BASIN

Behavioural Adaptation for Water Security and Inclusion

Behavioural research for water security: integrating design, systems thinking and social sciences

Summary

Inclusive water security and climate adaptation are 'wicked problems' – that is, complex, dynamic and multifaceted challenges that resist simple solutions and involve multiple stakeholders with conflicting interests and different interpretations of problems. While behavioural research has proven effective in addressing relatively simple, discrete behaviours, its conventional approaches face significant limitations when applied to complex systems. In the BASIN project, we argue that behavioural research can be advanced by integrating systems thinking, human-centred design and critical social sciences. This expanded approach to applying behavioural research to wicked problems aims to foster more holistic, equitable and sustainable solutions to water insecurity in a changing climate.

Key points

- Standard behaviour change interventions often focus on individual actions while overlooking power dynamics, systemic drivers, structural inequalities and unintended consequences. This narrow focus can reinforce, rather than resolve, the underlying challenges inherent in wicked problems.

- Combining behavioural research with systems thinking helps to map complex interconnections: identifying root causes, leveraging points and potential intervention outcomes, including unintended consequences.

- Integrating behavioural research with human-centred design provides a structured, iterative approach to problem-solving that embeds systems thinking. It emphasises a thorough diagnosis of problems, co-creation with affected communities and context-specific adaptable solutions.

- Applying behavioural research both as a tool for intervention design and an analytical lens, and moving beyond nudging, opens up space for integration with critical social sciences. This integration can illuminate power dynamics and inequalities, with the potential for enhancing the effectiveness and fairness of interventions for more inclusive water outcomes.

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Introduction

This brief explores how behavioural research can better address complex, 'wicked' problems such as inclusive water security and climate adaptation by integrating systems thinking, human-centred design and critical social sciences.

From the adoption of irrigation technologies to water hazard governance, climate change adaptation and inclusive water security have human behaviours at their heart. However, efforts to address these challenges have largely overlooked behavioural research, despite its potential to inform more effective solutions (Conway, 2024). Climate and water insecurity exemplify 'wicked' problems – complex, dynamic and hard-to-define issues, with high uncertainty, contested solutions, and no stakeholder group holding all the mandate or keys to solving them (Rittel and Webber, 1973). Their entanglement with social, economic, political and environmental systems means that actions in one area can trigger unforeseen challenges elsewhere, often exacerbating inequalities among the most vulnerable and marginalised populations who have limited power to respond. The different stakeholders involved often have conflicting values and interests, making water security and climate adaptation not just technical or environmental issues, but also deeply political ones (Nightingale et al., 2019).

Behavioural science has expanded tremendously over the past 15 years, especially in policy, but primarily for simpler, tractable issues, with limited engagement with wicked problems (Chater and Loewenstein, 2023; Straßheim, 2020). However, recent work signals rising interest in behavioural applications to wicked challenges (Singh, 2024). We outline in this brief how integrating behavioural research with systems thinking, human-centred design and critical social sciences can enhance its ability to navigate the political, ethical and structural dimensions of wicked problems (Hallsworth, 2023). This broader, interdisciplinary approach has the potential to increase the scope and impact of behavioural research, making it more effective in addressing wicked problems such as water security.

The standard behaviour change approach

While behavioural research is a multidisciplinary field,[1] its practical applications have primarily centred on behaviour change interventions based on behavioural science – a sub-field rooted in psychology, behavioural economics, neuroscience and experimental methods. Its standard approach follows a structured sequence: define the behaviour-related problem, research its context and drivers, identify a specific, measurable target behaviour, generate evidence-based hypotheses to inform intervention design, test efficacy experimentally, and scale up if desired (Hallsworth, 2023).

The most common application of the standard approach has been through choice architecture interventions or 'nudging', which consists of subtly changing how choices are presented to steer behaviour without restricting options. Notable successes of this approach include interventions to reduce household electricity or water consumption through appeals related to social norms, the public good, or social recognition (Allcott, 2011; Brick et al., 2023). Applied behavioural science also includes alternative, though less common strategies. These encompass for, example, 'boosting', which aims to enhance people's competence in making decisions aligned with their own goals and values (Herzog and Hertwig, 2025), and 'wise interventions', which support empowering shifts in individuals' self-perception and interpretations of their circumstances to foster sustained change (Walton and Wilson, 2018). These alternatives address some critiques of nudging,

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1. Drawing on diverse fields including psychology, economics, public health, anthropology, sociology, marketing and others.

particularly concerns around paternalism, where experts or authorities attempt to steer people's behaviour without engaging people's own agency, assuming they know what is best.

