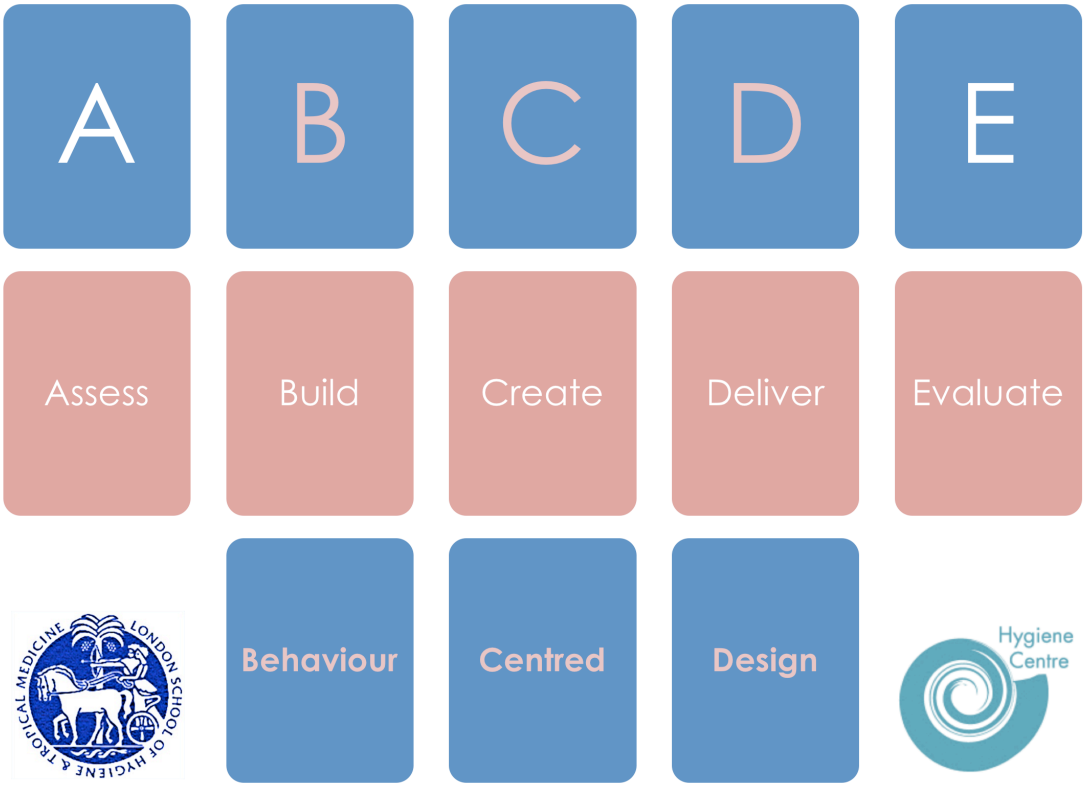

A Guide to Behaviour Centred Design

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Table of Contents

Introduction

Behaviour Centred Design (BCD) is a new and radically different approach to the problem of changing behaviour. Using an evolutionary framework, it unites the latest findings about how brains learn with a practical set of steps and tools to design successful behaviour change programs. This approach mixes both science *and* creativity because behaviour will only change in response to something new and challenging. [1-3] The approach has been employed successfully on a range of public health behaviours as well as in commercial product design and marketing.

Why is BCD necessary? First, because we fail to solve the world's most pressing health problems – not because we don't have solutions, but often because they are not *used* enough. We know that not smoking, vaccination, using toilets, oral rehydration, appropriate eating, safe sex and exercise could solve the majority of the world's health problems, but they are simply not taken up sufficiently. [4]

Similarly, marketers seek to make products more appealing to consumers, but often don't know which insight would work best to get them to change their buying habits. Their frustration is expressed in the famous quote (attributed to Henry Ford): 'I know half of our marketing efforts work; the problem is I don't know which half'.

People also form intentions to change their own behaviour (e.g., New Year's resolutions, dieting plans), but often fail to follow through. We know the benefits of recycling and paying our taxes, and we know not to bite our nails, but we still fail to do these things. All of these situations require a better understanding of how to change human behaviour.

While many approaches to behaviour change are being used today, most are based in trying to change cognition in one way or another: either through cognitive appraisals, [5-7] or modifying cognitive heuristics -- techniques used by behavioural economists. [8, 9] OAM approaches (for opportunity, ability and motivation) are also popular, but are based on information processing models of persuasive communication (that is, attitudinal, rather than behaviour, change). [10-13] None, as yet, is firmly based on the latest thinking about human behaviour itself, the purposes that it evolved to serve, or the way in which it changes in response to changing circumstances. With the recent revolutions in the understanding of situations, [14-16], environments [17] and brains, [18] it is time to update our approach to behaviour change. People largely *know* what they should be doing to influence (their own) behaviour, but just don't *do* it. So behaviour change programs need to focus on **behaviour**, not cognition or communication.

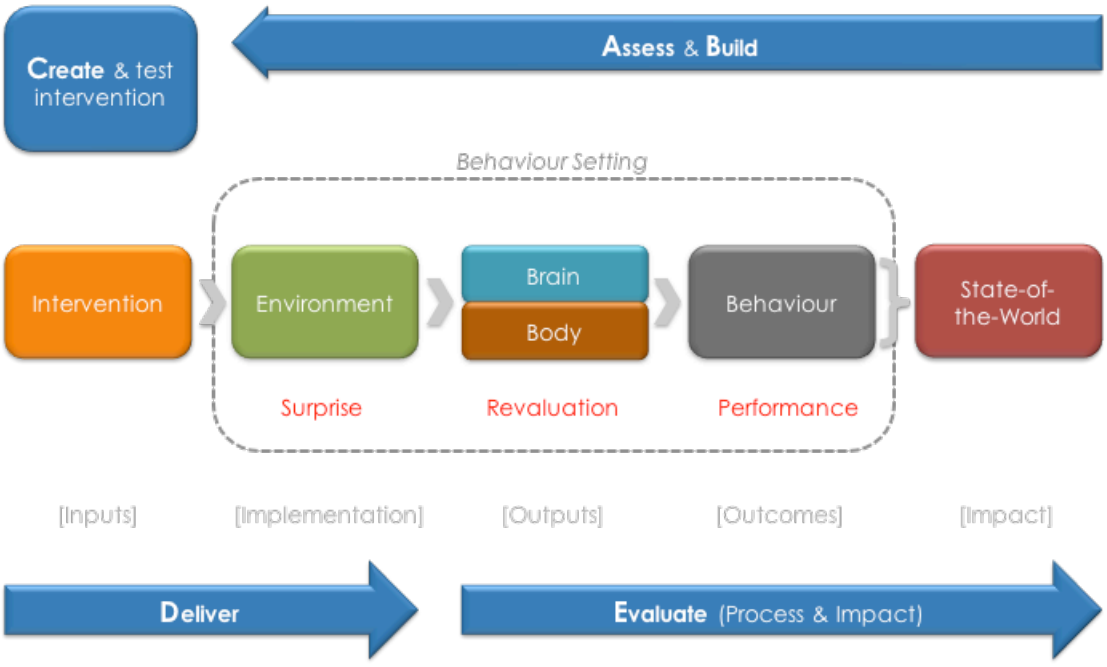
Behaviour Centred Design is a new approach which, as the name implies, is centred on behaviour. It differs from existing approaches in that it is a complete process for behaviour change, aimed at both individuals and societies. It provides a coherent behavioural model derived from reinforcement learning theory, develops a fundamental taxonomy of needs based in evolutionary biology, shows how the disruption of 'behaviour settings' (a key concept derived from ecological psychology that we explain below) is key, and sets out the steps involved in programming for behaviour change. So as well as providing a means of identifying the levers that can change behaviour, it also provides a design process, with steps and tools to use in conceiving, creating, implementing and evaluating a behaviour change program.

This document is designed to encourage behaviour change practitioners to think differently about behaviour – both in understanding how and why it is produced and in how to design programs to change it. Part 1 covers some basic theory which explains the processes that govern human behaviour, including habit, rational planning and motives, as well as the role of the environment and of behaviour settings. Part 2 discusses BCD's theoretical proposition about how to change behaviour, which is unlike traditional approaches that start and end with changing cognitions. Rather, we emphasize other psychological processes and environmental factors – and include the key principles of surprise, revaluation and performance. Part 3 describes the process of developing, creating and testing a behaviour change intervention, with five key steps – the ABCDE of behaviour change. We provide many examples along the way, as well as further material which we encourage you to consult via the links and suggested literature.

What is BCD?

One diagram will be used to describe the whole approach (see Figure 1). This is the BCD Process Model, which will figure throughout this monograph. Across the middle of the diagram is the chain of events that has to occur for behaviour to change. In a nutshell, an intervention has to change something in the environment, which has to change something in the brain and/or body of the target individual, which then has to impact on behaviour. The aggregate of these individual behaviours then has some impact on the state-of-the-world. This causal chain represents the BCD approach to defining what is known as a 'Theory of Change'. (For more background on Theories of Change see the Theory Box below.)

Figure 1: The BCD Process Model



BCD *THEORY*:
Theory of Change

Theory of Change is an emerging approach to guiding program development, execution and analysis [19]. Having an explicit Theory of Change helps one to think clearly about the pathways by which change occurs, to design interventions that are more likely to affect those pathways, and to better evaluate how program inputs have led to the desired outcomes and impacts. [19] It requires that program managers make explicit assumptions about the cause-effect relationships between program activities and behaviour change, about the operational/logistical expectations for delivery of those activities, and about the macro-environmental context within which the program is taking place. This allows program stakeholders to attribute results to program activities when both the program and the context within which it has been executed are complex (a useful ability in the era of 'evidence-based' policy). [20] A Theory of Change can be used in several ways: as a process description that makes explicit the causal connections between program inputs and outputs, as a strategic planning tool to guide action, and as a conceptual or thinking tool from which to learn from experience. [21] A particular view of how a Theory of Change should be organized forms part of the BCD approach.

But the key question remains: how to design the intervention such that it has the desired behavioural outcomes and impact? And then, how to learn if it has worked? Along the top and bottom of the diagram are depicted the five steps of the BCD program development process. We have dubbed these the ABCDE steps, as follows:

A: Assess – here program designers start by gathering what is known about the target behaviours, the target audience, the context and the parameters of the intervention. A framing statement sets out what is known already about how change can be achieved and sets out hypotheses about change mechanisms for further exploration.

B: Build – involves carrying out carefully targeted formative research with a sample of the target audience to find out the things that are unknown and explore hypotheses about the likely drivers of change. Unlike typical formative research, which typically involves key informant interviews and focus groups, BCD employs a variety of innovative methods such as motivational mapping, product attribute ranking, scripting and video ethnography in a rapid 'deep dive' with target audiences. The insights from this formative research are then ordered into a Theory of Change and distilled into a brief for the next phase.

C: Create – involves a creative team iteratively designing the intervention package and testing it on a small scale. Creativity is hard to package into a simple process but it is vital if interventions are to be engaging and motivating enough to stand out in the crowded lives of those targeted by programs. The result of the creative process is a package of surprising and disrupting intervention materials designed to have maximum effect on the target behaviour.

D: Deliver – the intervention package is then implemented via a set of planned activities which may involve direct and indirect contact via various channels such as community workers, events, mass and/or digital media that are appropriate to the audience and intended impact. This process is monitored to ensure that learning from this experience can take place.

E: Evaluate – ideally in a field trial at a scale that allows some definitive assessment of whether the processes expected by the program's Theory of Change have taken place. The learnings from evaluation should then provide the starting point for a new cycle of learning by engaging in the BCD process again to develop a new program.

In the middle of the figure we've highlighted three key tenets of BCD: that interventions require *surprise*, *revaluation* and *performance*, and that what links these together are the 'behaviour setting' in which they occur – concepts we will explain further below.

Whether you take just some elements from Behaviour Centred Design, or use it throughout to design a program, it should help you to find creative ways of changing behaviour that are surprising, that add value and that improve the performance of your program.

Part 1:
Understanding Behaviour

Plants can't do much beyond following the sun around with their leaves. Animals, when they evolved, developed a wonderful adaptation: purposeful and dynamic interaction with the environment to get what they need. [22] We call this 'behaviour'. Animals which produced the behaviours that were best able to extract resources from the environment or avoid its dangers produced more copies of their genes in subsequent generations. These genes also reproduced the brains that generated these adaptive behaviours in their offspring. The behaviours themselves wrought adaptive changes to environmental conditions. Brains, bodies and adaptive behavioural responses thus evolved in tight lockstep with environments.

In humans, behaviour almost always takes place in specific, repeated contexts, with specific features. The right behavioural response thus depends on the physical, social and temporal context in which people find themselves. These situations can be described as 'behaviour settings' – a concept developed in the 1950s by the eminent ecological psychologist Roger Barker. [23] (While we present the basics next, a more technical discussion of the background to behaviour settings is presented in the Theory Box below.)

Behaviour settings

Meal times, business meetings, air travel, classes, religious services, waiting at a bus stop – all constitute types of behaviour settings. Such settings can be thought of by analogy to a stage play where actors congregate in a particular place to perform oft-repeated roles with certain props and well-rehearsed scripts. Each setting thus has a purpose, a designated place, a set of objects, and a prescribed set of behaviours. Each person entering into a setting expects the others who simultaneously participate in it to perform their (implicitly) designated roles. Deviation from these roles is generally punished by those participating in the setting. To understand the power of settings, imagine that you are speaking in front of an important audience of your peers, and you forget what you meant to say. In effect, you have failed to play your role properly, having been let down by your memory, due to the stressful situation. Those in the audience will express displeasure and annoyance, and you will attempt to recover as quickly as possible – your embarrassment being an internal censuring system to get you to perform properly. (For more examples of setting regulation, see the many videos of 'social disruption experiments' on the web, which show what happens when people violate simple, everyday norms such as talking to, or sitting too close to, strangers in public places, or just not using silverware during a meal). Settings are a powerful means of understanding what directs people's behaviour. They suggest that we need to look to the supportive social conventions, physical objects and infrastructure that regulate ordinary behaviour. Behaviour settings are the situations within which people have learned what to expect from the environment, and from other people's behaviour.

To continue the theatre analogy, a setting can more formally be said to have the following elements:

- **Stage:** the place and things surrounding where the setting regularly occurs
- **Props:** the objects used to accomplish the behaviour (often called 'synomorphic' because they fit the behaviour – e.g., a hammer is designed both to fit the hand and to bang in nails efficiently)
- **Roles**: the interacting strategies used by the cast of actors which meet their needs separately and together
- **Routine**: a learned sequence of behaviours performed regularly, and typically in the same order, to fulfill a role
- **Script**: an individual's knowledge of a routine – that is, a set of mental instructions about how to behave (which may be implicit), in a particular behaviour setting, to play a role
- **Norms:** the implicit rules governing role-play in a setting.

Changing settings is therefore a powerful and sustainable way of changing behaviour. Indeed, behaviour change can be said to be essentially about *disrupting behaviour settings*. For example, in a food hygiene intervention in Nepal, groups of neighbours came together for 'kitchen makeovers' in which the kitchen space was repainted and decorated as a 'safe food' zone, food preparation gadgets were distributed and new behavioural 'scripts' were suggested to them – all of which succeeded in creating new, safer food preparation routines amongst mothers in the intervention villages. (Gautam, in prep)

BCD *THEORY:* Behaviour Settings

A 'behaviour setting' is a recurring situation composed of people interacting with their environment to fulfill an emergent function in a particular time and place. [23] Performance in a setting can be thought of as execution of a 'we-plan'– that is, an implicitly agreed social contract among members of a temporary social network to perform coordinated behaviours together, thus achieving goals that it would be more difficult for individuals to achieve on their own. [24] Behaviour settings can be considered the (still-evolving) products of cultural evolutionary processes for establishing the best ways of getting everyday jobs done. Indeed, they are probably a human elaboration of the rites and rituals in other animal species associated with evolutionarily important tasks like attracting females, competing with other males, or for territory. Elaboration comes in the fact that the behaviour sequences can be much longer and less rigorously defined (i.e., more flexible).

Our view of behaviour settings is also explicit about the conceptual linkages between Roger Barker's work and that of Irving Goffman on 'social occasions' [25], and the latter's 'dramaturgical' interpretation of face-to-face social interactions. [26] We therefore use terms like stage, script and role rather than Barker's original terminology. Goffman was aware of the conceptual link from settings to game theory as well, in which the 'moves' of an individual are dependent on those of others in the 'game' [27] – an important formalism for understanding the strategic inter-dependencies operating during behaviour setting performance, as those performing their roles properly depend on others doing the same simultaneously (e.g., when engaged in cooperative activity like eating at a restaurant).

The predictive brain

The human brain is composed of 100 billion neurons, each linked by around 7000 synapses to other neurons, forming a network of incredible complexity; indeed, it is one of the most complex objects in the known universe. Nevertheless, there is a growing consensus that how the brain works can best be described using a simple proposition: it makes predictions about the world it lives in and acts to correct mistaken expectations about how the world works. [28-30]

Evolutionary processes designed the brain to produce adaptive behaviour that makes use of opportunities and avoids threats in the environment. [31-33] More formally, the brain seeks to be in a low energy state, in which all its expectations are constantly being met by circumstances. [18] However, when something new and unexpected is encountered in the environment (e.g., because a behaviour setting has been disrupted), this implies that the brain may no longer be producing the optimal behaviour, so attention must be paid to seize the new opportunity, or to avoid the new threat. If the new situation is then dealt with effectively (i.e., the behaviour it produces in response results in a positive goal state), a reward signal in the brain causes that new behaviour to be reinforced, and hence repeated, when the opportunity presents itself again. (Obviously, the condition which originally produced surprise must persist.) This constitutes an episode of what is called 'reinforcement learning' by the brain. Eventually behaviour settles down into a new pattern, when what the brain expects is no different from what the environment offers. A new habit may even be formed as the new behaviour becomes a part of the normal routine. The brain has had a learning experience (that is, changed its model of how the world works in some way) and it settles down into a new low energy state where everything is again predictable. (A more detailed explanation of the predictive brain approach and reinforcement learning theory can be found in Appendix 1.)

Three levels of control

Changes to environments, or behaviour settings, have to work via psychological changes before they are realized in new behaviours (as the Theory of Change indicates). The predictive brain deduces what is the best strategy in response to disruptions, but the production of adaptive behavioural responses is controlled in three different ways: via reactive, motivated and executive mechanisms. [22] (See Appendix 2 for a justification of these distinctions as classes of reinforcement learning.)

Reactive behaviour

First, behaviour can be purely reactive -- a rapid, automatic response to a stimulus, without conscious awareness. In evolutionary terms, this is the first type of behaviour to have arisen, and has been present since animals first evolved. Examples include a flinch response to feeling a burning match or a learned automatism such as changing gear while driving up a hill. Reactions learned through repeated experience are called habits, [34] and much of everyday behaviour is produced in this way. [35]

Motivated behaviour

The second type of behaviour to evolve, in invertebrates, was motivated behaviour. Motivated behaviour is directed toward the achievement of goals. This direction is provided internally to the brain and body by the reward system, which provides indicators of progress toward, and achievement of, goal-states. Reward signals in the brain tell us that we are on the right track and teach us to repeat rewarding behaviour, but not to repeat behaviour that produces the opposite: punishment signals. Specific mental mechanisms have evolved to produce this goal-directed behaviour, which we call motives.

Reward

How do motives shape our behaviour? An animal, driven by Hunger (one of the evolved motives characterizing animal behaviour), may seek to savour a novel substance, but unless the taste experience is rewarding, the behaviour of eating that food will not enter the animal's repertoire. Such rewards guide animals on the way to beneficial end states (in this case, having consumed appropriate nutrients). Rewards can include sensory pleasures (hedonic sensations such as taste or smell) as well as metabolic benefits for the body (e.g., rising blood glucose levels from food consumption). Satisfaction of Curiosity, which increases one's knowledge of the world and how to do things in it, is also rewarded.

Rewards both guide behaviour along the path to meeting needs and also kick in when the end-state is achieved – that is, when a need is met. Rewards may or may not be consciously felt. So, for example, though saccharine and sugar may both feel sweet and hence rewarding to the tongue, the lack of physiological impact on blood glucose of the saccharine may make it less rewarding overall and hence less likely to be employed habitually than sugar. [36]

The human motives

The human way of life involves solving specific kinds of evolutionary problems, which are set by our niche, such as finding food, or a long-term mate, or ensuring we are treated fairly in social dealings. Motives are evolved psychological mechanisms that help us to choose the appropriate behavioural response to a situation – that is, the response most likely to lead to a satisfactory outcome in terms of the benefits accruing from that interaction with the environment (including other people). [22, 37, 38] For example, we are motivated to

- avoid bad smells because they may betray a disease threat (Disgust)
- give a present to our lover because it may help keep them around to help rear children (pair-bond Love)
- take free offers even for things we don't need (the Hoard motive)
- work to advance our social standing (Status)
- avoid threats of predation and accidents (Fear)

Each of these motives helped our ancestors survive and compete in our evolutionary past. Motivated behaviours often come at some short-term cost (in terms of physiological effort, time, or just missed opportunities to achieve other, easier goals). For example an animal might undergo immediate discomfort (like climbing a tree) to seek out a rare source of food such as honey. Or they might invest in Play behaviour when it equips them with social or manual skills to rear children or fight their conspecifics. (For a more complete description of the human motives see the Theory Box below; a full history and description of each motive can be found in our recent book. [22] It should be noted that the word for each motive has a

technical meaning derived from its evolutionary purposes, which does not always correspond exactly to the lay terms used to name them.)

BCD *THEORY:*
Human Motives

If one admits that motives achieve biologically important goals, then the set of motives can be derived from deductions about what kinds of goals are important to a species, given the way it lives. The set of human motives can therefore be assumed to reflect the particular set of evolutionarily important tasks humans must solve in order to survive and reproduce. Drives are those motives which provide direct changes to the state of the body; Emotions are motives which modify the state of the environment in ways that facilitate later satisfaction of evolved needs, while Interests are motives whose primary function is to provide information to the brain that can be used to eventually satisfy needs. The figure below sets out the full suite of human motives, showing at what stage each one evolved in our ancestral lineage.

Drives

Comfort. Because terrestrial niches vary in terms of physical conditions such as temperature, elevation and moisture levels, maintenance of the body's physiology requires behaviour such as relocating to shade when the sun is hot, covering the body with warm, dry clothes and finding shelter when it is not, removing thorns, tending injuries, saving energy by sleeping.

