

Ruprecht, Wilhelm

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0511

**From Carl Menger's Theory of Goods
to an Evolutionary Approach to
Consumer Behaviour**

by

Wilhelm Ruprecht

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please contact: evopapers@econ.mpg.de

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Max Planck Institute of Economics
Evolutionary Economics Group
Kahlaische Str. 10
07745 Jena, Germany
Fax: ++49-3641-686868

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Abstract

A characteristic feature of economic development is the ever changing structure of consumption patterns. Reducing the explanation of this phenomenon to changing prices, finally caused by changes in the availability of goods (or characteristics), would neglect a major force driving this change, i.e. the variation of consumer wants and consumer knowledge. The present paper aims at sketching an evolutionary framework for the analysis of consumer behaviour that takes account of these features.

For this purpose, Carl Menger's theory of goods is taken as a starting point. Whereas economists after the 'marginalistic revolution' were almost exclusively concerned with the determinants of exchange value and developing price theory, Menger puts as much emphasis on the user value as on the exchange value. Regarding the way of how user value changes a connection between Menger's 19th century theory of goods and 20th century learning theories is established. The problem of how to get from individual learning processes to aggregate consumption patterns is approached by recollecting the genetic underpinnings of human learning and its contingency on certain physical and social conditions. Taking into account that these conditions are dynamic, the presented approach allows interpreting collective learning processes as historical events and makes them fruitful for the analysis of economic change.

Keywords: Austrian economics, evolutionary economics, consumer theory, learning.

JEL classification: A 12, B 25, B 52, B 53, D 11, D 83

Wilhelm Ruprecht
Herthaplatz 3
D- 13156 Berlin
E-Mail: ruprecht.capellmann@t-online.de

“ ...The subjectivist research program of the Austrian tradition need not be associated at all with an antinaturalistic methodology, but can well be pursued within a causal explanatory framework.”

(Victor Vanberg)

1. Introduction

A characteristic feature of economic development is the ever changing structure of consumption patterns. This change is well documented in empirical studies on changing household expenditure patterns (see e.g. Hildenbrand 1994). These studies usually divide consumption expenditure into various categories such as food, clothes, entertainment etc. and show how the income share spent on each category changes over time. That there is also change going on within these individual categories is, however, sometimes overlooked here. In the literature on consumer price indices it is, however, well-known that there is a continual change in consumption opportunities occurring: new items are introduced and others disappear from the markets (see e.g. Nordhaus 1998).

Reducing the explanation of this phenomenon to changing prices, finally caused by changes in the availability of goods or characteristics (Lancaster 1966a, 1966b, 1971), would neglect a major force driving this change, i.e. the variation of consumer wants and consumer knowledge. So far, economic theory in general, and consumer theory in particular, have not taken adequate account of these features. As a major cause for this shortcoming recent axiomatic preference theory can be identified, and in particular the completeness axiom. In contrast to the dominant price theoretical approaches, which are concerned with the determinants of exchange value, an evolutionary theory of consumption would be interested in how user value comes into

being and how changes in user value take place.

For rethinking changing consumption patterns from an evolutionary perspective, looking into other disciplines that also deal with consumption behaviour, such as psychology and biology seems to be a promising strategy. Since each discipline has developed its own specific methods and theoretical perspective on this subject, a precondition for fruitful interdisciplinary exchange is the existence of conceptual interfaces and the development of a 'common language'. The goal of this paper is to provide such a conceptual interface.

For this purpose, Carl Menger's (1950) theory of goods which is outlined in the first two chapters of his 'Principles', is taken as a starting point. Menger's theory marks a turning point in the history of the utility theory: whereas after the 'marginalistic revolution' economists were almost exclusively concerned with exchange value and developing price theory, Menger himself puts as much emphasis on the user value as on the exchange value. This is indicated in his definition of how a thing is to become a good, which takes account of both features.

In section 2, I scrutinize whether the conditions, Menger claims to be necessary for a thing to become a good, are really necessary. Then, I propose slight modifications of Menger's approach which allow taking account of the insights of psychological learning theories which were established more than fifty years after Menger's principles were published (section 3).

2 Carl Menger's Theory of Goods

In his 'theory of goods', which is outlined in the first two chapters of his 'Principles', Carl Menger defines:

„If a thing is to become a good, or in other words, if it is to acquire goods-character, all four of the following prerequisites must be simultaneously present:

- 1. A human need.*
- 2. Such properties as render the thing capable of being brought into a causal connection with the satisfaction of this need.*
- 3. Human knowledge of this causal connection.*
- 4. Command of the thing sufficient to direct it to the satisfaction of the need.,,*
(Menger 1950: p. 52)

Two aspects of this definition deserve emphasis: first of all, Menger's concept contains scarce goods, which are objects of market exchange (commodities) as well as free goods. Second, the Mengerian good is defined in terms of necessary conditions.¹ Menger claims that all four elements of his definition are necessary conditions, i.e. when only one element is lacking, a thing loses its good's character. Keeping in mind that definitions can never be wrong, but only more or less useful, subsequently, the conditions are examined in turn. This strategy prepares the ground for the analysis of how consumption patterns evolve.

2.1 The Elements of the Theory of Goods – a Critical Review

Condition 1: Needs

It is intuitively plausible that the existence of a human need, is a necessary but insufficient condition for a thing to become a good. Without the possibility of need satisfaction, a thing simply remains a thing. It is possible, of course, that one

¹ This characteristic makes Menger's definition different from the Lancasterian (1966a, 1966b, 1971) and the Saviottian (1996) definitions of a consumer good (for the former see Ruprecht (2005), for the latter see appendix

consumption item satisfies even more than one need. For instance, a car can be regarded as a prestige object and, for example, as a means of getting excitement or cognitive arousal by its speed.

Conditions 2 and 3: Objective and Subjective Cause-Effect-Relationships

For Menger, the existence of an objective cause-effect relationship, which is how I interpret his second condition, is necessary for a thing to become a good. In his third condition, Menger admits that objectively true knowledge about cause-effect relationships cannot be taken for granted. Consequently, the second and the third conditions are discussed simultaneously. In particular, their ontological and their epistemological implications are in the centre of the analysis.

a) The Ontological Implications

For the question of how a thing is to become a good subjectivity has a crucial role. That goods are concepts, which in contrast to things, do not exist independently of individuals conceiving them is a direct implication of Menger's definition of goods. Menger (1950: 58) was clearly aware of the ontological implications of his third condition. Unlike Friedrich August von Hayek (1979: 44-5) who edited Menger's collected work, however, Menger did not explicitly use the term 'concept' in the context of consumer goods.