The standard approach is best suited for relatively uncomplicated (though not necessarily easy-to-solve) problems with clear causal relationships and broadly agreed solutions, but struggles with wicked problems (Hallsworth, 2023). These limitations are most visible in nudging, as the most widespread approach. Nonetheless, despite their more context-sensitive and agency-enhancing orientation, alternatives such as boosting or wise interventions remain grounded in the same standard approach and are not immune to the broader challenges described in the next section. They too, must be applied carefully to avoid reinforcing structural inequalities, shifting responsibility onto individuals, or addressing surface-level symptoms rather than deeper systemic issues.

Limitations to the standard behaviour change approach

The first challenge of the standard approach to behaviour change is limited impact due to inattention to power and structural factors. Behavioural science has been accused of 'tinkering around the edges' of large societal problems (Chater and Loewenstein, 2023; Hallsworth, 2023). Critics argue that its focus on individual-level behaviours diverts attention from underlying structural causes and systemic reforms, which are often more impactful (Chater and Loewenstein, 2023). Furthermore, behavioural interventions overwhelmingly target the behaviours of downstream policy recipients, such as individual citizens, households or frontline workers. Rarely do they focus on the most influential actors in the system, such as politicians, donors or business leaders (Read and Selinske, 2024). This is equally true for the scarce applications of behavioural research to water security (Conway, 2024). Combined, the lack of attention to influential actors and structural change risks limited impact and even reinforcing, rather than challenging, the dominant forces underlying complex societal and environmental problems (Conway, 2024; Read and Selinske, 2024).

The second challenge is the limited view of system-wide dynamics and the resulting risk of maladaptation. The standard behaviour change approach usually applies a relatively mechanistic, static and narrow focus on target behaviours (Hallsworth, 2023), with limited attention to unintended consequences or feedback mechanisms. Moreover, individuals are usually seen in relative isolation, with little consideration of social interactions, power dynamics or structural inequality (Read and Selinske, 2024). This is important for adaptation and water security because there are knock-on effects from modifying one part of the system. For example, promoting solar-pumped groundwater irrigation as a way to strengthen farmers' water and food security can, in some contexts, lead to groundwater depletion (Gupta, 2019), while encouraging the settling of pastoralists as a drought mitigation measure can reinforce conflict with other groups (Magnan et al., 2016) – ultimately resulting in maladaptation.

Furthermore, if there is inattention to unintended consequences of interventions, it can exacerbate inequalities, for example by placing water points in community centres but far from elderly or disabled water users. It can also result in targeting marginalised but easily accessible populations who may have less capacity to cope with the burden of changing their behaviours (Crosman et al., 2022).

The source of the above challenges might largely lie in the predominant way that behavioural research has been applied. To address a challenge, it tends to ask, 'Where could we apply a behavioural change approach to this problem?' rather than 'How might we apply behavioural knowledge to

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this problem to maximise impact and equitability?' Thus, to make more effective use of behavioural research in the context of wicked problems, instead of looking only for opportunities to change behaviour, we should also understand the psychology and behaviour itself within the broader infrastructural, societal, economic and political space.

Towards new behavioural research for wicked problems

How human-centred design helps

One approach that is increasingly combined with behavioural science to avoid reliance on narrow, predefined behavioural targets and ensure greater engagement with contextually relevant questions and stakeholders' needs is human-centred design or design thinking. This is a structured, yet flexible and creative approach to innovation and problem solving, rooted in understanding people's needs, motivations and behaviours in their wider (socio-ecological) context (Lambe et al., 2020). It is particularly valuable for wicked problems like water security, as it seeks to ensure the alignment of interventions with cultural norms, community needs and local governance structures. As a result, multiple behaviour change frameworks have begun to incorporate its principles (although to varying extent).