Hunger. Like all organisms, humans have basic metabolic needs to sustain bodily tissues. These are met through the acquisition of resources such as nutrients, water, oxygen and sunlight.

Fear. Humans, like most animals, face threats from the environment. Fear drives behaviour that avoids 'hurt-from-without' threats, including predators, but also aggressive conspecifics and the chance of accidents like falling from a cliff.

Disgust. Animals also need to avoid 'hurt-from-within' threats – that is, parasites – which are able to sneak undetected into the body. This motive causes the avoidance of bodily fluids, sick others, 'off' foods, disease vectors and contamination. It has been linked to our reasons for avoiding people who violate social norms as well in the form of 'moral disgust'.

Lust. The need to maximize the production of gene copies in the next generation causes people to engage in copulatory behaviour, because humans reproduce through sexual intercourse. This requires a search for and pursuit of appropriate candidates and the consummation of sexual union.

Emotions

Nurture. Mammalian offspring are born dependent, requiring provisioning, protection and education. Nurture is the motive to rear offspring and aid kin. The Nurture motive drives feeding, cleaning and protective behaviour, providing opportunities for play learning, and attempts at influencing the social world in favour of kin (nepotism).

Attract. Humans have to compete for mating opportunities. Making sure one is attractive can help secure one-time copulations or long-term pair-bonds. It causes individuals to produce displays of sexual attractiveness through body adornment, painting or modification, provocative clothing or through activities that display mate quality such as sport and dancing.

Love. Human mothers need to keep men around long enough so that they can share the burden of rearing highly dependent offspring. Love causes both males and females to invest in a pair-bond that ensures this investment with tactics that include making costly gifts, offering tokens of commitment and the jealous driving away of rivals.

Affiliate. To gain the benefits of group life, humans invest in membership in groups. We are motivated to participate in social activities, to form alliances, to conform to group norms, to display our intentions to

cooperate, to seek to engender trust, and to share resources, including knowledge about others.

Status. In hierarchically organized groups, individuals seek to enhance their relative social position so as to have priority access to resources. This is achieved by tactics such as flattering superiors, submitting to authority, drawing attention to one's one contributions, displaying wealth, ability and 'taste' and seeking recognition and title.

Create. One's habitat can be improved such that it is more conducive to survival and reproduction. Tactics include building dwellings that are safe and dry, removing dangers such as predator or parasite habitat, planting, weeding and irrigating, cleaning, tidying and repairing habitat and making artefacts such as bows and ploughs that aid the diversion of energy towards survival and reproduction.

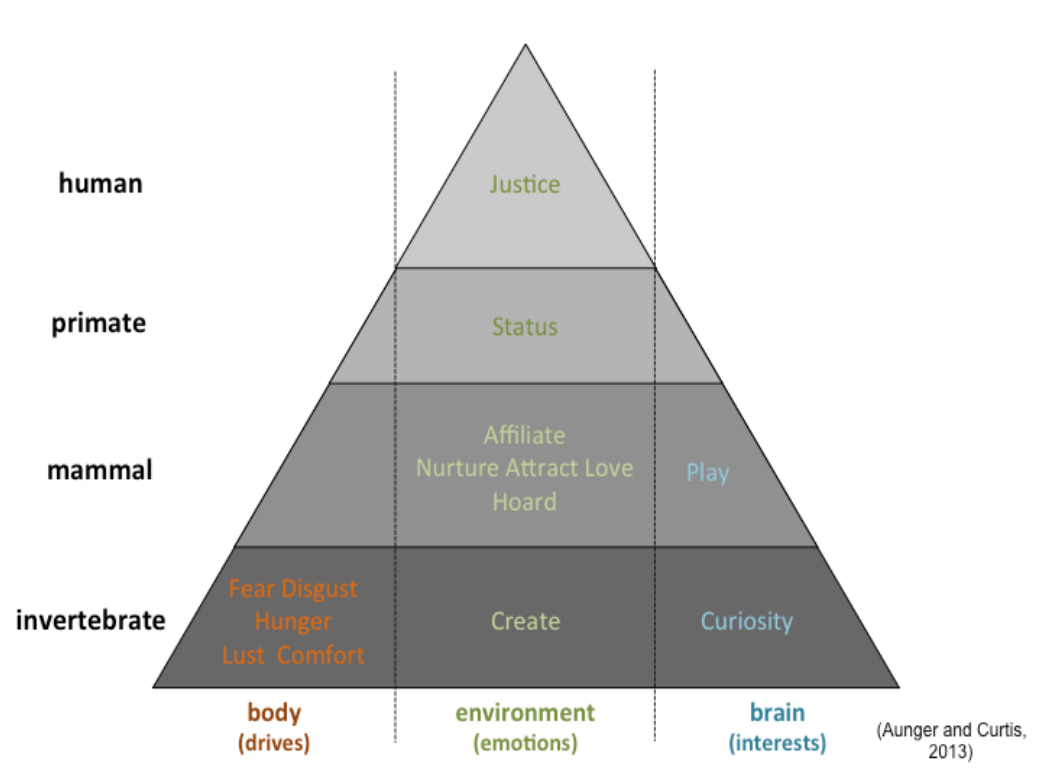
Hoard. Actions can be taken now to ensure that resources are available later, when they may be required, but less readily available. Hoard motivates behaviour that involves the accumulation of resources, either directly by growing, collecting and storing, or more indirectly, by negotiating the rights to territory, or the fruits of group production. It may also require the guarding of resources from pilfering by others.

Justice. Only humans live in very large groups of unrelated individuals. Cohesion in such groups appears to be regulated by people's willingness to punish not only those who mistreat them, but those who mistreat others in the social group. The Justice motive causes humans to enjoy punishing those who behave anti-socially.

Interests

Curiosity. Because the environment is constantly changing, it is necessary to update one's information about current conditions. The function of the Curiosity motive is to collect and codify information, thus reducing a gap in knowledge about some facet of the world. Curiosity motivates exploratory behaviour and results in brain structures being created or updated, such as world-maps and situational expectancies.

Play. Time can sometimes be spent acquiring skills to be used later in contexts important to biological fitness. Play drives the acquisition of embodied skills and knowledge of one's own physical competencies through the repeated practice of particular behaviour sequences. Play-driven behaviours involve simulating activities such as nurturing babies, fighting, hunting, or courting, without its related dangers.



Planning and executive control

Finally, higher primates have a third means of producing behaviour. They can use executive control to plan beyond the time horizon of immediate reactivity and short-to-medium term motives. They can imagine alternative futures, evaluate which are likely to be most beneficial (still valued in terms of reward) and hence plan to do something even more beneficial. They can sacrifice the opportunity of an extra-pair mating by imagining the consequences for their family, or forgo the opportunity to attend a party for the sake of getting better marks on an exam, both of which may have greater payoffs in the long term. Humans (and possibly some other animals) can even direct their own thinking processes consciously to make decisions about what to do next – the 'highest' form of behavioural control. Most efforts at behaviour change have focused on addressing this 'rational' deliberative brain, on the assumption that it is primarily in control. However, new evidence suggests that this part of the brain is reserved only for particular types of situations. [39, 40] Most behavioural decision-making is in fact carried out elsewhere, in automatic conformity to scripts and routines in behaviour settings and in the comparative valuation of routes to goal states, weighed up in the currency of reward.

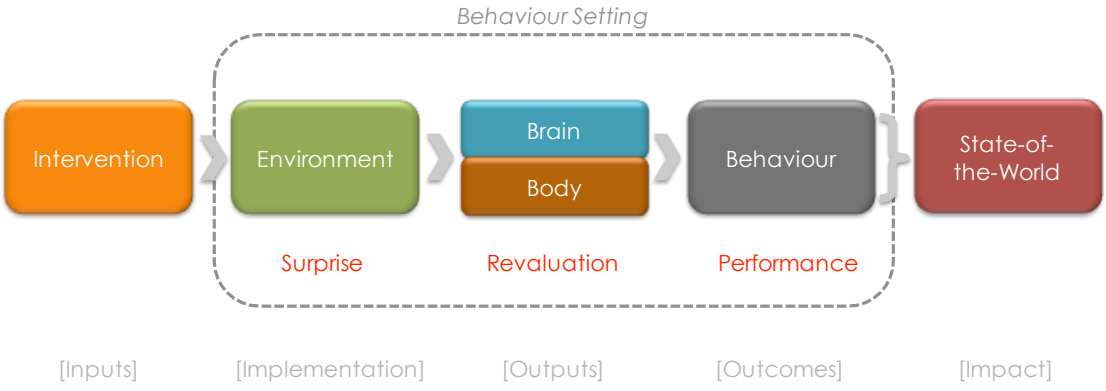
What are the implications of the three-level brain for changing the behaviours that we are interested in? First, habits, by their nature, are hard to institute, but if habits can be created they are likely to persist. Second, motives can be harnessed to drive the behaviour in question. If disgust of dirt and contamination is an important driver of hygiene behaviour then perhaps it can be harnessed to increase handwashing, as we have done successfully in several interventions. [41, 42] If a behaviour occurs publicly then perhaps it can be made a token of Affiliation: what 'our group' do and hence rewarding. Third, while we like to think that the top-level brain – the one that carries our conscious rational planning – is in charge of our behaviour, mostly it is not. Long-term plans are weak in the face of immediate temptation, and often give way to habits. The best way to use our rational brains to change our behaviour may be to find clever ways to 'trick' our habits and motives -- by placing cake out of sight or not buying it at all, when one wants to diet, for example.

Part 2:
Changing Behaviour

We have discussed how environments, bodies and brains in behaviour settings interact to *determine* behaviour. But understanding how behaviour is determined does not lead directly to an understanding of how to *change* behaviour. How can the resources available to a public health program most effectively be used to shift the largest number of people in a given population into the healthiest behaviours? How can a company get the biggest sales and profit from a new marketing campaign? How can an individual ensure that their current level of motivation to change will actually result in new, but stable patterns of behaviour in their daily life? Which elements of the model should be recruited as levers so as to change the particular behaviours that are being targeted?

At the centre of the BCD process diagram (Figure 1 above) is the Theory of Change (see Figure 2), which suggests that three causal links must be made: from the environment (modified by an intervention) to psychological change in the target population, to performance of the target behaviours (which result in changes to the state-of-the-world). Any change to the environment is perceived by the animal, processed for its potential implications to the animal's survival or reproduction, and a strategy for dealing with those environmental changes is then produced (based on predictions about the likely consequences of action), leading to a behavioural response. This response of course produces new modifications to the environment, which feed back to the animal as new perceptions, leading to another round of learning. (This formulation of the Theory of Change reflects its foundation in the predictive brain approach, described earlier. See Appendix 1 for a formal discussion.)

Figure 2: Theory of Change



Applied to the challenge of behaviour change, we summarize these steps as three problems that have to be solved:

- Create *Surprise*
- Cause *Revaluation*
- Enable *Performance*

Solving these three problems is the central focus of BCD. (The strong relationship between these problems and the reinforcement learning process is discussed in Appendix 1.) As will be noticed in Figure 1 earlier, these problems are all linked by taking place within one or more behaviour settings.

Surprise

The first principle of behaviour change is *surprise*. Most everyday behaviour is settled into fixed channels. To shake behaviour out of these ruts, something new has to happen. So if we are to persuade behaviour into new directions, we first of all have to provide surprising stimuli.

Creating surprise can be broken down into two sub-problems:

- Getting exposure
- Grabbing attention

Getting exposure

If the immediate environment doesn't contain new stimuli, then no learning can take place, and individuals will not respond to the intervention with changed behaviour as a consequence. Hence the first job of any behaviour change effort is to get new stimuli and people together in time and space. Marketers tackle this problem in a systematic way, by analysing how and where their target population segments spend their time. They identify 'touchpoints' – the places and times that they can exploit to connect people with products or to channels of communication. [43] For example, mothers with new babies may be targeted via pharmacies, while people looking at property websites may be targeted with furniture ads. A premium is charged for placing products besides tills in supermarkets or billboards beside heavily used transport routes. A touchpoint analysis in a rural low income setting may reveal that clinics, despite being an obvious choice for health messaging, may be a poor channel of communication, as mothers may, on average, spend very little time each year in a clinic, and then may only interact with a health worker for a few short minutes. Behaviour change campaigns that do not get exposed to the target audience fail at the first hurdle.

Grabbing attention

A second problem is that, though people are constantly being exposed to new stimuli, especially in modern environments, the stimulus may not be attended to. Ensuring that the target stimulus gets processed is a design problem.

Luckily, we know what makes a stimulus stand out. We pay attention when we encounter a stimulus that seems to suggest that the world model in our heads may be wrong. [44] This

means that we could be behaving inappropriately and possibly dangerously, and that we need to attend to learning how to fix the problem. So a stimulus that we attend to is one that confounds what we already know and expect. For example, no one pays attention to small stones by a path, but when the same stone is moving in a trajectory likely to collide with our bodies, we respond immediately. No one pays much attention to a crowd of people queuing at a ticket barrier, but when one individual behaves unexpectedly, by doing a handstand, for example, we pay attention. Phenomena which defy evolved expectations are surprising. For example phenomena which defy our mental models of how physical objects or biological creatures act – such as physical objects moving by themselves or non-human creatures talking. Think of seeing an ad with a picture of a tree with eyes: trees are plants, but only animals have eyes, so a tree with eyes confounds expectations and therefore is surprising. In terms of the predictive brain hypothesis, this is called 'prediction error': we predict how we expect the world to be, and pay attention when we find the prediction to be wrong, as it may mean that we have to fix something. [44]

Producing a surprising stimulus is therefore what interventions should do, as such stimuli should grab attention -- assuming people are in 'the right place at the right time' and have been exposed to the intervention stimulus. Creative people are good at coming up with surprising ideas, because they can think 'out of the box', which is why engaging creative people to help design behaviour change programs is a good idea.

Revaluation

Of course, a program's aims won't be achieved just by getting people to attend to a randomly surprising stimulus. Surprise has to have consequences that result in desired changes to target behaviours.

So what sort of surprise will help us to achieve behaviour change? We need to create the sort of surprise that will lead brains to think that the individual can get what they need by performing the target behaviour. Brains are constantly scanning the environment for opportunities to employ behaviour to get what the brain or body needs (or avoid what might harm it). What are those things that we need? Luckily the list is limited to 15 categories of things, which satisfy the needs associated with motives (as we saw earlier in the section on motives).

Alter rewards

So how can the human motives be used to change behaviour? One way is by emphasizing the rewards from performing the behaviour (or alternatively highlighting the possible negative consequences). In both cases, the sensory salience, temporal proximity or statistical likelihood of these rewards being experienced may not be obvious. For example, contagion of pathogens is imperceptible but nevertheless causes disease – a real threat that simply isn't easy to understand or identify using the human senses. By artificially making this process visible through exaggeration (e.g., the supersized 'bugs' with evil personalities inhabiting the mouth that appear in toothpaste ads), the benefits of the behavioural practice can be made more salient.

Similarly, people may have the perception that rewards will only appear in the relatively distant future, and therefore discount them maladaptively. For example, the benefits of

education may only be associated with eventually getting a better job. This misperception can be corrected by emphasizing the good feelings associated with being more knowledgeable and capable in everyday matters now.

Finally, the likelihood of experiencing desired rewards can be increased by offering guarantees of various kinds. For example, marketers often offer 'money back if not satisfied' deals on new products.

(Hyping up health benefits is unlikely to make people experience (or imagine) any immediate, tangible reward for behaviours which may be difficult, uncomfortable or expensive to enact. Hence we suggest that health messaging is unlikely to be an effective strategy for public health behaviour change efforts. [45])

In summary, occurrence of a given behaviour can be made more likely if the rewards that naturally follow from performing it can be altered by making the reward appear more/less obvious, more/less immediate, or more/less likely.

These ways of altering some aspect of the link between doing a behaviour and the experience of reward that follows should have an impact on whether the behaviour actually gets performed. However, this tactic may not actually change the amount of reward that is experienced from carrying out the behaviour – only some perceived quality of it (e.g., how fast it is experienced, or its sensorial richness). Hence any revaluation may only be temporary. Behaviour may change once and then revert to the old pattern. The next tactic addresses this problem.

Modify value

A key task for the would-be behaviour changer is to modify the value of the target behaviour. One way is via the classic marketing strategy of adding value to a product by associating it with a high Status individual (e.g., celebrity), or adding moral value to a brand by suggesting it is environmentally friendly or socially conscious.

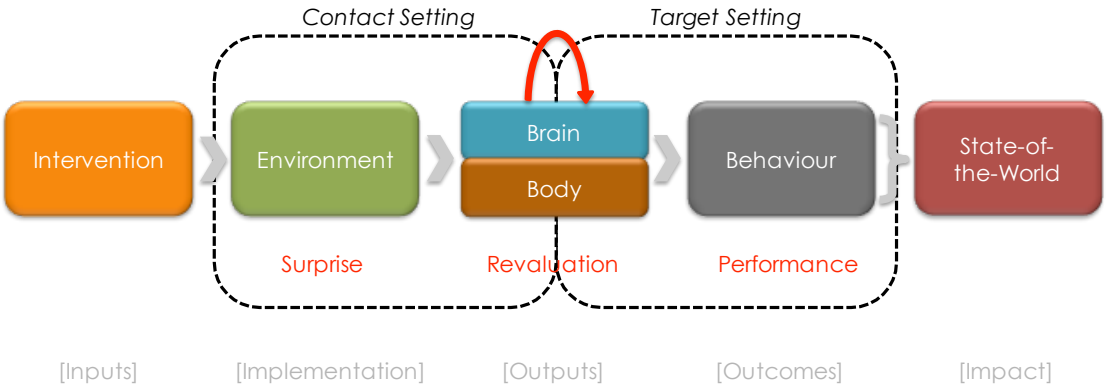
All behaviours have a 'proper domain' motive (i.e., that for which they evolved – such as eating to assuage the Hunger motive, while Hoarding is about gathering resources for a rainy day). However, other motivations can also typically be recruited to help instigate behaviour change (e.g., make eating an Affiliative activity or one that displays your Status). For example, through branding, values of all kinds can be added to a food -- it can be environmentally sourced (the Hoard motive), or grown by local farmers (Affiliation motive). Obviously, the opposite can also be important: anti-smoking campaigns try to make smoking *less* valuable by suggesting that the practice isn't really popular among peers (i.e., not a norm in the Affiliation group), or only practiced by those of low Status, thereby *reducing* the number of motives associated with the behaviour. By varying the number of motives and kinds of rewards attached to the performance of the target behaviour, new behavioural patterns can be established.

Facilitate processing

Finally, it is important to note that target individuals are typically exposed to an intervention in one setting (e.g., a community event), but perform the target behaviour in another (e.g., mealtimes at home in the case of a nutritional program). For behaviour change to occur, the individual must retain some mental novelty (e.g., an intention to perform the target

behaviour) during the period between exposure to the surprising stimulus and the time when opportunities to perform the target behaviour occur. We call this the 'Setting Transfer Problem' (see Figure 3; note the red arrow highlighting the specific problem).

Figure 3: The Setting Transfer Problem



This problem is related to the issue in psychology called 'prospective memory', in which an individual must recall an intention to do something at a specific time-and-place in the future. [46] The prospective memory literature has shown that the Setting Transfer Problem can be overcome to some degree by making the intention to perform a behaviour specific to a particular situation -- that is, couching the intention in the form of an implementation intention, [47] or by placing reminders in the target setting that will help cue performance. [48] (Use of the word '*performance*' also purposely implies 'acting out', or playing a role on a stage – to emphasize that it occurs in a particular setting.)

However, the Setting Transfer problem is more general than suggested by the prospective memory literature. It can also be solved simply by creating some new mental association which is remembered long-term – that is, information which comes to form part of long-term memory – but which isn't a conscious intention. Just finding the target behaviour more attractive, because it is now linked (relatively permanently) to new, desirable goals (that satisfy other needs than the primary one), can work to cause the target behaviour to be performed.

This kind of processing – forming an intention or long-term memory -- is more likely to happen if, at the time of exposure to the intervention, individuals:

- have relatively few other stimuli to process (i.e., low cognitive load and low stress)
- have relatively more time before the next behavioural response must be produced
- are in a social setting so that the experience can be shared
- are in a 'teachable moment' or life-change event (such as birth of child, moving house), when people are seeking to learn how to behave differently.

These are all situational variables that can be modified by choice of touchpoint. For example, a doctor's waiting room may be a good touchpoint because people in the waiting room may be in a teachable moment, and with time between activities.

There are also ways in which the stimulus itself can be presented that make processing easier. These include employing:

- multiple sensory channels (e.g., TV with sound and vision, versus radio, which is only sound)
- simplification and exaggeration of stimuli (as in animations) [49]
- highly recognizable settings to encourage rapid perceptual identification
- narrative (i.e., using our evolved ability to process the simulated experience of others).

The Revaluation of the target behaviour that results from exposure, attention, and mental processing can occur both at the point of exposure and over time (i.e., in multiple settings), as individuals reflect on their exposure to the surprising stimulus, and continue to learn about it. The completed Revaluation can be considered the *output* of the intervention in Theory of Change terms.

Performance

The target behaviour must still be enacted. This problem can be split in two:

- Opportunity creation
- Action selection

Opportunity creation

For the target behaviour to be performed requires an opportunity – that is, a situation must arise that can be played out as a particular instance or enactment of the Target Behaviour Setting. For example, if the behaviour is playing a game of tennis, it may not happen until there is a meeting of the Tennis Club, which is the setting within which the individual always plays tennis. The purpose of Performance is to interact with – and change – the environment in a way that minimizes the Surprise previously perceived – that is, to remove the perceptual 'error' through behaviour and thus make the 'look' of the real world conform as closely as possible to the person's internal world model. [44] Performance of the target behaviour should be the means by which this reconciliation between the individual's world model and the world itself is achieved.

Obviously, Revaluation (from the previous step) should lead the target behaviour to have a higher perceived value, which will cause people to expend greater efforts to perform it, all things considered. Other factors are likely to be specific to the behaviour setting in question. The basic rule is: disrupt the Target Setting in some way so that the target behaviour is performed.

