Designing policy interventions to change environmental behaviours: theory and practice

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Abstract. Policy interventions are usually intended to encourage changes in human behaviour to achieving social, economic and environmental outcomes. So, it is helpful for policy makers to have descriptions of human behaviour and theories of change that can improve the effectiveness and efficiency of natural resource policy. This paper reviews some of the available approaches that have been developed from a range of disciplines including economics, sociology and psychology. The frameworks and models for understanding human behaviour include examples that are both quantitative and qualitative. These are described separately from frameworks that can be used to develop strategies for influencing behaviour change. In particular, the paper includes frameworks that consider the conscious and subconscious relationships between attitudes and behaviour (dual processing) as well as the contextual issues involved in societal change. Selecting an appropriate framework for understanding a behaviour and adding a framework for change provides for robust evidential policy interventions.

Keywords: dual processing, behavioural economics, psychology, sociology, networks, diffusion.

Introduction

To achieve key policy outcomes, governments depend more on motivating and encouraging the behaviour of individuals and communities than trying to achieve the same result through government services (Australian Government 2007). The implementation of New Zealand's Resource Management Act (RMA) is an example of the importance of understanding human behaviour and how regulations may be developed that encourage changes in behaviour (NZ Government 1991). The RMA largely devolves national resource management from central government to sixteen regional and unitary councils and their communities (NZ Government 1991, section 30). These councils must prepare regional policy statements and regional plans at least every ten years. The plans for each region provide for people's needs whilst they maintain and enhance water bodies, land, air, coasts, biodiversity, natural character, and heritage. A range of policy options are available to council staff in their planning, but to use them effectively, some understanding of the behavioural frameworks that underpin them is required (Ministry for Primary Industries 2015).

As well as the plans themselves, the RMA requires councils to produce summaries that describe how they evaluated the policy options particular to each planning objective, this includes any rules, fiscal incentives or disincentives and information or education frameworks that they have considered (RMA section 32). Although a prescription on how this may be approached is not provided in the RMA, councils have been advised by central government to apply an appropriate framework for considering the social and human behaviours associated with each of their policy issues (Ministry for the Environment 2017). Not all councils have made their evaluations publicly available (Percy 2008), and those that have, generally applied an economic framework in their reports, using a benefit-cost analysis of each option (examples include Hawke's Bay Regional Council 2013 and Greater Wellington Regional Council 2015).

A survey of council staff throughout New Zealand suggested some of the reasons why they may have been only using an economic framework for their Section32 reports (van den Belt et al. 2010). These were that they preferred frameworks that:

- Had been developed specifically to suit each policy issue, incorporating factors from the local context.
- Could be developed by external agents with the involvement of the stakeholders for each issue, avoiding the need for developing in-house capability and resources.
- Provided outputs with the evidence for a clear policy direction.
- Could be clearly and unambiguously communicated to other parties.

Policy makers were concerned that they lacked the ability to assess how the various approaches might add value to what they were doing (van den Belt et al. 2010). They considered that some approaches could be too complicated leading to mis-understandings about how they could be best applied.

In comparison to policy makers, marketing agencies seem to have become very sophisticated at using a range of frameworks to encourage behaviour change, but governments have lagged

behind them (Australian Government 2007). To encourage a wider consideration by policy makers of possible frameworks, this paper separates those that can be used to describe people's behaviour from frameworks that can be used to underpin behaviour change. The human behaviour models enable policy makers to understand how people's behaviours reflect their world views, beliefs and life-situations. For example, to understand the behaviour of Queensland sugar cane growers along the Great Barrier Reef, Pickering et al. (2017 and 2018) applied a cognitive social psychological approach.

However, understanding behaviour is necessary for policy development but it is not enough for people to then design policy interventions (Rose et al. 2018). For effective policy interventions, additional behaviour change models are needed and they should be carefully selected to address policy needs for on-going evaluation, social equity and to reduce the risks of unintended consequences (Darnton 2008). Once a behaviour is understood through a selected change-framework the principles associated with that framework can be applied in the design of an intervention.

The Institute for Public Policy Research in the United Kingdom developed an approach for using these frameworks in the design of interventions that encourage behaviour change, particularly in areas of human health, climate change, environment and social policy (Lewis 2007). The same frameworks were applied by the Australian Federal Government in developing a comprehensive strategy for tobacco control (Australian Government 2007).

In this paper, after outlining some principles common to all the frameworks and beginning with a classical economic perspective, this paper describes the social and human theories that have been incorporated into each example. The frameworks included have all been part of discussions with central government staff on issues to do with the management of natural resources. A diagram is included to assist, clarify and communicate the dynamics of each framework. Where possible, examples are given describing how each of them has provided insights into environmental policy issues.

