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Salience, chains and anchoring
Reducing complexity and enhancing the practicality of behavioural economics

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Abstract
One problem facing "nudge units" is the lack in behavioural economics of a core unifying model of the mind and behaviour. Portable Extensions of Existing Models (Rabin, 2013a; 2013b) make it difficult to approach the problem of structuring choice architecture to "nudge" people (Thaler and Sunstein, 2008) into behavioural change in an integrated, holistic and systematic manner. The purpose of this essay is to advance a new proposal which might address this problem and make behavioural economics more "intellectually competitive" (Harstad and Selten, 2013) and its use more practical. We make use of a new theory of the mind as a network structure within which the psychological process operates. Within this structure we identify three properties –salience, chains and anchoring– by which behavioural change is brought about. This has both intellectual and practical value for policymakers by reducing the complexity of behavioural economics and making it more easily applied.

JEL Classification: D01; D04; D81; D83; D90; D91

Keywords
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Introduction: weaving a more coherent and useful tapestry

Matthew Rabin (2013a; 2013b) has brilliantly categorised the bulk of the behavioural economics discipline as consisting of "Portable Extensions of Existing Models". That is to say, the tendency of behavioural economics is to take standard rational agent models and modify them to account for this observed deviation from its predictions or that, sometimes (as in the case of Prospect Theory) three or four at a time. The problem with this approach is that such models (even, as Barberis (2013) has noted, with Prospect Theory) are not "intellectually competitive" (Harstad and Selten, 2013) with the models they seek to modify, producing tens of variations for tens of different "irrationalities" (see two of the leading textbooks, Baddeley (2012) and Cartwright (2011)). This also has the effect of "pathologising" the errant consumer (as Mehta (2013) put it) as well as making the implementation of "nudge" policies (Thaler and Sunstein, 2008) more difficult to approach in an integrated, holistic and systematic manner.

The argument of this essay, drawing on the work of Peter Earl (1983; 1986a; 1986b; 1990; 1995; 2015; 2017), (formalised in Markey-Towler, (2018)) is that we can discern three fundamental properties of the mind and psychological process which reveal the myriad "biases and heuristics" identified by behavioural economics to be manifestations of simple, indeed reasonable, aspects of the human psyche. This has value both intellectually and practically for "nudge" policies by reducing the complexity and enhancing the usability of behavioural economics.

We begin by introducing a theory of the psychological process as operating within and upon networks in the mind. We then consider the place of "nudge" policies within this theory and identify three fundamental properties of the psyche –anchoring, salience and chains– which may be understood to underlie a number of "biases and heuristics" identified in behavioural economics. We conclude by considering how this has intellectual value for understanding behavioural change and how it may greater enhance the practical value of behavioural economics by providing an integrated, holistic and systematic approach to human behaviour.

The psychological process: operating within mental networks

Friedrich Hayek (1952), Kenneth Boulding (1961) and Peter Earl (2017) have all advanced the concept (formalised in Markey-Towler (2018)) that the mind, much like the brain, may be understood as a network structure within which the psychological process operates. It is sufficient for our purposes here to fix the structure of this network, as "nudge" policy tends to operate over short enough a time horizon for the evolution of mental networks (considered elsewhere – see Markey-Towler (2017a)) to be relatively second-order. The

nodes of this network are conceptual representations in the mind of objects and events in the world, things such as goods, services, media of exchange, attributes, wants, needs, our actions and those of others. The connections in this network are representations of the relations we construe between various objects and events in the world. Dewey (1910) spoke of these as inferring the "unseen relations" in the world, Kelly (1963) of them as our constructions of the expected course of events, Hayek (1952) and Boulding (1961) of them as a sort of "map" for understanding the world, much as Piaget (1923) would refer to them as a "schema".

We exist in a world of information (Shannon, 1948a; 1948b), to which it is the role of the psychological process operating within this network to respond. Firstly, our ***perception*** must map this information into conceptual representations of the objects and events in our environment (both internal *and* external (Simon, 1956)) so that our minds may operate with it. As Merleau-Ponty (1945; 1948) and Polanyi (1958) might have said, perception provides the interface between the world and our personal knowledge of it. It correlates anterior stimuli with antecedent representations thereof within the mind, as Brunswik (1934) may have said. This mapping from environment to the nodes in our mental networks is the process by which we literally "see".

