (Hume 1739-40: 2.1.1.4), nor at the beginning of its third part (Hume 1739-40: 2.3.1.1). Still more, in this last section, Hume writes that it is "not comprehended among the passions" (Hume 1739-40: 2.3.1.2).

Such seemingly contradictory statements require some explanation. The issue, for Hume, was highly polemical since it was this of free will, in which he supported a conception of freedom as "liberty of spontaneity" (that is, lack of violence in the determination of action), by contrast to the "liberty of indifference" (which implies that actions do not obey to necessity, that is, are independent from desires), which he rejected (Hume 1739-40: 2.3.2.1-2)[10]. Suppose the will is excluded from the list of passions. It might therefore be understood as a faculty liable to determine action and to take precedence over the passions, allowing free will in the sense of the liberty of indifference. This clearly argues in favour of the opposite position, that is in the inclusion of the will within the list of passions. However, such inclusion is not fully satisficing, since it leaves open the possibility that the will is another determinant of action, with its own informational content. Now, Hume had explained at length how the determining role of pleasure and pain is distorted by belief in order to give rise to desire and aversion[11], and there is no more room for a supplementary and hardly understandable distortion of desire which would give birth to different will. According to Hume, the will says nothing else than the desire already said – except that it is to be followed by action when it is not altered by a transformation of passions:

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10 "Few are capable of distinguishing betwixt the liberty of spontaneity, as it is called in the schools, and the liberty of indifference; betwixt that which is opposed to violence, and that which means a negation of necessity and causes. The first is even the most common sense of the word; and as it is only that species of liberty which it concerns us to preserve, our thoughts have been principally turned towards it, and have almost universally confounded it with the other" (Hume 1739-40: 2.3.2.1). See the discussion of Hume's position on free will by N. Kemp Smith (1941: 439-41), P. Árdal (1966: 87-9), and P. Russell (2008: 225-38), who also replaces Hume's argument within the religious debates among his contemporaries.

11 On the place of Hume's beliefs in decision-making, see *supra*, p. 11.

> "DESIRE arises from good consider'd simply, and AVERSION is deriv'd from evil. The WILL exerts itself, when either the good or the absence of the evil may be attain'd by any action of the mind or body" (Hume 1739-40: 2.3.9.7).

In other words, the will only converts the prescriptions of desire into action. This is a sufficient ground to explain Hume's uneasiness facing the place of the will: there are good reasons to include it in the passions, but as such, it would add nothing to them – so that the basis of such inclusion is not that firmly established.

But leaving apart the question of knowing if the will is or is not a genuine passion, its characterization leads to the conclusion that from a Humean point of view, if we choose according to what we will in a context of choice, what has been chosen fits what we contextually prefer the most, according to our desire:

$$C(S) = \{x \in S : \forall y \in S, (x, y) \in R_S\} \text{ (contextual compatibility)} \quad [12]$$

Such compatibility might be viewed as an attenuated kind of rational choice like in [7], but restricted to one context of choice and to contextual preferences.

3.2.3 Till the whole circle be completed: allowing free choice

Though contextual completeness [11] and compatibility [12] show an embryonic content in terms of rationality of preferences and of choice, the assumption of changing preferences seems far more important. This change means a revision of our general dispositions, which concerns more than isolated contextual preferences and the corresponding context of choice, as stated above in [9]. The story and the meticulous description of such changes is a typical exercise from Hume. In the second *Enquiry*, for instance, when he was discussing something apparently quite different (the "qualities useful to ourselves") he came to examine the comparative effects of close and distant agreeable objects. And he shows that when such object becomes nearer, this does not only mean that our desire for it increases, but also, in Hume's words, that our "general resolutions" have changed (Hume 1751: 6.15). The phrase is successful. It means that a change in specific desires (contextual preferences) R_{S_i} gives birth to a change about which we have not that much information, except that it occurs and that it is general, thus involving general preferences R_{X_i} to such an extent that they can supersede the contextual preferences R_{S_i} in case of conflict concerning the choices on S_i. This also leads to modifications of the domain of choice F_i, as described in Diaye and Lapidus (2005a: 101-2), as consequences of the effect on choices of the revised preferences. But generally speaking, whatever the precise characteristics of these modifications, they yield:

$$\left(R_{X_{i-1}}, F_{i-1}\right) \xrightarrow{R_{S_i}} \left(R_{X_i}, F_i\right) \text{ (general preferences, domain of choice)} \quad [13]$$