One kind of disruption can be role change – the strategic position played by some individual in a setting. Attaching particular behaviours to the enacting of a role – e.g., via pledging – is one way to create new opportunities for the behaviour to be performed. Pledging is making a commitment – preferably in public, to add weight to the promise – to perform the target behaviour. It is also well-known that making the pledge specific as to the situation in which it should be performed – what psychologists call an 'implementation intention' – makes it more likely to be performed. [50, 51] An implementation intention thus makes reference to

particular behaviour settings. Having people sign their pledge as well turns it into an implicit social contract, lending it further weight because failure to adhere to the contract can be punished by others.

Another thing people can do to facilitate performance is to modify their environment by increasing the level of technological support for the target behaviour. For example, installing an irrigation system makes watering the garden regularly much easier – even automatic, if a timer is included. Getting people to take their medicine is facilitated by buying a special container with the time and day labeled on separate cells in the box, making it easy to determine whether this afternoon's dose has been taken or not. Simply putting the medicine out on the counter, rather than behind a cabinet door, can cause the medicine bottle itself to serve as a reminder. Such simple tricks can often suffice to increase the likelihood of performance when an opportunity arises. Similarly, the Target Setting can be modified such that some barrier to performance of an undesirable behaviour is introduced, as when people stop having snacks in the house.

Ensuring that the target behaviour is performed may require modification of the script for the setting. For example, people may currently think that getting their hands clean before eating simply requires rinsing them with water to remove any visible dirt. An intervention may suggest that this is insufficient because there are also dangerous but invisible agents that need removing from hands. To be effective, this intervention must ensure that individuals believe that the handwashing setting can only be successfully completed by including a new step in the routine: washing with soap as well as water. This means the individual must modify their script for this setting to include this extra step. Even if the step is omitted next time through habit, memory of the script may cause the individual to go back and insert the soap use before leaving the setting.

The target setting can thus be modified in many ways to safeguard that the target behaviour is performed.

Action selection

Even if all the previous steps have been taken, the target behaviour may still not be enacted when an appropriate situation arises. This is because before a behaviour is performed, it must be selected from among many other potential behaviours. [52, 53] That process can be delegated to the environment, as when a cue triggers an automatic habitual response. Alternatively, a motivated (though implicit) calculation may suggest that, in the present state of hunger, consuming food has more value than hoarding it, for example. However, there are executive control factors that can also affect whether a behaviour gets performed:

- *Cost*: the more expensive the action in terms of energy, time and mental resources, the less likely it is to be performed
- *Confirmation bias*: the tendency to value choices consistent with existing beliefs and values
- *Availability* in memory of relevant information (for example, one can more easily remember the name of a celebrity than a friend due to the former being heard in so many different contexts)
- *Endowment effects*: the tendency to de-value choices that require one to give up something that one has already acquired (for example, to pay tax on income)
- *Locus of control bias:* the tendency to believe exogenous environmental factors can be influenced through action

- *Mere exposure effect*: the tendency to value things simply because they are familiar, not due to intrinsic qualities of the thing
- *Fundamental attribution error*: the tendency to believe that others willfully choose to engage in behaviours rather than recognizing the power of the situation on them

The above 'biases and heuristics' (or rules of thumb) for decision making have been investigated by behavioural economists, who see these as 'predictably irrational' forces behind behaviour. [9]. Yet, from an evolutionary standpoint, all of these biases are rational in the sense that they help people to make adaptive choices. For example, it makes sense to ascribe greater value to something one has possession of now than to a promise of the same thing later, since the future is always unpredictable and promises are not always kept. Similarly, the locus of control bias is often adaptive because it is better to assume that one is a forceful agent in the world than powerless, in which case no attempt at goal achievement would be made. For example, children with an internal bias function more positively and efficaciously in achievement situations than those with an external locus of control. [54] The fundamental attribution error is simply the locus of control bias applied to other people, rather than oneself, and has a similar explanation: assuming others are responsible for their actions is a natural consequence of trying to predict others' behaviour by imagining their mental states. [55] Further, overestimating the probability of others having aggressive intentions (and preparing a defensive response) is a better error to make than assuming they are benign and risk deterrence failure, exploitation, or attack. [56, 57] The 'error' can be explained as an appropriate bias when it reduce the costs of erroneous inferences. [58]

The final valuation of a behaviour is thus a function of the intrinsic value of the benefits received, as modified by the relevant action selection factors. The name of the game is for the target behaviour to win in comparison to all other options.

In Theory of Change terms, Performance can be considered the *outcome* of the intervention. As a consequence of having gone through this process of Surprise, Revaluation and Performance, the desired outcomes should occur. Theses processes can be summarized in a 'central principle' of BCD: ***Disrupt settings with Surprise to force Revaluation and so cause Performance***. This principle requires that the causal mechanisms linking the program implementation to the Target Setting in the Theory of Change – that is, interventions creating surprising new stimuli which run counter to the brain's predictions, forcing it to reconsider its evaluations, such that new behavioural performances result – actually work as predicted. In other words, the program design problem is to create an 'earthquake' at the front end of the Theory of Change which propagates itself through the brain and body such that a 'tsunami' at the opposite end forces the target behaviour to happen.

With this overview, we can now move on to describing how the BCD process should be used to develop behaviour change programs.

Part 3:
Designing a Behaviour Change Intervention

Programs that aspire to change behaviour need to do more than just understand the drivers, or 'active ingredients', of behaviour change processes. Behaviour Centred Design also offers a methodology for designing, delivering and evaluating behaviour change programs. It is inspired by theory and our own experience of designing behaviour change programs to change different kinds of behaviour (e.g., handwashing, food hygiene, sanitation, infection control, child nutrition, women's nutrition, exercise and product use). This process is centred on developing a Theory of Change that encapsulates the program assumptions about how to change the target behaviour. The Theory of change also helps with delivery and evaluation, so that lessons can be learnt and extrapolated elsewhere. By following the BCD program process a program can be developed that maximizes the chance of having the desired impact on the State-of-the-World.

The BCD approach divides the program development and execution process into five steps (note the mnemonic of 'ABCDE'):

- **Assess**: determine what is known and unknown about current and desired behaviours and their determinants
- **Build**: fill in the knowledge gaps by collecting data (e.g., through formative research)
- **Create**: produce the concepts and materials that will have an impact on the program objective
- **Deliver**: execute the plan to expose the target population to the program's activities
- **Evaluate**: determine whether the predicted environmental, psychological and behavioural changes occurred

The diagram in Figure 1 displays the development process steps A, B and C along the top, and the execution steps D and E along the bottom. Development is conceptually a 'backwards mapping' process with respect to the Theory of Change (in the middle of the diagram): beginning with a long-term goal (i.e., impact) and working backwards through a chain of mechanisms towards the earliest changes that need to occur, the intervention. In backward mapping one builds the outcomes pathway starting at the most general and longest-term outcome, then drills down by identifying each set of preconditions, ending at the most particular, immediate, and short-term outcomes to be achieved.

The process we set out here is not unlike many others used across fields such as training development (e.g., the ADDIE model, designed for the U.S. Army [59]), humanitarian response processes (e.g., the UN OCHA model [60]), organizational capacity development (e.g., the UNDP model [61]), software development, [62] or public health program development (e.g., the PRECEDE-PROCEED model [63]). Each of these models tends to have somewhat different sets of steps (e.g., the UNDP capacity development model consists of engage, assess, plan, implement, evaluate), which makes it difficult to know how to choose the most effective process from among the many similar candidates. The BCD process consists of the minimal set of necessary and sufficient steps for designing and conducting an

effective program. Each step is necessary because program executions that ignore or skip over a step are unlikely to achieve any impact. (The steps could be further broken down – for example, Create involves both the conceptualization of designed materials and their actual production – but such sub-steps would still share the basic function mentioned above for each step.) And the steps are sufficient, because they progress from the beginning of program definition to the end of program execution and analysis. (See Appendix 1 for additional material about the essential features of the BCD process.)

As with any project, it is essential to form a Core Team which oversees the process of designing (and delivering) the behaviour change program. Marketing experience suggests restricting this team to 6-8 stakeholders and behaviour change experts who anchor activities and seek specialist support when needed.

Here we set out the ideal version of the overall process which might employ considerable resources, many experts and a long time-frame (e.g., a year). This is warranted for large investments. However smaller programs should also follow each step in some form, as it is the logic of this process that produces better results in terms of behaviour change at the end. We discuss each of the ABCDE steps in detail next.

BCD *EXAMPLE:*
Introduction to the SuperAmma Program

Throughout our discussion of the BCD process steps, we will illustrate principles with an example. The 'SuperAmma Campaign' was a project funded by the Wellcome Trust with the objective to test behaviour change principles so as to reduce child mortality due to diarrhoeal disease in rural India. ('SuperAmma' is 'SuperMum' in Hindi; see www.SuperAmma.org.) Look for subsequent 'Example Boxes' to follow this story along.

Assess

The Assess step is concerned with setting out the scope of the program and identifying what is known about the target behaviour(s). This provides the basis for the next step: Build, which addresses any remaining gaps in knowledge required by the developing Theory of Change. First, existing information is collated concerning the determinants of behaviour, and second this information is developed and organized into a Theory of Change via a framing process.

Background review

The Assess team first determines what is known already, ideally by conducting, or commissioning, a background review that collates existing knowledge. It may be possible to locate previous formative research in the country, or from elsewhere, to provide good insights into the drivers of current behaviour. For example, in the SuperAmma project (introduced above) we reviewed the findings of formative research into handwashing behaviour in eleven countries and were able to draw out many insights. For example, we learned that disgust and the perception of local handwashing norms were important factors in driving handwashing around the world. [64] In a nutrition project in Indonesia we learned from reading previous formative research of a 'culture of frugality', with families keen not to 'waste' money on food. [65] Key informants present at a framing process in Zambia were able to explain that, though most mothers *knew* that they should breast feed exclusively, very few *did* so, helping us to rule out lack of knowledge as a reason behind poor rates of exclusive breastfeeding. (Greenland, in prep.)

Framing Process

Second, stakeholders and experts can be brought together (e.g., in a workshop) to frame the overall task and to agree as to what is known and what is still be found out.

To ground program development in practical reality it is useful to create a 'straw man' intervention – a rough, preliminary idea of what the behaviour change program might look like, taking into account the limitations of time, human, institutional and financial resources. For this aim, participants can use the BCD Process Model diagram to draft an initial Theory of Change: what are the desired impacts, behavioural outcomes, changes in brains, environments and settings and how might this causal cascade be brought about through an intervention?

Filling in the Theory of Change (see Figure 2 above) requires answering a number of questions:

- What is the **state-of-the-world** the program wants to change (i.e., its goal)?
- **What** exactly are the current and target behaviours?
- **Who** is in the target population?
- **Why** is the behaviour performed (i.e., what psychological mechanisms cause it to be enacted)?
- **How** can the target individual's situation be influenced so that they might be induced to change their behaviour?

We next describe the answers to each of these questions in more detail – in reverse order, based on the Theory of Change, because that is the way the causal links are built up.

State-of-the-World

The ultimate *goal* of a program is typically the starting point for program development. It can be expressed as the desire to modify some substantial aspect of the world-at-large, the *impact* of the program. It may be pre-defined -- as may other aspects of the program by the funder/developer, such as country of operation, budget, time-frame and scale of operation. The goal is typically associated with an impact that can only be achieved in the long term, and may be beyond the program's 'ceiling of accountability' [66] – the program cannot be held responsible for delivering them because the program is typically not the sole cause of the changes to these variables, and they can be impracticable to measure. (This is why, in the Theory of Change diagram [Figure 2], there is a summation sign indicating that the effects from potentially many behaviour settings need to be aggregated to achieve impact.) For example, a goal may be to 'reduce mortality among children under five years of age from diarrhoea by 5% in region X by 2020'. The program may not expect to be able to measure this, but this goal is what guides the logic of the program.

Impact can be about changes to different kinds of states-of-the-world:

- the power or ability to achieve an objective or engage in a practice (e.g., easier access to health facilities, strengthened organisational responsiveness, increased social capital, increased government funding)
- the state of some phenomenon with respect to its quality or functionality (e.g., improved working conditions, increased employment, reduced domestic violence, safer food supply, reduced stunting, improved national security, lower crime rate, reduced poverty, improved stock on railway network)
- the way system components are organised or distributed, which can be physical (e.g., increased reach of internet infrastructure), biological (e.g., decreased deforestation, reduced atmospheric carbon) or social/institutional (e.g., increased financial market regulation).

Because Impacts are often beyond the scope of current program activities, a program **objective** needs to be defined that is considered the 'reachable' indicator of program success, or progress toward the (longer-term) goal – it is the measurable criterion used to make a final determination of whether the desired impact is likely. It is the impact to which a program can be held accountable. For this reason, an objective needs to be 'SMART':

- Specific
- Measurable
- Attainable
- Realistic
- Time-bound

In some cases, this objective will couched in terms of behaviour rather than any of the types of impact listed above. This can be because behaviour is more easily measured, and because the link between performance of the behaviour and the longer-term or larger-scale Impact variables are already well-established in the literature, such that behaviour change should be a good indicator that the program goal will be achieved.

In the case of SuperAmma, the program was set up to change handwashing behaviour. Since the link between handwashing and diarrhoeal disease is already well established, it did not make sense to use scarce resources to measure health impacts. The same might be true of a vaccination program. Where vaccine efficacy has already been established, the important question for programs is how to ensure vaccine uptake, and this uptake behaviour is what it is most useful to measure.

BCD ***EXAMPLE:***
SuperAmma Objective

The basic public health problem addressed by the SuperAmma program was to reduce diarrhoeal disease. The goal was defined to reduce diarrhoeal disease among children under 5 in a particular rural Indian population.

After much discussion among stake-holders, and with reference to the SMART criteria, the following statement of objective was agreed at the SuperAmma Framing process:

- To sustainably increase baseline levels of handwashing with soap after defecation and before eating by 50% in the adult rural Indian population around 'location X' [kept anonymous for ethical reasons].

The goal obviously takes the target behaviour (defined next) and elevates it, in this case, to target population level to provide an indicator, given that increased handwashing with soap is known from the academic literature to be correlated with diarrhoeal disease reduction (the state-of-the-world the program wishes to influence).

Behaviour

Having expressed the desired state-of-the-world change via goals and objectives, the next step is to define the behaviour to be changed. This is often not a simple task; a final formulation may only be arrived at after completion of the Build step. Nevertheless, it is critically important to define the exact behaviour that the program wishes to change, and to get as good an idea at this point as possible. (Note that behaviour means what people will *do*, not what they will *say* or *think* or *feel* or *know*.)

Criteria for identifying such target behaviours include:

- **Causal significance**: There should be strong evidence that the selected behaviour has an impact on the program goal.
- **Incidence:** The behaviour should be enacted by a large enough group of people, and often enough, to influence the program objective.
- **Feasible to change**: It should be possible to perform the targeted behaviour with the resources available (e.g., it would be unhelpful to promote the use of products which are not available in the market), and for the program to be able to influence this behaviour using the means available.

BCD *EXAMPLE:*
SuperAmma Target Behaviour Definition

As a consequence of having conducted many similar campaigns on handwashing, program personnel rather easily

agreed on the following definition:

- Hand-washing with soap (by adult household members in the target population).

Based on indications of public health relevance from the published literature, as well as biological plausibility, the target handwashing behaviours were further refined to be those occuring after fecal contact (both own defecation events, as well as contact with child feces in the case of child-carers), and before contact with food (including preparation and serving events).

Body (Population)

The primary target of the behaviour change effort is those individuals whose behaviour must change to achieve the desired impact. This may be a single individual (in the case of self-help programs), institutions (such as the prison system), or it may include whole populations. The more tightly defined the target group the easier it is to develop the program. To increase the chances of a healthy pregnancy, for example, should a public health program target all adolescents to set up good eating habits? Or would it be feasible to target just those women in the first months of pregnancy? Do mothers and husbands play an important role in deciding what pregnant women eat? Such people may form an important secondary target audience – as may teachers, social opinion leaders or other key influencers – on the primary targets. The more that can be learned about the target groups the better the program can influence them. Hence the need to gather what is possible about daily life, work patterns, education, and the social and physical infrastructures in which they live.

The target population is labeled 'body' in the Theory of Change because BCD emphasizes the situational and physical nature of behaviour (remember that behaviour is defined as interaction of a body with its environment). But of course, at a program level, measurements are taken at the population level, summing over individual cases. The typical demographic characteristics of the target individual – gender, age, education level – can be considered bodily traits, and so define a typical target population profile.

Bodies can themselves be important in behaviour change as well. For example, when the target behaviour is obesity, changes in body morphology can be an indicator of program success; when it is an anti-smoking campaign, physiological dependence on certain chemicals can be a significant factor to take into consideration when designing the program.

BCD *EXAMPLE:*
SuperAmma Target Population

In the Framing process, the following was also agreed:

- Primary target: Mothers in the intervention area with children under-five
- Secondary target: Other carers of children, Anganwadi and school teachers, and Gram Panchayat head

Brain (Psychology)

Here the primary question is to determine what kind of psychological processes are responsible for producing the behaviour. Is the behaviour habitual? If so, what cues it? What are the key motives that might drive performance of the target (rather than current) behaviour? What plans do people make to carry out the behaviour and does this help actual performance? Further, for target behaviours that are regularly practiced, consideration should be given as to whether the behaviour can be *made* habitual through the kinds of mechanisms available to the program. If there are serious barriers that can be removed by modifying the environment (e.g., by providing technological support), then the Assess Team should think about psychological drivers to motivate the target audience to undertake the desired changes to their own environments.

Researchers at University College London have systematically reviewed the literature to develop a list of over one-hundred 'behaviour change techniques' that can be used for inspiration. [67] Examples include

- Provide rewards contingent on effort or progress
- Prompt review of personal goals
- Facilitate use of social support
- Prompt commitment from the client there and then
- Demonstrate the behaviour
- Prompt use of imagery

Techniques more likely to influence the target behaviour in its setting should be considered seriously.

BCD *EXAMPLE:*
SuperAmma Psychology of Change Hypothesis

Handwashing with soap (HWWS) is motivated by feelings of disgust, but also by a need to care for children who are unlikely to wash hands for themselves. It is probably also important that HWWS becomes part of an individual's sense of identity to make sure it is sustainably practiced. Including HWWS as part of everyday manners – that is, behaviours engaged in to ensure that one doesn't pass any infections on to others (e.g., by shaking with dirty hands) – could also be motivating, and be felt as a sense of social obligation.

Environment (Touchpoints)

Behaviour always takes place in some environmental context. There are aspects of the environment which are important to performance of the target behaviour in its setting, and those which are not. For example, having a coffee in a coffee shop depends on coffee cups as props, the water supply as infrastructure, the coffee shop employees and customers playing their complementary roles, etc. On the other hand, the achievement of the behaviour setting's goals is not directly dependent on how much oxygen is in the room, whether there are a few microbes on the tables, nor the colour of the paint on the walls. These relatively extraneous aspects of the environment are considered as belonging here, rather than as part of the behaviour setting per se.

The environment is also the place where program activities are implemented. For example, posters may be placed in public places, or messages broadcast from loudspeakers on the tops of roving cars. These are considered the intervention's *touchpoints*, the places and times through which program activities come into contact with the target population. What are the ways in which they might experience the program? Do they currently have or watch TV, or radio, and if so, what programs do they watch/listen to/enjoy? Do they wait at bus-stops, use rickshaws, attend village gatherings such as weddings, funerals and political meetings, wait in line for water or attend parent-teacher meetings? In the Assess step data is gathered about the touchpoints where target populations can be contacted and affected; a more detailed consideration of what contact behaviour settings look like, and their relevant, can only be determined once a more complete picture of what the campaign will look like has been developed (i.e., after the Create step).

In parallel it is of course important to explore what can be thought of as 'macro-environmental' or contextual factors. What other programs and activities are occurring (or have occurred) in the target area which might compete or be complementary to the planned program, and thus assist, or interfere, with the Theory of Change mechanisms? Could a handwashing program be piggy-backed on an existing vaccination program, for example [68]? Could the marketing of one product be coupled with that of another to achieve economies of scale for the company? These contextual factors – including the general political, economic and social climate within which the program has to work – can influence program outcomes, and so should be taken into account during formulation of the Theory of Change as well.

Setting-based factors

Here, the interest is to isolate the contexts within which the target behaviours occur currently, and potential intervention settings. In Part 1, we learned that settings have the following components: stages, roles routines, scripts, norms infrastructure and focal objects (props). These issues are typically not well understood by existing literature (which is seldom specific about the physical and social contexts of actual behaviour as it is practiced), hence at the Assess step not much may be known about them. Nevertheless, insiders with knowledge of the target behaviours may be able to come up with some hypotheses as to the setting-related factors that may be determining behaviour, and how they might be changed.

Intervention

Once something of the behaviour settings, target individual profile and other circumstances are known, then candidate interventions can be outlined that will set off the causal chain which will result in the maximum program impact.

With a set of touchpoints decided, and the set of behaviour change techniques available in hand, ideas about an incipient Theory of Change can be developed, linking touchpoints to psychological changes to behaviour change. More specifically, potential behaviour change techniques should first be matched to the useful qualities of the touchpoints. For example, household visits are a likely site for in-depth social interaction, being private and narrowly focused, although not likely to involve multiple visits and hence not long-term. It may actually be the site where the target behaviour is performed as well. This situation suggests use of one-on-one based techniques such as:

- Facilitate barrier identification and problem-solving
- Advise on environmental restructuring
- Change routine
- Prompt commitment from the client there and then
- Elicit and answer questions

On the other hand, bus stops are public places where the type of people visiting cannot be controlled or managed, visits may be repeated, but each one is short in duration and attention may be focused elsewhere. So techniques such as

- Provide instruction on how to perform the behaviour
- Emphasize choice
- Prompt self-recording
- Suggest behaviour substitution

are more likely to be effective in that situation.

Second, the question should be asked: whether the mental change hypothesized to result from use of the chosen technique is likely to have an effect on the target behaviour in its setting. In the case of the household visit, is pledging to perform the behaviour (a form of commitment) likely to influence actual performance if the target behaviour typically takes place in the house? Could its effectiveness be supplemented by demonstration of the target behaviour during the visit? In the case of the bus stop, would information about how to engage in performance of the target behaviour be effective if the target behaviour doesn't actually require much skill? Is the behaviour to substitute for current practice obvious to everyone without much variation in opinion (so you can be sure of the consequence of the technique)?