In BASIN, we have adopted the widely known Double Diamond model from the Design Council in the UK as the basis for the framework to guide our research process – see Figure 1.
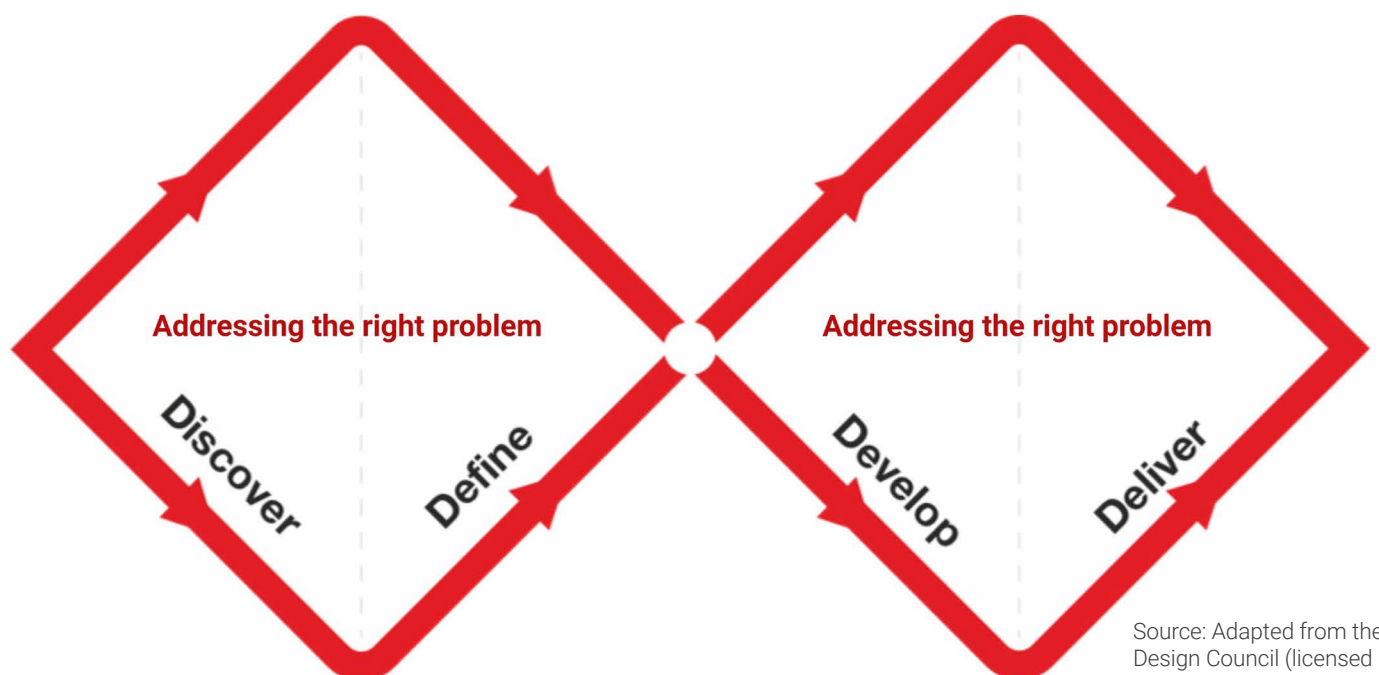
The design process starts with an in-depth exploration of the context and diagnosis of a problem ('addressing the right problem' – the Discover and Define phase in the Double Diamond process), before prototyping and testing solutions ('addressing the problem right' – the Develop and Deliver phase). While most behavioural change approaches lack this initial exploratory step, it offers an ideal point to integrate a system-level analysis in a structured way, in order to develop a holistic view of system-wide dynamics (see further below).[2]

Design thinking also stresses rapid iteration between different stages of intervention development. The principle of 'fail early and often' allows

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2. The exploration step is incorporated in some behavioural frameworks referencing design, e.g. in Behavioural Service Design, BehaviourWorks Australia Method (Smith et al., 2024), and RARE's Behavior-Centred Design. Others, however, begin directly with a predetermined behaviour, like the ABCD model popular in WASH (Aunger and Curtis, 2016).

Figure 1. The Double Diamond Framework

Addressing the right problem

Discover   Define

Addressing the right problem

Develop   Deliver

Source: Adapted from the Design Council (licensed under CC BY 4.0)

practitioners to refine how they understand a problem and explore multiple potential solutions to quickly home in on the most promising ones (Lewrick et al., 2020). Iteration is especially beneficial for wicked development challenges, whose context-dependent nature often limits transferability of solutions from elsewhere or may require refinement to further optimise effectiveness (Ramchandani et al., 2023). Practitioners may have limited time and resources to spend on lengthy development processes. By emphasising early-stage problem understanding and empirical solution testing, this approach can save time and money, and produce more impact compared with standard development intervention practices where learning and evaluation tend to come only after full-scale implementation (Osborne et al., 2022).

