



Nudges for people who think

Aba Szollosi^{1,2,3} · Nathan Wang-Ly¹ · Ben R. Newell^{1,2}

Accepted: 2 November 2024 / Published online: 3 January 2025
© The Psychonomic Society, Inc. 2024

Abstract

The naiveté of the dominant ‘cognitive-miser’ metaphor of human thinking hampers theoretical progress in understanding how and why subtle behavioural interventions—‘nudges’—could work. We propose a reconceptualization that places the balance in agency between, and the alignment of representations held by, people and choice architects as central to determining the prospect of observing behaviour change. We argue that two aspects of representational (mis)alignment are relevant: cognitive (how people construe the factual structure of a decision environment) and motivational (the importance of a choice to an individual). Nudging thinkers via the alignment of representations provides a framework that offers theoretical and practical advances and avoids disparaging people’s cognitive capacities.

Keywords Behaviour change · Choice architecture · Cognitive miser · Decision-making · Nudge · Representation alignment

It is now commonplace to hear that addressing the grand challenges of today’s society requires substantial changes in behaviour. Such calls come not only from the academy (e.g., Bergquist et al., 2023; Van Bavel et al., 2020) but also from politicians (e.g., President Obama’s executive order encouraging the use of behavioural science¹), regulators (e.g., the Australian Securities and Investment Commission highlighting the importance of behavioural science for policy²), and the United Nations (e.g., the UN Secretary General’s guidance note on Behavioural Science³). These calls to arms place psychological and behavioural science at the forefront of understanding how such widespread change can be achieved. Answering the call has led many researchers to make bold claims for the potential of simple techniques that facilitate positive behaviour change without impinging on people’s freedom of choice (Thaler & Sunstein, 2009).

Aba Szollosi and Ben R. Newell contributed equally.

✉ Aba Szollosi
aba.szollosi@unsw.edu.au

✉ Ben R. Newell
ben.newell@unsw.edu.au

¹ School of Psychology, UNSW Sydney, Sydney, Australia

² UNSW Institute for Climate Risk & Response, Sydney, Australia

³ Department of Decision Sciences, Corvinus University of Budapest, Budapest, Hungary

These techniques, collectively and colloquially known as ‘nudges’ capitalize on promoting ‘desirable’ options by making changes to the choice architectures (physical, social, and psychological) in which decisions are made.

Discussions about the effectiveness of nudges are receiving increasingly widespread coverage (Chater & Loewenstein, 2023; Hallsworth, 2022; Maier et al., 2024; Simmons et al., 2022). Such debate is welcome and necessary given the importance of the challenges we must address and the potential for the low-cost, quick-win policy instruments that nudges seemingly represent. However, much of this recent debate has centred on questions about ‘what works and when does it work’ at the expense of questions about *how* and *why* (e.g., Osman et al., 2020; Szaszi et al., 2018). Such focus is understandable; a government that wants rapidly to encourage people to wear masks or stay at home may not care all that much about why a particular nudge works, it just wants to know that it will work, and quickly.

In the long run, however, this approach is self-defeating: If we do not understand why a technique works and then it stops working, we are unlikely to know how to make it work again. Without a deeper understanding, we cannot know how long a particular nudge will work—or if it would

¹ <https://obamawhitehouse.archives.gov/the-press-office/2015/09/15/executive-order-using-behavioral-science-insights-better-serve-american>

² <https://asic.gov.au/about-asic/news-centre/speeches/asic-and-behavioural-economics-regulating-for-real-people/>

³ <https://www.un.org/en/content/behaviouralscience/>

work at all in a novel situation (i.e., that is not the unique one it was originally observed in). Offering these techniques to governments without such an understanding may even undermine the credibility of behavioural scientists. Despite a general sense that there is something called “nudge theory” (e.g., Cai, 2020; Schmidtke & Vlaev, 2020), the promise of such a theory seems like a mirage given the assortment of often loosely defined and tangentially related intervention techniques in the choice architect’s toolbox (see for example the MINDSPACE map in Annex 1 of Dolan et al., 2010). Attempts to overcome this chaotic state of affairs are often responses to practical considerations and so focus on providing organizing principles—such as taxonomies (Michie et al., 2011) or meta-analyses (Mertens et al., 2022). While these are helpful tools for practitioners, they can lead to a “throw everything at the wall and see what sticks” approach to testing nudges, thereby offering little in terms of coherent explanations for why and when nudges work and substantially constraining how general our understanding of them can become.⁴