When Menger considers both, the objectivity of the cause-effect relationship (condition 2) as well as the individual consumer's awareness of this relationship (condition 3) to be necessary conditions, it follows that an objective causal connection between a thing and consumer needs is not sufficient for a thing to become a good as long as this connection is not known. Taken together, the elements two and three of the Mengerian definition allow for the application of a 'bimodal ontology'.² A bimodal ontology implies that objective cause-effect relationships (world) and the subjective perception of them (mind) can change independently of each other.³ Given a bimodal ontology, as it is inherent in Menger's

1).

² See Herrmann-Pillath (1996).

³ This requires an analytic framework that does not assume an objective "production relationship" between things and "need satisfaction" as it is proposed e.g. by Saviotti (1996). In this approach so called "technological characteristics" have no capability to change independently from so called "service characteristics" (see Appendix 1).

concept of a good, it is not only producers of goods who are involved in innovative activities. Even when nothing else in the world changes, changes in the perception of behavioural opportunities can take place. This changing perception can be a major force for socioeconomic change (Witt 1989a: 96).

That subjective ideas about cause-effect relations precede their objective realization is no necessity. It is equally consistent with a bimodal ontology that it may be the other way round, i.e. that cause-effect relationships objectively exist but are not recognized or understood immediately: cause-effect relationships may exist without anybody recognizing them. This possibility is illustrated by two examples:

- The first one is the detection of the impact of citrus fruits on scurvy prevention. Although citrus fruits had, of course, been known for a long time and already had the status of goods because of their caloric content, their juiciness and their taste, this causal connection was an objective novelty. The knowledge about the nutritional causes of scurvy did not emerge until the mid seventeenth century (Mokyr 1998: 129). The objective impact of citrus fruit consumption on the prevention of scurvy is, of course, independent of a consumer's subjective awareness of this impact.
- The second example, asbestos, shows that there are also cases in which new knowledge turns former 'goods' into 'bads' (Witt (1996a)). Because of its resistance to fire, asbestos was once used as a construction material satisfying the need for shelter and safety. Later, it was discovered that asbestos fibres support the emergence of a certain type of cancer. The detection of this detrimental causal connection between asbestos and the incidence of cancer was certainly a novelty. It had not been detected earlier since there was a time lag between cause and effect as well as multicausality in the way the illness proceeds.⁴

⁴ A similar case is described in Mokyr (1996) who uses an example from the beginning of the 19th century when Louis Pasteur detected the causal connection between household cleanliness and child mortality. Although this connection had always existed, the new knowledge contributed to remarkable changes in hygienic and consumption behaviour.

Summarizing briefly: it is true that in both cases, asbestos and citrus fruits, the positive or negative cause-effect relation exists independently of human knowledge. Although things may be objectively suited to satisfying needs, the point is that they had not been perceived as goods - or bads - , until the corresponding knowledge had emerged. The added value of Menger's approach consists in the possibility of taking account of the fact that the conceptual character of an item may change in subjective consumers perception.

b) The Epistemological Implications

Now, the epistemological problem involved in the acquisition of knowledge of cause-effect relations, i.e. Menger's third condition, is to be addressed. It is useful in this context to separate the *generation* of new beliefs about cause-effect relationships, be they true or false, from their *diffusion*. For this purpose, a distinction between objective and subjective novelty is useful. „*There are genuine novelties which have not been previously experienced by anybody including the scientific observer. On the other hand, something may be a novelty in the sense defined above for some particular individual whereas it is already well-known to others, e.g., researcher observing the diffusion of an innovation in a certain region or population.*„ (Witt 1989b: 420).

That the mere existence and availability of new knowledge about cause-effect relationships between things and the satisfaction of needs is not sufficient for a thing to become a good can be illustrated by the subsequent example⁵: Some 50 years ago, the Peruvian public health service started a campaign to persuade villagers from Los Molinas to boil their drinking water. To boil water can be considered as a hygienic innovation that influences life expectation. For several reasons the causal relationship between drinking unboiled water and diseases is difficult to understand by simple logical induction.

- It is not water but invisible bacteria which cause the disease.
- Not every sip of unboiled water necessarily contains sickness-inducing bacteria.
- Even when there are bacteria within the drinking water a healthy organism with a functioning immune system may not get ill.

⁵ The case is taken from Rogers (1995).

The health campaign failed: only eleven out of 200 housewives started boiling the water after a two-year campaign. One reason for this diffusion failure lies in the local belief system which contradicts and prevents the adoption of the boiling practice. According to this belief system, boiled water is linked to 'illness' in Los Molinos. The belief system assigns an inherent 'temperature' to all foods, liquids and other edible substances that is different from their actual temperature. This hot-cold distinction governs behaviour and attitudes towards pregnancy and further health related problems. In Los Molinos, the practice of boiling water did not become a good although the knowledge about its beneficial impact on health was available. Although the knowledge was in principle available the diffusion campaign failed because people were not willing to believe it.

So far, it has only been established that, due to the knowledge problem involved in Menger's third condition, the objective causal connection cannot be considered to be a sufficient condition. However, it has not been questioned whether an objective cause-effect relationship between things and need satisfaction has to exist at all. When we switch from *ontology* to *epistemology* we challenge Menger's (1950) view according to which the objective character of this relationship is a necessary condition for a thing to become a good. Menger himself may have been aware of certain ambiguities of his definition in this respect since he emphasizes a class of items which lack even an indirect causal relationship to need satisfaction. As examples he enumerates aphrodisiacs or love potions and amulets which could be subsumed under the label of 'placebos', very much like the hot-cold-distinction system in Los Molinos. For these items, no objective causal relation to the desired effect that fulfils the scientific standards has been established, at least not so far.⁶

Withholding them from a full status of goods Menger calls them 'imagined goods'. He speculates that their importance will disappear during the process of economic change: „*As a people attains higher levels of civilization, and as men penetrate more deeply into the true constitution of things and of their own nature, the number of true goods becomes constantly larger, and as can easily be understood, the number of imaginary goods becomes progressively smaller. It is not unimportant evidence of the*

⁶ The possibility that placebos may have health impacts which are caused by an individual's subjective conviction of a positive cause-effect relationship is not denied.

connection between accurate knowledge and human welfare that the number of so-called imaginary goods is shown by experience to be usually greatest among peoples who are poorest in true goods.,, (Menger 1950: 53-4)

On the objectivity requirements for knowledge in the present context Hayek holds a view that is different from Menger's. According to him, subjective beliefs matter *"...wherever we have to explain human behaviour toward things; these things must then not be defined in terms of what we might find out about them by the objective methods of science, but in terms of what the person acting thinks about them. A medicine or a cosmetic, for example, for the purposes of social study, is not what cures an ailment or improves a persons looks, but what people think will have that effect. Any knowledge which we may happen to possess about the true nature of the material thing, but which the people whose action we want to explain do not possess, is as little relevant to the explanation of their actions as our private disbelief in the efficacy of a magic charm is to understanding the behaviour of the savage who believes in it."* (Hayek (1979: 51)

From an ontological point of view, Hayek is certainly right. Menger's statement could be regarded as an imperialistic way of judging cultures, being not only highly politically incorrect but, even worse, implying an interpersonal and intercultural utility comparison. Bearing in mind that all human-beings, Menger included, are socialized within a culture-specific belief system, who has the right to declare certain items that are appreciated by other people to be 'imagined goods'?