Using this process, the Assess Team can produce ideas about what form they think the intervention itself should take. Interventions are the ideas, materials and activities through which environments are modified (in the form of an implementation). What should the program promoter doing a household visit say and do? What should the poster at the bus stop say? These can be agreed as hypotheses to be tested in the field via formative research or even through simple small-scale prototyping prior to the Build step, if possible, to eliminate any ideas that obviously aren't going to work. Prototyping can be as simple as getting informants to tell stories about how the desired process could take place (e.g., how they would go about acquiring the new product in question), or getting them to role-play a new role (e.g., a 'supermum'), or drawing a picture of an ideal family and then describing how it is different from existing models. The result of these efforts of imagination and practice can be a first draft of the program Theory of Change, as links have at this point been suggested from intervention to implementation, leading to brain-based change, and thence to behaviour change.

BCD *EXAMPLE:*
SuperAmma Touchpoints Analysis

The decision of the Core Team (even prior to the Framing process), given budgetary constraints and field logistics, was to deliver the campaign to individual villages, via a travelling pair of implementers conducting a series of activities over a relatively few days (so as to allow for the program to be scaled up). This suggested a program based on community-level activities (with street theatre elements) as well as innovative media

(such as animated cartoons). The approach was borrowed from the practice of Lifebouy rural soap marketing in India.

Participants in the framing process thus endeavor to agree as to answers to the Theory of Change questions (as far as possible). Ensuring proper consideration of all factors that might determine behaviour, and about which something should be known, can be facilitated by use of the BCD Checklist. This tool helps to organize knowledge from the literature and the experts into a set of findings about what is known – and unknown – about the hypothesized mechanisms of change. The unknowns constitute the factors that require further research during the Build step (discussed next; see Appendix 2 for a detailed presentation of the behaviour determination theory on which BCD is based, and from which the elements in the Checklist are derived). The filled-in Checklist is a useful summary record of the Assess step and provides the agenda for the next step, Build.

BCD *EXAMPLE:*
SuperAmma BCD Checklist

SuperAmma Program					
Factor	**Sub-factor**	**Now**	**Desired**	**Change strategy**	**Unknowns**
State-of-the-World	Goal	High diarrhea among under 5s in India	Reduced diarrhea rates		Unlikely to be measurabe
	Objective				
Behaviour	Target	No soap use when handwashing	Regular soap use when handwashing		Best means of measuring HWWS?
	Who	No one	Adults and children		
	When	Never	After defecation, handling child feces and before eating		
	Where	No designated place	Close to household		
Environment	Physical				
	Biological	Contaminated environment		None	
	Social	Role models don't use soap	Role models use soap	Get prominent people to endorse soap use	
Brains	Executive	Everyone knows soap use is healthy already	Identity: SuperMum	Change identity, not knowledge	
	Motivated	Smelly/greasy hands can prompt disgust Mothers want status for their children	Even 'clean' hands can be 'dirty' Ideal mothers HWWS	Disgust, nurture, affiliation to be emphasized	Which of these motives is most important lever of change for HWWS?
	Reactive	No HWWS	HWWS practiced	Bathroom	How long does

		habit	without thinking	stickers	it take to form a habit?
Body	Traits	Conscientious, Female			What other characteristics are important?
	Physiology				
	Senses	Smelly/sticky/ visibly dirty hands	More aware of dirty hands	Use glo-germ demo	How to use at scale?
Behaviour Setting	Stage	Bathroom area in front of compound			Is change needed? Possible?
	Roles	Good-enough mum?	HWWS is Mannerly behaviour	Mothers teach good manners to their children	What other good manners are commonly taught?
	Routine	Handwashing with water only	Includes soap use		
	Script	Proper handwashing	'Complete' handwashing event includes soap use	Lots of examples of HWWS on display	
	Norms	No one does it	Others do it and expect me to do it too	Highlight that 'everyone thinks it is important to do it'	
	Props	Soap present	Handwash place established	HW corner	How to overcome practical difficulties?
	Infrastructure	Water source hard to access	Bowls/jugs in HW corner	Designate a HW corner	Ditto
Intervention	Touchpoints	PTA meetings, rickshaws, community meetings, Panchayat messenger	Community events, school events, posters on trees	Generate community 'buzz' about importance of HWWS issue	What other kinds of events happen in villages?
Context	Programmatic	Rajiv Gandhi poverty reduction program, Gov Vaccination programs, etc	All deliver HWWS message?		
	Political	Hygiene competes with many other kinds of programs		Get Gov on board	How far can Gov be influenced?
	Economic	Soap is perceived as expensive (but is not)		Reduce perceived cost of soap	
	Social	Caste system influence on perceptions of 'dirty' behaviour?		Avoid any mention of caste	

Build

The Build stage is designed to 'fill in' any missing information in the developing Theory of Change. This typically involves primary data collection called 'formative research'. [69]

Formative Research

The purpose of formative research is to answer the questions that those in the framing process were unable to answer and to explore hypotheses about how to change the targeted behaviours.

Behaviour, as we have seen, is not just a function of rational decision-making, but is controlled by motives, which may be subconscious, and automatisms of which people are entirely unaware. It is also critically a function of behaviour settings: the roles, scripts, stages, props and social control that surround behaviour. Therefore, formative research 'the BCD way' uses data collection techniques that focus on getting at an understanding of situated behaviour. (A manual detailing how to implement the package of field methods developed to conduct BCD-style formative research is available on the web.)

There are an endless number of techniques that can be used to study behaviour and its determinants. One can participate in the lives of the target audience, film them, ask them to play a game on-line, use sensors to record what they do, tell them stories, ask them to create collages, to categorise or to co-create products. How then can we decide which methods to use in a formative research study?

We argue that better data collection methods are more 'realistic'. This can be defined quite precisely. First, the process of data collection can itself be seen as a situation, typically involving some form of social interaction. [23] This situation has some relationship with that in which the target behaviour takes place. Typically the situation is quite different. For example, an interview takes place in quite an artificial situation – that of a formalized social interaction in some location and time typically quite remote from performance of the target behaviour, such as a lab room. Also, the behaviour required of the informant is verbal behaviour, which requires executive control to produce (i.e., it is thoughtful and consciously considered). If the target behaviour, on the other hand, is produced automatically – for example, because it is habitual – then this is another way in which the behaviour occurring during data collection is 'far' from that actually under investigation. We consider data collected under circumstances closer to the conditions under which the behaviour is normally produced to be of higher quality. This is because it is more likely to be 'true' evidence of the processes that potentially need changing. (In an interview, a person can report that they regularly perform the behaviour and that it is habitual to them when in fact they don't engage in the behaviour at all. This is why self-report data is so often at odds with that resulting from observation.)

We therefore rank the kinds of data collection methods according to the type of behaviour they require of the person providing the data, and the relationship between the situation of the data collection event and that of the target setting. The best data collection methods are near, situationally and psychologically to the behaviour the program is trying to change.

'Near' techniques

Situated observation is the closest type of data collection, especially when it takes place with minimal interference by the observer. For example, *video ethnography* is a method that uses an individual close in their characteristics to that of the observed individual as the videoer (to minimize disruption). The idea is simply to follow someone from the target population around while they engage in 'normal' daily activities, filming them as they do so, especially those of interest to the program.

In *participant observation*, the observer goes through the motions of performing the target behaviour themselves, as well as trying to learn about how and when individuals from the target population perform the behaviour. This method has a double focus, on self and other. The observer in this case also engages in performance to see what it feels like in their own body, as a further source of information about what it takes to engage in the behaviour.

On-site Prototyping or *Co-creation* is a more dynamic, active form of within-situation data collection. It involves program and target population members working together in situations as close to reality as possible, generating and/or testing ideas. These ideas can be about new designs for objects that can be used to facilitate the behaviour, or infrastructional manipulations to support performance of the target behaviour, or purely behavioural insights and experimentation, such as improvised role-play, to explore new routes and routines to achieve behaviour setting goals.

Often experiments on each of these types of ideas can be conducted in parallel. In particular, use of a new object may require new types of action during role-play, or to be supported by infrastructural changes as well. For example, introducing a handwash stand to facilitate handwashing with soap requires that people accept new actions in the script for their handwashing routine: the use of soap. It also requires that water be provided on-site so that hands can be rinsed of soap, and that soap itself (the object in this example) be present where needed.

Co-creation with members of the target population can begin with a 'minimum viable prototype' (MVP) for each sort of modification to the setting. An MVP can consist of a very simple mock-up of a new object (e.g., some form of replacement for soap that achieves the same objective of removing pathogens from body surfaces), a random idea about a behavioural strategy to inject soap use into the handwashing routine (e.g., via story-telling about how to do handwashing 'properly'), or a low-cost, easy-to-install method for ensuring quick access to a water supply as an infrastructural support for the target behaviour. These MVPs can then be elaborated as necessary and appropriate from testing on-site.

'In-between' methods

The 'in-between' methods rely on data collected in situations that closely mimic the target behaviour setting (e.g., being in the same place and time), but performance is explicitly requested by the observer, so it may not be representative of what the individual normally does. The investigator may ask the participant to do something that is not in their regular repertoire, and for which they don't have the requisite skills, but which is -- or bears some interesting relationship to -- the target behaviour. For example, just to see how they might try to manage performance, given more or less conducive circumstances, we may ask people to wash their hands with soap but with or without a ready source of water. Such data therefore has some ecological validity, but is not as valid as more naturalistic observation.

What we call '*behaviour trials*' and '*behaviour demonstrations*' fall into this category. A behaviour trial differs from a behaviour demonstration in that the trial leaves the participant to engage in the target behaviour over some period while 'on their own' (with a follow-up to ask how they got on), while in a demonstration the requested behaviour is observed *in situ*, at the time of observation. We assume that because they are being watched, and because the behaviour may be unfamiliar, that such demonstrations are produced quite consciously.

'Far' methods

Most of the standard techniques used in social science research fall into this category, despite its low quality (given the BCD classification scheme). *Interviews* and *focus group discussions* are the techniques most often used, but often most remote from the circumstances of actual behaviour, since they are typically conducted in specialized, formal situations, and demand consciously produced behaviour (typically verbal responses to questions posed by the observer). Because they are so familiar, it isn't necessary to discuss them further here.

So-called 'projective techniques', developed primarily in commercial marketing, attempt to reduce one aspect of ecological invalidity: production by the wrong type of psychological control (i.e., executive control, rather than motivational). They do this by trying to directly tap into motivated behaviour production for behaviours that are normally produced in this fashion.

The BCD formative research toolkit contains many techniques that fall into this category. '*Motive mapping*', for example, presents informants with a story-board of the target behaviour (i.e., a set of drawings that depict the desired sequence of actions, properly situated for the informant's cultural group), followed by a story 'ending' that depicts some form of reward being given (e.g., the depicted individual's spouse saying 'I love you for doing that!'). The informant is then asked to indicate whether this kind of feedback or ending is realistic, likely, motivating, etc. Obviously this method, despite the situational distance from its normal context, attempts to reduce psychological 'distance' by simulating the behavioural context using a pictorial narrative, and to minimize reflection by focusing directly on the reward from performance.

Attribute ranking puts a number of pictures or objects in front of the respondent and asks them to rank these stimuli from low to high on some dimension. For example, food items can be ranked according to how healthy or affordable they are; pictured body types can be ranked on how ideal they are.

'Other' methods

There is a type of data collection that doesn't readily fit this typology, as it is doesn't require individuals to produce behaviour at the time of data collection. Rather, it depends on the 'observer' collecting information from indicators left in the environment produced as a *consequence* of performance. Here, the investigator is left picking up 'traces' of what behaviour has left behind. An example is trying to determine what someone has eaten by gathering food wrappers from their household garbage. This is obviously quite indirect and so again does not provide data of optimum quality from the BCD perspective.

BCD therefore suggests use of a variety of data collection methods, and provides a decision-making criterion for selecting among them, prioritising methods that capture real behaviour in its proper setting. In the absence of these 'gold standards', the 'second-best' methods of behaviour trials, role-playing (preferably in the appropriate behaviour setting) or simulation of some kind (i.e., imagined behaviour on computers, projective techniques) should be preferred. Third-best are verbal reports (e.g., interviews, focus group discussions).

Hypothesis-testing

A good BCD investigator also brings theory to a field investigation. In every structured interaction during formative research the investigator should be looking at the problem through the eyes of the BCD categories set out in the checklist: what 'setting' is this I am seeing, and what are its components, its purposes and its history? How does the target behaviour serve this setting and how could it make a setting more productive? What primary motives are at play and could new ones be added? How could the target behaviour be made more rewarding? And could the target behaviour become habitual?

In common with consumer researchers, formative research can be conducted with an eye for major insights, or information that sheds new and surprising light on why people do what they do. For example, during participatory exercises in Zambia, we realised that the preparation of oral rehydration salts was seen as a cooking task, so ingredients were never measured properly (i.e., inappropriate rules were applied from a cooking setting), and mothers stockpiled the free packets so as not to waste them (the Hoard motive). In Indonesia, video ethnography showed mothers chasing children down the road trying to feed them family meals. Closer investigation revealed that children were not hungry because they had been fed snacks just before meal-time to keep them quiet; otherwise mothers might be accused by neighbours of poor parenting (motives: Hunger/Affiliation).

A formative research investigation can be as long or as short as time and resources allow. For a small project it might consist of one investigator spending just a couple of days in the company of representatives of the target audience (e.g., doing visits to relevant sites, such as households, factories, markets – wherever the behaviour is likely to be actually practiced – to observe and/or record behaviour as well as collect other relevant data). If one is preparing a major project, however, weeks of more thorough investigation by a larger team might be warranted. In any case, the field team seeks to ensure sufficient knowledge is gained about the gaps in the BCD Checklist. A rough guide might be to spend 5-10% of the total budget on the Build step.

BCD ***EXAMPLE:***
SuperAmma Formative Research

Staff spent three weeks in rural Indian villages collecting data on existing and potential behavioural practices and related psychological and environmental factors, using the following methods:

- Video ethnographies of women with children under five, ensuring that all daily activities were filmed
- Household inventories of water, sanitation and hygiene facilities including all types of soap and its uses
- Behaviour trials, in which informant household members were urged to wash their hand with soap at relevant times-of-day, and then visited several days later to see how well they fared
- Key informant semi-structured interviews to conduct the Motives mapping, attribute ranking and other projective exercises

Design Process

The next part of the Build step is to convert the findings of formative research into a Theory of Change for the program. We have broken down this process into nine steps (listed in the following Tool Box), which take the process from a large number of Findings derived from the field to production of a Creative brief that reflects a single program Focus. These steps are best achieved using a team with a variety of expertise and degrees of acquaintance with the program problem and population. Getting the relevant people to work together in a workshop is often an optimal solution to identify the best program Focus. [70]

***BCD** TOOL*:
Program Design Process Steps

1. Download significant **Findings** using an organising *framework*
2. Cluster Findings into **Themes** (i.e., rich areas for exploration) using *expert consensus*
3. Brainstorm **Ideas** that address target behaviour via Theme using *analogies*
4. Build **Platforms** from (promising) Ideas, incorporating related Findings, Themes, and additional knowledge using *clustering*
5. Perform **Appraisal** by ranking Platforms using *Platform assessment criteria*
6. Agree program **Focus** using stakeholder *decision-making*
7. Develop program **Components** using *expert consensus*
8. Agree Program **Theory of Change** using stakeholder *decision-making*
9. Write **Briefs** (defining task based on Focus and [set of] Touchpoints) for Creative/Delivery/Evaluation Agencies using *forms*

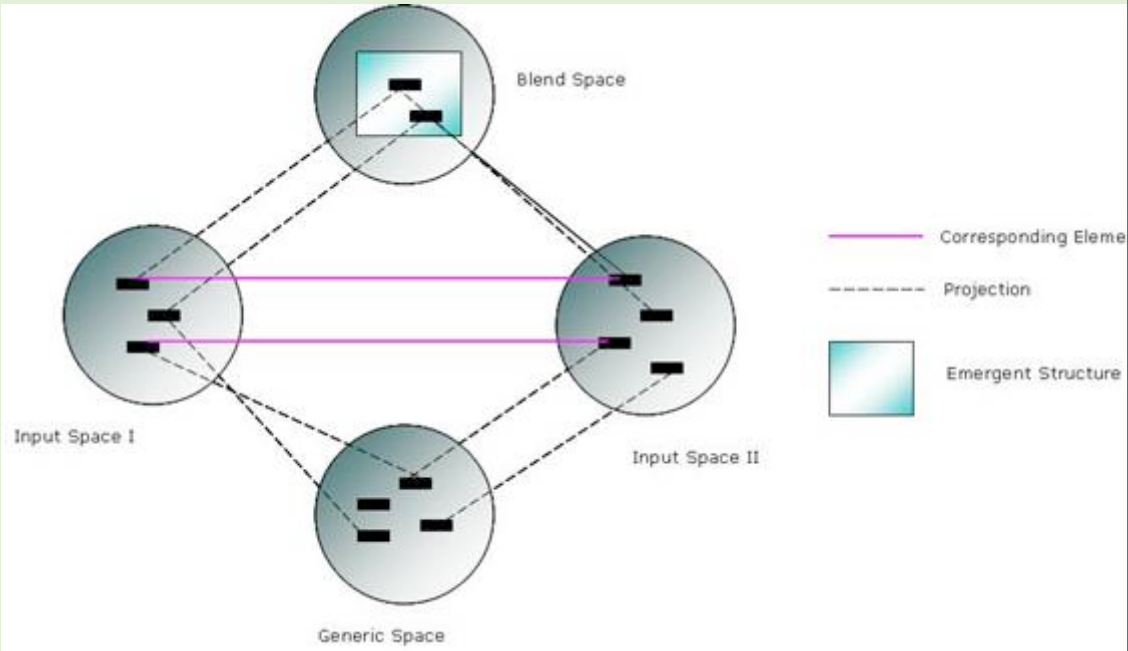
Once the formative research data have been analysed, program managers are in position to identify the causal links that they believe are most likely to have a significant influence on making the target population perform the target behaviour. This part of the process remains more art than science, but development of a complete Theory of Change helps to isolate specific causal links which are currently missing in the target population's way of life, but which, if introduced, would have a large impact on the likelihood of the target behaviour being widely practiced.

Getting some Focus

The Program Design problem that arises at this point can be seen as one of shrinking the mass of information produced by the Build step into a single insight that forms the foundation of the program Focus. To achieve this, we follow a process that is as standardized as possible, given the mercurial nature of creativity. Many of the steps in this process can be described as examples of 'conceptual blending' (see Theory Box below), in which a concept cluster of a certain size is added to or subtracted from in order to form a related cluster of a different size. A number of tricks can be used to help groups go through these steps of conceptual blending, such as having a clear goal, enforcing equality among participants, complete concentration (to achieve a 'flow' state), close listening (without criticism), relying on familiarity rather than formality, and maximizing communication to achieve the most productive levels of cooperation. [70]

BCD *THEORY:* Conceptual Blending

The steps in which concepts are aggregated (i.e., Steps 2,3,4, and 6) can be viewed as examples of conceptual blending. Conceptual blending is a theory developed originally in linguistics, but subsequently applied in a variety of fields to describe processes of abstraction and creativity. [71-74]



(Diagram from [75])

Conceptual blending takes place through three steps (see Figure above):

- Recognize an analogy between concept Domain 1 and Domain 2. This produces a mapping of some of the elements of Domain 1 into Domain 2 and vice versa.
- Recognize the elements of Domain 1 and 2 that are held in common as a set which can form the foundation of a 'generic space'. This abstraction can serve as one of the grounds for further mental elaboration in later steps.
- Build Domain 3 (the blended model) in a separate mental space, from the analogical elements of Domains 1 and 2, but also adding in relevant background knowledge so that the new domain has emergent characteristics of its own (what conceptual blending practitioners call a '*conceptual integration network*' [76]).

A classic example is 'trashcan basketball'. [77] Imagine the Creative Team is sitting around trying to come up with Themes by writing down phrases on pieces of paper. Some of these ideas are immediately discounted, and the paper thrown into a trashcan. One of the team calls out 'Goal!' This exclamation is based on an insight -- an understanding that an object in one conceptual space (i.e., a wad of paper) corresponds to an object in another space (a large leather ball in the mental cluster that describes the game of basketball). The crumpled up piece of paper thus becomes a ball -- exploiting a mapping between two conceptual domains. This sparks a process that results in a whole system of correspondences between the two domains of 'throwing away waste' and 'basketball game'. These mental space connections can be based on identity, similarity, or analogy. The paper-wad-as-ball is based on similarity (both objects are round) and analogy (throwing into a trashcan is like throwing into a basket). Because it is based on only partial mappings from the source domains, plus independently added material, the blended space ('trashcan basketball') has a unique representational structure of its own – that is, it has emergent qualities which can be exploited (e.g., might be surprising). For example, the realisation that one can add meaning to throwing away a piece of paper by turning it into an act of skill development or even a competitive game is a novel idea that can be inspiring.

Conceptual blending forms the foundation of the creative process in BCD, as each of the most difficult steps – those of generating more complex concepts -- can be seen as building up connections into a more complex

concept using this mechanism. From this theoretical perspective, Themes, Ideas, Platforms and Foci are simply increasingly complex concept-clusters formed by taking the blended domain from one step and then building upon it by adding elements from other source domains as well as additional background knowledge into a larger blended domain. The links to even more abstract concepts might be made using mappings from the generic space to a new source domain to create the new blended domain. In this way, hierarchical relationships can be established, drawing in mental resources from increasingly disparate conceptual domains. The process finally results in the most robust conceptual cluster, called a Focus. The Creative Team then selects from among alternative Foci in the final step prior to writing the creative brief with the chosen Focus as its central 'message'.

Getting to a campaign Focus is achieved step-wise. The first step is to get all the salient Findings into the mix. This is facilitated by introducing an organizing Framework to stimulate knowledge that might otherwise get forgotten and to organize what is likely to be a large quantity of material. This can be achieved by summarizing important points from existing knowledge and formative research on Post-it notes, which are put on a wall for all to see.

The categories in the BCD Checklist should be used to organize these Findings. Findings can relate to anything from the Checklist: traits of the target population, their motivations, habits, socio-economic level, kinds of major investments they make, characteristics of their social networks, religious beliefs, etc. Here, we will use an example from a recent maternal nutrition program to illustrate the kinds of results that arise from each step of Program Design. In this program, one Finding was that 'Offspring are expected to send a significant proportion of earnings from their first job back to their parents'. These snippets of knowledge are then grouped according to some common element (Step 2). This common thread is given a name, and becomes a Theme. In our example, a number of findings were related to the Theme of 'Indonesian mothers are thrifty'. (For example we determined from a cluster of Findings that it is seen as virtuous to husband family resources, and to 'save for a rainy day'.)