The ***analysis*** of our percepts of the environment proceeds as our mind connects those various percepts of objects and events in our environment together using our mental networks to form an understanding of our environment. It is demonstrable in fact that this process may take the form of both intensive reasoning (in the original sense of that word as *ratio decidendi* –see Elster (2009)) or as the application of simple rules or "heuristics" expressed in algorithmic longform in our mental networks (as the cognitive scientists theorise - see von Neumann (1958), Simon (1968), Newell (1990), Gigerenzer and Goldstein (1999) and Pinker (1999)). Our minds often do this latter subconsciously and with such speed that we aren't even aware of it consciously until we get some "feeling" which is the output of that process, which Freud (1917; 1930) and Jung (1968) discovered was the origin of neurosis. But often we are also engaging in reasoning based on our past experience and our own personal schema for interpreting our world.

In this process our personality manifests (see Kelly (1963)) in the way our thinking is oriented to internal or external objects or events (Jung, 1921), or to the taking of particular actions (see Goldberg (1993) on trait conscientiousness) in a manner which is some admixture of procedurally and substantively rational (see Simon (1976; 1978a; 1978b)). In other words, both "system 1" and "system 2", "fast and slow" thinking (see Kahneman (2003; 2011)) coexist within mental networks and are drawn up into the psyche as part of the process of analysis. By this process we apply our personal knowledge about the world (Polanyi, 1958) to understanding our environment.

Decision proceeds on the basis of our analysis and it is here that the truth of rational choice theory applies. Contained within our analysis of the environment is knowledge of how and why to act in the world. One way (not the only way) to think about this knowledge surrounding and connected to the various courses of action available to people is that it contains our expectations of the *implications* of those acts. These chains within the network structure of the mind reflect the outcomes we expect will attend upon our actions based on our personal knowledge of the world (Shackle, 1969; 1972; Taleb, 2007)).

The motivational complexes within our mental networks (be they Freudian drives (Freud, 1917; 1930) Jungian archetypes (Jung 1964, 1968), Maslowian hierarchies of wants and needs (Maslow, 1943) or visceral emotions (Simon, 1967)) endow these expectations with an aesthetic "feel" which allows us to establish *preference* between them. Now these preferences might be trivially determined by the dictates of a behavioural rule in the psyche so that we are guided more by the rule than complex tradeoffs of preferences, but they allow us to go between our analysis of our environment and our response to it –our behaviour. A useful theory is that *we decide to follow that course of action we* think *to be associatied with the most preferable outcomes out of all feasible courses of action*.

Notice how this theory preserves the truth of rational choice theory (Mas-Collel, Whinston and Green, 1995; Rubenstein, 2006; Jehle and Reny, 2011), but acknowledges the psychological process which leads to behaviour. We can now identify the conditions under which behaviour may change and/or deviate from what might be considered "best" or "rational". Thus will we extract an integrated, holistic and systematic theory of the fundamental processes underlying "heuristics and biases" and what seems to be irreducibly complex human behaviour. As Herbert Simon argued in *The Sciences of the Artificial* (1968), the rules which govern behaviour must virtually of necessity be simple. Complex behaviour is as likely to be the result of a complex environment as any complexity of the mind.

Behavioural change and choice architecture: anchors, salience and chains

Behavioural change occurs when an individual switches from engaging in one course of action to another. In our theory, this occurs when one action ceases to be that associated with what the individual thinks to be the most preferable expected outcomes out of all feasible courses of action and another does. We will therefore observe behavioural change from some prior to some posterior behaviour if:

1. That posterior behaviour is feasible

2. That posterior behaviour is associated with the most preferable set of outcomes the individual *thinks* will obtain out of all feasible courses of action

It may seem academic, but it is important to note that in special cases either the anterior or posterior behaviour may be defined as "inaction", if the taking of no action is a decision rather than a reflection of decision paralysis (*a la* Schwartz (2004)). In such special cases, behavioural change manifests in the cessation of some behaviour, or the stirring of someone to action rather than the switching of one course of action to another.

Now the traditional, incentive-based method of inducing behavioural change which has been relatively unchanged since Marshall (1890) is to alter the price of engaging in some activity until it becomes technically infeasible (see Becker (1962)) or no longer preferable. This traditional approach (augmented by Sen's (1999) theory of capabilities) is not to be dismissed lightly, for as long as a state of *substitutability* may be attained between two courses of action (their expected outcomes become equivalently preferable) then we do not even require the drastic step of making prior behaviour infeasible, which is actually very difficult. We simply need to "get the incentives right" by changing the relative costs and benefits of engaging in that behaviour (Markey-Towler, 2017b).