Frameworks for understanding behaviour

Attitudes

Common to all the behaviour models included here is the concept of attitude, where attitude is considered to be predisposition towards specific behaviours formed as a result of people evaluating the consequences for them of behaving in particular ways. Attitudes can therefore be either positive or negative (Albarracin 2014).

Dual processing

Dual processing of people's learning, reasoning and decision making has been widely used in psychology to explain how some behaviours reflect rapid, automatic and seemingly effortless decision making while other behaviours are characterised by thoughtful, considered and slow decision making. Sometimes within one person, the two types of thinking can even appear to be in conflict with each other, such as when we automatically purchase a familiar brand of food instead of stopping to consider whether or not an item matches our list of most desired attributes. These two types of processing are described in this paper as intuitive decision making and reasoned decision making (Parminter & Neild 2013). The dual processing behind behavioural choices has also been described by Kaine and Johnson (2004) as 'low involvement' and 'high involvement' decision making, and as 'system 1' and 'system 2' decision-making processes by Kahneman et al. (2011).

The intuitive process makes use of routines, habits, emotions and heuristics (rules of thumb). These can replace the contribution of information in reasoned decision making and even dominate it (Darnton 2008). Novices generally need rules and guidelines when they first start out in a new technical area to support reasoned decision making. Intuitive decision making is common with experienced people when they become experts in their field of practice (Benner 1982; Dale et al. 2013). Expecting technical experts to follow procedural rules in their area of expertise can become frustrating for all involved (Couvillion & Fairbrother 2018).

Policy interventions are typically designed to influence reasoned decision making and so suit high investment, complex, risky behavioural choices. Policy interventions seem less designed to influence intuitive decision making even though this is the main way that people's day-to-day behaviour is determined (Thaler & Sunstein 2008).

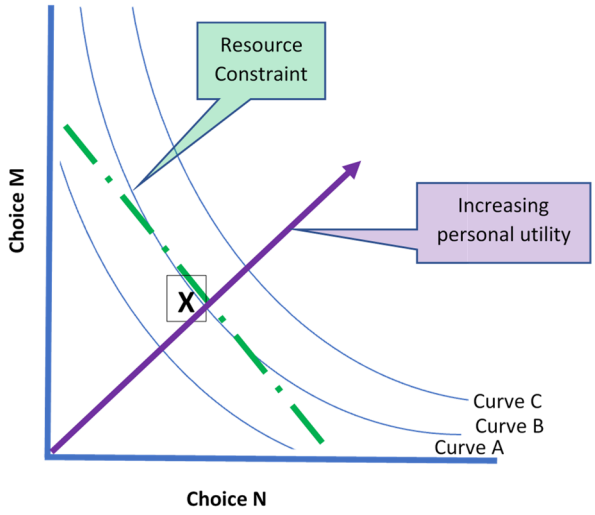
Economic understanding of behaviour

Behavioural decisions that involve considerable time or effort and that have clear stable sets of benefits and costs suit economic understandings of human behaviour. Humans in these

circumstances rely on reasoning to choose between alternatives using calculated comparisons of benefits and costs. In classical economic approaches people's preferences between alternative behaviours are expected to be well-ordered, consistent, and unvarying (Darnton 2008). This is despite possible changes in the availability of the options, the resources available, or the length of time involved in decision making. Rational economic decision makers are expected to be autonomous, act as if socially isolated, and seek the most self-interested outcome. When they are making behavioural choices, they are expected to maximise their resulting utility, such as their levels of satisfaction, happiness or personal benefit (Darnton 2008).

Figure 1 represents a simple decision-making choice involving two alternatives – M and N. The decision maker improves their utility the more that they can do of both M and N in combination. In the figure, Curves A-C represent points of equal utility. Combinations of M and N lying along each of these lines provide equal satisfaction. Therefore, the behavioural combinations along Curve C represent greater utility than the combinations along Curve B and Curve A. Decision makers have resource constraints (such as money and time) and in the figure the greatest utility available within the resource constraint lies along Curve B. A fully informed decision maker will therefore find that the combination of M and N providing the greatest utility is at X (Torgerson and Spencer 1996; Pannell 2017).

Figure 1. Indifference curves representing people's decision-making behaviour



Source: Developed from Torgerson & Spencer 1996

The origins of people's preferences are not part of economic understandings of behaviour (Darnton 2008). The attributes that they are seeking may result in disadvantageous outcomes for them or be considered irrational by most other people, but if they are well ordered and consistent, they can still be analysed according to rational choice decision making and aggregated up to whole markets (Keen 2011).

In order to analyse choices through rational decision making, individuals need to have access to all the information they need to make selections based on how their preferences relate to their choices, and how to process this information to optimise their decisions and maximise their utility (Simon 1996; Degnegaard 2018). Economists understand that people's access to information is constrained but 'descriptive realism' has been less important to them than the 'analytical power' of these assumptions (Darnton 2008).