The revision procedures [9], [10] and [13] (which constitute a simplified version of the "UPDATE procedure" in Diaye and Lapidus 2005a) do not contain, by themselves, a regulating device which would take them to an end. It is when discussing the part played by the association of impressions in the mechanism of the double relation, that Hume suggests that there is a moment when the revision is completed:

> "Grief and disappointment give rise to anger, anger to envy, envy to malice, and malice to grief again, till the whole circle be compleated" (Hume 1739-40: 2.1.4.3; see also Hume 1757: 145).

Till the whole circle be completed: Hume's expression suggests a cumulative process, in which grief, disappointment, anger, envy and malice – all the possible emotions linked by the natural relation of resemblance – follow one another again and again, till they do not change anything to our general resolutions, that is, to our desires and will. This amounts to saying that there exists a step, denoted n, after which the new contextual preferences which appear as in [9], preserve general preferences in [13]:

$$\exists n: \forall i \geq n, (x, y) \in R_{S_i} \Rightarrow (x, y) \in R_{X_i} \text{ (preference stabilization)} \quad [14]$$

Preference stabilization [14], jointly with contextual compatibility between preference and choice [12], show that there is a moment when the decision process is achieved, which means that decision is not prevented from occurring by emotional changes, and that it now respects stabilized preferences and choice. In other terms, it fulfills desire and will. Such fulfillment is obtained when the decision process is not interrupted by any external circumstance, and is left to its own evolution toward a stable configuration. This means that the described decision process leads to a *free choice*, in the precise sense of the already mentioned "liberty of spontaneity", which Hume had endorsed in the *Treatise*, by contrast with the "liberty of indifference". The first *Enquiry* is still more explicit than the *Treatise*[12]:

> "By liberty, then, we can only mean *a power of acting or not acting, according to the determinations of the will*; that is, if we chuse to remain at rest, we may; if we chuse to move, we also may. Now this hypothetical liberty is universally allowed to belong to every one, who is not a prisoner and in chains" (Hume 1748: 8.23).

One aspect of the contrast between this liberty of spontaneity and the liberty of indifference, ruled out by Hume, should be stressed, when dealing with free choice resulting from Hume's

[12] As pointed out by P. Russell (2008: 375, n. 65), Hume's vocabulary has changed between the *Treatise* and the *Enquiry*. The "liberty [...] universally allowed" from the latter corresponds to the "liberty of spontaneity" in the former. From a strategic point of view, this change helped transforming an opposition between the supporters of different kinds of liberty, into an opposition between the supporters of a conjunction of liberty and necessity and those who deny it.

decision process: the choice is free not according to an external observer like, for instance, from a libertarian viewpoint which would mean liberty of indifference, but only according to the feeling of the decision-maker himself or herself. With a different formalization, it has been shown in Diaye and Lapidus 2005a that this decision process pictured by relations from [9] to [14] gives birth, when completed, to the two types of rationality in decision-making identified above, in section 2:

1. *Rationality of choice*: when i is greater than or equal to n, the choice function $C(S)$ defined on F_i is rationalizable by the general preference relation R_{X_i}.
2. *Rationality of general preferences*: when i is greater than or equal to n, R_{x_i} is a complete preorder, that is both complete and transitive.

This amounts to the claim that, in the specific meaning of the phrase in a Humean framework, a decision process leading to free choice makes this choice rational, along with the decision-maker general preferences.