However, if a state of substitutability does *not* exist, we require a more fundamental change of environment ("choice architecture") to affect behavioural change unless we wish to change mental networks themselves. This is the role of "nudge" policy (Thaler and Sunstein, 2008), and we may now show that it is exploiting three fundamental aspects of the psyche: anchors, salience and chains.

Anchors

The "hinge point" for behavioural change, the core factor in behavioural change outside of substitution and incentive, is the concept of the ***anchor***. Now we mean that in a more fundamental sense than behavioural economists tend to (see Earl (2015) on this point), we mean that in the psychological sense advanced by George Kelly. What Kelly (1963) and especially his student Dennis Hinkle (1965) taught was that none of our knowledge of the world can apply, and no objects or events can be made sense of but in relation to *other* things. Objects and events can only be made sense of if they are anchored relative to some classificatory axis (an "anchor"), and ultimately the axiomatic moral core of our schema for understanding our world –our personality. For instance, income and consumption in and of themselves mean nothing until they are *anchored* to what they obtain for us or how they compare to past and peer income and consumption (Veblen, 1899; Duesenberry, 1949; Easterlin, 2001; Clark, Frijters and Shields, 2008).

Now this is quite interesting, for in our theory the preferences which guide our behaviour are quite stable (they change only when the entire aesthetical system of the individual does), and they are defined over personal knowledge (the expression of a personality) which we have taken here to be fixed. Yet we find that our psychology arrives at a conclusion, much the same as Stigler and Becker (1977), that change may emerge from underlying stability due to environmental influences. Here this is because the manner in which personality, personal knowledge, interacts with the environment means that what is "called to mind" out of that personality may change fairly radically and thus behaviour with it.

Networks are rarely fully modular, their interconnectedness and the conditionality of those connections on other connections means that changes to one part of the network can have significant effects on the network as a whole. Hence the perception of some anchor may alter the overall analysis one forms of one's environment fairly radically. Anchoring relations may so condition the entire analysis of one's environment that their presence or non-presence may be sufficient to alter the preference between the expected outcomes of behaviour in a discrete fashion.

We may say that an anchor is *non-inert* if its presence in an individual's analysis alters the preferability of expected outcomes between at least two courses of action. If a positive non-inert anchor with respect to some posterior behaviour improves its preferability, and a negative non-inert anchor with respect to some prior behaviour disimproves its preferability, this may alter an individual's thinking sufficiently to change behaviour.

The classic anchors in behavioural economics are past or peer behaviour –known as reference levels. This is the foundation for Prospect Theory (Kahneman and Tversky, 1979), in which all prospects are judged relative to some reference level, though we find such notions in even the most canonical texts of rational choice theory, notably Markowitz (1952), extending on Friedman and Savage (1948). Such anchors we know have a positive influence if the anchoring relations indicate the expected outcomes of some behaviour are an improvement on reference levels (no surprises), but have an even sharper negative influence if they indicate a disimprovement. These anchors give rise to loss aversion and the endowment effect whereby the individual becomes reticent to engage in *any* behaviour, even less risky behaviour, which is anchored in such a way as to indicate a loss relative to reference levels.

Such reference levels, when we consider the mind as a network, may also be important for establishing preferability for some posterior behaviour based on its being a *status quo* course of action or one with an already established place in the mind of the individual. Ironmonger (1972) and Lancaster (1966a; 1966b) for instance taught that we can make sense of "new" behaviour sufficiently for it to become preferable as long as it can be anchored to established and understood *attributes* in the mind of the individual. Such attributes might be as simple as peer or past behaviour or the behaviour desired by some authority (see Simon (1947)). Individuals are thus subject to the influence of power, social pressure as well as default and status quo "bias" (it hardly makes sense to label such a procedurally rational phenomenon a mere bias).

The most potent anchors however are those at the core of personality –the visceral emotions. If these are present in analysis they may completely overwhelm other considerations and have an extraordinarily potent impact on thinking

and thus behaviour (see Elster, (1998), Loewenstein (1996; 2000), Bauermeister and Tierney (2011), Mischel (2014), Sapolski (2017) and of course Goleman (1996)). Freudian drives (Freud, 1917; 1930) Jungian archetypes (Jung 1964, 1968), Maslowian hierarchies of wants and needs (Maslow, 1943) serve a similar purpose, for unless behaviour is anchored relative to motivations, we cannot really expect people to be motivated toward this or that behaviour.

So if anchoring provides the "hinge" on which behaviour turns, the question then turns to how they might be elicited in perception and factored into the process of analysis. The question is how positive non-inert anchors relative to posterior behaviour, and negative non-inert anchors relative to prior behaviour, might be elicited or suppressed. For this we need to consider the psychology of perception (see Vernon, (1962)), wherein we discover two potent yet simple properties which are pertinent for behavioural change.