Rational choice understandings of human behaviour have been helpful, but to accommodate more complex behaviours it has been integrated with theories from social psychology to develop behavioural economics models. These models include decision 'short-cuts' to attitude formation about behavioural preferences. They describe rational decision making when information is difficult to obtain, when people may lack decision making ability, or when time is short (Kahneman & Tversky 1979; DellaVigna 2009). Understanding this 'bounded rationality' in decision making is a way of improving its efficiency by considering broad categories of options rather than each specific option.

Behavioural economics does not have a unique behavioural model or framework, instead it draws on frameworks from other disciplines (DellaVigna 2009). These have been applied in field research to produce insights into how people make their decisions and how policy interventions may be formulated to 'nudge' people towards certain behaviours (Thaler & Sunstein 2008).

From these insights there are four aspects of people's behaviour in selected target groups, that need to be considered by policy agencies (adapted from Emmerling 2018). These are:

- How to obtain the decision-maker's attention; in relation to the specific behaviours being considered, knowing the judgements and decisions currently being made by people, the choices that they have and the personal, physical and social context of their decision making.
- Information processing. The way that the target group learns, adapts, takes in and discards information.
- Decision making. The number and type of decisions made by individuals that affect their behaviour. The parts of people's decisions that are subconscious and automatic (intuitive) and the parts that are deliberate and effortful (reasoned). It is useful to know the cognitive load, emotional interferences and contextual influences on the decision making of people in the target group (Botha & Roth 2011).
- Taking action. Knowing how strongly linked people's intentions are with their actions (Argyris & Schon 1974; Nicolaides & Yorks 2008). Differences are expected due to people's degree of self-awareness, access to resources, approaches to planning and breakdowns in decision making.

These four insights enable policy makers to identify just where in the target group's decision making and behaviour a limited intervention (or nudge) might have the most influence. After the context has been identified the intervention itself needs to be designed. There are four basic principles from behavioural economics that can be included in formulating policy interventions to increase their effectiveness. These are (Emmerling 2018, p. 42):

3. Interventions should be contextual', in that decision makers need to consider the implications of an intervention at the point at which they are initiating a behaviour and it should be relevant to their context.
4. Interventions have to be intuitive', so that people assume them as part of their decision making in whatever form that takes.
5. Interventions must be unconstraining', they may change the process of decision making but they should not add or remove decision-making choices.
6. Interventions have to have observable and measurable results', so that they provide feedback for the decision maker and the results of interventions can be tested by the policy agencies.

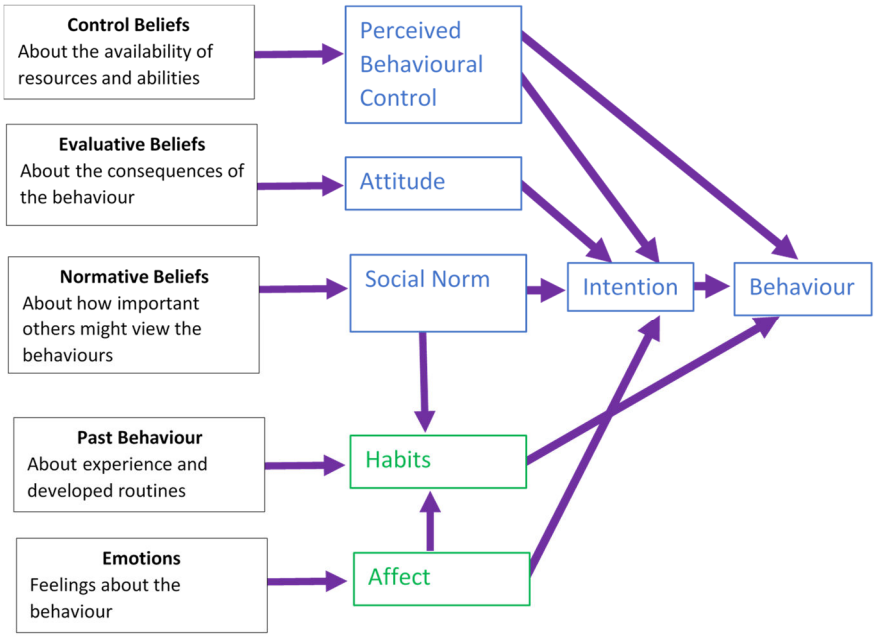
Social-psychological framework for understanding behaviour

While useful for general behaviours, social psychologists examining the relationships between attitudes or preferences about specific behaviours have found them to be tenuous and they explain at best about 30% of people's specific behaviour (Guyer & Fabrigar 2015). On their own, attitude measurements are more closely related to general behaviour than specific behaviour, e.g. taking a range of steps to keep livestock out of waterways compared to the specific step of fencing riparian strips five meters wide along every waterway on a farm. For specific behaviours, the Theory of Planned Behaviour (TPB, Figure 2), has been put forward as a way of looking deeper to find the antecedents underlying attitudes and behavioural preferences and to increase explanatory power (Aijzen & Fishbein 2005). The TPB is based on people's beliefs about behavioural outcomes and their evaluation of those outcomes determining their intention to behave in specific ways. The evaluation can be through both conscious reasoning or subconscious influences (Ajzen & Fishbein 2000).

