The Sensory Order, the Economic Imagination and the Tacit Dimension

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Abstract

Purpose — This paper examines Hayek's view of the mind to see if it provides a useful and unifying foundation for understanding both deliberative choices that involve conscious information processing (the 'economic imagination') and choices that are not determined by conscious processes such as those involve 'gut feelings' or knowledge that the chooser is unable to articulate (the 'tacit dimension').

Methodology/approach — The paper analyses Hayek's view of the mind from the standpoint of evolutionary economics and biology. Because of the significance of pattern detection in Hayek's analysis, the paper examines parallels with key ideas in personal construct psychology and artificial intelligence. As well as exploring the evolutionary advantages of behaviour based on programmed responses to the detection of particular patterns, it also explores possible evolutionary and neural origins of dysfunctional heuristics and biases.

Findings — Hayek's theory of the mind provides useful foundations for analysing choice in a evolving, pluralistic and context-based manner rather than seeing all choices as made in much the same way on the basis of 'given preferences' that obey the axioms of rational choice theory. His theory complements work in psychological economics based on Kelly's personal construct psychology, cognitive dissonance theory and Maslow's hierarchy of needs. The analysis leads to questions being raised about the conventional faith in the notion of a diminishing marginal rate of substitution.

Originality/value of paper — The paper shows how very different ways of choosing can be understood in terms of Hayek's analysis of the mind.

Keywords tacit knowledge, decision rules, gut feeling, cognition, decision-making templates.

Paper type research paper

JEL codes A12, D01, D83

1. Introduction

This paper explores the possibility of using an evolutionary perspective on Hayek's (1952) book *The Sensory Order* as a basis for understanding how people try to cope with the challenges of a complex, changing world. These challenges can be addressed in a variety of ways and different ways of choosing may be appropriate depending on the challenges that different contexts present. On each occasion for action, decision makers thus face a multi-level problem, the first level of which is to make a 'meta choice', the choice of a means of choosing. Most economists ignore both the context aspect and the 'meta choice' issue and use a one-level, 'one size fits all' approach to choice. Such an approach simplifies analysis and avoids a potential problem of infinite regress: how do people choose how to choose? This question might seem safe to ignore on the basis that people in practice do not normally end up paralysed by the need to choose: their minds work so as to ensure the decision process is truncated even if this means that a lot of effort goes into making decisions come right rather than making the right decisions in the first place. However, perhaps if we actually consider how the mind might be expected to have evolved to work at this 'meta' level of choice to remove the infinite regress problem, we may be able better to understand how people choose at the level at which economists habitually focus.

This paper uses the theory of the mind set out in *The Sensory Order* in such a role. Put very simply, the underlying argument is as follows: (i) Hayek provides us with a theory of how the mind perceives events by classifying them in relation to previous perceptions; (ii) occasions for choice are events in their own right that our minds likewise classify; and (iii) among the ways in which the mind classifies these occasions for choice is with respect to the kinds of decision-making processes that they require. The paper uses this line of thinking to explore how *The Sensory Order* can provide underpinnings for two broad decision-making processes: conscious deliberation ('the economic imagination', as per the subjectivist/behavioural perspective offered in Earl, 1983) and for decisions for which the chooser would be unable to offer a verbal account that went beyond 'intuition' or 'gut feeling' ('the tacit dimension', as per Polanyi, 1967).

The rest of the paper is structured as follows. Section 2 explores further the plurality of strategies for choosing and highlights their contrasting evolutionary properties. Section 3 focuses on how consumers learn what products have to offer and examines the relationship between Hayek's view of the workings of the mind and the analysis of choice in terms of the characteristics possessed by rival products. Section 4 explores how Hayek's thinking can help us understand instinctive behaviour and choice in unfamiliar situations, while section 5 focuses on the development of

both conscious decision-making capabilities and tacit knowledge. Section 6 considers perspectives from *The Sensory Order* and from evolutionary psychology as a basis for understanding the origins of heuristics and biases that can compromise the quality of decisions. Section 7 considers the complexity entailed in distinguishing between different brands of competing products and addresses the question of what the mind's apparent ability to cope with this implies for its ability to make complex computational tradeoffs when choosing. Section 8 offers concluding reflections.

2. A Pluralistic Perspective on Choice

Survival in a complex and changing world requires the ability either (i) to *respond* sufficiently rapidly via forms of behaviour that deal well enough with the challenges currently at hand, or (ii) to *predict* the challenges that may be faced and put into place strategies that are effective for preventing them from eventuating or for dealing with them if they eventuate. Both kinds of behaviour can be seen 'as if' they result from people doing cost/benefit estimations about a variety of possible courses of action, from which it becomes clear which one is the best. This simplifies matters analytically but is potentially misleading if, in some contexts, the actual process of choosing does not involve deliberating about alternatives and instead just entails classifying the situation at hand and instituting some kind of programmed response without assessing opportunity costs.

Programmed responses to challenges may not be the choices that a globally rational decision maker would reach but, as Alchian (1950) pointed out, survival does not require the best possible response, merely one that is good enough as a means of dealing with the threat that is at hand. An appropriate programmed response could thus be perfectly adequate for survival purposes. Non-deliberative, programmed behaviour can also be the means an organism uses to construct a more secure environment in the face of uncertainty. For example, an animal may end up storing food in several places because that is what it does instinctively, rather than by sizing up the pros and cons of being able to concentrate on defending a single store (with some probability of losing it outright) versus the risks of having multiple stores and losing one or more of them whilst others go undetected by predators. Human decision makers may make rather similar decisions about their retirement investment strategies, using simple rules rather than in the light of careful analysis of financial data and economists' forecasts. For example, even a monetary economist as distinguished as Charles Goodhart (2008, p. 7) admits to using a very simple rule, namely, 'Martin Wolfe of the FT is always right'.