Once all the Findings have been organized into Themes, the Themes are themselves augmented with additional bits of supporting knowledge and creative insight (often based on making some analogy between conceptual domains) into Ideas (Step 3). One of our nutritional Ideas (related to the Theme above) was 'Make eating while pregnant into an investment' (because a fetus is an investment in the family's future). A number of candidate Ideas should result from this process of repeated aggregation. (Other Ideas included that the moment when new wives learn how to cook for their husbands was a 'teachable moment' and the insight that Indonesians are 'Not big on big' – they are worried that at term their fetus might be too big to be delivered naturally and inexpensively.)

These Ideas must then be built up into potential Platforms, or central concepts, that can support the program as a whole (Step 4). Our nutritional Platform that built on the investment Idea was that 'Babies are the investment with the highest return available to target households'. This is getting closer to an organised cluster of knowledge and insight which could motivate behaviour change. Several Platforms should be developed through this developmental process.

At this point it is necessary to identify a single conceptual framework with which to move forward into the Create step. To determine which Platform has the 'longest legs', each is subjected to an appraisal using several (rather subjective) Platform Assessment Criteria (Step 5):

- **Richness**: the number of associations which can be linked to the basic premise

- **Cogency**: the tightness of the logic to causes that will change the target behaviour
- **Plasticity**: the way in which it attacks an aspect of the target behaviour susceptible to
- Change **Novelty**: the level of surprise it should inspire
- **Defensibility**: the degree to which other agents/campaigns are incapable of making the same claims
- **Acceptability** to the target population

Using these criteria, the investment-based Platform was determined to be the best in our nutritional program.

However, Platforms are often still abstract, and not directly related to the target behaviours. They therefore require additional Focus, which again typically requires a bit of creative insight (Step 6). To continue with our example, the Focus arrived at was 'Consuming the target foods is the best investment in the household's best investment: a (financially/socially) successful offspring'.

The chosen Focus should then form the basis for the brief that goes to the Creative Agency/Team as the organizing principle for the development of the intervention itself.

Obviously, a major consideration is whether the chosen Focus will pass the 'Theory of Change test' -- that is, it should be surprising, cause revaluation of the target behaviour (e.g., by adding value in the form of new associated motives), and help cause performance as well. If it does not do so satisfactorily, it has to be modified through further creative effort so that it will. How this can be achieved is discussed further below, but the initial choice of Focus should nevertheless be checked for plausibility with respect to a Theory of Change at this point. For example, it can be field-tested with a small sample to determine whether it has real potential. If not, then modifications should be made.

BCD *EXAMPLE:*
SuperAmma Focus

Handwashing with soap can become habitual if inculcated early in life, and thus produce sustained behaviour change. The task of producing this kind of inculcation lies with the primary child carer: the mother. In rural India, the identity for women with greatest social importance lies is in being good mothers (i.e., in being good at Nurture). Hence:

Very good mothers – SuperMothers – are those who instill hygienic habits, particularly handwashing with soap, in their offspring – e.g., via calling them 'good manners' [a reference to the Disgust motive].

This Focus thus encompasses several added motives (including Status, or social aspiration, and Disgust) to the basic identity of a mother (associated with the 'primary domain' motive Nurture) in this population, and links performance of this identity specifically to the target behaviour of handwashing with soap. The SuperAmma concept emphasizes hints at mothers as superheroes, who have the job of not just being care-takers but teachers of the next generation. In this way, it also provides a specific mechanism for ensuring that the practice can spread, as parenting strategies can be mimicked, and will be automatically replicated in the next generation.

Component Development

However, the Design Process is not yet complete. The basic kinds of program components need to be determined (Step 7). Overall program design can be said to depend upon a single criterion: finding the mix of components that are likely to have the maximum effect in terms of behaviour change, and which will produce the maximum impact (i.e., biggest change in program objective), for a given budget. In short, this means finding the components that, per dollar, most strongly flow through the Theory of Change mechanisms, disrupting the Contact Setting (where people come into contact with the components) in ways that work through to the Target Behaviour Setting (where behaviour change must happen). The question is how to know what combinations of components are most synergistic. Unfortunately, little is known about this, so much remains guesswork.

And why do we think that using multiple components, each with a different causal pathway, is better than relying on a single one, given whatever power each might have? Most programs seem loath to depend exclusively on, for example, just using mass media. This may be due to fears that 'putting all one's eggs in a single basket' is risky, given the considerable unknowns that usually prevail in terms of whether the postulated Theory of Change is correct. In most cases it seems sensible to spread the risk across several causal pathways.

So while the Focus can be thought of as the central 'message' to be communicated, programs are typically not just about delivering a single message in a single way, but rather rely upon multiple channels of delivery. At this stage, the basic kinds of intervention components to be undertaken should be determined.

The components of an intervention can be classified by the particular combination of touchpoint, activity, channel and behaviour change technique they utilize (see table below).

Facets of Intervention Components

Facet	Feature	Theory of Change Link	Examples
Touchpoint	Time/place	Environment	Household living room in the evening, Saturday food market, Sunday morning religious service
Activity	Situation or context	Behaviour Setting	Demonstration/simulation of target behaviour, Persuasive face-to-face interaction, Interactive game, Educational lecture, Community event
Channel	Information transmission modality	Body	Aural, Visual, Tactile
Behaviour Change Technique (BCT)	Psychological mechanism	Brain	Verbal persuasion about capability, Emotional social support, Adding object to environment, Social comparison

Touchpoints are essentially the place and time at which the intervention will be delivered. For example, people can be reached in their living rooms at night, while shopping at the food market, or while waiting for a train at the station.

Second, activities are situations within which to convey the information, making particular reference to the most relevant aspects of the behaviour setting. Thus, community events can be created specific to the campaign – situations in which a location is taken over, specialized equipment may be set up (e.g., for a music concert or film display) and unusual behaviours performed (e.g., dancing, singing). On the other hand, the activity-situation may be a regular, everyday context such as a waiting for the bus to work every weekday morning at the bus stop in which nothing out of the ordinary occurs except the appearance of a new poster on a nearby wall.

BCD is particularly associated with a particular kind of activity: 'Emo-Demos' (short for emotional demonstrations). These are activities, often participatory, which are inexpensive to produce, take only a short time, can involve numerous participants, and align with program objectives. Their core function is to cause an emotional 'aha' moment -- that is, they seek to produce a memorable experience likely to be recalled later in a way that will spark performance of the target behaviour. For example, to promote exclusive breastfeeding, young mothers are shown what the tummy of their baby would look like if they were not exclusively breastfed. First, milk alone is put into a transparent plastic bag and mothers are invited to drink this, which they readily do. However, they are then asked what else they feed their babies, and these foods are then added to the bag (e.g., crisps, snacks), creating a disgusting-looking mess. When asked if they will drink this, they refuse, and are told that nevertheless, this is what they are asking their babies to eat. This produces a revelation that leads to new feeding practices.

Third, the channel is the means by which information will be passed to the intended audience. For example, people can be reached in their living rooms via TV broadcast, at the market by a product display and demonstration, or in a train station via a billboard or poster. Determining the most profitable mix of components can be aided by information about who in the target population makes use of the various media-based channels of communication (e.g., TV, radio, newspaper, mobile phone messaging, etc). Data concerning the reach of various channels can often be purchased from media monitoring companies.

Finally, a behaviour change technique (BCT) specifies the psychological technique by which behaviour change is expected to be achieved. Potential behaviour change techniques should be matched to the combined qualities of the touchpoints, activities and channels already chosen. For example, household visits are a likely site for in-depth social interaction, being private and narrowly focused, although not likely to involve multiple visits and hence not long-term. It may actually be the site where the target behaviour is performed as well. This situation suggests use of one-on-one based techniques such as:

- Facilitate barrier identification and problem-solving
- Advise on environmental restructuring
- Change routine
- Prompt commitment from the client there and then
- Elicit and answer questions

On the other hand, bus stops are public places where the type of people visiting cannot be controlled or managed, visits may be repeated, but each one is short in duration and attention may be focused elsewhere. So techniques such as the following should be appropritate here:

- Provide instruction on how to perform the behaviour

- Emphasize choice
- Prompt self-recording
- Suggest behaviour substitution

Thus, one component of a campaign might be a 'mass media' broadcast. In this case, the touchpoint is the household at night; the activity is the everyday before-bed routine/setting; the channel is a television broadcast; and the BCT is demonstrating approval by important social others. The market demonstration has a touchpoint of town marketplace on Saturday afternoon; the activity of the weekly food shop; the channel of narrative dramatization [skit]; and BCT of stimulating anticipation of future rewards. The billboard has touchpoint of a particular platform at the bus stop whenever the target individual happens to be waiting for the bus; the activity is waiting for the bus; the channel is printed matter; while the BCT conveys new, unexpected consequences of performing the undesirable behaviour. To these components, the campaign committee might add an emo-demo at a community event and a group pledge (touchpoint of community event; activity of face-to-face-interaction; channel of interpersonal verbal dialogue; BCT of agreeing a behavioural contract).

Decisions about each of the facets of a component are inter-dependent – that is, they should match one another in terms of their ability to make the component, as delivered, maximally effective with respect to changing behaviour. Some activities can't incorporate certain kinds of channel: for example, large community events can't depend on one-to-one contact with target population members. Similarly, static media like billboards must be used very creatively indeed to convey certain kinds of BCTs, such as self-talk (getting people to provide commentary on their own performance of the target behaviour), or rewarding completion of the target behaviour.

This viewpoint also links components directly to the Theory of Change: touchpoints are particular points (and times) in the target population's environment; the activity is the type of situation or behaviour setting in which the touchpoint becomes relevant to the target population, with particular emphasis on the role it requires the target population member to play (e.g., passive message recipient when reading a billboard versus active participant in a pledging ceremony at a community event); the channel is the means by which the content of the activity is communicated to the body (e.g., via spoken message or visual modeling of the target behaviour); and the BCT is the means by which a brain-based change is effected. This should all produce behaviour change as a consequence. Failures of a component to achieve each of these links can be assessed by the process evaluation, discussed later.

Thinking about components as combinations of these four facets (touchpoint, activity, channel and BCT) helps to make it clear how they will work, which assists with the final task the Design Process participants have to complete: to develop a draft Theory of Change (Step 8). It is the job of the Theory of Change to provide a complete picture of the causes of the target behaviours and links to the impact, and of formative research to ensure that all relevant aspects are known in sufficient, situated detail to inform intervention design, which is the next step (Create).

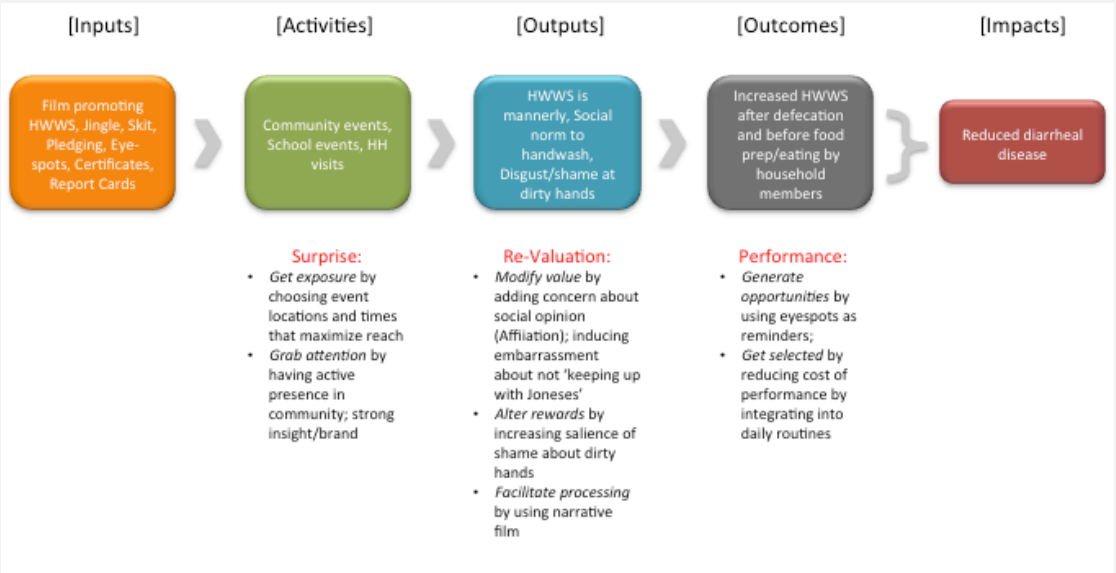
Draft Theory of Change and Campaign Analysis

Completing the Theory of Change requires thinking about how the Focus will work itself through the various stages of outputs, outcomes and impact to achieve program objectives. The Example Box below shows the logical links that were agreed upon at this stage of program development by the SuperAmma program managers. Note that the Theory of

Change is explicit about each sub-task: how components will be *exposed* to the target population, get their *attention*, cause them to *process* the stimulus in ways that *add value* to the target behaviour, increase *opportunities* for performance of the target behaviour, and get it actually *selected* when those opportunities arise. Many components can work in roughly the same way, via the same mechanisms of psychological and behavioural change. On the other hand, some components may have specific roles in the overall plan: for example, 'teaser posters' (which include only vague indicators of something about to happen) can work simply to attract attention to the campaign (i.e., achieve a degree of surprise), without causing further change (i.e., no revaluation or performance). Other components may rely on one specific mechanism to change one of the target behaviours (e.g., the SuperAmma skit was strictly about inducing disgust at having not washed hands before eating). It is the overall plan which must be 'balanced' in the sense of ensuring that all those exposed to some likely combination of components will be able to progress all the way to the end of the causal chain and change their behaviour appropriately.

BCD *EXAMPLE:*
SuperAmma Draft Theory of Change

This is the first draft of a Theory of Change diagram for the basic components of the program.



Development of such a complex framework should be helped by an ability to critique the overall design of the campaign. BCD provides a tool for this task as well (see the Tool Box below), with specific criteria for determining whether the current suite of components is most likely to be effective. Obviously, only components with strong causal links in the Theory of Change and which can be economically influenced by means available to the program should be considered. Further, only a limited number of components should be prioritized, as multiple elements tend to rapidly dissipate the power of an intervention. Also, complex interventions are harder to implement and evaluate. For all of these reasons, it is desirable for programs to focus on a very small number of behaviours, and to use a unified, or 'branded' (i.e., easily identifiable), intervention campaign to address them. It is one of the jobs of the

creative team to find a way to link the causal changes into a single 'carrier wave' idea that will become the central platform of the campaign.

The structure of the campaign thus should have a number of characteristics in order to be successful. These are listed in the Tool Box below, which can be used to score potential designs against one another. Obviously, some variables in the Campaign Design Analysis Tool will be difficult to analyse at this early stage of program development (e.g., sustainability, cost-effectiveness). However, even rough estimates of the quality of the campaign with respect to these features should enable better decision-making about the overall 'look and feel' of the proposed campaign. Again, branding should be considered as a factor, especially in 'noisy' environments, to ensure that the campaign has an identity that distinguishes it.

Note, however, that branding is not always a good thing: in some cases, the desired impact can be achieved through other means. For example, a campaign to reduce injuries on railway lines in India employed markings on the track that changed the perception of the speed of the oncoming train, and so stopped people thinking they could cross the tracks in time (http://finalmile.in/behaviourarchitecture/category/irrationality/safety) -- a purely environmental implementation to which people respond subconsciously, and which would work less well if people were made aware of the manipulation, much less have been 'branded'. In such cases, the branding-related criteria should be ignored.

Contextual factors are those which try to insulate the campaign from external influences that might reduce program effectiveness such as dependence on organisations outside the control of the program, or disruptive economic conditions.

Effectiveness is also dependent on being able to deliver the components with good fidelity – otherwise the message or intended influence can be diluted or perverted. Sustainability is an important criterion in many cases because it takes time – for habits to form or for secondary processes to take place (e.g., 'buzz' effects) -- before maximum impact can be felt.

***BCD** TOOL*:
Campaign Design Analysis Tool

Simplicity:
[All campaigns have limited resources, the effect of which is diluted the more complex the communications/activities become]
Measured by number of types of touchpoints, multiplied by number of components delivered per touchpoint, multiplied by number of target behaviours (higher values are worse)

Creativity:
Branding: Ensure stakeholders agree a central identity (or 'unique selling point' [USP]) for the campaign. (This is especially necessary for complex campaigns, or those which take place in a crowded messaging environment.) This allows all contacts with the target population to be 'branded' in a way that

- adds certainty about the source of the communication
- adds authority established by that source
- enables potential synergies between the content of those contacts

Deliverability:

- Corruptibility* (i.e., susceptibility to poor fidelity between planned intervention and implementation)
- Logistical complexity*
- Cost per exposure*

- Dependence on agents external to campaign

Evaluability:
Ensure component delivery and impact can be readily monitored and evaluated so that (program level) learning can take place; this can depend on:

- Ability to identify and monitor 'indicators' (measurable variables) that the Theory of Change mechanisms have worked
- Randomization of exposure to campaign components
- Inclusion of control condition/population
- *Coverage*: ensure number of recipients and numbers of contacts per recipient will be sufficient to reach desired impact
- Identifiable consequences of program activities (e.g., compared to other, similar campaigns) [related to branding]

Sustainability:
Use methods that ensure activities can continue without further injections of time/money/staff from the program (e.g., institutionalize the activities)

Cost Effectiveness:
Measure of (expected) impact versus campaign cost

Context:
Minimize dependence of impact on uncontrollable macro-environmental conditions or processes, including:

- Activities of competing campaigns
- General economic conditions
- Involvement of extra-campaign agents playing central roles (e.g., village head, health professionals)
- Development, sales or distribution of program-specific products/services/technologies

NOTES:
Scoring: Single point for each positive response; higher scores better
* = variable measured on dimension of low/high (with low getting point)

Creative brief

With the components of the program now chosen (based on the Campaign Design Analysis Tool), and organised into a draft Theory of Change, the final task of the Design Team is to write a brief for a creative agency – or those on the Core Team responsible for development of the intervention materials (Step 9). This brief is where all the critical information that those involved in designing the intervention must know. It is infused with behavioural information and insights because it has been arrived at through a rigorous process. It is the pivot that the project turns on moving from gathering and analysing information to using what's relevant to create a behaviour changing intervention. The brief should also contain essential information about the budget available for intervention and any constraints on the type of channel that can be used and time to project completion (see the Example Box below).

BCD *EXAMPLE:*
SuperAmma Creative Brief

- ① **STAKEHOLDERS**
- Project stakeholders are: St. John's Research Institute (logistics coordinator), Centre of Gravity (creative agency), Mudra Max (rural activation agency), the London School of Hygiene & Tropical Medicine (project lead).
- ② **BACKGROUND INFORMATION**
- **What are the facts about diarrhoea and behaviour change?**
- Diarrhoea is endemic among children under five in the target population.

- These women's lives are incredibly busy and their behaviour tends to be rigidly bound in by their energetic, temporal social and other requirements.
- The most important behaviour for reducing diarrhoea is handwashing with soap.
- **What do we know about the target behaviours now?**
- Almost no one practices them currently.
- ③ **GOAL**
- We want to reduce diarrhoea among under-fives in peri-urban and rural low-income households in our pilot areas. This means changing the following behaviours among their caregivers: handwashing with soap after defecation and any contact with food.
- ④ **OBJECTIVE**
- HWWS after defecation and during food preparation among target profile individuals should increase at least 50% from baseline and be sustained for a period of at least six months.
- ⑤ **FOCUS**
- Very good mothers are those who instill hygienic habits, particularly handwashing with soap, in their offspring.
- ⑥ **INTERVENTION DESIGN PRINCIPLES:**
- Must work for rural and peri-urban settings and be scalable for the rest of India.
- All implementation must work for low/no-literacy communities.
- Must be consistent with Theory of Change (i.e., include disgust, aspirational element)
- No mention of health or nutrition
- No knowledge transmission: film should communicate through common understandings, story arc, feelings, not lecturing
- Tone: naturalistic
- Must demonstrate target behaviour
- Must show benefit/consequence
- ⑦ **AGENCY DELIVERABLES & REQUIREMENTS:**
- The core agency outputs will be: a 10 minute animated film, script for disgust-based play, materials for pledging (e.g., certificate, eyespots), logistics plan for implementation in each village.
- ⑧ **BUDGET AND TIMELINE:**
- [not included here]

The Build Team may also write a report summarizing the findings of the formative research for publication or further use.

Create

The job of this step is to produce the materials that will go into the intervention. These materials have to be able to instigate the change mechanisms postulated in the Theory of Change. This means that programs should create the *maximum useful surprise*. Too little surprise will fail to overcome the attention hurdle. Too much surprise might not be believable or create a sense of panic or immobility. This will normally require that the creative *insight* (a surprising concept associated with the Focus in the brief) be converted into an *intervention* (creative materials), and then into the *implementation* (environmental modification, through activities) with *minimum loss of surprise*.

There must also be an explicit strategy for causing revaluation – hyping the evolved motive associated with the target behaviour, and/or adding/subtracting other motives. Ensuring the Target Setting will facilitate performance should also be considered. The process for getting to an actual intervention is described in the Tool Box below. It essentially expands out the program Focus (resulting from the Design Process) into the suite of materials that will go into the intervention.

BCD *TOOL:*
Create Process Description

1. Develop component **Content** using *imagination*
2. Vet creative **Reverts** using *Component and Campaign Analysis tools*
3. Pretest campaign **Components** using *behaviour trials*
4. Produce program **Materials** using *production processes*

Creative Process

The Create step is primarily about the development of creative materials that form the components of the intervention (including event plans). Developing component content is largely an imaginative exercise, and so should be done by experts where possible. There are many types of creative agency from international conglomerates with a huge range of experts on tap, to 'barefoot' creatives, who might be local theatre directors, artists or entrepreneurs. Big international agencies will have experience of delivering not just 'above the line' components (i.e., TV commercials, internet content, billboards etc), but also 'below the line' components (i.e., direct consumer contacts such as events in stores, football games in the community, etc.).

Briefing and managing a creative agency requires particular skills. For tips about how to conduct this relationship, see the Tool Box below.