The TPB has been extended for specific behaviours (Parminter 2008). In Figure 2 the framework includes both reasoned and intuitive influences on behaviour by adding in parts of Triandis' Theory of Interpersonal Behaviour (1977). The framework in Figure 2 shows behaviour resulting from the direct influences of habit, intention, and behavioural control. The relative amount of influence that these factors have can be determined from the strength of people's beliefs, emotional responses (affect) and habitual ways of doing things. The framework also indicates that habit can be reinforced by social norms and disrupted by emotions such as fear (Darnton 2008).

Although models developed using the TPB can explain over 50% of people's environmental behaviour each model is very specific to the actual behaviour being modelled and developing a complete model can be very data intensive (Parminter 2009). TPB models generally assume that beliefs precede behaviour and that isn't always the case. However, for behaviour to be sustained it is important for beliefs to become aligned. For example, initially people may have felt legally constrained to wear seat-belts in cars. However, over time they have generally developed supportive beliefs and their behaviour has become self-regulated and more automatic. Realigning beliefs to support new ways of behaving is explained by Festinger as overcoming initial cognitive dissonance (Festinger 1957; Fointiat et al. 2011).

Figure 2. An extended version of the Theory of Planned Behaviour to incorporate the Theory of Interpersonal Behaviour



Source: Developed from Parminter 2008

While the Theory of Planned behaviour lacks feedback paths these are implicit for its authors. Other behavioural frameworks such as Bandura's social cognition theory of self-regulation (Bandura 1991; Eccles & Wigfield 2002) make these more explicit.

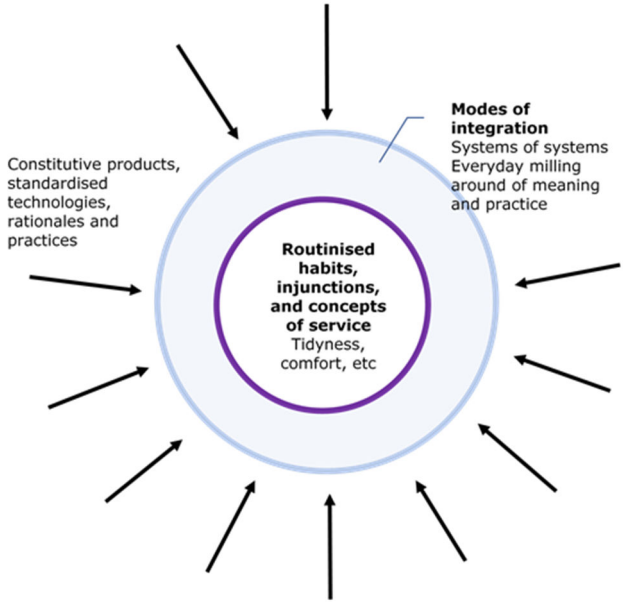
Contextual models of social behaviour

Both the economic framework and the social psychology frameworks presented here are centred on an internal evaluation of choices and preferences. That is not the complete story however, as both the resources available in the economic model and the perceived behavioural control concept in the TPB are dependent on the interactions between people's external situation and their behaviour (Shove 2010). The influence of external variables on attitudes and behaviour have been widely explored in New Zealand (examples include Payne et. al. 2016 and Scrimgeour 2016). Darnton (quoting Triandis) calls these facilitating conditions. These studies may have described the influences as providing opportunities for people to undertake certain behaviours, but more commonly they have been considered as barriers to particular behaviours, interacting between people and their day-to-day world (Darnton 2008). Gray (2001) explored how context affected farmers' decision making and behaviour and linked this to how they used tools for formal and informal planning. However, addressing issues such as climate change and sustainability go beyond changing specific behaviours to evolving whole new ways of doing business, providing government services and taking collective responsibility (Shove & Walker 2010).

Shove (2003) describes people's behaviour as evolving in clusters in response to their social and physical environment. Once behaviours have become accepted as a part of people's lives they are held in place by each person's organising principles and the ingrained habits that decide what should be done, when it should be done, and how it should be done. Behaviours and their context become inseparable with sets of behaviour reinforcing certain ways of life and ways of life reproducing their associated behaviours (Shove 2010).

In Figure 3 the practices and technologies around the outside of the diagram are organised and made sense of in the first circle shape and then incorporated and locked into people's daily lives in the inner circular shape. People are not entirely in control of this process as the routines themselves help form the technologies and practices that themselves co-evolve new ways of living. In this way, farmers can develop ingrained routines around where and how livestock graze on their farms and the forms of cultivation that they use to prepare paddocks for sowing crops. Once these routines become established they are self-reinforcing as the only ways that these things can be done (Nuttall 2016).