4 Conclusion: From Philosophy to Economics

On first view, the rationality of choice and preferences seems to be a rather strong statement: in spite of a different treatment, the transposition of Hume's teaching in the words of decision theory brings about the same result as canonical theory does. But on second view, it becomes evident that such conclusion would be misleading. In canonical theory, rationality is assumed, as consistency hypotheses which come at the very beginning of the description of the properties of preference and choice: such is the case with rationality of preferences, insofar as completeness and transitivity are concerned; such is also the case with rationality of choice, which might be approached through various consistency assumptions, like the weak axiom of revealed preferences, or Houthakker's axiom of revealed preferences, or the so-called properties α or β. In all cases, rationality is embodied as consistency requirements of individual behaviour. On the opposite, Hume's initial statements do not recover such initial consistency requirements. It only expresses some disposition of our mind: a way to make the world inhabited by our emotions. See, for instance, what might have appeared as the first expression of minimal rationality content: contextual completeness [11]. It is not given as such, but it is a consequence of the working of our mind, when it appropriates the world through desires, going from one object to another, and relating two objects where they are linked by a third one. The same can be argued about the general conclusions on the rationality of preferences and choices. Such rationality was not presupposed at an initial stage. The only thing that we have to regard as granted is that our emotions are changing, among which our preferences, inducing us to revise them again and again; and since our mental world at last quiets down, after a certain point they do not need any more to be revised. If this point is reached, it means that we are in the conditions of a free choice. Then, rationality stands out,

but now as a consequence of the working of our mind in the decision process, no more as its prerequisite.

As economists, this challenges directly the way we take up rationality in decision-making. It leads us to give up questioning its relevance as normative behavioural assumptions, and, conversely, we are prompted to question the effects of all the external or internal circumstances which might deviate or interrupt the functioning of the mental process which opens onto decision: instead of being alternative views of individual behaviour, rationality and irrationality become the outward signs of the absence or of the presence of a hindrance to the course of the decision process.

Yet, Hume's challenge is also more indirect, in that it concerns implicit but determining philosophical positions which govern the way we are presenting a problem as economists, like in the opposition made by Sugden in his seminal paper of 1991, between already Hume and Kant. Here, it compels us to question what usually remains to us out of reach, if not out of interest: our understanding of an individual whose description boils down to the specification of the part of the external world which constitutes his or her set of choice, and of his or her preferences. Such spontaneous understanding expresses a philosophical position. Hume obviously offers another one, in which the part of the external world on which choices are to be performed is constructed by our preferences. We may agree or disagree with this philosophical position. But after all, this is not the most important: what really matters is that as a by-product of an investigation on Hume, we acknowledge that we have a philosophical position, that the latter is responsible of what we do as economists and that, for this very reason, it has to be questioned.

References

Alt, F. (1936) 'Über die Messbarkeit des Nutzens', *Zeitschrift für Nationalökonomie*, 7: 161–9; English translation: 'On the Measurability of Utility', in Chipman, J., Hurwicz, L., Richter, M. and Sonnenschein, H. (eds.) (1971) *Preferences, Utility and Demand*, New York: Harcourt Brace Jovanovich.

Árdal, P.S. (1966) *Passion and Value in Hume's* Treatise, Edinburgh: Edinburgh University Press.

Arrow, K.J. (1948) 'The Possibility of a Universal Social Welfare Function', *Rand Corporation*, [working paper], P-41, September 26.

Arrow, K.J. (1950) 'A Difficulty in the Concept of Social Welfare', *Journal of Political Economy*, 58(4): 328-46.

Arrow, K.J. (1951) *Social Choice and Individual Values,* 2nd edition (1963) New-York: John Wiley and Sons.

Arrow, K.J. (1959) 'Rational Choice Functions and Orderings', *Economica*, 26: 121-7.

Baier, A.C. (1991) *A Progress of Sentiments – Reflections on Hume's* Treatise, Cambridge (Mass.) and London: Harvard University Press.

Binmore, K. (1994) *Game Theory and the Social Contract*, Vol 1: Playing Fair, Cambridge MA and London: MIT Press.

Binmore, K. (2005) *Natural Justice*, Oxford: Oxford University Press.

Bjerkholt, O. and Dupont-Kieffer, A. (2007) 'Ragnar Frisch's Axiomatic Approach in Econometrics', *12th European Conference on the History of Economics*, Sienna, October.

Cohon, R. (2008) *Hume's Morality – Feeling and Fabrication*, Oxford: Oxford University Press.