BCD *TOOL:*
Tips for Hiring/Managing a Creative Agency

Selecting an agency:

- Make a shortlist
- Look at previous work, is it surprising, different?
- Meet the team, are they good listeners?
- Ask for a presentation, ask to see commercial and non-commercial work
- How strong are the team (sometimes you'll meet their star creative at this stage, but they'll never work on your campaign)
- If you ask for the team that works on commercial projects not charity projects you may get a tougher, more professional job
- Discuss behaviour change with them, give them this monograph and ask for their thoughts
- Decide if they seem ready to flex and adapt to what you want
- Figure out procurement: it can be hard to use public money to hire a creative agency; there may be a long tendering process which you have to build into your timeline.
- Recognize that creativity costs money; few agencies will be prepared to work *pro-bono* (though some may have access to sources of subsidy for charity projects)

Briefing:

- If you want something 'new' and 'edgy' then your briefing should mirror this
- Try briefing the agency on site
- Explain why what you are doing matters, and the sort of international exposure you might be able to get for them
- Show them examples of the sort of campaign you like
- If you make the process fun, exciting and encouraging of wild ideas you will motivate them
- At the same time, set out the constraints. Hence, for example, you may want an 'edgy' campaign (that will create surprise), but your client may be risk averse and want you to do something that is acceptable to everyone
- Its tempting to give a loose brief in the hope that the agency will come up with something magic that you haven't thought of. This rarely happens -- creativity is stimulated by tight constraints, so stick to the brief throughout

Reverts:

- Once they've been briefed, the agency will expect to go away and come up with some ideas
- When they come back you may hate what they've done, but try to stay positive, tell them what you like and why; when you really do like what they've done, convey your excitement
- Prepare for multiple reverts in your timeline, you may be talking to your agency for months before they get it right
- Use the tool box below to evaluate candidate ideas
- At the end of each revert, minute what you've agreed. Try very hard not to go back on those agreements, otherwise the agency can't progress

Long term:

- When you've built a good relationship with a creative agency try and use them again

Having given the Creative Agency/Team their brief and some time, they will be expected to come back to the Core Team with their first set of ideas. The first reverts to the Core Team in these Creative Meetings will be in the form of potential concepts for the central Focus of the campaign. Rarely will the first ideas brought back by the creative agency be powerful, on-brief, and acceptable to the client. Typically, several iterations of critique and revision will be required (Step 2). The idea is to use the criteria in the BCD Component Analysis Tool (see

Tool Box below) to make this process more explicit and productive for each potential campaign component.

This tool includes novel elements specific to BCD. These elements are related to the 'Setting Transfer Problem' (discussed earlier), or the fact that the setting in which contact with the program intervention takes place is rarely the same setting in which the target behaviour will take place. The point is that it can be difficult both for individuals to hold intentions or memories from one setting (that in which they become familiar with the campaign message) to another (that in which they need to perform the target behaviour), much less interpret a communication that places the imagination in yet another setting (that depicted in some advertising narrative, for example). To illustrate these differences, consider that a campaign using TV ads can have a Contact setting of a target individual's living room at night (while they are watching TV). The TV ad comes on and depicts an elegant woman eating in a fancy restaurant (the Communication Setting). Meanwhile, the Target Setting (where the target behaviour occurs) is yet a third behaviour setting: shopping at the grocery store for some new foodstuff. We assume that campaign components which require target individuals to both interpret an imaginary setting (the one in the communication) and to hold an intention to change their behaviour for a long time before being able to engage in that behaviour (i.e., while waiting to go to the grocery store) will be weak relative to one that has roughly the same Theory of Change mechanisms, but doesn't require so much imagination or holding an intention for such a long period. Further, components which require target individuals to imagine themselves playing new roles, or to purchase expensive items to modify their own Target Settings or to alter their everyday routines will be less effective at changing behaviour than ones which don't require such extravagancies.

The brand-based criteria in the Component Analysis Tool are familiar from marketing. Brands are important to distinguish campaigns or programs from similar ones in the marketplace; brands give program activities a coherent 'personality', and add trust and associated values that make them cumulatively more powerful.

The behaviour change principles reflect 'best practice' in behavioural science terms. They are all criteria for increasing the likelihood that reinforcement learning takes place, via surprise, revaluation and performance.

Finally, the communication-based criteria largely reflect particular principles that arise from evolved aspects of human communication. For example, the ability to interpret narratives or stories via 'theory of mind' [78] enables more complex messages to be easily digested. Ensuring that exposure to target materials takes place in a social arena is a particular means of adding force to just about any behaviour. Making it explicitly clear that existing practices have some previously unnoticed negative consequence is a also a powerful way of making the target behaviour more likely to be selected.

***BCD** TOOL*:
Component Analysis Tool

Setting-based
[The following aspects of settings to be scored with respect to two comparisons: Touchpoint vs Target settings; Communication vs Target settings; a point is scored for small (cognitive) difference between the element in the two settings]

- Behaviour's *stage*
- *Time delay* between exposure and performance of target behaviour in the two settings
- Primary *actor*
- Primary actor's *role*
- Primary actor's primary *motive*
- Primary target's *routine*
- New *infrastructural support* for target behaviour (suggested or provided)
- New *synomorphic support* for target behaviour (suggested or provided)

Brand-based

- Specific *brand elements* included
- Consistent with *brand aesthetics/feel/tone*
- *Uniqueness* and *defensibility* of proposition/'insight' (a previously unknown, unrecognized or under-appreciated link between the target behaviour and some value)

Behaviour change principle-based

- Shows target behaviour
- Shows link between behaviour and (new) rewards
- High expected present value of promised reward (temporal discounting/uncertainty/'Believability of benefit')
- Causes *Surprise*: engages + attracts attention
- Causes *Revaluation*: alters valuation of target behaviour
- Hypes the primary domain motive
- Adds a new motive
- Causes *Performance*: encourages target setting execution with 'correct' behaviour

Communication-based

- *Sensory**: richness of channel
- *Narrativity*: Activates the imaginary 'mental theatre' that causes people to virtually experience rewards/punishments
- *Visibility*: Makes 'invisible' forces or causal connections visible (e.g., action of microscopic agents)
- *Sharing*: exposure causes people to go through experiences communally so they experience social reinforcement
- *Problematizes existing behaviour*: discovers and makes evident a cost or negative consequence of existing practice (e.g., not practiced in some desirable group)

NOTES:
Scoring: Single point for each positive response; higher scores better
* = variable measured on dimension of low/high (with low getting point)

Field Testing

Once some initial agreement about a direction forward has been achieved, some of the central components can be tested experimentally in the field by the Creative Team (Step 3). Concepts should be pre-tested prior to roll-out where possible, with additional reverts to account for any learnings in terms of interpretability, acceptability, how engaging and surprising the idea is, likeability, etc. Once everyone is satisfied with the concept and material prototypes, then the next step of development – production of intervention materials – can be performed (Step 4).

BCD *EXAMPLE:*
SuperAmma Concept Testing

The Creative Team rapidly identified the figure of 'SuperAmma' (or SuperMum) as the personification of the campaign ideal. As this personification was the central 'brand' component, it was thoroughly tested in the field. Initial beliefs about the most acceptable aesthetic for the SuperAmma character (shown in the top right corner

below) proved not to be best liked. The bottom right was seen as too childish/cartoonish, while the top left was not sufficiently aspirational. The bottom left struck the most appropriate balance between being realistic yet aspirational.

BCD *EXAMPLE:* **SuperAmma Film**

The essential insight, that handwashing is good manners and a characteristic of an aspirational way of life, was clearly evident in the animated film that was especially commissioned from an Indian media company, Centre of Gravity. In the film, SuperAmma's son learns to become well-mannered in many ways (including staying neat for school, and respecting elders), and as a result goes to the city to be educated, winding up as a doctor. (This film is available at http://www.superamma.org/download-English.html.) These are powerful rewards for a diligent mother, and the grown-up son respects his mother for what she did for him when he was young as well. The narrative was achieved through multiple iterations to achieve maximum potential impact on behaviour, ensuring the strongest kinds of rewards for instilling handwashing behaviour (teaching handwashing is an important part of the role of being a good mother, but is rewarded by improvements in the offspring's life-chances, and appreciative, loving relationship with the mother), and providing the best possible role model for mothers in the target audience.

BCD *EXAMPLE:*
SuperAmma Intervention Materials

Elements of the campaign were identified and agreed:

- Use of the SuperAmma character to personify the campaign
- An animated film to embody the central insights
- A jingle with campaign messages embedded in it
- A skit for schools
- A pledge for willing participants
- A report card for school kids to log their handwashing behaviour
- The 'Wall of All': a large board in the middle of the village with names of all who have pledged
- Posters with faces of village authorities supporting the campaign

Development of the materials and hiring of the Delivery agency was coordinated by the Creative agency in the SuperAmma case.

The final job of the Create Team is to write a report for the Deliver Team, in the form of an Implementation Manual that outlines the procedures for all intervention activities, including a time-line and logistics.

Deliver

Delivery is about implementation of the intervention. Implementation is the result of program-related activities in a particular context. The Delivery Team can involve an agency specialized in conducting community events in particular kinds of circumstances (e.g., rural areas of a developing country), or a media company that arranges and supervises broadcasting schedules, for example, to facilitate delivery.

When considering alternative approaches for using channels and touchpoints, financial considerations are often paramount, and time-lines can be critical as well. Small-scale piloting of delivery pipe-lines and processes are a good idea to ensure that delivery goes to plan, and stays within budget.

Delivery strategies

Beyond providing for direct contact with the target audiences, programs can take advantage of a number of techniques for ensuring larger impacts:

- Add more role-players:
    - Aim to influence the target population both directly and indirectly, via secondary targets such as friends/neighbours or the health system
    - Create advocates that independently begin to assist in the achievement of program objectives (e.g., by creating 'buzz' around the program ideas that snowball through a population without further activity by the program itself)
    - Create formal partnerships with other organisations which add their authority and own activities to the program
    - Support community action to demand change
- Use institutions:
    - Create new groups to which target population members can belong (e.g., fan club or interest group; this can support behaviour by making it a group norm or a badge of status within the group)
    - Set up new training courses, change curricula, train trainers, develop institutional rules and norms, create enduring role models, set up monitoring and feedback systems, enforce rules and laws
    - Piggyback on existing social structures to efficiently implement program activities
    - Create new institutions (e.g., via policy or production of new organization, such as a small business) that implement part of the overall plan.

One thing that these strategies can produce is increased 'layering' of program activities by involving groups at various levels of organization, in a nested fashion that creates strata of authority and regulation over program activities, which increases the likelihood of high fidelity delivery. Supervision at multiple levels can reduce the likelihood of agents at any particular level deviating (for whatever reason) from program objectives.

BCD *EXAMPLE:*
SuperAmma Delivery

The SuperAmma campaign was delivered one village at a time by a pair of promoters moving around in a van that carried the materials. Two days were spent in each village.

The rural activation agency, MudraMax, delivered a campaign composed of a variety of events and interactions. For example, the largest such event involved inviting the entire community at an evening gathering during which the SuperAmma film and films of local leaders endorsing handwashing were shown, skits were played, and community members pledged to wash their hands with soap.

Monitoring

Monitoring is as essential to the management of behaviour change programs as it is to any intervention program. Indeed, it is perhaps more so, as experience shows that surprising innovative approaches are often resisted or perverted by actors who are more comfortable with the status quo, and may have prior allegiance to other approaches. Behaviour change program activities based, for example, on Emo-Demos about disgust, can easily be turned

into health education harangues by health agents, however well they have been trained. Program managers need a comprehensive monitoring plan to track the delivery, the reach, the fidelity and the audience response to the interventions along the Theory of Change. This requires reporting mechanisms, regular supervision, and can be aided by the design of incentives paid to program actors or institutions in return for producing real, audited results -- a strategy that is increasingly being used by program funding agencies.

In a perfect world managers act on this intelligence, revising and improving the program as necessary, either on the fly or at a specified interval, for example after a mid-term review. Sometimes feedback from sales, or product uptake for example, can be used in real time to tweak promotional messages. This will become much more possible in future as large-scale programs increasingly involve electronic devices, mobile phones, smart products, or web interactions. It is even possible in some cases to conduct small-scale experiments to see whether alternative methods of delivery might work better. However, such in-stream changes require sophisticated research designs, as well as resources which are beyond the scope of many programs at present.

It should also be recognized that there can be costs associated with flexible programming. In industry it is common to design an intervention, set out its 'non-negotiables', and then roll it out across multiple geographies. While some modifications can be made to parts of the program, the heart of it is 'locked down'. This is to ensure the maintenance of quality, clarity and motivation for program staff and to simplify management tasks. Endless revisions can sap energy and dilute the single-minded focus that an intervention has striven to achieve, as well as incur significant transaction costs in terms of management time, human capacity and program resources.

Methods used for program monitoring can, and should, be both quantitative and qualitative. They should follow the Theory of Change, ensuring that the intervention is delivered, that it has modified the environment of the target audiences, that this has produced some, or all, of the desired changes in the brains of the target audience, and that this is indeed leading to changes in behaviour. If problems are diagnosed upstream (e.g., program funds have not been released to the implementer) then there is little point in looking for impacts down-stream.

In large-scale behaviour change programs, specialist agencies can be hired to carry out the monitoring function -- for example, media monitoring specialists check that television and radio commercials have been aired as planned, that state auditors visit remote rural communities to check that local activities have taken place, and that slots can be bought in national product use surveys to examine product purchasing behaviour.

After implementation has been completed and all monitoring data has been collected, the Delivery Team should write a report or brief about the implementation problems experienced so that the Evaluation Team can have a better foundation for their process evaluation. (This can also be thought of as an implementation evaluation. [79])

BCD *EXAMPLE:*
SuperAmma Implementation Problems

- Delivery issues:
  - The generator, sound system or laptop on which the animated films were screened malfunctioned in

some cases
    - Printers were often not available locally to print posters with faces of local people
    - School closures due to holidays, weather or teachers' meetings inhibited performance of skits
    - The school report cards proved unsuitable for the youngest students, who were not able to follow the instructions
    - It was difficult in some cases to find or get permission to use a place for the 'Wall of All'
- Fidelity issues:
    - Promoters learned as they went from village to village, getting better at performing the skits and ensuring there were no technological problems

Evaluate

Finally, execution of the program should be analysed by the Evaluation Team in order to learn from the experience. Traditionally, practitioners divide this task in two: first, showing that an impact has occurred as a consequence of the program (the impact evaluation), and second, a demonstration that the hypothesized 'pathways' of causal influence in the Theory of Change were actually achieved by the program (a so-called 'process evaluation'). [80-83] The primary task of the Evaluation Team is thus to write reports concerning both the Impact and Process Evaluations.

Impact Evaluation

Obviously, program managers will be anxious to know whether the program objectives have been achieved. Often, this is the only question answered by an evaluation (e.g., in a randomised controlled trial). However, it is not always clear that the program can be held solely responsible for any observed change in the impact variables – one reason for conducting a process evaluation as well. In addition, the question of whether unintended consequences have also occurred should be addressed.

The question of how an intervention should be evaluated is a complex and contested one. [84-87] In a perfect world, a candidate behaviour change intervention would be tested in a randomized controlled trial (RCT) against a counterfactual (the standard model), or doing nothing, depending on the investment decision to be made. Behavioural and state-of-the-world variables should be measured, program costs should be modelled and the data should tell us whether the candidate intervention is likely to be good value for money when compared to other uses of similar investment. The RCT is the gold standard for program evaluation, and many scientists argue that other methods have so many methodological flaws that they are (sometimes worse than) useless. [88-90]

However, RCTs are complex, expensive and subject to a number of critiques. First, measuring a long-term outcome such as a change in mortality rates or community cohesion is likely to be prohibitively expensive in terms of sample size and hence resources. Second, only one version of the intervention can be tested, typically, making the trial a very blunt instrument. One learns only if that particular intervention in that place and time had the desired effect. Third, while one may endeavour to deliver an intervention that can be scaled up, it is almost inevitable that in real-world conditions, some of the effect that may be seen in a trial may be diluted or lost because large-scale programs receive less intensive support and scrutiny. Fourth, there are many issues associated with the unbiased measurement of outcomes in trials, which may cast doubt on trial results. For example previous studies with apparently excellent results in improving handwashing were possibly affected by courtesy bias: when participants display improved behaviour differentially depending on whether they realize that the evaluation is connected with the earlier intervention. [91]

However, behaviour change interventions are also hard to evaluate because often there is no perfect, or validated, measure of behaviour and compromise indicators have to be found. There are many other types of evaluation design, some very sophisticated (e.g., propensity

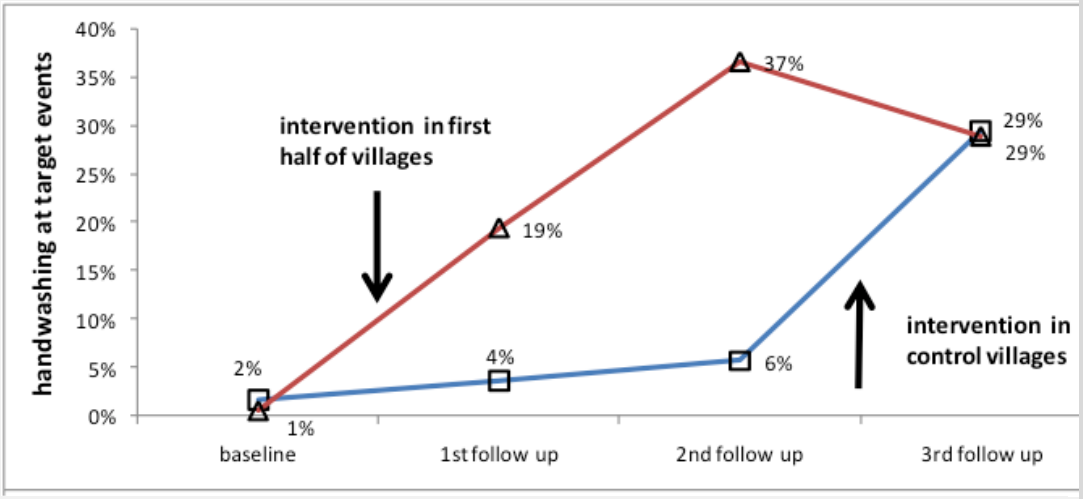
score matching [92]) which we do not go into here. Suffice to say that scientific impact evaluation is a specialist task which cannot be undertaken lightly.

Despite all of these problems, it is vital that new and innovative efforts to change behaviour be subject to trial, because that is how, over the years, a body of knowledge about what works to change behaviour will be built. For example, the SuperAmma trial (the results of which are shown below), was a complex and expensive scientific undertaking, but it represented an important step because it suggested that new approaches to behaviour change for handwashing with soap -- involving approaches other than health education -- could be a successful way forward for public health.

BCD *EXAMPLE:*
SuperAmma Impact Evaluation

As SuperAmma is a behaviour change intervention, with a 'ceiling of accountability' stopping at behavioural outcomes, desired health impacts will be assumed to have resulted if relevant behaviour change has occurred.

Control and intervention villages were compared for levels of performance of the target behaviours, first at six weeks following the intervention, with a second follow-up at 6 months and a third at 12 months. The figure below indicates that the target behaviours increased significantly in the intervention villages from a nearly non-existent baseline, and these improvements were largely maintained for a year afterwards. A similar pattern was seen in the control villages when they experienced the intervention six months after the first set of villages. This is an excellent result for the first randomly clustered trial of a handwashing intervention in a developing country.



Process Evaluation

A process evaluation is designed to understand what aspects or components of an intervention have produced good outcomes. Whether the results of the impact evaluation are positive or if they are poor, the process evaluation should be able to explain why. Process evaluation is built on the back of a good ongoing monitoring system and it asks similar questions, again following the logic of the Theory of Change. A good process evaluation should be able to identify several different kinds of failures that can influence program success:

- **Operational/logistical**: These failures are due to a lack of proper management or flaws in campaign structural design. For example, if no funds have been disbursed to conduct activities, or if the implementing agency was inept at conducting proper monitoring, so that certain planned activities were neglected, then it is unlikely that any further changes will have taken place.
- **Implementational**: These failures have to do with expected consequences of program activities not occurring due to improperly theorized or implemented behaviour change principles (measured with respect to each campaign component):
    - **Touchpoint**: maybe people don't actually go to the place/time selected as believed during program design (e.g., women don't buy food from the kinds of markets chosen as touchpoints)
    - **Activity**: perhaps target individuals are reluctant to participate in certain kinds of activities (e.g., don't like to engage in public commitment ceremonies)
    - **Channel**: perhaps people at the touchpoints were not in an appropriate state of mind or lacked the physical ability to receive information via the chosen modality (e.g., too much noise at the site to hear the messages being broadcast, or the visual transmission was not bright enough to be seen)
    - **Behaviour change technique**: if communications activities have taken place, but the target audience ignored them (because the messaging was unsurprising or repetitive, or the choice of behaviour change technique was inappropriate), the desired outcomes are again unlikely to have been found.
- **Contextual**: It may be that some macro-environmental factor changed during implementation, which impacted on links in the campaign Theory of Change. For example, market conditions like a change in exchange rates can reduce the resources available to program managers, causing massive disruption in the activities they can support.

The process evaluation should also be able to detect unintended consequences of the intervention. For example, promotion of some foods might actually reduce overall nutritional status due to secondary effects on cooking practices.

If a significant change in behaviour *has* resulted, then the next question is usually, how can we do this better and more cheaply? Again the process evaluation should be able to tell a plausible story about the aspects of the Theory of Change that had 'flowed' well to produce an impact, and those that can be dispensed with, reducing the overall cost.

Because interventions using BCD are based on an explicit theory of situations or settings, it becomes much more likely that the learnings from one program can be abstracted and applied to another. This is because the original and new settings can be compared with the likelihood of applicability being a function of how similar the two settings are. A good BCD process evaluation can therefore 'pan for gold', seeking to pick out the 'active ingredients' of an intervention which will be replicable in other circumstances.