Salience

A basic property of perception, which can be summarised by a tautology which belies its significance, is ***salience***. We only notice what is noticeable relative to the rest of the environment. A percept (such as an anchor) is perceived if and only if the information corresponding to it makes sufficient "impression" on the sensory organs to exceed a threshold of arousal generated by the environment.

Though basic, almost trivial, this property of the psyche gives rise to a broad range of "heuristics and biases". We overweight extreme events because their salience announces them more readily to our senses and perception (see Tversky and Kahneman (1974; 1981)) – hence extreme event "bias", though again it does seem procedurally rational to immediately notice events which might have an especially extreme effect on us. Similarly, we will tend to vastly overweight the likelihood of events whose antecedents announce themselves to our senses simply because they are literally easier to "see", and therefore we will tend to vastly underweight those events which are literally less foreseeable but in a manner which belies their actual likelihood. We can always make sense of "Black Swan" events after the fact, for instance September 11 of 2001 or the Global Financial Crisis of 2007, but they are almost defined by their antecedents being hidden from view before the fact (Taleb, 2007).

Salience also offers a deeper foundation for loss aversion. Kahneman and Tversky (1979) (and earlier Markowitz (1952), extending on Friedman and Savage (1948)) noted that losses assume a more significant place in our mind, they are more noticeable for us, and we can imagine there are good evolutionary reasons for this. So not only are they potent due to anchoring, perceived losses also announce themselves more readily to our perception than gains and are more likely to enter our analysis and effect behaviour.

Salience, further offers us a more fundamental basis in psychology for the phenomenon of impatience and "hyperbolic discounting" (Frederick, Loewenstein, and O'Donoghue, 2002; Rick, Scott and Loewenstein, George, 2008). Our consideration of future events is vastly less in analysis than a "rational" person would give, and we give far more weight to the present and immediate future. Rather than applying a hyperbolic discount rate in our mind (a complex procedure) what is likely happening is that the more distant the future, the more it simply isn't presenting itself to our sense –it is too distant in time to be sufficiently salient for perception, so we can't "see" it. Unless the real "feeling" of the future is made salient in the present, we are unlikely to consider it but in a most abstract sense.

But once again, and most powerfully of all, emotions have a strong hold on our attention and perception. Visceral emotions by their nature (Goleman 1996; Elster, 1998; Loewenstein 1996; 2000; Bauermeister and Tierney 2011; Mischel 2014; Sapolski 2017) are as salient as any internal state of mind can be. They thus have a powerful hold on our perception, and vicariously our minds, and dominate our behavioural responses when aroused. Indeed in highly stressful environments we can rely on little else to orient our thinking about behaviour in the world.

Chains

David Hume (1777) said of thoughts that they "introduce each other with a certain degree of method and regularity". In other words, one concept arising to mind often appears to call others to mind as well. We know, of course, that this is reflected in our neurophysiology. If a particular neuron acquires sufficient electrical charge from antecedent neurons, it will "fire" and pass that charge through synaptic networks to subsequent neurons and so on.

We call this (somewhat clumsily) the "follow-on" property of perception. If a group of percepts are sufficiently strongly connected to some other relative to the threshold of perception imposed by the environment, then that other will also be perceived. Extending this property to its logical conclusion, whole ***chains*** of thought may be called to mind by this process of perception.

As Kant (1781) famously argued, we must have an *a priori* schema for understanding and interpreting our world. Our personality is thus crucial for what we even *see* in the world, for it is the schema by which incoming sense-data are filtered and categorised at higher and higher orders of abstraction (Hayek (1952) especially made much of this). We are not even aware of this process until it breaks down, for instance the way the brain reconciles the two quite distinct images perceived from our eyes into one (see Pinker (1999) and Eagleman (2011)). The dysfunction of chains in perception is the manifestation of a number of the neurological disorders observed by Oliver Sacks (1984; 2010) over the years. As the neurophysiological basis for his patients' schema of categorisation disintegrated, their perception became distorted even to pathological levels.

The phenomenon of chains in perception underlies two essential heuristics identified by behavioural economics: the availability and representativeness heuristics (Tversky and

Kahneman (1974; 1981), Kahneman 2003, Rabin, 1998). In the case of the former, our perception of some object or event causes the most "available" (read "strongly connected") characterisations and categorisations to come to mind as chains of concepts manifest themselves in perception. In the case of the latter, some of our perception of some object or event causes our perception to call to mind categories of which that object or event might be judged a representative element, or yet other objects and events by which it may be represented based on the strength of its connections to those percepts.