Debreu, G. (1954) 'Representation of a Preference Ordering by a Numerical Function', in R.M. Thrall, C.H. Coombs, and R.L. Davis (eds) *Decision Processes*, New York: John Wiley.

Diaye, M.-A. and Lapidus, A. (2005a) 'A Humean Theory of Choice of which Rationality May Be one Consequence', *European Journal of the History of Economic Thought*, 12(1): 89-111.

Diaye, M.-A. and Lapidus, A. (2005b) 'Why Rationality May Be a Consequence of Hume's Theory of Choice', *European Journal of the History of Economic Thought*, 12(1): 119-26.

Diaye, M.-A. and Lapidus, A. (2012) 'Pleasure and Belief in Hume's Decision Process', *European Journal of the History of Economic Thought*, 19(3): 355-84.

Dupont-Kieffer, A. (2013) 'Mesure de l'utilité marginale et indice de prix chez Ragnar Frisch', *Oeconomia*, 3(1): 23-57.

Ellingsen, T. (1994) 'Cardinal Utility: A History of Hedonimetry', in Allais M. and Hagen O. (eds) (1994) *Cardinalism*, Dordrecht: Kluwer Academic Publishers.

Frenkel, J.A. and Johnson, H.G. (1976) 'The Monetary Approach to the Balance of Payments – Essential Concepts and Historical Origins', in Frenkel, J.A. and Johnson, H.G. (eds) (1976) *The Monetary Approach to The Balance of Payments*, Toronto: University of Toronto Press.

Friedman, M. (1987) 'The Quantity Theory of Money', in Durlauf, S.N. and Blume, L.E. (eds) (2008) *The New Palgrave Dictionary of Economics*, 2nd ed., New-York: Macmillan, vol. 6: 793-815.

Frisch, R. (1926) 'Sur un Problème d'Economie Pure', *Norsk Matematisk Forening Skrifter*, Serie I, 16: 1-40; republished in *Metroeconomica*, 9(2), August 1957; English translation: 'On a Problem in Pure Economics', in Chipman, J., Hurwicz, L., Richter, M. and Sonnenschein, H. (eds.) (1971) *Preferences, Utility and Demand*, New York: Harcourt Brace Jovanovich, 1971.

Frisch, R. (1932) *New Methods of Measuring Utility*, Tübingen: J.C.B. Mohr.

Frisch, R. (1933) 'Poincaré Lectures', in Bjerkholt, O. and Dupont-Kieffer, A. (eds) (2009) *Problems and Methods of Econometrics*, London, New-York: Routledge.

Georgescu-Roegen, N. (1954) 'Choice and Revealed Preference', *Southern Economic Journal*, 21(2): 119-30.

Hume, D. (1739-1740) *A Treatise of Human Nature*, edited by D.F. Norton and M.J. Norton, Oxford: Oxford University Press, 2000.

Hume, D. (1740) *An Abstract of a* Treatise of Human Nature, in D. Hume, *A Treatise of Human Nature*, edited by D.F. Norton and M.J. Norton, Oxford: Oxford University Press, 2000.

Hume, D. (1748) *An Enquiry Concerning Human Understanding*, edited by T. L. Beauchamp, Oxford: Oxford University Press, 1999.

Hume, D. (1751) *An Enquiry Concerning the Principles of Morals*, edited by T. L. Beauchamp, Oxford: Oxford University Press, 1998.

Hume, D. (1757) *A Dissertation on the Passions*, in *The Philosophical Works of David Hume*, edited by T.H. Green and T.H. Grose, vol. IV, [London: 1882], Darmstadt: Scientia Verlag Aalen, 1964.

Hume, D. (1777) *Essays Political, Moral, and Literary*, edited by E.F. Miller, Indianapolis: Liberty Classics, 1987.

Kahneman, D. and Tversky, A. (1979) 'Prospect Theory: An Analysis of Decision under Risk', *Econometrica*, 47(2): 263-91.

Kelly, J.S. (1987) 'An Interview with Kenneth J. Arrow', *Social Choice and Welfare*, 4(1): 43-62.