***BCD** Tool*:
Process Evaluation Components List

- **Implementation** (Environmental changes)
  - Context within which implementation took place
    - Socio-political/economic conditions
    - Other projects/programs
  - Exposure to project-specific elements (with frequency/dosage)
  - Proportion of target population reached with each type of exposure (reach)
  - Fidelity of implementation to intervention plan (management of delivery)
    - Touchpoint-based failures
    - Activity-based failures
    - Channel-based failures
    - BCT-based failures
- **Outputs** (Psychological changes)
  - Plans/beliefs (including norms)
  - Motive salience
  - Automaticity of performance
- **Outcomes** (Behavioural changes)
  - Target behaviour frequency
  - Contextual determinants of performance
- **Impacts** ('State-of-the-World' changes)
  - New psychological/performance abilities
  - Psychological well-being
  - Institutions/organisations (i.e., ways of social working)
  - Physical infrastructures (e.g., sidewalks)

The BCD tool for conducting a process evaluation (outlined in the Box above) refers again to the elements of the Theory of Change. Each aspect should be measured as best as possible with available resources. For example, in the SuperAmma process evaluation we documented all of the inputs, tried to trace the impact that the intervention had had on the environment (for example that in some villages there was no place to put our public display of commitment by village members), and asked a simple set of formal questions to a population sample concerning psychological variables (see the Example Box below).

BCD ***EXAMPLE:***
SuperAmma Process Evaluation

A variety of measures were taken as indicators confirming the existence, and use of, the causal pathways predicted by the Theory of Change for this program:

- Exposure was confirmed by questions concerning informant knowledge of campaign-specific information, such as the campaign 'brand elements' (recognition of figure of SuperAmma, jingle, etc)
- Reported attendance at campaign events
- Changes in variables concerning the value of the target behaviours in control and intervention villages were compared between intervention and control villages.

Analysis of the responses suggested that there had been a substantial revaluation of handwashing. In campaign villages handwashing was more often seen as being good manners, and was more often seen as 'what everyone does round here' showing that norms around handwashing had changed significantly. Handwashing also became seen as a nurturing act and one that might enhance status. We therefore concluded that elements of our approach

were responsible for the success of the campaign, but we don't know which.

Response	Intervention	Control
HWWS is good manners	84%	21%
HWWS protects children	63%	2%
HWWS leads to success in life	30%	0%
Everybody around here HWWS	35%	8%

The SuperAmma process evaluation indicated that there had been wide-spread exposure to the campaign, that it had affected relevant beliefs, as well as behaviour (as seen in the impact evaluation). These psychological changes were in line with expectations from the campaign's Theory of Change, which lends credibility to the results. Finally, the cost of the intervention was $1000 per village, which compares favourably with other health investments, suggesting that it should be a candidate for replication at a larger scale. [93]

Dissemination

The last actions the Program Team need to conduct are to agree on the content of the evaluation reports, and on the next phase of activities (e.g., a repeat of the process, or scaling up of the existing program, potentially modified in some ways from what has been learned). Evaluation results are important, not just to inform the next program cycle, but also for other behaviour change practitioners. Hence publication in a publically available form, ideally after peer review, is important. The impact and process evaluations can be written up for internal consumption only (i.e., as project reports) or disseminated more broadly (e.g., as academic papers), and constitute the ultimate learnings from having conducted the program. (In the case of the SuperAmma project, both reports were published as academic papers. [41, 93])

If results are positive and if the new program designed using BCD is good value for money, then it is vital also that policy makers learn about it and learn from it. In the case of SuperAmma, the creative agency built a dedicated website to lodge all of the materials, made a short animation explaining how the intervention worked and the results, and efforts were made to pass the results to the Indian Government in various fora (ongoing). A major soap producer is now scaling up the intervention and it is being adapted to various countries in Africa and Asia.

Conducting a full circuit of BCD (i.e., all five alphabetic steps) as we have described here should ideally be seen as simply one iteration of a longer-term process. Populations have a history, and this often means they have been exposed to multiple behaviour change programs, often with respect to the same behaviours, prior to the present campaign, and will be again after. Trust can be crucial to the success of both today's campaign and tomorrow's. Indeed, a large part of the value of a campaign can be due to development of this trust, the result of relationships formed over time through repeated interaction between consumers and companies, or government agencies and the general public.

Conclusion

The BCD approach is unique in being able to encompass factors ranging from the psychological to the macro-sociological in one coherent conceptual framework issuing from behavioural theory. Other approaches tend to be concerned with only parts of the behaviour change chain. Health psychological and behavioural economic models, for example, typically focus on individual psychology, and while Social Ecological models extend from micro- to macro-scale social groupings, they are not explicit about behaviour change mechanisms. BCD sets out clearly a necessary and sufficient chain of events that must occur to generate behaviour change, and provides a raft of theory-based tools to help with that task.

What gives BCD its conceptual unity is its focus on *learning*, which is the way in which all change occurs, whether at individual, organizational or program level. In fact BCD contains a hierarchy of learning models:

- **Individual-level learning:** the BCD Behaviour Change Model is a reinforcement learning model embedded in a behaviour setting.
- **Organizational-level learning:** the BCD 'Theory of Change' Model embedded in the centre of the Behaviour Change Process Model concerns how individuals or organisations themselves learn from exposure to an intervention.
- **Program-level learning:** the ABCDE steps in the BCD Program Process Model describe program execution as a set of processes that result in learning from the experience of developing and implementing the program itself.

The fact that the models are hierarchically embedded ensures that they are consistent with one another as well as being theoretically grounded.

The BCD process has been presented in quite linear fashion, for simplicity. However, each step can involve iterative learning – Assess can make a first effort at defining target behaviours, but then reformulate them in the light of new information from background searches or critique by an expert. Formative research during the Build step will always begin with one set of questions but end with another, and can include field-based experiments that test initial hypotheses about the form and/or content of the eventual intervention, to reduce the number of 'live' options prior to handing off to the Create Team. The Create step is a process that can involve numerous generations of idea invention, plus quick, small-scale field testing, and refinement prior to roll-out of the 'finished' intervention. Delivery can also be iterative in some cases, if monitoring picks up ways that implementation is deviating from plan, this operational failure can be corrected, or if some element of the expected psychological change have not occurred (a behaviour change theory failure), then new activities can be arranged. The Evaluation Team can go back to the field to try to learn what went wrong, to isolate particular causal pathways, and hence reconsider the final lessons from program execution. The degree to which iterative testing and refinement take place at each step is a function of the time, financing, and technical capabilities available to the program. The basic rule is that it is always easier to test early and test often than to risk rolling out a campaign at scale which is not as effective as it could be.

The basic principle of BCD is: ***Disrupt settings with Surprise to force Revaluation and so cause Performance***. This principle reflects the logic of the BCD Theory of Change, which suggests that interventions modify environments in ways that influence psychological processes in predictive brains such that new actions are chosen. The Theory of Change is central to the entire BCD process, and describes how this disruption is expected to arise: the Assess and Build steps (through formative research) identify a program's Theory of Change, Create produces materials and a Delivery strategy that will lead to the desired outputs and impact, and Evaluate documents whether the Theory of Change (and its hypothesized mechanisms) are a true description of what happened during implementation.

It is interesting to note that the BCD program process can itself be expressed as a reinforcement learning process:

- Assess = recognition of a problem from some stimulus
- Build = interpretation and contextualization of the problem/stimulus
- Create = development of a potential response
- Deliver = behavioural activity/response (body-environment interaction)
- Evaluate = learning from environmental feedback

Another reason to believe that the steps identified by the BCD process are essential is therefore that they describe an organisational learning process that is similar to the reinforcement learning happening at the individual level.

Obviously, any good program should result in those associated with the program having learned important lessons that can then be applied to future programs of a similar kind. Using a BCD process makes this more likely to happen, as it is couched explicitly in processes based on learning. Further, this learning process should be cumulative, as the organisations behind program development take learnings from each iteration of the BCD process into the development of subsequent programs. Only in this way can we all get better at achieving socially desirable impacts through behaviour change programs – whether to improve public health, lobby to modify policy, form a company to sell a new product, or help oneself to improve one's own behaviour.

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Appendix 1: The Predictive Brain

The human brain can be called a prediction-generating machine. [18, 94-96] It has been designed by evolution to produce realistic expectations about what might happen as a consequence of engaging with its environment via behaviour. From this perspective, the job of any brain is to minimize the size and number of prediction errors it makes about the consequences of its own actions. This requires the brain to have a good idea of how the environment will respond to its own behaviour. That is, it must 'understand' the environment, or have a good model of what it is like to predict what the environment will 'do'. Note that although the human brain is often called the most complex thing in the universe, this is a very simple way of describing what it regularly does – with a single optimization algorithm: the brain is about minimizing its own prediction errors by developing the best possible behavioural 'policy'.

The brain doesn't just passively react to situations (so the standard psychological word of 'response' is something of a misnomer), but rather carefully monitors its situation and engages pro-actively whenever something unexpected is perceived. It is thus constantly making predictions about what the external conditions should be, and whenever there is a discrepancy seeks to 'correct' it via behavioural interaction with the environment.

The brain's expectations should be consistent with what the world is likely to actually offer, because thinking unrealistically would likely lead to dangers or lost opportunities. Thus, what an animal requires is to have the most accurate mirror of the real world in its brain that it is feasible to produce, given constraints on experience and information processing capabilities. The brain does this in two ways: first, by being the product of a long process of evolution, so that its initial structures can already do quite well in any sort of environment it is likely to be born into. Second, the brain is able to learn from experience of local conditions, so that its expectations become more finely attuned to what is really happening around it. This second process is best described as reinforcement learning.

Reinforcement learning

Reinforcement learning (RL) describes the everyday processes by which an agent learns, via trial and error, to act upon a changing environment so as to maximize a future stream of rewards, based on only partial knowledge of its world. Reinforcement learning explains how animals or robots can adapt their behaviour to varying contingencies by repeatedly updating their estimates of the rewarding value of alternative actions, thanks to feedback received from the environment. Being surprised by unexpected levels of reward can lead, over time, to different responses to the same stimulus – behaviour change.

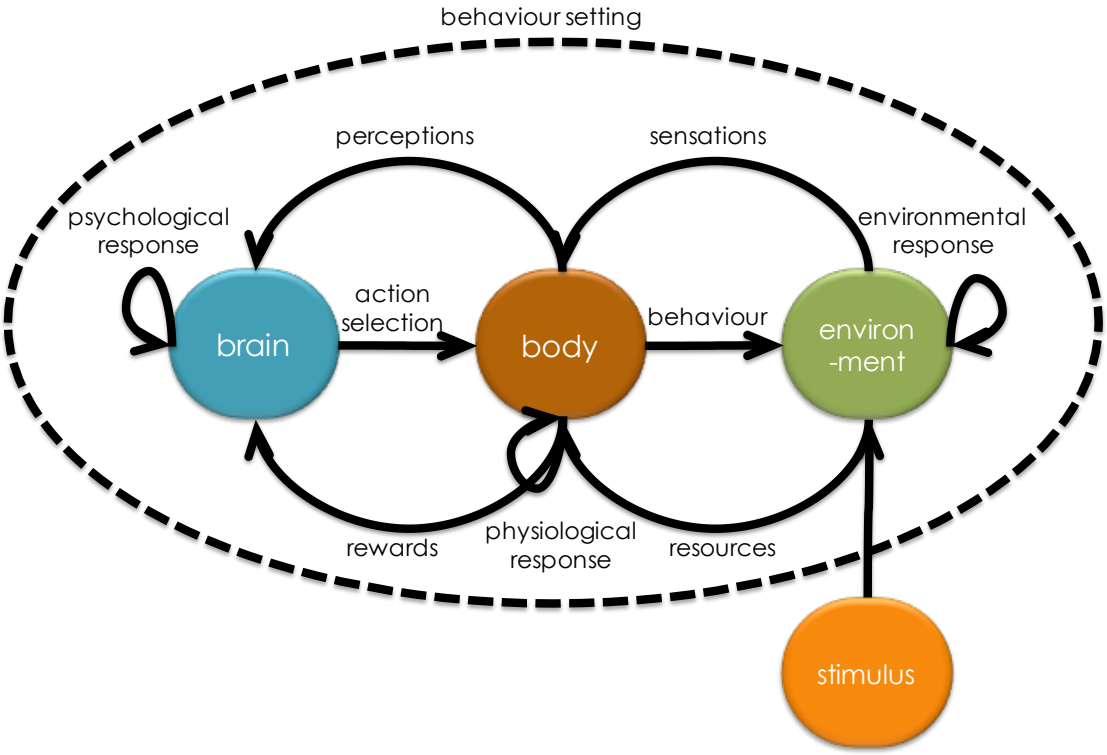
The reinforcement learning-based way of modeling the predictive brain has recently become the dominant approach to understanding neuroscientific processes, [97, 98] human learning from behaviour, [99] intelligent robot behaviour production, [100, 101] and operations management. [96] This is because it has been found that the brain's reward system operates

in a fashion consistent with the mathematical formalizations of reinforcement learning, [102] because robots programed with software that operates using RL algorithms produce the most sophisticated behaviour, [103] and because using the RL formalism produces a very efficient and effective means of describing organizational changes generally. [104]

More specifically, the RL mechanism has now been shown to characterize motivated learning in brains, in which there is a close correspondence between the behaviour of mesolimbic dopaminergic neurons and the prediction error term described in formal temporal-difference models of reinforcement learning. [105] This correspondence has been demonstrated both in monkeys [106, 107] and humans [108-110]. Such neuronal signaling can be used to revise expectations from experience, and also to learn new behaviours. [111] So evidence is accumulating that the mechanisms hypothesized by this computational model characterize the way the human brain works. [97]

The Reinforcement Learning Model (Figure A1 below) is a slightly modified presentation of this model, adding the context of a behaviour setting, and an exogenous stimulus as the source of behaviour change. So the BCD behaviour change approach is based on situated learning through reinforcement from behaviour stimulated by some externally-introduced influence (the program intervention). This model simply makes more explicit the particular context of learning in this case – from an environmental change induced by program activities, within a particular behaviour setting.

Figure A1: The Reinforcement Learning Model



We can now describe the sub-processes that take place during an instance of RL in greater detail, beginning with an act of behaviour (on the middle right of the diagram). The relevant

consequence of behaviour is modification of the environment. The environmental response loop is added here to the normal RL model to represent any endogenous processes that occur within the environment as a consequence of behaviour, such as growth of a plant that has just been watered, or the response of a tiger to noticing a potential prey.

The net consequences of behaviour are thus changes to the environment. This outcome is what is sensed by the individual's sensory systems (e.g., as a pattern of light on the eye's retina). Further processing can disclose a perception (a tiger is present). Further meaning is extracted by the brain through additional, endogenous processing (the 'psychological response' loop), reaching the conclusion that the tiger is getting closer and threatening to attack.

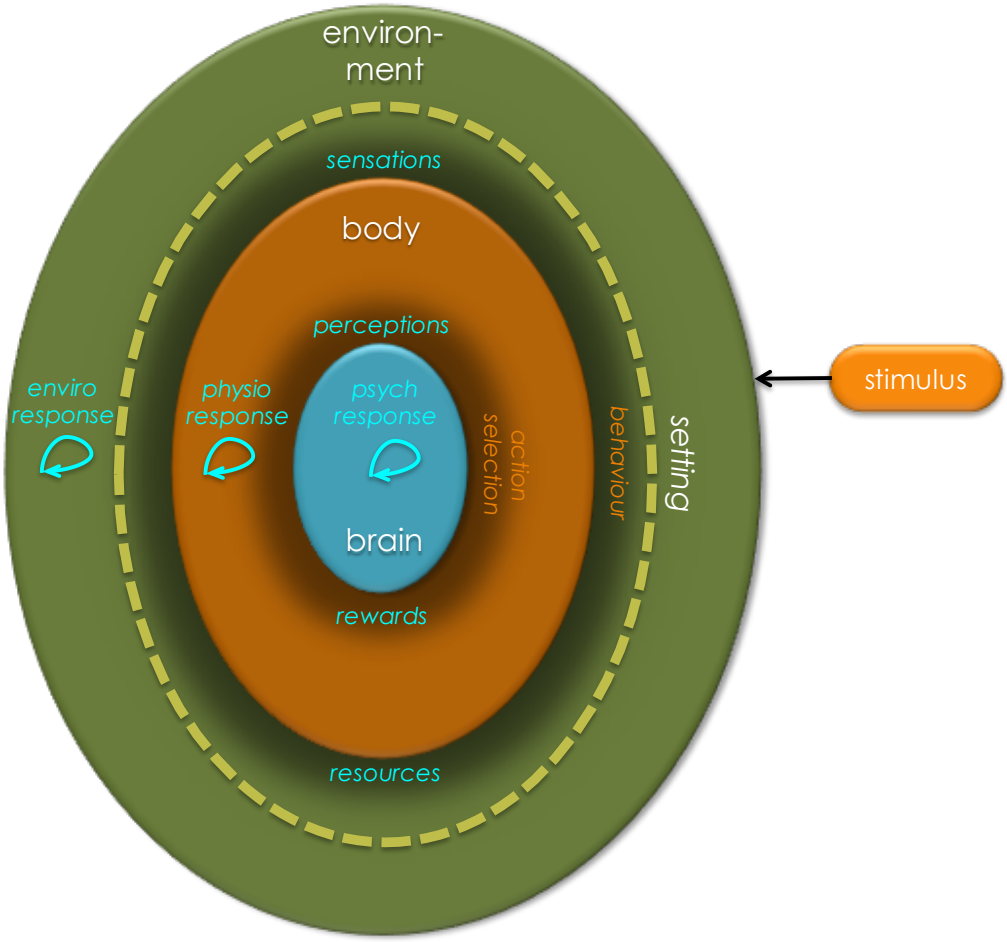
Simultaneously, interaction with the environment through behaviour can produce new physical, biological or social resources for the individual (e.g., a sense of pain from having stubbed one's foot, food, or indicators of changed social status). In our case of a tiger having been prodded, the resource is an indicator of a biological threat: of being eaten by the tiger. Based on this indicator a (negative) reward is then calculated based on the (negative) resources acquired through behaviour, minus the metabolic/arousal costs of engaging in the behaviour in the first place. In our example, the negative reward (also called 'punishment') is fed into the psychological response as part of the inputs to mental processing. Learning is the changes in the brain due to this reward and perceptual processing (i.e., an association of reward to prior action selection and perception of the environmental response). Memory storage can be another consequence of the psychological response.

A further consequence is often action selection – that is, formulation of a behavioural response from among alternative courses of action (in our case, fight, flight or freeze). Action selection is based on the current best model of the state-of-the-world (e.g., how far away is the tiger, what is my rate of speed compared to that of the tiger, etc). Action selection first causes metabolic response and arousal, which then produces behaviour by the body (e.g., running away from the tiger), which causes change to the state of the behaviour setting, which can cause reactions by the environment (e.g., the tiger begins chasing). Note that this process can run repeatedly: that is, after learning is complete, another action is selected, and the cycle begins anew.

BCD Behaviour Change Models

However, the representation of this process in Figure A1 is not ideal in certain respects. First, it uses the box-and-arrow form of representation which is causally clear but ontologically abstract. In fact, brains sit inside bodies, and bodies move about within environments, not each as separate entities (as depicted). Second, the arrows suggest a simple linear effect from one entity to the next. In fact, the interactions between brains and bodies, and bodies and their environments – even within the restricted time-frame of an instant of learning and response – are dynamic and potentially cyclic. The BCD Behaviour Change Model (see Figure A2) takes account of these facts and re-represents the RL process so that the hierarchical embeddedness of brains, bodies and environments is clear, as is the dynamic nature of their interactions (represented as a fuzzy cloud at the boundary between brain and body, and body and environment).

Figure A2: The BCD Behaviour Change Model

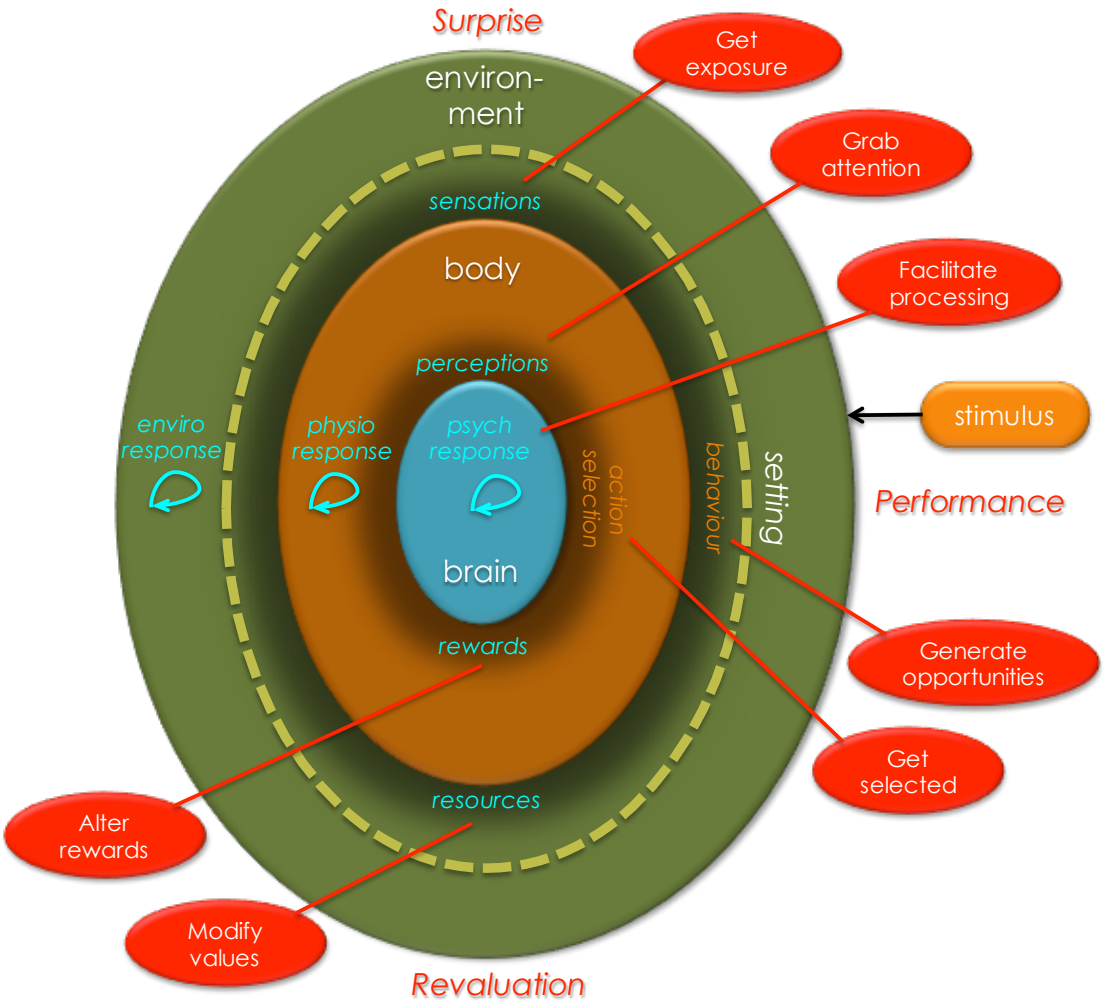


This model represents the initial feedback effects from a novel stimulus in terms of dynamic processes named with blue text (such as perceptions and rewards), while the behavioural response processes are in brown text (action selection and behaviour itself). The behaviour setting is pictured as a constraining band holding many of the other components together. (But there are aspects of the environment which do not play a role in any given setting, so the environment is a larger domain than a behaviour setting.)