The problem, however, does not consist in declaring items to be 'imagined goods'. The problem consists in assuming items to be 'true goods'. Obviously, in this case one has to assume the possibility of objective knowledge about the nature and constitution of things. Indeed, Menger's propagation of an objective cause-effect relation as a necessary condition could be interpreted as the introduction of an external scientific observer who is gifted with objective insight. Nowadays, Popper's critical rationalism, which emphasizes the limitations of scientific knowledge, is a broadly accepted position in epistemology. In contrast to Menger, critical rationalism denies the possibility of knowing the 'true constitution' or 'nature' of things. More

modestly, only the state of non-falsification of certain hypotheses gives these hypotheses a state of acceptance in science, might it only be transitory.

Critical rationalism is an example of what Hayek (1979) calls the 'objective methods of science'. It is incompatible with the idea of 'true knowledge'. Within the framework of critical rationalism there is nothing like true knowledge; there is only knowledge that is not (yet) falsified. From this point of view, both, the patient as well as the doctor, hold beliefs or hypotheses on cause-effect relations that are not necessarily 'true'. Does critical rationalism and its rejection of true knowledge make the placebo a paradigmatic case? Some scholars are in favour of this position, the more so as it cannot be denied that these items are traded in markets and, therefore, at least are commodities. When a look at the history of medical science is taken, it reveals that humans have always shown the capacity to set up, to test, and to falsify hypotheses about causes and effects. Ex post, many alleged cause-effect relations have been found to be wrong. Therefore, it can indeed be concluded that placebos have a huge economic relevance: „...*The long-term history of medical treatment has been characterized as largely the history of the placebo effect.*„ (Grünbaum 1984: 131)

The discussion of the placebo case and Menger's 'imagined goods' has implications for Menger's conditions. It has already been shown that, for ontological reasons, an objectively true cause-effect relationship is not sufficient for a thing to become a good. This is in accordance with Menger's own position. Now, the impossibility of objective knowledge and the possibility of the placebo case show, in addition, that for epistemological reasons, it cannot be a necessary condition either.

The epistemological position of critical rationalism, however, does not imply that a cause-effect relation between a thing and the satisfaction of a human need does not exist. This would be not an epistemological but an ontological statement. The possible existence of objective cause-effect-relations is not denied.⁷ For the question whether a thing is to become a good however, the subjective sphere simply seems to be the decisive one. Even when a conjectured cause-effect relationship has been falsified it cannot be concluded that the corresponding items are no goods. For the inhabitants of Los Molinos, unboiled water has not lost its quality as a treatment.

⁷ There are good reasons, for instance, to be convinced that any thing containing calories is a food item.

Boiled water, in spite of its statistically significant positive correlation to health, is no good to them.

When the possibility of objectively true knowledge is denied, an alternative criterion is needed that allows consumers to differentiate between competing cause-effect hypotheses. 'Non-falsification' may be a candidate for such a criterion. However, there are cases in which consumers have to choose between several hypotheses that are not (yet) falsified but where they have no opportunity or capability of testing these hypotheses. Cause-effect relations are usually not directly observable. Moreover, there are cases in which huge time lags may separate causes from effects, such as in the asbestos example. The possibility of multi-causality can further complicate induction for consumers. When people lack the opportunity or the capability of testing competing hypotheses about cause-effect relations, they have, nevertheless, to make up their minds which hypothesis to trust and whether they should act upon it or not. While Mokyr (1996: 19) has characterized this problem as a 'problem of induction', I will – in less philosophical terms – refer to it as a 'knowledge problem'.

Whereas Popper's critical rationalism is a normative concept, we need a positive approach to how consumers solve their knowledge problems. Mokyr (1999a: 4) establishes in this context the concept of 'tightness'. He defines tightness of knowledge as „...*the degree of confidence that individuals have in the truth of this knowledge and their willingness to act upon it...*... Given this confidence, consumers transform knowledge into what Mokyr calls 'recipes'. He characterizes recipes as follows: "*In the consumption process, households do not just purchase consumer goods but convert them into final uses by using a set of techniques I will call recipes...Recipes should not be confused with technologies that are used by the household but generated outside it.*" (Mokyr 1996: 2) Tightness is a matter of social conventions (Mokyr 1999b: 4). The belief system in Los Molinos can be interpreted in this light; as a social convention that determines how people cope with new beliefs and which beliefs diffuse and which do not.⁸ It is important to note that introducing the

⁸ It is, of course, by no means excluded that scientifically tested knowledge is simultaneously tight knowledge.

tightness concept into consumption theory contradicts a radical 'tabula rasa' view, according to which consumers can be manipulated in an arbitrary way.⁹

Now, the question arises: can 'tightness' of beliefs replace the 'objectivity of cause-effect relations' as a necessary condition in Menger's catalogue? While tightness has a clear social connotation, giving things a good's property is, in contrast, the act of an individual. An individual may well consider a thing to be a good, although the contemporary social conventions are not at all in favour of or are even against this idea. Because the process of becoming a good takes place at the individual level, 'tightness' cannot have the status of a necessary condition. Rather than being a necessary condition for a thing to become a good, the 'tightness' of consumer beliefs seems to be a necessary condition for its diffusion. As a social convention, tightness can neither be a property inherent to a particular piece of knowledge nor a property inherent to goods.