Figure 3. Pathways from practices to normality



Source: Adapted from Shove 2003, p. 409

Frameworks for understanding behaviour change

Theories of change are different from theories of behaviour and they are informed by a number of other disciplines in addition to economics and social psychology. Change can be resisted by individuals and communities through maintaining habits and routines and remaining aligned with group values and norms. In many situations such resistance is considered a strength, but in others can be misguided. For example, society would benefit from having less people abuse alcohol (showing resistance to excessive drinking), and would benefit by having more people increasing their exercise and changing their lifestyle (Thaler & Sunstein 2008). A recent review found only 9% of published papers addressed changes in behaviour, whilst over 90% of papers focussed on understanding people's behaviour (Rose et al. 2018). Knowing the internal factors involved in setting people's behaviour so that they behave the way that they do is not enough to inform the development of strategies for behavioural change. Changing behaviour needs first the establishment of the new behaviours and then on-going maintenance and addressing peoples' external contexts so that there is reinforcement of their changes. This could be through providing additional benefits, reinforcing routines, feedback about results and social approbation (Darnton 2008).

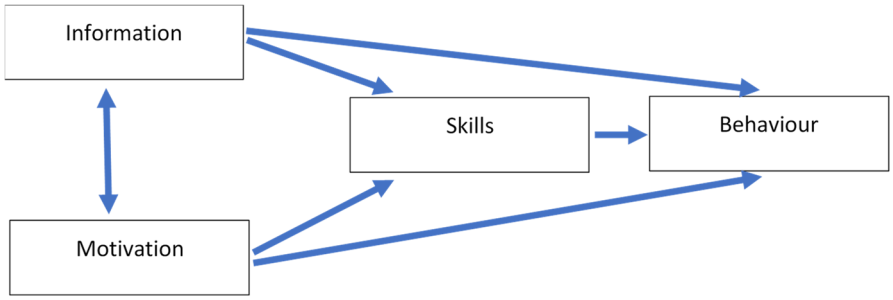
Change as learning

Learning processes have been shown to be very important for changes in behaviour to be lasting (Darnton 2008). People learn through two different processes depending on their situation and experience (Benner 1982; Couvillion & Fairbrother 2018). Of these two, explicit learning is generally accessed through formal processes whereas intuitive learning occurs mainly through informal learning processes. The Information-motivation-behavioural-skills (IBM) approach to designing policy interventions is an explicit learning model that has been used widely in human health (Fisher et al. 2009). In Figure 4, information availability encourages people's motivation to follow expected ways of behaving and the information itself encourages people to have positive attitudes. From there people's skills grow and their confidence increases in their abilities to achieve successful results from changing their behaviour. The additional confidence and skills lead to changed behaviour.

The technical approach to learning described in the IBM addresses behaviours with a specific set of information and skills that can be taught and practiced. It particularly suits people that may be novices or beginners and linear models of extension (Leeuwis 2004).

It does not build people's own capacity to learn and problem solve, adapt the information they have been given, or resolve future issues that go beyond their existing experience. For that people need to learn skills in how to learn, or engage in double loop learning (Argyris & Schon 1996; Prelipcean & Bejinaru 2016).

Figure 4. The information, motivation behavioural skills approach for the design of policy interventions

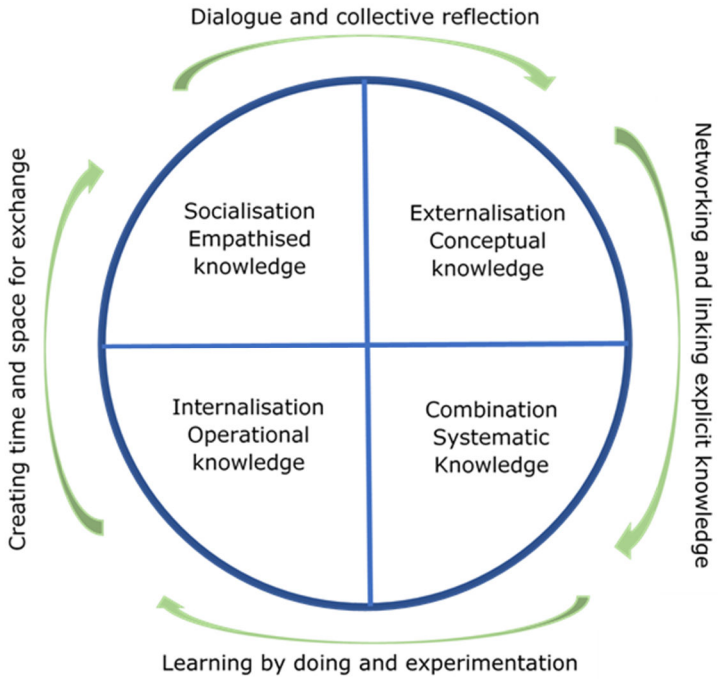


Source: Adapted from Fisher et. al. 2009, p. 28

The IBM can be a useful framework for addressing explicit learning; however, it may not suit behaviour change amongst very experienced people, knowledgeable locals and experts (Couvillion & Fairbrother 2018). These people can be expected to rely heavily on their own intuition when working in the subject areas with which they are most familiar. Learning about intuitive behaviours and how to apply them may be particularly important when novices are learning from technical experts (Benner 1982). Being able to access intuitive knowledge is made more difficult when the experts themselves may not know why they do things in particular ways.