Though rule-based responses to the detection of particular stimuli may go against the mainstream economists' focus on

opportunity cost/benefit calculations they may in some contexts increase the chooser's survival potential. As Winter (1964) pointed out, if the environment keeps changing, the longer it takes to work out the best way of responding to an initial change, the less suited that response may be to the environment that the organism faces by the time the response is implemented. Furthermore, deliberation itself consumes time and other resources that could have been used for doing other things. In some cases delaying action is an efficient strategy (for example, when a standards battle is going on and there is the risk of an expensive loss if one selects the technology that fails to dominate). However, in other cases delay may constrict the organism's future range of options, either because it produces major negative consequences (for example, death due to dithering instead of immediately stepping out of the way of a vehicle that one has just noticed heading rapidly in one's direction) or because first-/early-mover advantages are foregone.

Once we recognize the distinctions between reactive and anticipatory/strategic behaviour, and between programmed and deliberative behaviour, along with the possible efficiencies in some contexts of reactive or non-deliberative choices, there appears to be a case for analysing human action in a pluralistic manner. To force-fit all choices into a single framework of optimization amongst alternatives subject to various constraints may be misleading if programmed forms of action result in decision-makers failing to respond to market incentives in ways consistent with the predictions of the traditional framework. Instead we need a framework for understanding the distribution of decision-making methods among different kinds of contexts. Let us now see what Hayek's *Sensory Order* has much to offer towards the construction of the latter kind of framework.

3. Connections, characteristics and constructs

Hayek's focus in *The Sensory Order* is not on decision making but on how the mind perceives events, either external phenomena or imagined as sets of qualities. As such, it has the potential to provide cognitive underpinnings for Lancaster's (1966) characteristics-based view of choice. The latter was offered with an emphasis on its ability to provide a way for economists to analyse how consumers cope with the introduction of new commodities. Lancaster did not see consumers as having any need to form new preferences in such contexts so long as their preferences were over characteristics rather than goods, and so long as new goods were nothing more than new combinations of characteristics that were already incorporated into consumer preference orderings. New products might have unprecedented features but the services they perform may be entirely familiar ones, delivered to standards not previously available. However, Lancaster did not attempt to provide a theory of

how consumers come to locate new products in characteristics space: he proceeds as if their qualities are objectively given.

Austrian economists, by contrast, would see consumers as subjectively constructing in their imaginations personal perceptions of what products have to offer. Different people may thus reach different conclusions. Consider Figure 1, which show an advertisement for Raleigh bicycles that was used in Africa in the early 1950s. Some might construe it (as the designers of the advertisement probably intended) as implying that an all-steel Raleigh bicycle would be much more dependable than other brands because it could be pedalled at speed over rough ground without falling apart—fast enough, indeed, to be a means of escaping from a lion. Others might simply infer that those who own a Raleigh bicycle are likely to be chased by lions. Yet others might draw a more sophisticated inference leading to the latter conclusion, namely, that a Raleigh bicycle enables its user to go so fast that lions will mistake them for a gazelle, and so on.[1]

Figure 1: The ambiguous consequences of owning a Raleigh bicycle in Africa

[1] A full colour version of this advertising poster can be found in electronic format at http://flickr.com/photos/dreamtargets/1084477112/ ('Vintage Raleigh Poster – Lion', by Dreamtargets). The Indian version of it featured a tiger instead of a lion and, according to Professor Peter Payne, in a talk on the history of advertising that he gave at the University of Stirling in the early 1980s, many Indian consumers actually saw it as implying they would get chased by tigers if they rode a Raleigh.

Hayek's view of the mind has at its core the idea that events in the world (including possible events that we imagine in our heads) are not perceived in a manner determined by incoming sets of sensory stimuli. Rather, what we see depends on the patterns that we can find in the flow of sensory inputs that overlap with patterns stored from past experience. Events are classified into particular categories because the sensory inputs associated with them fire up patterns of neural connections similar to those that have previously been fired up by other events. For example, we can make sense of an 'airbag' as an automotive safety feature if we have mental concepts relating to notions such as 'a bag', 'pneumatic devices' and 'what happens when a car stops suddenly'. The uniqueness of a particular event resides in the unique combination of neural patterns that its unique combination of sensory ingredients triggers compared with previously experienced events. It is its particular *combination* of qualities, not the possession of unique kinds of qualities, that makes an event stand out as something unique compared with other events and against background 'noise' in the chooser's perceptual field, for if its qualities bear no resemblance at all to anything we have previously experienced, our minds will be unable to make any sense of it at all (Hayek, 1952, p. 142)

Hayek's argument about our blindness to qualities we have note previously experienced may be illustrated with the example of how two different people may assess a particular flow of sound emanating from a radio. Neither may have heard this particular flow of sound before. One of them, who has previously listened to a lot of modern popular music, has developed mental pigeonholes for a wide variety of genres and hears it as a piece of music that is a fusion of heavy-metal and hip-hop. This may be precisely how its performers, their producer and their record company saw it. However, the other person is not someone who listens to modern popular music and instead listens to classical music, jazz and songs from musicals. The sound fails to trigger any of the latter person's past musical memory patterns but does trigger some of the same neural patterns as are triggered by news reports from a war zone or dangerous urban environments. This latter person is probably going to call it, at best, 'a load of noise'.