Another version of this model, the BCD Behaviour *Challenge* Model (Figure A3), makes explicit the connection between each step of the reinforcement learning process and one of the sub-tasks identified in the BCD Theory of Change. How the sub-tasks are grouped into the three main tasks of Surprise, Revaluation and Performance is also made clear: Surprise is about the process (running top-down in the diagram) of perceiving a stimulus (via sensations and perceptions, with additional psychological responses, expressed as the problems of getting exposure, grabbing attention and facilitating processing); Revaluation is about the parallel (bottom-up) process of analysing the stimulus for its value (via resources being acquired and valued in terms of rewards, the tasks of modifying value and altering rewards in behaviour change terms); while Performance is about the forward-chained process of

establishing the best behavioural response to the stimulus (via action selection and behavioural performance itself – by getting selected and generating opportunities for peformance). Since Surprise, Revaluation and Performance are glosses on implementation, outputs and outcomes, this model demonstrates a tight connection between a fundamental learning process and the BCD requirements for developing a clear Theory of Change – an integration not previously achieved in the Theory of Change literature.

Figure A3: The BCD Behaviour Challenge Model



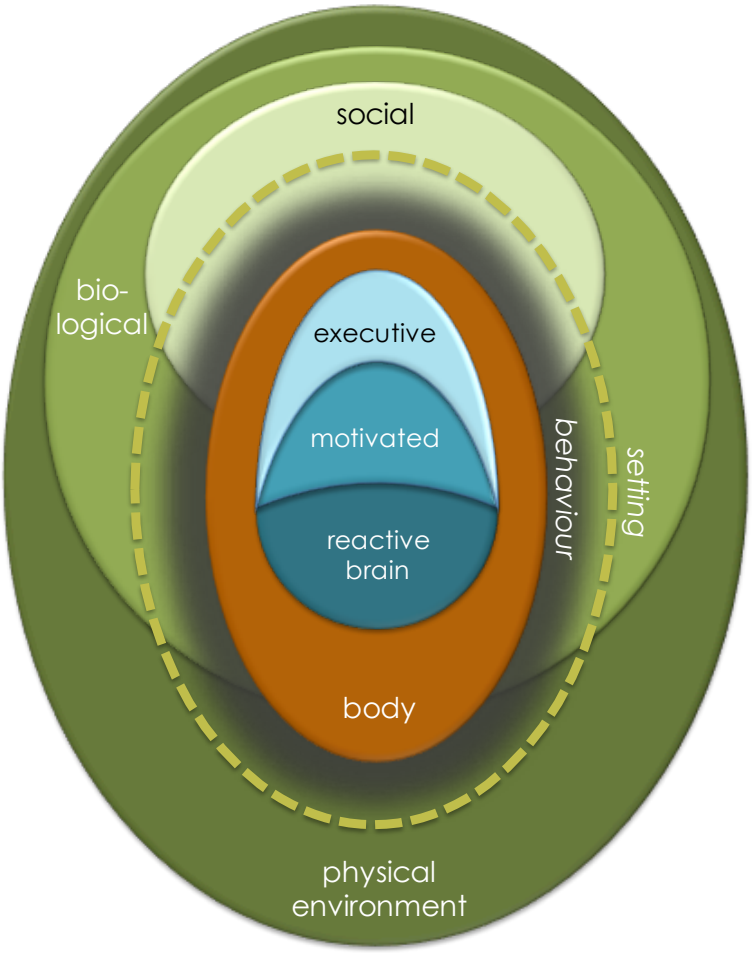
Based on the RL family of models, there can be two kinds of error (each associated with one of the two pathways from the body to the brain in Figure A3). [112] First is that which is about the nature of what is perceived (i.e., some situational incongruity about the state of the environment, such as seeing snow on a tropical beach). This kind of error is called 'perceptual' because there was a 'state prediction error' about what the state of the world was. It constitutes the 'surprise' stream in the Figure, which begins at the top of the diagram with novel sensations, culminating in a psychological response.

On the other hand, 'utility surprise' is about the *value* of the environmental response to the animal (in terms of whether it is likely to satisfy some need), which has proved higher or lower than expected. This is called a 'reward prediction error'. This is associated with the Revaluation stream in the Figure, which works its way up from the bottom of the diagram with resources being provided as feedback from behaviour, that spawns a reward calculation. Each of these kinds of error can be used in interventions (we call them the 'grab attention' and 'alter rewards' strategies, respectively).

Appendix 2:
BCD Behaviour Determination Theory

It is often useful to think about all of the things that can influence an individual's behaviour at a given moment in time, rather than about the dynamics of learning. For this purpose, the BCD Behaviour Determination model (previously called the 'Evo-Eco' model [113]; see Figure A4 below) can be used. As with the BCD Behaviour Change and Challenge Models, it is essentially a representation of the Theory of Change or reinforcement learning model rotated 90 degrees, so that all of the components become overlaid visually on one another, capturing their causal relationships in a single instant, with the behaviour setting remaining as a kind of 'force field' linking the various components together. The brain is presented as being causally constrained by its presence inside the body, and the body in its environment. Environmental and brain components have been divided into three categories to provide additional detail about the nature of these components. In particular, the environment is broken into social, biological and physical components, while the brain is divided into executive, motived and reactive (per earlier discussions of behaviour control mechanisms).

Figure A4: The BCD Behaviour Determination Model



Levels of control

It is worth noting that the predictive brain viewpoint (see Appendix 1) provides explicit foundations for our basic claims about mental operations. In particular, there are three 'families' of RL models which conform to the three types of behavioural control identified by BCD.

First, the 'policy-search' family of RL models is equivalent to our Reactive level of control. This type of model involves the immediate use of a response 'policy': depending on its assessment of the situation, it just chooses a response from a pre-defined suite of possible responses (the so-called 'policy' set) – equivalent to in-born reflexes – or chooses an action based on some average value function, previously learned, which represents the aggregated experience from many previous trials (which is the equivalent of a habit). Neither of these responses explicitly represents the actual outcomes or contingencies in the task: they simply are preferred actions or summaries of some prior valuation. As a consequence, like stimulus-response habits, they cannot be adjusted if the appropriate end-state happens to change, because there is no representation of a goal. [114-116]

Second, value-function based RL models correspond to our Motivated brain: they engage in search for actions that maximize value, using the temporal-difference (TD) algorithm to evaluate progress towards a goal. Value function models attempt to find a response that maximizes the agent's return from behaviour by maintaining a set of estimates of expected returns from all the available options. This kind of model does evaluation based on the agent's current position or situation, but looks only at possible options from the current position, evaluating each in turn (it doesn't look backward). [116, 117] Given its cached estimates of the value to be returned from each behaviour, it chooses the one with the highest value.

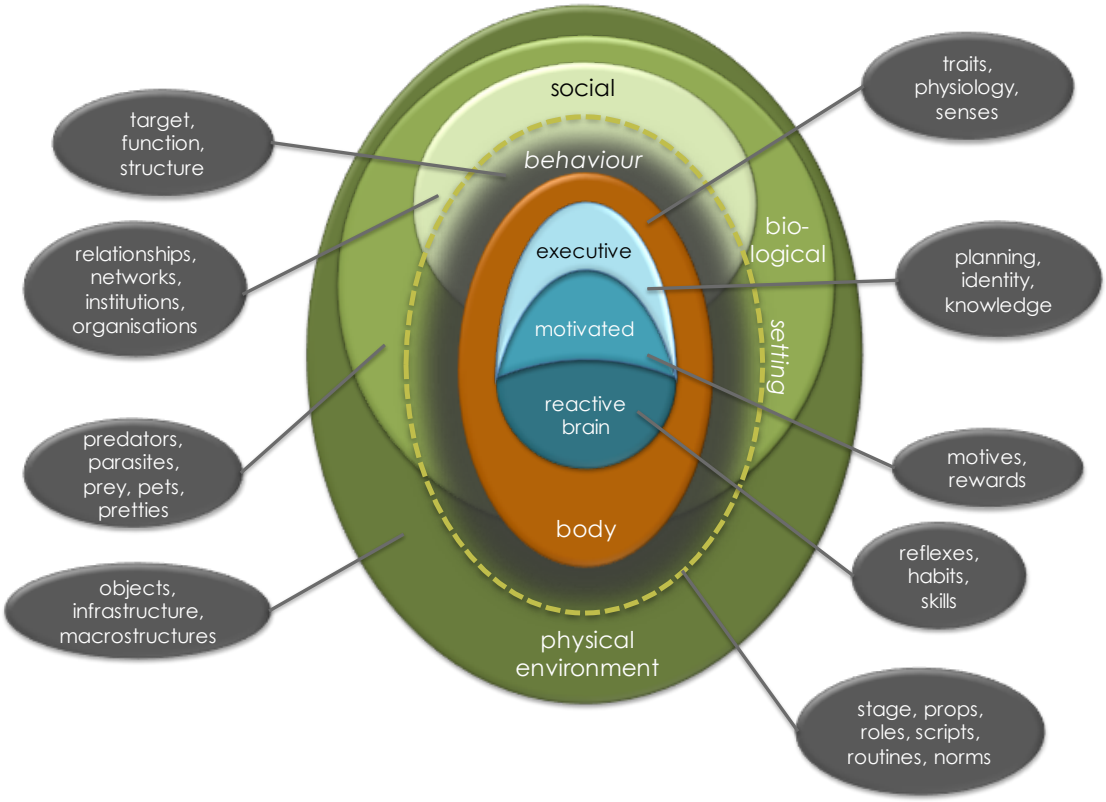
Finally, 'model-based' RL is the way the brain's Executive function operates: it encodes how likely each possible outcome is, and can learn an internal model of probable consequences of being in some state. That is, it learns state transition probabilities. [118] [96] This kind of model can do both forward and backward tree-like search through all possible outcomes to find the best strategy. This can be considered to be more about learning than immediate use, as it optimizes over longer-term aggregate reward rather than single goal-achievement. The model can infer the likely value of alternative future courses of action based on any situation (not just its own current one) – which is the primary function of imagination. Sophisticated model-based algorithms explicitly compute a separate transition matrix for the probability of ending up in each next state, given the current state and each possible action choice [96, 119] This resembles human planning, which can be used to find an optimal generated (rather than pre-existing) policy over several sequential goals, and hierarchical model-based RL speeds up this learning process by chunking potential behaviours into event sequences.

These different types of control are presumed to all be available in the human brain, operating in parallel, with the system that produces the least uncertainty about the highest-value option 'winning' the competition to instruct what the next behaviour should be (i.e., their action gets selected in the action selection sweepstakes). [114] [120]

The 'Extended' Model

As shown Figure A5 in below, specific factors can be associated with each component of behaviour determination, resulting in a checklist of factors to be considered in any intervention program (e.g., through formative research).

Figure A5: The BCD Behaviour Determination Model (Extended)



A detailed discussion of the elements of the Behaviour Determination Model is most efficiently presented as categories of factors that go into the BCD Checklist. Each element has a precise definition, provided in the Table below, with examples. These categories directly correspond to the expanded model above. An example of a completed Checklist is provided in the main text.

Element	Definition	Examples
Behaviour	A functional, dynamic interaction between the body and environment	
Target	Whether the behaviour in question is the primary or secondary focus of the program	primary, secondary, non-target
Function	The type of evolutionary benefit provided by performance of the behaviour	reputation, food, knowledge

Structure	The hierarchical clustering of co-occuring behaviours	routines
Body		
Traits	Relatively permanent characteristics or behavioural predispositions	openness, disgustability
Physiology	Aspects of body morphology (shape), size, and general body functioning	gender, age, BMI, metabolism
Senses	Specialised organs for acquiring information from the environment	taste, smell, hearing
Brain		
Executive		
Planning	Engaging in imagined evaluation of potential future events	writing shopping list, daydreaming about being pop-star
Identity	A supra-setting narrative about one's place in the social world	mother, writer
Knowledge	Consciously available, learned associations between specific concepts	facts ('George Washington was the first US President'), beliefs ('Unicorns look like horses except with a horn')
Motivated		
Motives	Psychological mechanisms to produce behaviour that solves evolutionarily important tasks in the human niche	Lust, Affiliation, Status, Create, Hoard, Hunger
Rewards	Benefits of unexpected value received as a consequence of behaviour	'extra' food or money, unexpected success in 'mating game'
Reactive		
Reflexes	Innate automatic behavioural responses to environmental stimuli	suckle, blink
Habits	Automatically triggered responses acquired through experience	tooth-brushing, driving
Skills	A capacity to perform particular behaviours with facility developed through repeated practice	hitting a ball, cooking a meal, giving a speech
Environment	The causally exogenous factors impinging on behaviour	
Social		
Relationships	Dyads with 'special' psychological significance to participants	friend, neighbour, colleague (at work)
Networks	Personal, but informal clusters of people	bridge partners, 'tennis club members that I meet socially'
Institutions	Sets of behaviour settings linked by a	market, marriage,

	common purpose, often occurring in a common place	village
Organisations	'Formal' institutions, with rules/regulations/policies for converting roles into positions, and for excluding/admitting individuals into specific roles, which thereby become personalized	business, club, guild
Biological		
Prey	Species that are consumed by people	food species (plant and animal)
Predators	Species that consume people	lions, bears
Parasites	Species that crucially depend on people for survival and reproduction	pathogenic bacteria
Pets	Species that humans have domesticated for companionship, not consumption	dogs, cats
'Pretties'	Species that humans have domesticated for aesthetic pleasure	flowering garden plants
Physical		
Objects	relatively small-scale, rapidly improvable physical implements which are often significantly affected by use (and hence are prone to obsolescence)	ball, soap, watch
Infrastructure	'Local' structures that directly facilitate or constrain behavioural performance while not being affected through use; typically circumjacent to the behaviour setting (i.e., encapsulated within the setting 'stage'); mid-sized structures that are not manipulable (at least by a single individual) but which nevertheless play important roles in a setting	table, room of a building
Macrostructures	Large-scale systems which have an indirect causal impact on behaviour (e.g., delivering the water that is used to wash hands with soap); tend to be super-setting-sized, but to intrude into settings in particular ways	*Systems*: water supply, electricity grid, road or computer network; *Mega-structures*: skyscraper, dam
Behaviour Setting		
Stage	The place and things surrounding where the setting regularly occurs	waiting for a bus, eating at a restaurant
Props	The objects used to accomplish the behaviour (often called 'synomorphic' because they fit the behaviour)	dinner-plate, fork, knife
Roles	The interacting strategies used by the cast of actors which meet their needs separately and together	waiter, chef, customer
Routine	A learned sequence of behaviours performed regularly, and typically in the same order, to fulfill a role	enter restaurant through front door, walk to table, sit down,

		study menu, interact with waiter, etc.
Script	An individual's knowledge of a routine – that is, a set of mental instructions about how to behave (which may be implicit), in a particular behaviour setting, to play a role	choose a table, order food, eat, pay at the cash register
Norms	Implicit rules governing role-play in a setting	don't leave without paying

Appendix 3:
Variant uses of the BCD approach

Thus far, presentation of the BCD approach and process has been couched in terms of developing a standard communication- or activity-based campaign (e.g., for public health or marketing purposes). However, much the same approach and process can be employed with respect to other kinds of behaviour change projects. These alternative uses will be discussed briefly through illustrative scenarios below.

Policy-based change

In the case of seeking to change public policy, the target population is not a fairly general demographic profile (as was true of public health and marketing programs), but rather a specific, and relatively small class of people, or perhaps even a single individual – that is, one or more policy-makers. Use of the BCD approach in this case forces recognition that policy-makers are individuals who need motivation, who play specific roles in particular settings, and perform particular behaviours (like signing policy into law), just like anyone else. Take the following scenario as an example:

A former US senator starts a political lobbying group in Washington DC, called Smoke-Free, with the mission to promote federal anti-smoking legislation (outcome), so that rates of lung cancer in the US can be reduced by inhibiting the number of people taking up this practice (impact). **Assess**: The lobbying organisation's staffers write a background document on the scientific evidence for a link between smoking and lung cancer, as well as a document on the means by which other lobbying groups successfully gained access to policy-makers or caused changes in public opinion (e.g., through publicity-seeking). **Build**: The staff develop a BCD Theory of Change to direct their efforts at convincing lawmakers of the need for a new policy (e.g., by causing them to cause the policy-maker to Re-value the value of the target behaviour for his constituents, and writing up a draft proposal of the relevant policy to ease the job for legislators), and a separate Theory of Change about their efforts to change public opinion. **Create**: Smoke-Free goes to a professional media company to help them with tag-lines, poster design, and radio ads (all they can afford) as materials to be used in their publicity campaign; staffers themselves write the draft legislation. **Deliver**: Smoke-Free targets legislators directly by meeting with the staff of crucial legislators, passing on their evidence-base and use motivational patter to persuade these second-in-commands about the justice of their cause. Simultaneously, they target the general public via media campaigns to change public opinion in ways that will support their cause and apply pressure on the lawmakers. These include attending constituent meetings of the legislators likely to vote against such a proposition. The result is that the sought-for policy fails to be written into law. **Evaluate**: The lobbying group performs an internal assessment of its strategy (i.e., process evaluation), to identify the reasons it failed to have the desired impact, and develops plans for a second attempt during the next political cycle using a revised Theory of Change.

Marketing/re-branding

Sales of a new product are not increasing as fast as the Acme company believes is possible, despite several different marketing efforts. They desire to increase both the market share and the market size for this product (outcomes), as a means to greater company profits (impact). **Assess**: Acme hires an external research agency, Beta Research, to prepare a background report on market conditions and sales over the time of the prior marketing pushes. **Build**: Beta Research also conducts some consumer research to uncover reasons for the lack of appeal of prior marketing campaigns to target consumers (using the BCD Campaign Analysis Tool to help design the research). In a meeting between Acme and Beta staff, consensus is reached about a new Theory of Change for targeting the brand profile of consumer, and a creative brief for the new marketing campaign is written. **Create**: The Acme company uses their regular creative agency, Create-Great, to design story-boards for two new TV ads. These are critiqued through several iterations using the BCD Component Analysis Tool before being accepted by Acme management and then produced by a media production company subcontracted by Create-Great. **Deliver**: Create-Great then follows an implementation plan previously created by Acme together with Beta Research to broadcast the ads in particular markets at particular times of day, to maximize reach and the dosage of exposure, given their budget. **Evaluate**: Acme management commissions an internal report to examine whether objectives were met (i.e., the impact evaluation), with particular attention to the cost-effectiveness of the different kinds of broadcasts, to improve financial efficiency over the next advertising cycle (i.e., process evaluation).

Business development (incorporating product innovation)

Ms Smith makes a business pitch to Ms. Jones, a serial entrepreneur, concerning her idea for a device that will markedly improve the ability of some product to achieve its primary function. Ms Jones decides to take the case on, to see if the device can serve as the primary product of a new, profitable retail company (impact). **Assess**: Ms Jones engages in some research into the market for the improved product and determines the idea is worth further investigation. **Build**: Ms Jones then develops two different Theories of Change: one to check if there is a way to produce the potential product at a profit via a business that relies primarily on production and sale of this product, using the BCD Theory of Change to help organize her thoughts about how the product can be engineered and then sold to consumers with a particular profile. She also uses the BCD Theory of Change to guide her efforts to get backing for a new business (which involves crowd-sourcing and personal contacts to get an initial round of funding for small business that will produce and market the device). **Create**: Using the crowd-sourced money, Ms Jones hires an engineering firm to create prototypes of the new product, which are iteratively refined over a couple of years through repeated consumer piloting and redesign using the BCD Component Analysis Tool. Simultaneously, she hires a creative agency to design a marketing campaign for the product, whose reverts are critiqued using the BCD Component Analysis Tool. Third, she also hires a variety of personnel to form the foundation of the small business that will eventually manage production, distribution, marketing, sales and servicing of the new product. **Deliver**: The new company begins production, achieves a stockpile of merchandise, is publically launched via news announcements to the business press, and initiates the marketing plan. Sales begin to come in, which are tracked. **Evaluate**: After the first year of business, Ms Jones has some of her staff write a market report (for internal consumption only) to look at company profitability (i.e., the impact evaluation), the level of customer satisfaction with the product and the viability of their servicing model (i.e., process evaluation).

Self-help

Mr. Brown wakes up one morning in a hotel room he doesn't recognize, and realizes he is isn't sure which city he is in, or what day it is. He immediately vows to reduce his consumption of alcohol, so as to enjoy a better quality of life. **Assess**: Having made this commitment to himself, Mr. Brown buys a couple of self-help books for alcoholics, and reads them. **Build**: Having learned in the books about Alcoholics Anonymous (AA) and their excellent record of getting alcoholics to quit drinking, he searches for local AA meetings on the web, and finds one that conveniently meets nearby his workplace on Wednesday nights. (AA has a very explicit Theory of Change for how to convert alcoholics into non-drinkers, relying heavily upon recovering alcoholics as therapists, peer-led self-help therapy groups, and teaching the Twelve-Step process, including self-identification as an alcoholic, which Mr. Brown – at least implicitly – has found compelling during his reading.) **Create**: Mr. Brown clears his calendar of other activities on those nights, and plans how to get to the meeting-place from work. **Deliver**: He goes to his first AA meeting the following Wednesday. He finds the experience so rewarding that he goes again the next week, and the next. He finds that he is learning techniques that will help him to quit. Together with others in the AA group, he plans his quit date. When it comes, he quits drinking outright. **Evaluation**: After 3 months of sobriety, Mr. Brown is asked in one of the AA meetings to reflect on his experience (i.e., conduct a process evaluation) and share it with others in the group (to have further impact on himself, and others, via the AA Theory of Change).

This suite of scenarios should help demonstrate that the BCD approach is quite general to any organizational process that involves changing behaviour in any population (down to a single individual).

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