Finally, human-centred design emphasises empathy and co-design, meaning engaging stakeholders in defining the problems and co-creating solutions, improving adoption and impact. Co-design and deliberative practices also facilitate the voicing and integration of values and perspectives of different stakeholders, including marginalised groups who might otherwise be overlooked.

Our own co-design process to shape the BASIN research agenda highlighted the value of co-designing with stakeholders such as policy advocates in expanding behavioural change approaches towards more powerful actors and systemic change (Read and Selinske, 2024). This synthetic, demand-led, transdisciplinary engagement with academic and non-governmental organisation (NGO) partners allowed us to identify five impact-focused research questions that align with local needs while addressing shared knowledge gaps across different countries and case studies (Ingram et al., 2025). Three of these questions focus on the actions of regional and state-level actors to enhance water security and climate adaptation rather than directly targeting the behavioural responses of water insecure communities. By emphasising the underlying causes of problems and the broader socio-ecological context, as well as empathising and co-creating with stakeholders, design thinking enables the design of more holistic, equitable and sustainable solutions.

How systems thinking helps

Wicked problems like water insecurity or adaptation are part of complex, dynamic socio-ecological systems. A complex system is a set of interconnected components such as actors, resources and structures, bound by their relationships, constraints, feedback loops, rules and boundaries, working together in a way that produces some goal or function (Del Valle et al., 2024). Examples include river basins, markets, villages and governance systems.

Systems thinking helps to see a problem in its broader context, as embedded within – and often emergent from – patterns of behaviour shaped by system structures over time. Systems thinking also enables analysis with a lens of gender equity and social inclusion to identify who is affected in what way, which is important for identifying equitable solutions. In the context of water security, systems thinking has been shown to help dissolve disciplinary silos, change the spatial scales at which water challenges are addressed, and integrate socio-ecological issues of justice and power with more traditional biophysical dimensions (Polaine et al., 2022). Mapping complex systems can provide a way to apply behavioural science as a lens to help to diagnose problems or structure policies in a behaviourally-informed way (Hallsworth, 2023), with a holistic account of individual-level and structural factors, for example to understand and influence unsustainable water services, unequal water distribution, and governance failures.

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While many systems thinking methods exist, ranging in difficulty and expertise required, even a simple system mapping exercise can help visualise and consolidate knowledge about a problem (Smith et al., 2024). This includes its underlying causes, the pathways linking it to key threats or outcomes, and the possible ripple effects or unintended consequences of intervening in different parts of the system. Importantly, system mapping can help identify leverage points, such as key actors, behaviours or structural influences, where change could have the greatest impact across the system. At the same time, it can highlight where coordinated changes across multiple components may be necessary to tackle a challenge effectively.

Given these advantages, systems thinking forms an important part of design thinking and is increasingly integrated into behavioural research to account for complexity. In BASIN, we use various simple behavioural system maps to help us define the research problems, make sense of data, identify leverage points and select potential interventions to develop.