To address this dilemma, intuitive knowledge must first be made explicit before it can be codified and communicated to others (Figure 5). The codified intuitive knowledge can then be communicated to others and it is then assimilated by them to become their own intuitive knowledge (Nonaka & Hirotaka 1995; Elezi & Bamber 2018). This process is further described in a paper on New Zealand farmer knowledge (Parminter & Neild 2013) in which a learning approach that addresses both explicit learning for inexperienced people and intuitive learning for experts provides a comprehensive approach to behaviour change.

Figure 5. Formalised learning about intuitive knowledge



Source: Adapted from Parminter & Neild 2013, p. 233

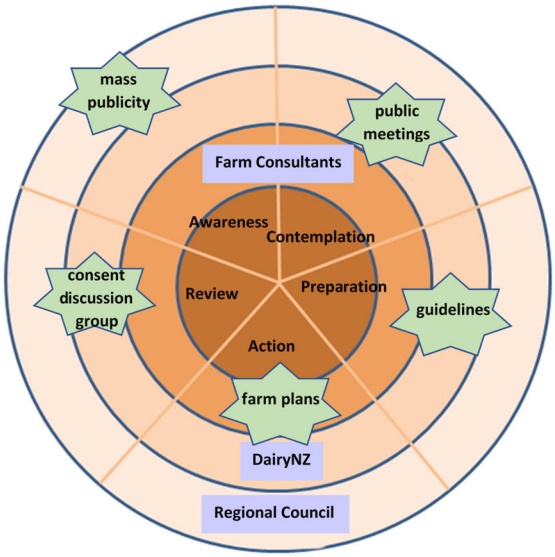
Stages of change

The stages of change framework was developed from field observations of the change process; initially this was the cessation of smoking (Prochaska & DiClement 1983; Prochaska et al. 1991; Okonski 2003). It is most helpful as a framework for segmenting populations and matching the different segments to behaviour-change interventions. Some marketing segmentation has used

people's existing behaviours to target extension strategy, but these have not been related to the processes of change (Red Meat Profit Partnership 2015).

The stages of change framework was applied to the work of the dairy industry and the regional council in the Manawatu Wanganui Region (Figure 6). The five stages of change are shown in the centre and around that the main mechanisms encouraging learning. When people are not familiar with a behaviour they engage mainly in intuitive learning (as described above) and least cost engagement. This suits mass publicity and public meetings. For those people beginning to apply learning to their own circumstances more substantive communication will assist them with reasoned thinking. Guidelines and plans can be useful for them. After people have initially tried out a new behaviour further support is generally required to assist them review the results and further adapt what they are doing. In Figure 6 each concentric ring involves a different actor with specific roles including policy organisation.

Figure 6. Farmer segmentation used to design a strategy for behaviour change



Source: Parminter et al. 2016, p. 27

Socio-technical change

A socio-technical framework for behaviour change can address the complexity often found in behaviour change by integrating its social, technical and institutional aspects (Geels 2004). The social system is the research, production, distribution and use of new practices and technologies within societal functions such as food production and between societal groups such as scientists, producers, engineers, users, consumers, media and policy agents. The technical system encompasses the development and supply of practices and technologies, as well as their diffusion and use. The institutional system is the rules that coordinate activities between actors within the other two systems including the development of expectations, norms and regulations.

Over time the boundaries of systems in the 21st century have become more dynamic and flexible. This has provided opportunities for increasing co-learning, co-design and co-production (Vereijssenet al. 2017). For modelling short term changes the social, and institutional systems may be considered relatively constant. For more long-term changes aspects of them will need to be described and addressed (Geels 2004).

Socio-technical systems approaches helpfully address the emergent properties that result when policy interventions are being developed in new areas (Baker et al. 2011; Cousins 2018). These sometimes have unexpected results when different component policies are all linked together in something like a regional plan. Systems thinking has two approaches (Maani & Cavana 2009). If the definition of a problem has been largely agreed to by the affected actors and its components are well recognised it can be analysed using hard system approaches. If there is still some uncertainty about the precise nature of the situation and the issue is confusing to many people, a soft systems approach might be best.