Though Hayek's analysis of how the mind comes to see events as patterns of qualities has an immediate resonance in relation to a characteristics-based view of choice, his connectionist viewpoint can also be used for understanding how people get their ideas about causal relationships. To achieve this, our minds need to be able to sense patterns made up of multiple patterns: a cause is one event in the external environment and an effect is another. If our minds are to be able to sense which events are linked, and how, they may need to be programmed to identify and then connect pairs of

patterns that tend to occur together, or where one patterns repeatedly tends to precede another. Either way, to recognize one event as the cause and the other as the effect requires seeing which of them fits the patterns the person has previously used to classify a 'cause' and an 'effect'. When multiple possible causes are identified the person may be expected to apply further classificatory rules to decide which patterns are plausible and which are not. Hayek sees these patterns of connections as a viscous mass: our understanding of the world around us is something that we continually modify, both in terms of causal relations between events and the nature of the events themselves (Hayek, 1952, p. 175).

Hayek's view of human perceptual processes has much in common with the personal construct psychology of George Kelly (1955, 1963) whose ideas were first used in economics a quarter of a century ago by Earl (1983, 1986a) and Loasby (1983). Kelly sees people as if they are like scientists: they theorize about events in their lives by constructing models of what they believe they are looking at in terms of their existing templates for categorizing events. These templates comprise bi-polar construct axes (for example, music versus noise, safe versus dangerous, and so on) and Kelly suggests that they are organized into complex hierarchical systems in which what people can see in a particular situation is shaped by the rules of their construct systems as well as by the set of construct axes they have at their disposal. If two possible ways of construing an event clash, people will resolve the cognitive dissonance by seeing the event in a manner consistent with the construct they rank the highest (hence, for example, the difficulties that some have accepting the loss of a loved one around whose continued presence they had built many of their expectations). This view is very similar to the thinking of Lakatos (1970) in the philosophy of science: he suggests that some of a scientist's ideas will be 'core' to their research programme and not open to challenge, with the burden of adjustment to problematic data being placed on 'auxiliary hypotheses' in their research programme's 'protective belt'.

Where Hayek goes beyond Kelly, however, is by offering an underpinning neurological analysis of how events come to be categorized via the patterns of neuronal connections formed by the patterns detected in their received sensory inputs. This enables a more physiological view of learning than that offered by personal construct psychology. Both approaches see people as learning by revising the connections they make or creating new ones but Hayek's analysis allows for underlying neural connections to be strengthened by the repeated firing of particular combinations of sensory inputs. By extension, it also allows for memory decay due to established connections not being fired up to make sense of new inputs because these particular connections have not lately been

useful for finding patterns. (There is a clear parallel with social networks here: if we don't keep using parts of our social networks because they seem to have become less useful to us, they tend to be harder to reactivate at a later date as means to bring about particular new connections.) As a consequence of the latter, the corresponding construct axes or template configurations of constructs cease to be available.

At a conscious level, there is a case for initially being tentative about the connections one is forming: it may be unwise jump to conclusions about what things comprise on the basis of a single set of sensory inputs being compared with patterns from ones memory (for example, a single review of a product, unless one ha, over repeated samples, come to see the particular reviewer as very reliable), or about patterns of cause and effect. From an evolutionary standpoint, then, there is a good statistical reason for our brains to have evolved so that they only gradually firm up underlying neural connections when forming perceptions, just as they do when developing the connections that give us fine motor skills. There may also be evolutionary advantages to the brain resisting new connections that require existing ones to be unravelled: to flip between different ways of looking at the work, and hence to different ways of behaving, may preclude in-depth learning about anything and is likely to cause major problems for social coordination because those with whom we interact will have trouble predicting our behaviour. In some situations, however, evolutionary advantages come from the brain being able to make very rapid connections. Seemingly instinctive responses to threats or opportunities are a sign that this capacity exists.

4. Cognition and instinctive behaviour

Hayek's argument that new events are only capable of being perceived if they have similarities to what we have seen before needs careful examination in the case of infants: how can they make any sense of events around them when everything is new to them, and how can they progressively develop more adult-like ways of discriminating between different events? With no personal experience to call upon initially, the infant's perception must begin on the basis of experience that, as Hayek (1952, p. 168) puts it, has been acquired previously 'by the species'—in other words, programmed sets of neural connections that are hard-wired from birth to use as templates. These templates need not be particularly sophisticated and their application need not require any human sense of 'self' or any ability to envisage consciously the implications of discovering a particular class of object in the sensory field; all that evolution requires is that organisms have reliable method of matching objects to actions such that chances of survival are increased in the environments they are prone to encounter.

Studies of non-human behaviour show the evolutionary importance of basic pattern-detection skills with matched behavioural responses. A famous case from Tinbergen's (1951) work on animal behaviour is the need for young geese to run for cover if a hawk is overhead: if they do not respond in this way the moment they see it, the hawk may swoop on them. To survive, they do not need to have an abstract concept of 'a predator', or related concepts such as 'violent death'; they just need a combined stimulus detection/response rule that makes them run for cover when a hawk is overhead but which does not divert them from foraging if a threat is not present. (A perceptual system that caused them to run for cover when threats were not present would hinder their chances of survival by interrupting their feeding—just as in humans excess anxiety and paranoia can greatly interfere with everyday life.)

Seen from the ground and without good resolution, the silhouettes of a hawk and a goose are similar, even though a hawk has a long tail and short neck and a goose has a long neck and a short tail. A bold crucifix shape can represent either in silhouette form. To assign such a silhouette to one category or the other a further cue is required, the direction of movement: an efficient rule in this case is one that results in the gosling running for cover in the presence of such a silhouette if the shorter part of the central axis heads it, with the long part trailing it, but not if the movement is in the opposite direction. Possession of such a simple classification/response rule puts the gosling into a far better position for surviving than it would be in if it had a complex rule requiring it to deliberate, assemble a list of possible courses of action and choose the best one. There is an obvious parallel here between the survival value of fast and frugal rule-based action in the animal kingdom (cf. Bekoff, 2005, p. 36) and Winter's (1964) arguments about the potentially superior survival capabilities of a firm that uses decision rules rather than marginalist methods to cope with changes in its competitive environment.