Condition 4: Personal Command

Menger's fourth condition, the „...*command of the thing sufficient to direct it to the satisfaction of the need...*“, requires some clarification. At first sight, one can think of 'income' as necessary precondition for getting ownership or 'personal command' of something. Income is subject to systematic changes over time, particularly driven by the ongoing productivity gains. In his famous essay on 'social limits to growth' Fred Hirsch (1976) points out, however, that income – at least in absolute terms - is not sufficient for 'personal command'. This is because the speed and potential for productivity increases differ through the individual sectors of an economy. Hence, increasing income must not necessarily be accompanied by quantitative increases in the physical availability of all kinds of goods. Hirsch stresses the possibility that absolute or social scarcity imposes limits on the availability of certain items he calls 'positional goods'.¹⁰ When income rises on average through the productivity gains in non-positional sectors, not all consumers will get command of these 'positional

⁹ Such a view is represented by Kenneth Galbraith (1958: 156), who states: „...wants are dependent on production. It accords to the producers the function both of making the goods and of making the desires for them. It recognizes that production, not only passively through emulation, but actively through advertising and related activities, creates the wants it seeks to satisfy.,,

¹⁰ Scarcity can be defined as the case in which the quotient of requirements to availability is larger than 1 (Menger 1950).

goods'. Hence, it is not true that economic growth and growing average income automatically provide personal command of everything. The *relative* income position rather than the *absolute* income level seems to determine who is entitled to get command of the limited amount of certain goods which are not sufficiently available to meet all needs.¹¹ However, income increases are not only insufficient for getting command of a thing, they are not necessary either. This becomes obvious when the case of goods that are not traded in markets is considered. The command of free goods presumes only their sufficient physical availability but does not require any income at all.¹²

Having clarified the relationship between income and personal command, now, the question of whether personal command is, after all, necessarily a condition for a thing to become a good is addressed.

The example of positional goods shows that wants can be shaped independently of the personal command of a thing. It can, for instance, easily be imagined that there are potential Rolls Royce drivers who would immediately switch to actual ones given enough income. Apparently, for them, the Rolls Royce is already a good although they cannot afford it.¹³ This is because consumers learn wants not only by their own consumption experiences but also by observing the consumption of other people. There is a lot of empirical evidence for 'emulative consumption' behavior (see e.g. Bourdieu (1984) or Rogers (1995)) which is sometimes characterized by the label of 'keeping-up-with-the-Joneses'. What is important in the present context is that social imitation provides a strong argument against giving 'personal command' the status of a necessary condition for a thing to become a good. It can be speculated that Menger has included 'personal command' as a necessary condition in his definition

¹¹ This can be stated even though assessing when an individual considers a consumption item to be available given his or her monetary income is an unsolved problem in economic theory. Only little effort has been made so far to find out what determines the income elasticity and the price elasticity of goods. However, it is quite plausible to assume that consumer knowledge and need intensity, i.e. the conditions 1 and 3, are relevant for such an explanation.

¹² In the case of scarce goods robbery and theft are also possibilities to gain command of a thing, that require no income.

¹³ Swann (2001) has argued, in fact, that Rolls Royce cars are positional goods since they are produced in a limited edition.

since he needs this element later in his '*Principles*' when discussing the determinants of exchange value.¹⁴

2.2. Qualifying the Concept of Good from an Evolutionary Perspective

From the discussion of whether Menger's conditions are really necessary for user value to come into being, a qualified concept of goods can be derived. If a thing is to acquire goods-character, the two following prerequisites must hold simultaneously. There must exist

1. A human need for the thing and
2. Human belief on a causal connection between the thing and the satisfaction of this need.

Together, these conditions are necessary and sufficient in defining goods and in distinguishing them from related concepts such as 'things' or 'artefacts'. It is worthwhile to note that this qualified definition only refers to the user value of goods, whereas their exchange value is not taken into consideration at all.

Menger's condition 2 (an objective cause-effect relation between a thing and need satisfaction) and his condition 4 (personal command) turned out to be not necessary for the definition of a good. Personal command is not required although it is true that it is a condition for making own consumption experiences. However, a cause-effect relationship can also be established without such an experience, namely through social learning. Objective (technological) properties cannot be a necessary condition since objective knowledge is simply not possible according to Popper's critical rationalism. As a criterion for the trustworthiness of knowledge and beliefs that cannot be easily tested, 'tightness' to social conventions has been established. While 'tightness' of knowledge might be a precondition for diffusion, it is not a necessary condition for a thing to become a good. This is because a) consumers also can learn from own experiences without any social process and any conventions being involved and b) they can decide to hold untight beliefs.

¹⁴ This point I owe to Reinoud Joosten.

3. From the 'Theory of Goods' to an Evolutionary Theory of Consumption

Menger's question about how a thing is to become a good is certainly evolutionary in character. Its merit is to put emphasis on the dissemination issue, i.e. on the question of how new subjective cause-effect relations are established. So far, evolutionary economics has devoted much more attention to the technological innovation issue, i.e. the question of how new objective cause-effect relations are established. However, unless a vicarious entrepreneur is assumed who knows exactly what consumers want, the demand-side processes have to be analysed explicitly.¹⁵

It is true, that Menger's theory of goods is open to dynamics, but it is not very concrete about the actual processes. Hayek (1979: 48) suggests a way of addressing this shortcoming: *„So long as it was naively assumed that all the sense qualities (or their relations) which different men had in common were properties of the external world, it could be argued that our knowledge of other minds is no more than our common knowledge of the external world. But once we have learned that our senses make things appear to us alike or different which prove to be alike or different in none of their relations between themselves, but only in the way in which they affect our senses, this fact that men classify external stimuli in a particular way becomes a significant fact of experience. While qualities disappear from our scientific picture of the external world they must remain part of our scientific picture of the human mind. In fact, the elimination of qualities from our picture of the external world does not mean that these qualities do not exist, but that when we study qualities we study not the physical world but the mind of man.,,*

When economists take Hayek's advice to study the human mind seriously, they can take advantage of an exchange with the discipline which has specialized in dealing with processes occurring in the human mind, psychology. In this section, therefore, I introduce psychological approaches that provide answers to the positive question of how consumers link causes to effects.

¹⁵ It is interesting to note that the analysis of demand-side processes has been completely neglected in the technology push - demand pull debate (for a survey see Mowery and Rosenberg (1979)).

In the framework of an evolutionary analysis of economic change, it may not be surprising that also psychology is approached from an evolutionary perspective. Under the label of “continuity hypothesis”, applying a rigorous evolutionary perspective to psychology in order to address evolutionary features in economics has been proposed by Witt (2003).¹⁶ The basic idea behind this „continuity hypothesis“ is to consider cultural evolution as being based on biological evolution. It is important to note that, unlike in sociobiology, behaviour is not assumed to be genetically fixed but is explicitly considered to be open to learning processes. Only the structure of these learning processes is presumed to be hardwired, while their result is not pre-determined.