How critical social sciences can help

We believe that systems and design thinking can also help to bridge behavioural research with critical social sciences, which are concerned with understanding and challenging social conditions that foster structural inequalities and oppression. Such bridging has been rare and contested by many social scientists who see these approaches as incompatible. One reason, as explained earlier, is the association of behaviour change with a narrow, paternalistic and mechanistic view of change focused on individual behaviours (see e.g. Hunter-Pazzara, 2024). In contrast, many social science traditions see change as non-linear – deeply embedded in dynamic relations and subjective interpretations – with factors so tightly interwoven as to make distinguishing discrete 'causes' and 'effects' meaningless. Thus, they do not see systemic problems as neatly 'solvable' and instead advocate engaging with this complexity through participatory, deliberative and reflexive practices aimed at shifting shared meanings, practices and broader structures.
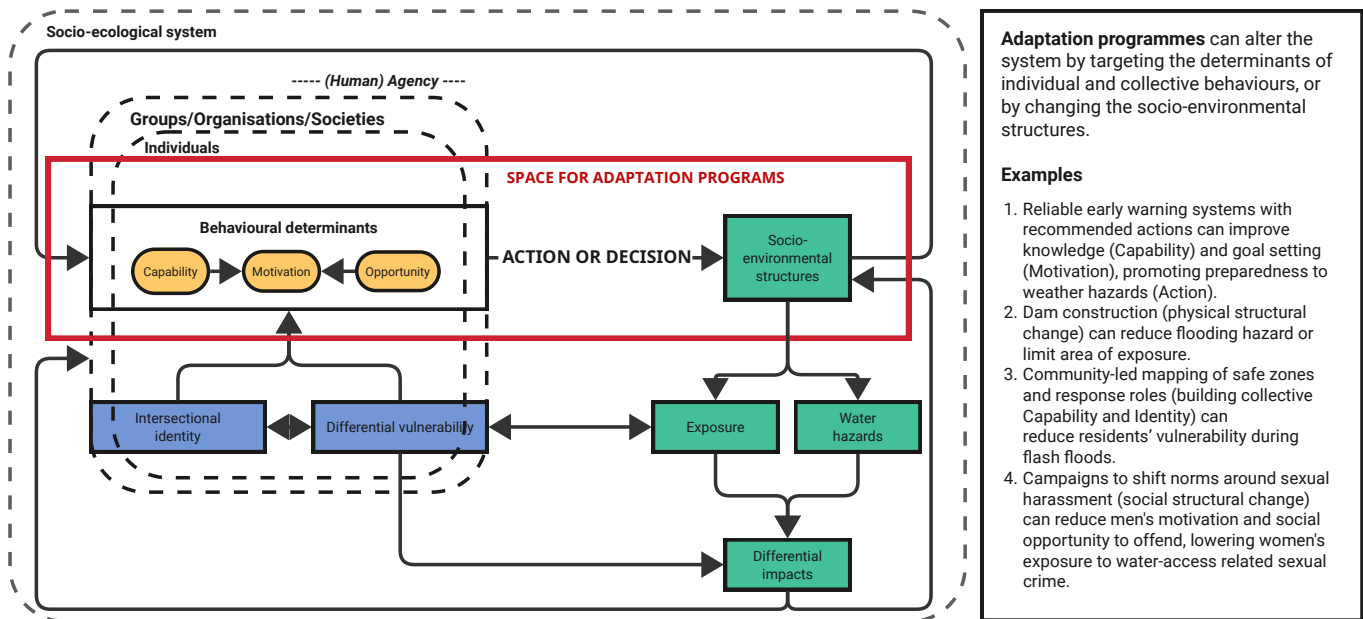
Despite these controversies, we believe that bridging critical social sciences and behavioural research is precisely what is necessary for effective behavioural applications to wicked problems. Here, the flexibility of design and systems thinking makes them well suited to integrating different disciplinary views and perspectives.

In BASIN, our strategy rests on integrating behavioural research with other fields – particularly political economy – along with design and systems thinking. This approach aims to produce a deep understanding of the specific contexts in which behaviours occur, their psychological determinants and the broader social and environmental structural factors at play. These include infrastructure and resource availability, but also historically rooted power dynamics, cultural norms, technology or formal and informal institutions. To support this, we created a framework conceptualising the role of human behaviour in the larger water security–climate complex, as shown in Figure 2.

Our framework draws on water security studies and political economy perspectives on intersectional vulnerability – recognising how multiple interacting factors such as gender, education or economic status influence vulnerability (Gannon et al., 2022). It posits that the external socio-environmental structures shape individuals, groups and societies, including their identities, vulnerabilities and behavioural determinants (Michie et al., 2011). These determinants shape individual and – as we argue – collective actions. The actions, in turn, transform socio-environmental structures and

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Figure 2. The BASIN conceptual framework: behaviour and adaptation in water security systems

Adaptation programmes can alter the system by targeting the determinants of individual and collective behaviours, or by changing the socio-environmental structures.

Examples

1. Reliable early warning systems with recommended actions can improve knowledge (Capability) and goal setting (Motivation), promoting preparedness to weather hazards (Action).
2. Dam construction (physical structural change) can reduce flooding hazard or limit area of exposure.
3. Community-led mapping of safe zones and response roles (building collective Capability and Identity) can reduce residents' vulnerability during flash floods.
4. Campaigns to shift norms around sexual harassment (social structural change) can reduce men's motivation and social opportunity to offend, lowering women's exposure to water-access related sexual crime.

affect water-related hazards, exposure and impacts (IPCC, 2014), which then feedback to influence people and the external structures.

In contrast to many behaviour change models, our framework highlights how adaptation programs can influence water security actions and risks either directly – by targeting behavioural determinants – or indirectly, by targeting socio-environmental structures. It also defines a broad scope for behavioural research to contribute to inclusive water security and climate adaptation – specifically at the intersection of behavioural and psychological factors and the components and flows outlined in the framework. It will guide our BASIN research in asking critical questions throughout project development, maintaining focus on various desired outcomes, with equality as a chief concern among them.

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