An analogy in relation to artificial intelligence is also instructive here, even though, as Steele (2002, p. 130 notes, artificial intelligence generally works with serial processing of inputs and particular storage locations for particular patterns whereas Hayek's view of the brain is very much that of parallel processing and distributed storage. Broadly speaking, modern sensing technologies work in much the same way as we are supposing the mind of a gosling works to produce behaviour without any conscious, abstract understanding of the situation at hand. Hayek (1952, pp. 47-9) himself clearly sensed this parallel even though the technology of his time was much less sophisticated. In trying to clarify his vision of how cognitive processes work he drew parallels with mechanical sorting machines such as those then being used to

sort census cards in which punched holes represented the data. Such machines were the forerunners of modern digital computers. Had he been writing today, Hayek could have noted parallels with visual recognition devices such as scanners that are programmed to do optical character recognition from text, registration-plate recognition devices used by police to search for vehicles of interest amongst the rest of the traffic on a particular stretch of road, or electronic quality checking machinery. Incoming light inputs are pixilated and the machine checks to see whether certain patterns of pixels are present. In some cases this works hierarchically with search for different kinds of patterns being done very rapidly in sequence (for example, first find and lock on to registration-plates on passing vehicles, then check them for each possible letter and digit). What the machine 'sees' thus depends on what it is programmed to look for. Other modern devices imitate other senses. For example, a smoke detector can serve to some degree as a nose substitute, while the pickup and signal processor of a guitar synthesizer can rapidly count the frequencies at which the guitar's strings are vibrating, in effect working as a ear's cochlea.

Having detected the presence of particular objects, such devices can in turn initiate some form of action if this has likewise been programmed: a registration-plate recognition device may issue fines to motorists who have failed to pay a congestion charge, a smoke detector may emit a high-pitched note if smoke is present, and a guitar synthesizer may instruct digital samples of particular instruments playing particular notes be sent to an amplifier. At no point do these sensing devices need to have any conceptual understanding of what they do, any more than the gosling needs to think 'hawk' or 'predator' before running for cover.

In all of these cases, exactly as in Hayek's theory, the devices recognize only what they are programmed to recognize. For example, suppose hybrid petrol-/electric-powered vehicles are not liable for a congestion charge within an inner city zone. The registration-plate recognition system will only know not to send a fine to the owner of a hybrid if it has been programmed to recognize the distinctive shapes of such vehicles (as would be possible with a Toyota Prius) or, more likely, particularly since hybrid versions of some conventional vehicles are available, if it has been programmed to ignore the registration plates of hybrid-powered vehicles. These devices remain oblivious to all other patterns, not just in other sensory modes (for example, ignoring sounds or smells and only looking for visual patterns) but also within their particular sensory mode (for example, if programmed to recognize rectangular objects, they will ignore pixel patterns that consist of curves).

The selective vision of such devices makes it easier to see why Hayek objected to what he called 'mosaic psychology' (1952,

pp. 76, 153). A modern pixilated image is akin to a mosaic, but for it to be seen as an image of anything ordered rather than mere 'noise' requires that combinations of pixels of similar colours within it must be found to match up with some pre-existing pattern. Hayek sees the mind as working in a holistic manner as a complex system, whereas the mosaic approach is an aggregative, reductionist one.

Adults will rarely be in situations in which they cannot make any conscious classification at all of the events they are facing. Even so, they will experience something close to that of the infant human or gosling if they find themselves in a country where both the language and culture follow different rules from their home territory and they are unable rapidly to infer what the alternative rules may be. In such situations one's survival chances may be increased by behaving in a manner that involves copying the local population—'When in Rome, do as the Romans do'—with refinements insofar as one can discern people who seem to be the local equivalent of oneself.

New kinds of consumption activities or a newfound ability to choose in unfamiliar market segments resulting from significant changes in purchasing power may present rather similar 'new territory' challenges even on one's home turf. Products may have a language of their own in some respects and even some of the brands may be unfamiliar and difficult to judge relative to those that are known from other products and market segments. Here, too, following the herd is a simple means to survival, reducing the risk of being asked to provide the sort of account that a deviant choice might provoke. The leading brands may have got established in such a market segment on the basis of rules that are no longer currently appropriate. However, if new members of the population of potential buyers also suffer from a lack of familiar landmarks for making comparisons, other brands may have trouble dislodging them because the latter are not favoured by herd-based rules (cf. Choi, 1993).

For those who lack decision rules for a new situation and who cannot easily experiment due to time pressures, barriers to obtaining access to the product for trial (for example, by renting it if it is an indivisible durable), or because the initial trial involves a crucial choice in Shackle's (1972) sense (for example, because there is a risk of acute social embarrassment), the alternative to following the herd is to enter the 'market for preferences' (Earl and Potts, 2004) and access the insights that others have to offer about how well different products match with different consumer lifestyles. This is not without its challenges: in working out which authorities should be trusted one may still have to fall back on simple social rules.

5. Consciousness versus the tacit dimension

The acquisition of language is clearly one route to developing a more complex sensory order involving the emergence of the ability to engage in abstract, conscious thought. Language provides elements for making new connections and importing useful connection sets from others with a greater pool of experience. Whether a language is a spoken one or a symbolic one such as the language of mathematics, it provides a means for thinking logically about causal chains and the implications of particular propositions or actions. From the standpoint of Hayek's theory we can see that the human brain may develop a set of patterns that make up a working language via repeated exposure to particular words being spoken by other people in combination with other replicated sensory inputs. But the ability to recognize particular words does not necessarily imply any abstract understanding of what they mean in themselves: a machine can be programmed to recognize words and act upon what it hears, just as some students are able to memorize lecture note handouts verbatim and download them in exams without showing any sign they have understood the arguments in what they have memorized.