According to evolutionary psychologists humans have evolved several mechanisms that are capable of linking causes to effects.¹⁷ In the present investigation, two different mechanisms – non-cognitive reinforcement learning and social-cognitive learning - are examined more closely.¹⁸ Integrating a cognitive learning mechanism in the analysis invalidates the fundamental reservation of some Austrian scholars against the application of a Stimulus-Response scheme: the intentional and teleological character of human behaviour is sufficiently incorporated.

In discussing the necessary conditions of Menger’s definition of a good, two types of learning have already been distinguished: 'social learning' and 'learning from own experiences'. It has been stated that learning by own experiences requires personal command and that beliefs about cause-effect relationships require 'tightness' in order to be transformed into actual behavior. This simple idea, I argue, is helpful for identifying the elements that an evolutionary theory of consumption comprises. It is, of course, quite reasonable to expect that the necessary conditions for a thing to become a good, i.e. needs and knowledge, are elements of such a theory. The question of whether a thing is to become a good is, however, an issue that should not be confused with a theory of how consumption patterns change. First of all, actual

¹⁶ For a similar pleading see Vanberg (2004).

¹⁷ see e.g. Barkow et al. (1992) or Baker et al. (1996). The idea that the design of behavioural dispositions and the design of learning processes is the result of different adaptations to the physical world is called, in the terminology of recent evolutionary psychology, the ‘modularity’ of human behaviour.

¹⁸ In doing so, I do not claim completeness, since it is not clear how many different learning mechanisms may have evolved during human phylogeny.

consumption is possible only when a consumer has command of a thing. When the evolution of consumption patterns is discussed, the forces influencing personal command can, of course, not be neglected. Otherwise, the evolutionary theory of consumption and demand would abandon any claim to being an explanation for observable economic phenomena. An second major problem is that Menger's (1950) 'theory of goods' refers to the individual level just as learning of cause effect relations occurs at the individual level. An evolutionary theory of consumption, in contrast, is interested in phenomena that occur at a more aggregate level.

How to cope, then, with this aggregation problem? That 'tightness' and 'personal command' were not found to be necessary conditions for a thing to become a good, by no means implies, that they are irrelevant in an evolutionary explanation of changing consumption patterns. On the contrary, when 'tightness' and 'personal command' are considered to be preconditions for learning to take place, it is obvious to consider them as candidates for elements of an evolutionary theory of consumption. Their particular advantage is that they can be located at the aggregate level. The connection of 'tightness' to the aggregate level is quite obvious, since 'tightness' relies on norms which are inter-individual entities. In the case of personal command, a close connection to the aggregate level is provided by 'physical availability' that was identified above as a necessary condition for personal command to become possible. The physical availability of an item is quantifiable and can be considered as an aggregate.

It is for these reasons that I propose complementing the two necessary conditions for a thing to become a good, needs and consumer knowledge, by 'tightness' and 'physical availability' as the third and the fourth element of an evolutionary theory of consumption (see tab. 1).

Conditions for a Thing to Become a Good (Menger)	Elements of an Evolutionary Consumption Theory and their Dynamics	
	Elements	Dynamics of Elements
Need	Need, reinforcer	Emergence of secondary reinforcers by reinforcement learning
Objective cause-effect relation	Tightness	Evolution of institutions and norms changes „tightness,,
Knowledge of this cause-effect relation	Knowledge/ beliefs on a cause-effect relation between a thing and need satisfaction	Generation and Diffusion of new knowledge/ beliefs on a cause-effect relation between a thing and need satisfaction
Personal command of a thing	Physical Availability	Process innovations and technical progress increases physical availability of things

Tab. 1: Comparison between Menger's conditions for a thing to become a good and the elements of an evolutionary theory of consumption and their dynamics

That all of these four elements are dynamic, is the basic hypothesis underlying this section. Subsequently, the processes and forces driving the dynamics of the four elements are addressed. Corresponding to their affiliation to the two learning processes, it is discussed how the dynamics of needs is related to the dynamics of physical availability (section 3.1), and how the dynamics of knowledge is related to the dynamics of tightness (section 3.2).

3.1 Reinforcement Learning

The Dynamics of Needs (Element 1)

Menger himself does not have much to say about needs, their material content and their evolution. When he wrote his '*Principles*', biology and psychology were less developed than today. Since the behaviouristic school in psychology was established fifty years after Menger's '*Principles*' were published, Menger himself could not make a link between his theory of goods and reinforcement learning theories. The crucial

point is, however, that both, Menger's concept and its qualified version are compatible with behaviourism.

With a recourse to evolutionary biology, explaining the emergence and evolution of needs or wants becomes possible. It is plausible to assume certain universal wants which have been formed during human phylogenesis.¹⁹ Humans share these wants for certain objects with other mammals, e.g. air, liquids, nutrients, sleep, warmth, nutrition, sexual activity and maternal care, as has been found in and confirmed by thousands of psychological experiments (see Millenson (1979)). This list can be refined, e.g. in the case of nutrients, by the preference for „sweetness“ involving adaptative advantages by allowing mammals to identify quickly food items covering carbohydrates rich in nutrients (see Ruprecht (2005)).

It is argued, now, that the ontogenesis of wants can be based on their phylogenesis. According to theories of operant²⁰ and classical conditioning, the learning process starts from reinforcers such as food items, aqueous solutions, and the other items listed above. Their reinforcing quality is assumed to have a genetic base. In classical conditioning processes, such stimuli act as primary reinforcers. When they are regularly paired with other items, the latter then obtain reinforcing potential in their own right and become secondary reinforcers (see e.g. Skinner (1966), Pulliam and Dunford (1980)). Reinforcement learning may even take place at the level of a culture.²¹

Both primary and secondary reinforcers can be regarded as goods. The crucial difference between the two types of reinforcers is that the link between cause and effect in the case of primary reinforcers is genetic, whereas in the case of secondary reinforcers, it is learned. In further processes of operant and classical conditioning, the secondary reinforcers act as rewarding experiences, and preferences²² of higher

¹⁹ See Witt (2001). While it is assumed that the biological evolution of the cognitive apparatus of homo sapiens was completed during the pleistocene era around 100.000 years ago (see Miller and Todd (1994)), other, more primitive, behavioural dispositions may have evolved earlier in prehistoric times.

²⁰ Operant conditioning means, that behaviours, which are already present in the behavioural repertoire, are repeated more often when they are rewarded (Witt 2001).

²¹ In many consumption related fields, children have no capability of knowing what is good. Hence, parents vicariously expose their children to goods they like themselves. Through reinforcement processes, wants that are acquired by one generation can be transferred to the next generation. *Ceteris paribus*, this kind of 'exposure learning' implies a genealogical process which can be compared with the corresponding processes in biology.