Kemp Smith, N. (1941) The Philosophy of David Hume – A Critical Study of its Origins and Central Doctrines, New-York: Palgrave, 2005.

Lange, O. (1934) 'The Determinateness of the Utility Function', *Review of Economic Studies*, 1(3): 218- 25.

Lapidus, A. (2010) 'The Valuation of Decision and Individual Welfare: A Humean Approach', *European Journal of the History of Economic Thought*, 17(1): 1-28.

Lapidus, A. (2011) 'The Possibility of a Welfare Policy in a World of Emotion-Driven Individuals: A Humean Point of View', in Ege, R. and Igersheim, H. (eds) (2011) *Freedom and Happiness in Economics and Philosophy*, London, New-York: Routledge.

Luce, R.D. (1956) 'Semiorders and a Theory of Utility Discrimination', *Econometrica*, 24: 178-91.

Moscati, I. (2013) 'How cardinal utility entered economic analysis, 1909-1944', *European Journal of the History of Economic Thought*, 20(5): 906-39.

Pribram, K. (1983) *A History of Economic Reasoning*, Baltimore, Johns Hopkins University Press.

Putnam, H. (1996) 'Über die Razionalitet von Praeferenzen', *Allgemeine Zeitschrift für Philosophie*, 21(3): 209-28; English translation: 'On the Rationality of Preferences', in Putnam, H. (2002) *The Collapse of the Fact/Value Controversy and Other Essays*, Cambridge (Mass.) and London: Harvard University Press.

Radcliffe, E.S. (1999) 'Hume on the Generation of Motives: Why Beliefs Alone Never Motivate', *Hume Studies*, 25(1/2): 101-22.

Richter, M.K. (1966) 'Revealed Preference Theory', *Econometrica*, 34: 635-45.

Richter, M.K. (1971) 'Rational Choice', in Chipman, J., Hurwicz, L., Richter, M. and Sonnenschein, H. (eds.) (1971) *Preferences, Utility and Demand*, New York: Harcourt Brace Jovanovich.

Russell, P. (2008) *The Riddle of Hume's* Treatise – *Skepticism, Naturalism, and Irreligion*, New-York: Oxford University Press.

Samuelson, P.A. (1938) 'A Note on the Pure Theory of Consumer's Behaviour', *Economica*, 5: 61-71.

Schabas, M. and Wennerlind, C. (2011) 'Hume on Money, Commerce, and the Science of Economics', *Journal of Economic Perspectives*, 25(3): 217-30.

Schumpeter, J.A. (1954) *History of Economic Analysis*, New-York: Oxford University Press.

Sen, A. (1987) 'Rational Behaviour', in Eatwell, J., Milgate M. and Newman P. (eds) (1987) *The New Palgrave Dictionary of Economics* (1st ed.), New-York: Macmillan, vol. 4: 8452-70.

Sen, A. (1993) 'Internal Consistency of Choice', *Econometrica*, 61(3): 495-521.

Simon, H.A. (1978) 'Rationality as Process and as Product of Thought', *American Economic Review*, 68(2): 1-16.

Smith, M. (1987) 'The Humean Theory of Motivation', *Mind*, 96: 36-61.

Stroud, B. (1977) *Hume*, London: Routledge and Kegan Paul.

Sugden, R. (1991) 'Rational Choice: A Survey of Contributions from Economics and Philosophy', *Economic Journal*, 101: 751-85.

Sugden, R. (2005) 'Why Rationality Is Not a Consequence of Hume's Theory of Choice', *European Journal of the History of Economic Thought*, 12(1): 113-18.

Tarski, A. (1941) Introduction to Logic and the Methodology of the Deductive Sciences. New-York: Oxford University Press.

Uzawa, H. (1956) 'Note on Preference and Axioms of Choice', *Annals of the Institute of Statistical Mathematics*, 8: 35-40.

Wold, H. (1943) 'A Synthesis of Pure Demand Analysis, Part II', *Skandinavisk Aktuarietidskrift*, 26: 220-63.

Zouboulakis, M.S. (2014) *The Varieties of Economic Rationality*, London, New-York: Routledge.