Understanding and consciousness of what one has understood are emergent phenomena in the sense that the brain is making new kinds of connections. The mind does not merely attach, say, 'cornflakes' to one kind of physical event (so that each time cornflakes are encountered the sound of the word is triggered in one's head as part of the pattern the brain assembles) and 'rice bubbles' to another kind of physical event. It also connects 'food' to particular physical events and begins to see sets of sub-categories: cornflakes and rice bubbles are thus in the category of breakfast foods, and breakfast is an event that happens soon after waking, and so on. A young child may acquire and use words without being fully aware of their meaning: breakfast food may include both 'cereal' and 'fruit', but 'muesli' might be seen by some children as 'a cereal' and by others as 'a breakfast food made up of cereal, nuts and fruit', but none of them may have any notion of what 'cereals' are in the sense of what they have in common as plants. Regardless of how far humans develop the linguistic side of their perceptual processes, however, it is clear that the ability to make linguistic connections of a complex kind is something that human brains are unique amongst living organisms in being programmed to be able to do.

The development of language skills and conscious connection-forming abilities are vital for having the kind of 'economic imagination' that can engage in deliberative problem-solving activities and provide accounts of how a decision has been reached that refer to the characteristics of rival options in cost-benefit terms. However, this should not distract us from the potential for a

wider range of experience to permit a greater capacity to take decisions in ways that cannot be readily put into words.

What we are talking of here is the growth in what Polanyi (1962, 1967) called 'the tacit dimension' and the basing of choices on 'tacit knowledge'. For example, most people would be hard pressed to say exactly how they can instantly recognize a person they know as matching their prior template for that person rather than having a set of features that comprise someone new to them. Another familiar illustration of the tacit dimension is how children normally find it something of a struggle to learn how to ride a bicycle without stabiliser wheels or to swim, despite their parents' and friends' best attempts to show them how. But eventually they get 'the knack' for performing these tasks: their brains establish workable sets of connections to coordinate sensory inputs with the movements made by their bodies (for example, to adjust their weight distribution from side to side when cycling, or breathing at the right time when swimming). In the process of acquiring such skills, their brains are, in effect, developing complex algorithms in which one set of connections triggers another. What children able to do, without conscious thought to avoid losing control of their bicycles when they are surprised by a bump in the road or have to pull up sharply is very similar to what electronic stability control and anti-lock braking systems are programmed to achieve in modern cars.

In situations of great complexity where there are many things to weigh up and considerable uncertainty, or where there is a lack of knowledge of the kind that can be processed consciously, decisions will require an instinct for what to do. It even seems that some kind of basic instinct to drive action is a vital aspect of choice even when decision makers are very knowledgeable: Damasio (1994) studied the decision making of patients with brain injuries and showed that particular kinds of brain injury leave people able to articulate differences between alternatives in great detail but completely unable to make choices between them. But 'gut feelings' may also be based upon the brain's unconscious processing of tacit knowledge, where it likens current options to past patterns in ways that cannot be put into words.

If we think of people as having evolved, for survival purposes, a tendency to keep asking themselves, tacitly if not consciously, 'is there any need for me to change what I am doing?' then from Hayek's perspective we would also see them as continuously classifying decision occasions (including, in effect, 'no change of action is required', versus 'I need to do something as my environment has changed'). Different kinds of choice strategies will have been attached to different kinds of events: for example, an imminent threat of a particular kind may have a simple fight or flight response, whereas other situations may be labelled, in terms

of fit with previous ones, as, say, 'the sort of decision where I ask a friend or check Amazon.com for a recommendation', 'the sort of situation where I carefully search for options, weigh up the pros and cons and don't rush to a verdict', and so on.

With our minds continuously scanning to see if action is required there may be periodic shifts between what we are attending to and our modes of choice. In some situations, rather like a modern computer that can have several programmes running at once, we may even be simultaneously choosing both consciously and tacitly in different domains. For example, when driving a familiar route we may at one moment be thinking about what to cook for dinner when we arrive home, without consciously reflecting on our use of the vehicle's controls or the route we are taking, but at the next moment we may abruptly cease thinking about the choice of meal and without hesitation step on the brakes because our minds have detected that the car in front is braking, or we may have noticed it is starting to rain and have to choose whether to turn the screen wipers on yet and in what mode.

From Hayek's standpoint we would expect that people who develop expertise in particular areas do so by forming connections regarding much bigger samples of pertinent events in their area than non-experts do. When faced with additions to their sample, they have a much bigger set of templates to call upon for making judgments about the fresh sets of sensory inputs. This is in line with the work of Herbert Simon and his colleagues (Chase and Simon, 1973; de Groot, 1965) on the skills of chess players. As Simon (1976, p. 145) comments,

> [W]hat appears to distinguish expert from novice is not only that the former has a great quantity and variety of information, but that his perceptual experience enables him to detect familiar patterns in the situations that confront him, and by recognizing these patterns, to retrieve speedily a considerable amount of relevant information from long-term memory. It is his perceptual experience that permits him to play, and usually win, many simultaneous games against weaker opponents, taking only a few seconds for each move.

In other words, a chess master does not possess a superhuman ability to work out the tree of possible consequences for each of many possible rival moves; rather, the chess master has much more experiences of patterns on a chess board and a bigger repertoire to call upon of strategies that have proved successful in similar situations. Simon (*ibid*.) argues that there is no reason to believe that the brain of the experienced business professional works any differently from the experienced chess player, so the executive can 'react "intuitively", without much awareness of his cognitive processes, to business situations as they arise'.