²² In using the term "preferences" I am aware of that is not entirely suitable in the present context since it is

order emerge. During the individual learning history, a spectrum of wants or a 'preference order' evolves (Witt 1987: 112-123).

Whether reinforcement learning is consistent with Menger's third condition, i.e. consumer knowledge about the causal connection between a consumption item and need satisfaction, is questionable. Interpreting reinforcement as cause-effect learning is certainly wrong because in reinforcement learning, no knowledge about the world is involved that is independent of the particular behavior. It can be argued, however, that in some sense, a cause-effect relationship is established. Baker et al. (1996: 1) characterize the result of reinforcement processes as „...*being able to react appropriately to causes...* „ as opposed to „...*being able to understand them...*“,²³

Already 1954 the economist Georgescu-Roegen proposed a 'theory of wants' which is remarkably similar to reinforcement learning. Conditioning theories could, indeed, be interpreted as a behaviouristic interpretation of Georgescu-Roegen's principle of the 'irreducibility of wants', i.e. the variety of wants cannot be reduced to an aggregate of 'pleasure', and of the principle of the 'growth of wants', i.e. there is always a next want. With regard to one essential aspect, however, reinforcement theory goes beyond Georgescu-Roegen's 'theory of wants' as it will become evident below: it is able to list conditions under which learning takes place:

- regularity in the effect following the cause;
- temporal contiguity between cause and effect, i.e. the two stimuli.
- local contiguity between cause and effect. (Baker et al. 1996).

The Dynamics of Physical Availability (Element 4)

Establishing conditions for reinforcement learning to take place, simultaneously imposes restrictions on the range of phenomena it is able to explain. Without these conditions being fulfilled, reinforcement learning will simply not occur. However, a theory of human behaviour that is restricted to associative learning may be incomplete. Such an approach would entirely ignore the forms of intentional behavior that are typical for economic processes (Witt 1987: 121).

defined as a relational concept in economics.

²³ The Pavlovian dog, for instance, established a relation between the sound of a bell and food.

In fact, there are strong indications for the existence of cause-effect learning mechanisms that work even in the absence of, let us say, the temporal contiguity of the unconditioned reinforcer and the neutral stimulus. Menger's definition contains a broader range of goods than associative learning theory would predict. Considering that, it is interesting to see that Menger specifies his second condition, i.e. the objective causal connection between needs and things with respect to temporal contiguity. In Menger's theory, the relationship between consumption and need satisfaction can be more or less immediate. So called 'first order' goods that are used for direct need satisfaction, such as bread for example, are distinguished from 'second' and 'third order' goods which are connected in a less obvious way to the satisfaction of needs. A typical example of a non-immediate cause-effect sequence occurs with goods that are inputs in a production process. This idea can be put into more familiar terms: Humans have the unique capacity to invest, i.e. to anticipate and to discount future rewards. It is probably this specific ability that enables humans to produce tools for further tool production in order to increase the availability of first order goods.²⁴ In ethnology, it is well-known that humans are the only tool-producing species: Since the paleolithicum, humans apparently not only use tools but are capable of producing them. It is true that certain monkey species use objects as if they were tools, and cases have been reported in which they have even refined these objects. Humans, in contrast, additionally produce tools in order to produce tools.²⁵ Whereas monkeys use objects only in specific situations and at specific moments, human behaviour regarding the use of tools is more complex since these tools are kept for further use in the future. Moreover, human tools are not just a prolongation of the body and its organs like the simple objects that monkeys use (Hirschberg 1996: 94-5). It is this tool producing capacity that has enabled humans to escape selection pressure. This has happened in spite of the scepticism of Thomas Malthus, who denied the possibility of intense growth since he was convinced of the dominance of biologically determined (reproduction) behaviour over human cognitive and innovative capacities. Through the prolongation of the production chain, the

²⁴ In principle, the same necessary conditions must hold for higher order goods as for first order goods. That objectivity in the cause effect relationship is not a necessary condition becomes plausible when one considers that objectivity refers to the relation between the higher order good and need satisfaction and not to the relationship between a fourth order and a third order good.

²⁵ In anthropology, this observation has inspired a discussion on whether tool production and usage has coevolved with language (Gibson and Ingold 1993).

availability of first order goods can be enhanced. Beside process innovations, simple investment in higher order goods that are required to produce first order goods, can also increase the physical availability of first order goods.

Sofar, psychology has been applied to an economic problem. In order to see how psychology can, in turn, profit from economics, one should remember that under the experimental conditions in psychology, the availability of reinforcers is given and controlled. In this respect, reinforcement theory is inherently static. Outside of the laboratories, however, the availability of primary and secondary reinforcers cannot be automatically taken for granted. That the physical availability (and number) of reinforcers can vary over time has already been mentioned above (see Tab. 1). In the continuing process of technological change, some reinforcers become more available, others become less available and new items may even become available for the first time. Apparently, technological change can alter the preconditions and the opportunities for reinforcement learning since the learning process is contingent on the sufficient availability of the reinforcers. Without sufficient availability, a regular pairing of the stimuli cannot take place.

3.2 (Social-) Cognitive Learning

As consumers, humans can anticipate positive and negative effects, too. For instance, in the case of some pharmaceuticals, e.g. antibiotics, a considerable time-lag between consumption and its positive impact exists. With regard to different types of learning processes it seems to be more convenient to talk about more or less immediate cause-effect relationships than about consumer and production goods.²⁶ It has already been mentioned that the possibility of less immediate cause-effect relationships than required by reinforcement learning theory has clear implications for psychology. When the condition of temporal contiguity is violated for higher order goods there must be another mechanism, which is independent of temporal

²⁶ The often made distinction between consumption and production goods according to their positions in the value-added chain is somehow arbitrary. It can for instance be argued that cars can be used as consumption goods as well as in a production process. Stigler and Becker (1977) have argued in their household production theory, quite similarly, that consumers can also produce.

contiguity, that links causes to effects. In contrast to reinforcement learning, cognitive learning provides „*knowledge about the world that is not tied to particular behaviour*„ (Toates 1998: 59). Due to their cognitive capacity, humans not only use things as higher order goods for production but they are also able to expand the number of first order goods beyond the range that is possible by simple reinforcement learning.²⁷

Subsequently, a closer look is taken at cognitive learning mechanisms in order to address changing consumer knowledge. In examining the question of where this knowledge about the world comes from, special attention is paid to *social*-cognitive learning. Applying again an evolutionary perspective to psychology, social-cognitive learning about cause-effect relations can be assumed to contribute to increasing the overall fitness since it enables humans to take advantage of conspecies' experiences when reacting to unknown situations. How social-cognitive learning of cause-effect relations actually works and under which conditions it takes place is to be highlighted below. Starting from the truism, that only beliefs that are perceived can influence actual consumption behaviour, the investigation proceeds in two steps. In a first step, perception is analysed and the main focus is on what gets attention and why. In a second step the conditions are examined under which beliefs are transformed into actual behaviour, i.e. become 'tight', and how these conditions can change.