Finally, the chain phenomenon in perception may make it such that objects and events in the environment can call to mind entire memories, imaginings and, once again, affective (emotional) states. That the human mind can do this has been well known at least since Aristotle, who warned aspiring orators to be wary of it in his *Rhetoric* lest they cause their audience to react adversely to their words as Socrates did when defending himself (pugnaciously) before the Athenian *demos*. As always, lest one be very careful, one may cause extremely powerful visceral emotions to be called to mind by perception, where they dominate analysis and thus behaviour.

Conclusion: Reducing the complexity and enhancing the practicality of behavioural economics

Abstracting away from situations in which we must see a change of mental networks, and supposing no state of substitutability may be feasibly reached, we will observe a change from some prior to some posterior behaviour without any change to their feasibility if:

- Sufficiently negative non-inert anchors of thought with respect to prior behaviour and sufficiently positive non-inert anchors of thought with respect to posterior behaviour enter into the process of analysis, which will occur if
    - The information corresponding to those anchors in the environment is placed and of a nature such that it makes sufficient impression on the sensory organs and thus perception.
    - Any information which corresponds to percepts which are strongly connected to either those anchors or other percepts which are is placed and of a nature such that it makes sufficient impression on the sensory organs and thus perception.

Of course, the opposite holds with respect to any anchors which are positive non-inert with respect to prior behaviour and negative non-inert with respect to posterior behaviour. These need to be suppressed.

Now we must notice that there remains a degree of ambiguity here. This is unavoidable and due to the individuated and intricate nature of the human mind. It is difficult to know a priori what the threshold of sufficiency is for an anchor to become non-inert, or percepts to be perceived. Personal knowledge is also substantially differentiated across the population, so salience thresholds and perceptual chains may vary across the population. Anchors may vary across the population not only in inertness but even in their positivity or negativity relative to some behaviour. Hence behavioural economics must adopt what Witt (2003) calls an evolutionary perspective on its knowledge, which is a generalisation of the experimental approach to economics in which experiments test the "fitness" of theories and spur adaptation. The present theory has value insofar as it provides a more integrated, holistic and systematic approach to the "front-end" of this process.

If we were to assess the behavioural economics of some product or service such as Afterpay for instance, we would first assess the environment it creates, and then apply our theory to hypothesise the effect it has on behaviour. Afterpay allows purchases to be paid in four fortnightly instalments. We would immediately recognise that the cost of some good or service is a powerful negative non-inert anchor with respect to purchases even beyond any considerations of costs and benefits – it establishes there is a loss associated with purchase. We would also recognise that breaking any costs down into four smaller costs incurred in the future (along with any late fees) makes them less salient to the perception of the individual. This would, further, make it less likely any other considerations connected to those smaller costs (such as overall cost) would be called to mind, especially those which require effortful calculations (such as adding four payments and any late fees together).

Our theory would therefore cause us to hypothesise that a service such as Afterpay would create a tendency toward more buying less saving because it has the effect of suppressing a non-inert negative anchor (loss of wealth) and other considerations related to it, and that this tendency might be removed by ensuring the information corresponding to that anchor (the price of a product) is displayed prominently relative to the sensory organs. A supplementary theory might be that this effect might be strongest amongst youth who have not yet had significant experience of having to account for the obscuring of future costs of some purchasing behaviour on their own. Experimenting with the design of Afterpay would then reveal if this hypothesis is an accurate description of its effect on behaviour.

In conclusion, we can see that the value which is gained from the analytical framework we have developed and the theory from whence it emerges is both intellectual and practical. On an intellectual level, the theory we have developed here has value insofar as it takes the complexity of behavioural economics and reduces it to a form of simplicity, proposing that three psychological phenomena underlie the various "biases and heuristics" currently modelled by Portable Extensions of Existing Models in a single unified theory of psychology and behaviour. This makes behavioural economics more "intellectually competitive" (Harstad and Selten, 2013). On a practical level, this theory offers policymakers and business strategists

a simple yet integrated, holistic and systematic method for appraising behaviour and developing policy outside of traditional incentive-based methods. It offers a practical theory, in other words, for developing "nudge" policies (Thaler and Sunstein, 2008) aimed at structuring the environment of the individual (the "choice architecture") to induce behavioural change. It is hoped, therefore, that this theory will contribute to the ongoing development of behavioural economics as a science of human behaviour, and as a practical science for government and business.

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