6. The fallible decision maker

The ability of humans to use intuition to cope with complex problems and ignorance does not guarantee that the decisions based on gut feelings will be of high quality. Evolutionary psychologist such as Barkow, Cosmides and Tooby (1992) argue that unconscious processing mechanisms in use today evolved early in human existence to deal with choice environments very different from those that people now face. If so, we might expect that in some modern contexts people will be prone to make errors. For example, we may be programmed to be more impulsive in some cases than the pressure of the situation actually requires: stone-age people facing predators who could also be food sources needed to be able to make 'fight-or-flight' decisions very rapidly, whereas modern consumers could often readily defer reaching decisions about which new consumer durable to buy and yet may be prone to leap impulsively because of the stress of dealing with pushy sales staff. Within modern behavioural economics we find US scholars such as Myers (2002) emphasizing the shortcomings of intuitive decisions in much the same way that in the work of Kahneman, Slovic and Tversky (eds) (1982) heuristics and biases are seen as leading to departures from mainstream economic views of rationality. By contrast, European scholars such as Gigerenzer (2007) marvel at 'the intelligence of the unconscious' and emphasize scope for training people how to avoid major errors.

Back in 1952, of course, Hayek himself had nothing to say about how the sensory order may operate to produce the kinds of heuristics and biases that have since been identified in empirical work. Clearly, some of these findings—such as the tendency to treat high probabilities as certainties and to ignore very low probabilities altogether—imply that the process of making neural connections has evolved a tendency to simplify in this context. The editing of probabilities looks irrational from the standpoint of expected utility theory. So, too, does the kind of focusing on the most attention-arresting pair of gains and losses that a strategy might offer that is central to Shackle's (1979) non-probabilistic 'expected surprise' analysis of choice under uncertainty. However, it seems plausible that evolutionary processes have *selected* this aspect of bounded rationality for its survival-enhancing capabilities. Clearly, it is cognitively possible for people to avoid these probability-editing biases and assess risks in the manner of expected utility theory rather than operating in a manner consistent with Shackle's potential surprise theory or Kahneman and Tversky's (1979 prospect theory: they just need to be trained to use their brains' potential rather better when dealing with hazardous situations. (Help is now readily available, from, for example, Gigerenzer, 2002.) From the standpoint of evolutionary psychology, and again

from the standpoint of Winter (1964), simplified ways of thinking about risk might be highly functional. Even though they might not be perfectly reliable (unlikely events may actually happen occasionally with dire consequences for those who ignore them as possibilities), they may nonetheless increase species survival chances overall by enabling faster responses to threats.

Further clues as to what may be happening come if we map Hinkle's (1965) work in personal construct psychology on to Hayek's view of how the brain works. Hinkle attempted to make sense of resistance to change on the basis that changing some constructs in a person's construct system may necessitate changing many others that are subordinate to the changed constructs. He called these changes 'implications' and developed a technique known as 'implication grid analysis' to map them. Hinkle found that resistance to change in a construct is a function of the number of subordinate implications it carries. This can be used as a basis for understanding elasticity of consumer demand (see Earl, 1986b). For example, most consumers would see few negative implications associated with switching between brands of tinned tomatoes to save a few cents, whereas to *fail* to switch might be at odds with their self-constructs (for example, as rational, thrifty shoppers) and potentially carry many negative implications. However, we might expect that the demand for a lone brand of *organic* tinned tomatoes to be much more inelastic due to its purchasers being people who see organic products in relation to core areas of their lives, such as their health or their views of themselves as eco-friendly individuals.

From Hayek's standpoint major changes in mental constructs and their organization would entail major changes in underlying patterns of neural connections. Hinkle's research findings seem to imply that human brains are programmed to preserve connections that have been firmly established and to reject cognitions that would unravel connections previously firmed up as means for coping with life's challenges.

This perspective is very much in line with the conservative nature of the findings of the heuristics and biases research, such as the endowment effect, sunk-cost bias and status-quo bias. If faced with a cognitive dilemma—i.e. a situation of cognitive dissonance involving inconsistent prospective perceptions—the human brain appears to have evolved an ability to come up with a cognitively harmonious perception that limits the amount of neural reordering as far as possible. This may not entail pragmatically compromising until one is able to find 'a happy medium' as one might expect from traditional trade-off notions from mainstream choice theory but, rather, *reframing the situation so that no trade-off appears to be being made* (cf. Steinbruner, 1974, chapter 4). Thus, for example, suppose we have 'set our heart' on obtaining a particular product that we see as having a great capacity to enhance our social

standing and buttress how we see ourselves. If we then find that it is more expensive than expected this will not result in us unravelling these expectations and their underlying neural connections. Rather, we will attempt to expand our budgets by trying to obtain credit even if a credit-based purchase is a source of cognitive dissonance because we have also previously formed connections between, say, our self-images and the idea that debt is something to be avoided. Dissonance will be removed by severing such connections and creating ones consistent with going ahead and borrowing if this is the easier form of neural reconfiguration than one involving abandoning the plan (cf. Maital, 1982, pp. 142-5; Earl, 1992). For example, the person might suddenly start being willing to perceive that being in debt with a new car is actually more financially responsible than continuing with an existing vehicle after raising their assessment of the likelihood of big maintenance bills on the latter, something that would not have happened had it not been necessary to find the extra funding to buy the new vehicle.

Taken together, these two perspectives on the origins of heuristics and biases in the mind's operations—i.e. that of evolutionary psychology and the Hayekian one of dominance of well-established, strongly coupled sets of neural connections over nascent and loosely coupled ones—do not bode well for timely responses of consumers to challenges presented by ecological issues. Potentially catastrophic events whose prevention requires major lifestyle adjustments (and hence major cognitive adjustments) seem prone initially to be simply ignored if they are presented as having low probabilities. Subsequent attempts to demonstrate that such events are actually on the way are likely to be argued away until enough evidence mounts to produce a cognitive tipping point in which the continuation of the existing lifestyle becomes seen as a bigger threat to the person's cognitive system than a change to a new 'sustainable' lifestyle.