The Dynamics of Knowledge (Element 3)

The necessity to examine the question of which beliefs receive attention and which not, arises from the fact that the human capacity to perceive and to process information is bounded. This implies that consumer attention is a scarce resource. Witt (1987: 116) notes that only a selection of the total amount of information humans are exposed to can be perceived and processed.

²⁷ In the context of cognitive learning and the ability of anticipating cause-effect relations it is interesting to note that Menger's academic teacher, Wilhelm Roscher, has distinguished humans from other animals according to the number and quality of their wants. According to Roscher (1886: 1), the desire for clothes or firing are examples for wants that are specific to the human species. Whereas the wants of other species are entirely genetically based and constant over generations, humans are able to expand the variety of their wants ad infinitum.

Using the metaphor of a camera lens, Witt (1989a) distinguishes two ways in which attention is focussed:

- The first way is shifting the whole focus of attention. Witt calls it the 'agenda-setting effect'. Because retrieval works sequentially, agenda-setting, e.g. by advertisements, is more effective, the more often a message is repeated (see also Woo 1992: p.97). In modern mass media societies, telecommunication technologies enable the broadcasting of information and centralized agenda setting (Witt 1996b).
- The second way to direct attention, which Witt calls the 'refinement effect', is to narrow down the focus to one issue which, in turn, can be perceived in more detail. Decentralized communication in small groups, e.g. among hobbyists who continually discuss very focussed issues, can contribute to the refinement effect.

Centralized communication and the agenda-setting effect seem to be more relevant than decentralized communication in small groups for an explanation of how beliefs spread from the micro- to the macro level – given the corresponding technological preconditions for spreading information centrally. In a mass media society that is characterized by many different radio and TV channels and information overload, however, it is not so easy to assess who actually sets the agenda. Witt (1989a) proposes applying the concept of competition to this issue: a competition between different providers of information for the scarce resource 'consumer attention' is going on.

By discussing what prominence is Witt (1989a) elaborates these concepts. While it is often assumed that prominence results from certain unique attributes or combinations of attributes that give a certain item or person a position of a natural monopoly, the present approach assumes that prominence can be the result of incidence and historical contingency. Whether beliefs or persons become prominent, and which topics receive attention depends on the relative strength and frequency of information. The recent success of 'Big Brother' TV shows in Germany and in other countries and the subsequent commercial exploitation of the prominence gained by several participants in the programs may support the view that prominence is probably not caused by unique personal characteristics but rather by the fact that the audience has been repeatedly exposed to certain persons or issues.

The Dynamics of Tightness (Element 2)

In general, people do not believe every message they receive. How do consumers manage to decide which beliefs to trust and which not, given that objectivity is not a valid criterion? To answer this question, the concept of 'tightness' that has been introduced above is useful.

Mokyr (1999a: 4) defines tightness as the *"...degree of confidence that individuals have in the truth of this knowledge and their willingness to act upon it..."*. Mokyr explicitly separates 'knowing' or 'perceiving' beliefs from 'trusting' beliefs. It is possible to relate Mokyr's tightness concept to psychological theory. Promising candidates for this are 'consistency theories' which start with the premise that people do not necessarily act upon their beliefs. Moreover, consistency theories provide an answer to the question, under which conditions people are inclined to act upon beliefs. A common feature of consistency theories is their postulate of an innate human need for consistency between the elements of an individual's cognitive system. Since discrepancies between these elements cause a feeling of discomfort, humans try to reduce this discomfort. According to Zimbardo (1992: 580) there are several ways of coping with cognitive dissonance. For instance, the relevance of new information for an individual's own behaviour can be systematically ignored, or the information source can be brought into discredit. Lauer (1996: 165) asserts that consistency theories can be divided into theories that hold for the 'post-decision phase' and others that hold for the 'pre-decision phase'. An exponent of the latter category is Ajzen's (1988, 1991) 'theory of planned behaviour' which has some relevance for the adoption of innovations when innovations are understood as actions that have not been carried out earlier (for this definition see Witt 1993: 92). In his preface, Ajzen (1988) describes the theory of planned behaviour as a research area to which the traditionally separate branches of personality theory and social psychology are converging. Correspondingly, the cognitive system contains 'personal elements' as well as 'social elements', such as norms. For the present purpose, the message of Ajzen's theory can be summarized as follows: people execute a certain behaviour when, firstly, they themselves evaluate it positively, secondly, when they have the

confidence to perform it, and, thirdly, when they believe important people think they should execute it (Lauer 1996: 155).

The consistency concept, allows questions to be addressed that are usually neglected by the economic and non-economic literature on diffusion. In the diffusion literature, authors have often relied on personality factors in order to explain inter-individual differences in the inclination to be innovative. For example, Rogers (1995) distinguishes different types of adopters, e.g. 'early adopters', 'later adopters', and 'laggards'.²⁸ Cultural influences and diffusion constraints, however, are less systematically examined. This is, however, something that can be highlighted by consistency theories. In order to become relevant for behaviour, a new behavioural option must not only be perceived but it also must be believed. For this, it must fit pre-existing norms and mental structures. It is true that this has a conservative implication. However, the theory of planned behaviour does not imply that innovative actions are not considered; it only specifies the conditions under which they are likely to occur.

Mokyr's tightness concept is related to the idea that there are social influences on planned behaviour by means of norms. In his explanation of why the industrial revolution started in Britain, Mokyr (1999b: 4) directs attention to the possibility that diffusion constraints have a cultural base: *„A society like Britain's, where people of wealth and power had a distinct 'taste' for scientific and technological problems, from mechanical pumps to crop rotations, could easily be said to 'demand' technological knowledge. These preferences created...an Industrial Culture which distinguished the British elite from, say, the Prussian junkers or the Chinese mandarins, whose social norms were quite different.,, (Mokyr 1999b: 4)*

Like Mokyr, Rogers (1995) assigns a central role to social authority and opinion leadership. This becomes clear when we go back to his example of the diffusion of the 'boiling water practise' that was discussed above. Rogers conjectures that the diffusion agent in the little Peruvian village suffered from a lack of social reputation. *„...She concentrated her efforts on village women like Mrs. A and Mrs. B.*

²⁸ Likewise, Witt (1996c) stresses the relevance of differences in the degree of personal curiosity for the inclination to adopt new items.