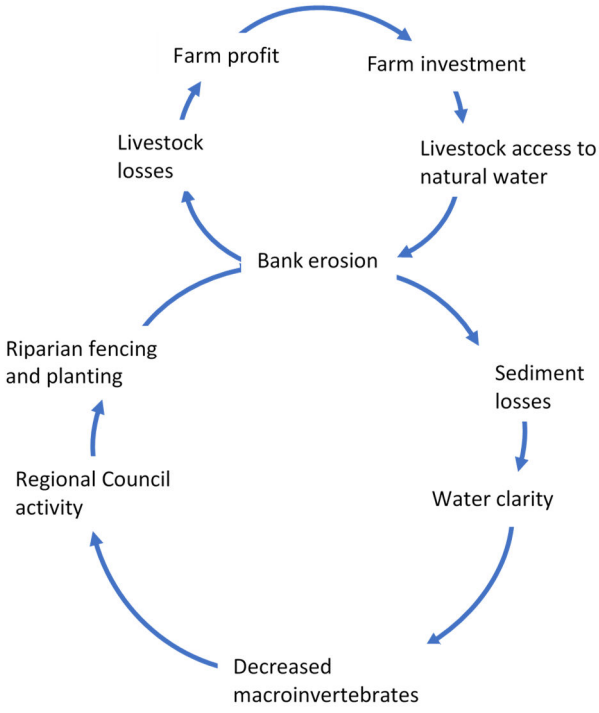
In Figure 7 there is an example of a hard systems diagram describing riparian fencing and planting activity of hill country farmers as a balance between livestock access to water for drinking and livestock losses from becoming trapped in the waterway by bank erosion. Regional council staff monitor water quality measuring water clarity and changes in the macroinvertebrate index. The

figure can assist regional councils designing policy interventions for educational strategies and rules to encourage riparian fencing and planting to reduce bank erosion.

Change through social networks

Social network theory describes the relative effectiveness of people in social networks at communicating innovation and encouraging change (Liu et al. 2017). Social networks are influenced by people strongly connected within networks (the opinion leaders) and also the people weakly linked (the bridge builders). Opinion leaders are those people widely linked within their communities, that are very knowledgeable about specific issues and that may have a lot of influence over other people. When opinion leaders have a low influence threshold, they are likely to be early recognisers of public opinion and industry trends. In health behaviour, opinion leaders have been able to model desired behaviours and encourage behaviour change amongst other similar people in their network (Volente & Pitts 2017). Bridging people may not be highly influential within their own communities but they act by linking their community with other communities. Such people have degrees of influence depending on the types of behaviours involved, the social norms that have been established and the stability of their places in the community. Bridge builders are particularly effective at introducing new and novel practices into their communities (Liu et al. 2017).

Figure 7. Systems diagram of on-farm riparian fencing and planting and regional council activity



Source: Developed from Parminter 2008.

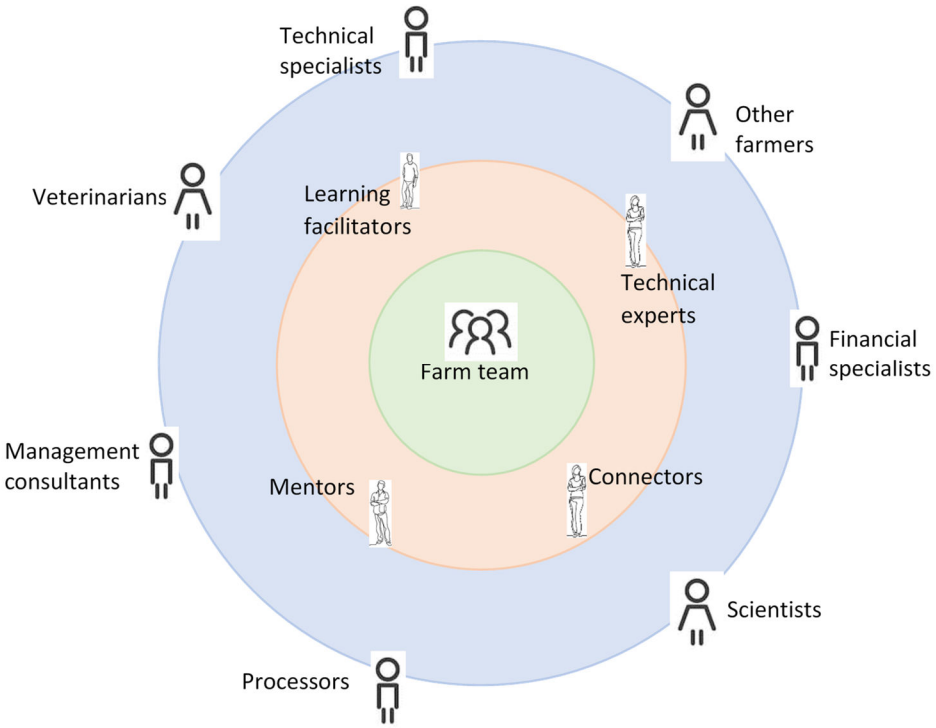
Most social network research has focussed on people's existing relationships and how these influence innovation and change. There has been very little research into expanding social networks (Abroms & Maibach 2008). The Red Meat Profit Partnership is one project that has put in place a social network model of extension linking farmers with information sources within their localities and extension-facilitators (Figure 8). In Figure 8 the social network is developed around each farm team, shown in the centre. The farm team is closely connected to the subject matter experts, connecters, mentors and facilitators to provide an on-going learning environment. Around these roles are arranged a number of professionals in a support capacity, as required.