7. Brands and criteria-based decision rules

Although consumers have in-built tendencies towards making decisions at odds with mainstream economists' notions of rational choice, these shortcomings should not distract us from their abilities to develop very refined powers of discrimination that enable them instantly to recognize people that they know and classify products as distinct combinations of characteristics. The height of the latter capacity is perhaps epitomized by the 'anoraks' who can immediately identify particular models of vehicle—for example, a 'Toyota Camry Ateva 2005 facelift', rather than simply a 'Toyota Camry from the generation prior to the current one' on the basis of whether of not it has body-coloured door handles and alloy wheels (which rule out the base Altise model), a non-chromed grille (which rules out the top-end Grande model), no body kit (which rules out

the Sportiveo variant) and the colour configuration of the rear lights (silvered tops and bottoms rather than silvered middles rule out the pre-facelift 2002-5 model).

An important thing to notice here, however, is that the knowledge used to make such distinctions may largely be codified and assembled as checklists. Such checklists are actually quite simple combinations compared with the combinations of curves and lines that less car-obsessed consumers need to be able to use to distinguish one car model from another. In the latter case, their knowledge may be more of a tacit kind, and where products are in many respects similar, puzzles may be resolved by looking at the manufacturers' badges.

For a particular manufacturer's products (in general) and its individual models to be instantly identifiable to consumers they must appear to be composed of *particular* combinations of visual cues, in exactly the same way that machines programmed to separate passing items on a production line into different categories need to be able to determine which *particular* combinations of lines and curves they comprise. (The mathematical underpinnings of object recognition systems are challenging, especially if it is necessary to be able to recognize a particular form from different angles. For some examples, see Hann, 2001; Hann and Hickman, 2002.) People and machines classify events into categories on the basis of invariant aspects that comprise some kind of signature at a general or more particular level. Car manufacturers can thus create distinctive looks for their products by combining codified features such as their signature front grills with much more tacit styling combinations. (For example, how the wheel arches are flared, and the relationship between the wheels and wheel arches may be chosen in an attempt to give their products a particular stance consistent with the image they are trying to create.) If they make a particular set of design cues a constant they may be able to ensure instant recognition even though they allow other design cues to change. For example, during the evolution of the Volkswagen Golf from the 1974 Mk1 to the Mk6 thirty-five years later, a Golf's external appearance remained distinctively 'Golfish' despite moving from an angular design to a much more aerodynamic shape based more on curves. The one obvious invariant that no other car in its class seemed consistently to have was its very thick, rather parallelogram-shaped rear pillar, but in other respects it is hard to put into words exactly what its signature is.

Now, if consumers can distinguish between products in these complex ways, a question that follows is whether or not, in choosing between them, their minds will go through a complex n-dimensional trade-off process akin to that envisaged in Lancaster's characteristics-based theory of choice. Though this seems perfectly natural to most economists, the economic imagination could work

very differently: for example, the mind could go through a choice process that is itself a template-based activity that initially classifies products as suitable or unsuitable in terms of whether they meet a set of checklist requirement and then applies tie-breaking or priority ranking template if the need arises (see Earl, 1983, 1986a).

However choices *are* made—and the forms of decision criteria/preferences may vary between different contexts—the clear message from Hayek's work is that while people may all be born programmed to make certain basic choices in the same way, they grow to differ in what they do because they develop different systems of neural connections as their pools of experience increase and diverge. Thus, if it is meaningful to speak of a consumer as having a 'preference system' it is one that the consumer has constructed and which may be very much a work in progress that consists of a set of rules for dealing with particular kinds of situations. As time passes, some rules may drive out others due to the relative frequency of their actual use affecting the relative strengths of the neural connections between types of situation and each of the rules that have been associated with them. To put it another way: if we start to perceive that a particular rule is prone to prove unworkable and force us to fall back on an alternative from our repertoire of rules for a particular kind of situation, we are more likely to use one of the latter in the first instance on future occasions of that kind.

There seems to be no necessary evolutionary basis for assuming that the classifying of product or characteristic bundles as better than, worse than, or as good as other bundles will be done in a manner that implies a diminishing willingness to make marginal substitutions. This contention may be better appreciated if we consider the key role of attention as part of the process of decision making. The brain needs to be programmed to allocate its finite attentive capacity to focus on a limited set of events at any one time whilst also scanning for potential patterns with greater attention-arresting properties. Rival possibilities represent competing claims on the brain's attentive capacity, so to have a hope of being selected they must stand out against the others. From the standpoint of evolutionary psychology we would expect that what will stand out is not 'outstanding overall value', but a stellar performance on a dimension that is important for immediate survival or longer-term reproductive success. The obvious means for firms to try to ensure this is to have (or claim to have) something outstanding to offer and advertise this whilst trying to divert attention from the compromises that have been incurred to make it stand out in a particular area. This would make it hard for a product that is a solid all-rounder but in no way *outstanding* to get serious consideration unless the brain is programmed to look for product configurations that that have no glaring shortcomings—or

unless consumers have developed a strategy for doing this and ignoring advertising 'hype'.

Clearly, many people do end up buying products that are unremarkable but functional, and they manage to filter out the advertising messages that aim to promote a focus on a single characteristic as if there were no such thing as diminishing marginal substitution. (It is tempting to assert that this seems particularly evident amongst the middle-aged and senior consumers who have had more time to develop scepticism and become aware of the potential downsides of products that have an 'exciting' allure in other ways; the younger generation, meanwhile, look upon their preferred products as 'boring'.) However, cognitive strategies that involve not being taken in by the loudest or brightest stimuli need not involve making trade-offs: as already indicated, they could instead involve being open to considering any products that met particular sets of criteria. Such a way of thinking is cognitively far simpler than assessing marginal substitutions across many dimensions.