Unfortunately, they were perceived as a sickly one and a social outsider, and were not respected as social models of appropriate water-boiling behaviour by the other women. The village opinion leaders, who could have activated local networks to spread the innovation, were ignored by [her, W.R.]..., (Rogers 1995: 5). As long as the opinion leaders do not change their attitudes, there will always exist a potential source of cognitive dissonance for the other community members. When they change their attitude or when other opinion leaders take their place, formerly dissonant knowledge gets a chance to become consonant. The diffusion of beliefs or better, the transformation of knowledge into actual consumption behaviour, is contingent on social norms.

Seen from the point of view of evolutionary economics, the theory of planned action has, like reinforcement theory, a static component. This can be argued since it is not capable of explaining the transition from cognitive dissonance to cognitive consonance although it contains different strategies to solve the feeling of discomfort that is caused by dissonance. To put it in Mokyr's (1999a) terminology: how beliefs which used to be not 'tight' become 'tight' and vice versa remains an open question.²⁹ To answer this question, a dynamic theory of tightness is required. Since tightness is a matter of social norms, as Mokyr, confirmed by consistency theories, suggests, one would just have to recombine the theory of planned action with a theory of changing norms (see e.g. Witt 1989c) in order to get a dynamic theory of tightness. The dynamics of norms, then, has at least the same relevance for explaining changing consumer behaviour as is the case for the dynamics of beliefs. As the case of Galileo demonstrates, such a dynamics of formerly untight beliefs becoming tight, may take considerable time.

Briefly summarized: Unlike psychology which usually does not consider the variability of the conditions under which learning takes place, an economic perspective requires explicitly addressing the dynamics of these conditions. It might be more appropriate, therefore, to consider the proposed theory as being consistent with psychological concepts rather than as a psychological theory in itself.

²⁹ Under what circumstances would, for example, the Peruvian villagers from Los Molinos be willing to act upon the belief that the practice of boiling drinking water prevents diseases?

4. Conclusions

The aim of the present paper was to provide an evolutionary framework for the analysis of changing consumption patterns that highlights the role of evolving consumer wants as a driving force. Because of its reference to user value Carl Menger's definition of how a thing is to become a good was chosen as a starting point.

Regarding the variability of user value a connection between Menger's 19th century theory of goods and 20th century learning theories was established. The question of how a thing is to become a good, however, should not be confused with the question of how consumption patterns change. While the former refers to the individual level the latter, in contrast, refers to phenomena that occur at a more aggregate level. In order to bridge the gap between the individual and the aggregate level, a perspective considering cultural evolution as being based on biological evolution was applied - suggesting that not the content but the structure of learning processes is genetically coded and common to all humans. In psychology, moreover, it is well-known that certain conditions - which are already insinuated in Menger's theory of goods – are necessary for learning to take place. Both aspects can be exploited to solve the aggregation problem: If a) the structure of learning processes is genetically coded and b) learning processes are contingent on certain environmental conditions, then identical environmental conditions should lead to identical learning processes.

By taking into account that the physical and social conditions on which learning takes place are dynamic, the presented approach not only stresses the adaptive and contingent character of both learning mechanisms. It allows to analyse collective learning processes as historical events, and makes reinforcement learning theory and the theory of planned action fruitful for the analysis of economic change.³⁰

³⁰ Along these theoretical lines, a case study on the development of the consumption of sweeteners has been conducted. Changes in food consumption patterns over time were explained as the outcome of collective learning processes. As they have been contingent on systematically changing environmental conditions these learning processes can be considered as historical events. It turned out, moreover, that the presented approach complements the Lancasterian characteristics approach to the adoption of novelty in consumption (see Ruprecht 2005).

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Appendix 1: The Saviottian concept of an artifact

According to Saviotti's and Metcalfe's twin approach³¹ artefacts consist of two sets of characteristics - technical and service - which very much resembles the distinction between genotype and phenotype in evolutionary biology. In figure A. 1, the two tupels represent n means (X) and m ends (Y), i.e. the entities which make up the efficiency relation of an artefact i .

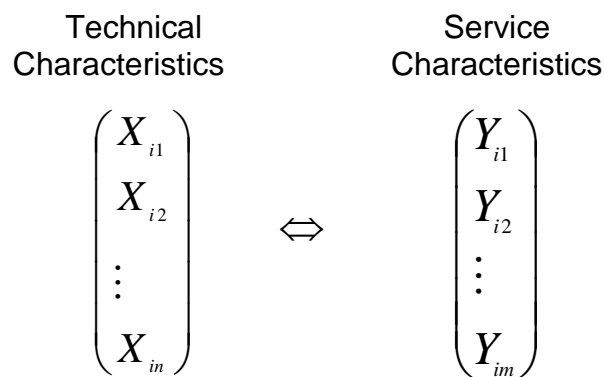


Figure A. 1: The Twin Characteristics Representation of Artefact i

Source: Saviotti (1996: 64)

Technical characteristics are connected to service characteristics by a kind of production relationship.³² Saviotti (1996: p. 64) compares technical characteristics with buttons "*...that, when pushed, produce required services.*"³³ For illustration purposes, Saviotti (1996: p. 67) chooses the example of helicopters. The 'length of a diameter' is a technical characteristic that produces the service characteristic 'maximum take off power'. Other examples are the technical characteristic 'engine power' that produces the service characteristic 'maximum speed', or the technical characteristic 'number and geometry of engines' that produces the helicopter's range as a service characteristic.

There is a crucial difference between the twin approach and the Mengerian concept of a good. Since the two types of characteristics are connected by a production

³¹ For a comprehensive survey of this approach which aims at explaining how artefacts emerge and how they evolve see Saviotti (1996).

³² In this respect it resembles Kelvin Lancaster's (1966a, 1966b, 1971) 'indirect utility approach' which also is based upon a production metaphor (for a discussion see Ruprecht 2005).

³³ Elsewhere, Saviotti mentions a 'pattern of imagination', represented by the double arrow between

relationship, service characteristics can change only when technical characteristics have changed first (see figure A.1). Since the Saviottian approach relies on a unimodal ontology, in contrast to Menger's approach, an independent change of service characteristics is not possible.

	Identical Service Characteristics	Service Characteristics Change
Identical Technological Characteristics	identical good	NOT DEFINED
Technological Characteristics Change	Cost reducing 'process' innovation, intertechnological competition	entirely new product

Table A.1: Changing Characteristics without Subjectivity in Saviotti's Approach