Social networks provide a mechanism for diffusing social change through communities. Rogers (2003, p. 5) describes diffusion as 'the process in which an innovation is communicated [or transferred] … among members of a social system' (also Ruth 2008; Bowman 2018). One of the factors involved is the degree of innovativeness shown by individuals in a social system relative to others in their social system (Figure 9).

The set of categories shown in the diagram are described as a way of 'understanding human behaviour' when social systems are confronted by change. Some people were hypothesised by

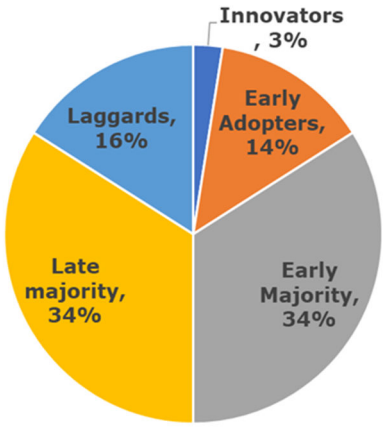
Rogers (2003) to be more innovative than others. Considering the social system as a whole, more innovative people may be more greatly connected with people that are socially different from them (Szreter & Woolcock 2004). This involves building, bridging or linking social capital. Innovators and early adopters with bridging social capital are able to learn about new ideas from people outside their peer group – people such as technical experts and community leaders. Those with linking social capital are engaged with people in industry and political structures around them. Less innovative people (the late majority and laggards) may have less bridging social capital and instead have more bonding social capital (Liu et al. 2017). They rely upon learning about innovations from people in their communities that are similar to themselves (Szreter & Woolcock 2004). The late majority and laggards may appear to outsiders to be resisting change when they just need time for the processes involved in social networking to happen within their communities. Adoption modelling tools are available that make use of some of these principles and reduce peoples' pro-innovation bias when designing behaviour change strategies (Kuehne et. al. 2017).

Figure 8. Red Meat Profit Partnership extension strategy using social networks



Source: Adapted from Red Meat Profit Partnership 2015

Figure 9. Adopter categorization on the basis of innovativeness



Source: Adapted from Rogers 2003, p. 281

Conclusions

Human behaviours are complex, arising from an array of sociological and social-psychological factors influenced by the personal, community, cultural and societal situations of people.

All the frameworks and models described in this paper provide insights into different parts of policy formulation for behaviour change. They can be applied in isolation or used in a co-ordinated way. To provide more understanding of people's existing behaviour, policy makers:

- May use economic frameworks to describe the balance between private-good and public-good benefits and costs.
- If the behaviours are more complex or lack clear private-good motivations for an economic framework, then using social psychology models such as the TPB might provide the necessary insight.
- To understand the background to existing behaviours and how established they are in the day-to-day life of decision makers, a contextual model of behaviour could be used.

From these understandings, policy interventions can be designed and tested in the conceptual models associated with each of the behaviour change frameworks to find where they can be most effective at achieving desirable outcomes.

- The change-as-learning models can be used to design formal and informal learning opportunities that support the dual processing of information and behaviour change.
- The stages-of-change framework provides a way of segmenting groups depending on how they respond to pressures for change, and what they need to build their confidence in finding a new outcome with benefits that they want. Communication and support strategies can be matched to each of the segments.
- Socio-technical frameworks provide a way of understanding how existing social structures and behaviours interact to produce undesirable outcomes and how these can be modified by adjusting existing interactions and changing the way that feedback is generated and received.
- Social network theory can be used to suggest who should be transmitting the information about desirable behaviour changes through their communities. Diffusion models of change highlight that social change through society is a process rather than an event.

The introduction to this paper identified that local government policy makers appreciated the simplicity of using economic models of social and human behaviour and how they could be easily adapted to local contexts. This paper suggests that there are additional frameworks that may provide further information for greater insight. The paper has also highlighted the importance for policy design of having an additional framework for guiding behaviour change and some of the various approaches commonly available. Taken together, the frameworks for understanding behaviour and the frameworks for guiding interventions for behaviour change strategies can be used to underpin more robust evaluation reports in the future.

Acknowledgements

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