From an evolutionary standpoint, the bigger the threat to our survival, the more attention-arresting something should be. Maslow's (1954) famous suggestion that people have a 'hierarchy of needs' goes against the grain of mainstream notions of substitution. However, it can be seen as perfectly reasonable in these terms, as there is an evolutionary reason for a hierarchy of needs being hard-wired at the species level: without water we die sooner than we die without food, so if we have neither, a set of neural connections pertaining to thirst will grab hold of our attention and we focus first on finding enough water. In Maslow's analysis it is only when all of our basic needs are covered that we are in a position to make tradeoffs and set about engaging in 'self-actualization', fashioning our lifestyles by choosing between those bundles of goods/activities that can be obtained without jeopardizing our basic needs. Before this stage, bundles of goods that are more efficient at getting the basic needs met will be the ones that command attention, and this is where the consumer's experience will be significant for classifying possibilities.

It is possible that a trade-off way of ranking possibilities could evolve as part of the process of dealing with a Maslowian hierarchy. From experience, the consumer might form templates that classify some mixes of products as more efficient than others for meeting particular basic needs. Such mixes might be constructed on the basis of rules that conflict with the trade-off notion by having satiation thresholds for some characteristics (for example, 'too showy/obvious' regarding some strategies aimed at meeting a need for social membership) but others might be consistent with the notion of continuously diminishing marginal rates of substitution in characteristics space. Thus for winning a member of the opposite

sex, a male may judge that it is, say, unwise to have terrible clothes and grooming but a great car, or vice versa, rather than a 'happy medium'. If attention is focused on the most important currently unmet basic need, the focus would be on assessing how product characteristics of various kinds could help towards that particular need: with a car as a potential means towards winning a partner, sleek styling might be seen as carrying good implications but not if achieved at the cost of a potentially embarrassing risk of unreliability. 'Implications' here can be viewed in the Hinkle (1965) sense, as discussed earlier, as a kind of common unit of measurement for different characteristics, to make an additive approach to choice possible. We could thus have a hybrid of programmed and learned attention-focusing preferences that mixes lexicographic and trade-off ideas.

We should not, however, jump to the conclusion that, subject to constraints of an evolutionary kind, as per the Maslow hierarchy of needs, consumers will necessarily evolve decision-making systems that approximate to conventional trade-off notions. Trade-offs become problematic for the consumer to compute in any conscious sense where there is a large range of products between which to choose and the products perform in very different ways across significant numbers of characteristics. Consumers who try to reason their way to a choice in such a situation will need a means of ranking products that permits simplification, such as a checklist of requirements to generate a shortlist, with trade-offs being performed, if at all, only in relation to the short-listed products. Otherwise, it will be necessary to choose on the basis of simpler decision rules, such as those involving familiar brands, copying others, or on the basis of intuition. In the latter case, the consumer's brain might unconsciously work in a manner approximating to trade-off notions as per the 'implications' approach to avoid undoing established neural pathways. If the way that cognitive dissonance gets removed involves denying at the conscious level that a trade-off has really had to be made, introspection may provide few clues about the underlying process, so debates about what actually happens might require an experimental approach to reveal underlying 'preferences'.

8. Concluding comments

Hayek's theory of the mind provides a unifying foundation for analysing choice in a evolving, pluralistic and context-based manner rather than seeing all choices as made in much the same way on the basis of 'given preferences' that obey the axioms of rational choice theory. If read from an evolutionary standpoint, *The Sensory Order* should encourage economists to recognize the role of intuitive thinking rather than conscious processing as a potentially efficient basis for coping in contexts where there are competitive reasons for

taking decisions quickly or where complexity and uncertainty make it problematic to rank rival possible courses of action. Its focus on finding familiar patterns in the midst of incoming sensory inputs should also encourage reflection about the possible role of template-based decision making in contexts where people are trying to solve problems in a conscious manner and have built up complex perceptions of the differences between a large number of rival possible solutions.

Since there are limits to what we can know about each individual's perceptions and their underlying patterns of neural connection, Hayek's analysis leaves room for Austrian economists to continue to emphasize limits to predicting very precisely the choices that people make. Even so, his view that these patterns are developed from interpretations of past experiences on the basis of even earlier experiences opens up potential for predicting behaviour in a broad enough sense to limit coordination problems. What we need to be able to do is to know, as the expression goes, 'where they are coming from'. This line of thinking is consistent with that suggested by Heiner (1983), who argues that prediction of behaviour is only possible in a world of singular events because people cannot work out the optimal way to deal with the singularity of an event but instead try to see what pattern it fits into and then apply a behaviour strategy developed for that form of pattern.

Finally, and perhaps controversially, it might also be argued that Hayek's analysis should make subjectivist economists more open to the writings of modern behaviourist consumer researchers such as Foxall (1990, 1997). Hayek (1952, p. 44) took issue with the strict behaviourist position that it is not necessary to understand mental processes in order to account for behaviour. To do so was to dodge the question of how stimuli came to be interpreted in one way rather than another. Behaviourists' tendencies to focus on the frequencies of individual stimuli also entail neglecting the significance of patterns of stimuli. This goes against what Hayek had picked up from the Gestalt psychologists for whom, say, it is the relationship between notes—i.e. the tune—that shapes a person's reaction to them, not each note as an individual stimulus (see Vecci, 2003, Caldwell, 2006). However, his emphasis on the importance of past experience for how current events are perceived, and on the time it takes for neural connections to firm up or decay, is not at odds with what behaviourists believe about learning and behaviour. If we can discover which past experiences have been seen as rewarding and which have been viewed by consumers as punishing, then this, too, may help us anticipate their behaviour.

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