To overcome this limited approach, here we offer a simple unified theoretical perspective of how and why nudges could work. Central to this perspective is challenging the cognitive miser metaphor that pervades the theorizing about nudging—that people are lazy, capacity-limited, and largely unaware of the reasons underlying their behaviour. This metaphor invites a passive-actor framing, but it is oversimplified and unjustified. In order to advance our understanding of how and why nudges work, we need to take more seriously the idea that people are *thinkers*—active agents in determining their behaviour and not passive recipients unthinkingly swayed by subtle changes in the environment.

We build our case by (1) reviewing the deficiencies in the cognitive miser metaphor in nudge research, (2) arguing that methods currently promoted in the field (such as meta-analyses) cannot overcome these shortcomings, and (3) presenting a novel theoretical framework that can overcome the limitations of the prevailing approach, but that also reveals strong boundaries on when we can expect nudges to work. We conclude with a discussion of the practical consequences of this framework for future research on behavioural interventions.

Deficiencies in the cognitive miser metaphor

The theoretical foundations of nudges are derived from two stylized ideas about human thinking. The first is that all else equal, we tend to avoid mental effort. Thinking is costly and

thus aversive and so if we can conserve our mental resources we will (Kahneman, 2011). The second is the idea that mental processes can be dichotomized and compartmentalised into different boxes that house styles of thinking that in some way align or coalesce (Evans & Stanovich, 2013). There are as many versions of this idea as there are papers written about it, but broadly speaking one box, ‘System 1’, captures automatic thinking that tends to be fast, associative, and operate independently of working memory. The other box, ‘System 2’, is the slower, deliberative system that relies on rules, is capacity limited, and is cognitively effortful.

The combination of these two ideas—that effortful thinking is aversive, but that we have a system that can think automatically—leads to the seductive notion that people’s behaviour can be influenced via interventions that operate on System 1, while bypassing System 2 altogether. If done successfully such interventions offer the promise of achieving what is often perceived as effortful behaviour change via an effortless channel. For example, rather than exhorting people to eat low-fat foods via information campaigns, just place those foods in more convenient places in supermarkets or canteens, where they are more likely to be ‘unthinkingly’ chosen.

Despite claims that dual-system dichotomies should only be considered metaphors, or devices to help organise thinking about thinking (Chater, 2018), the general framework and its combination with the notion of humans as cognitive misers has become widely adopted in the nudge literature (see related criticisms in Hertwig & Grüne-Yanoff, 2017; Mols et al., 2015). The idea that we need to influence the unthinking ‘lazy’ part of our cognitive apparatus in order to achieve change has garnered proponents from the World Bank Group (2015) to the National Academies of Sciences, Engineering, and Medicine (2015) as well as countless consultancies promoting their tools for capitalizing on the powers of automatic thinking.

There are several reasons to be sceptical about this characterization of human thinking as helpful for informing nudge techniques. The claim that mental effort is aversive is partly countered by evidence of engagement in cognitive activities that require apparently costly thinking. From solving the daily Wordle, to completing crosswords, Sudokus, and playing computer and strategy games like chess, it is clear that at least some of the time some people like to think and challenge their mental capacity (Embrey et al., 2023; Inzlicht et al., 2018; Thomson & Oppenheimer, 2022). The discrepancy between avoiding and seeking mental effort presumably arises because the goals or motivation for pursuing effortful activities can differ both within individuals (e.g., across time or tasks) and between individuals (e.g., Embrey et al., 2024). This heterogeneity suggests that the current approach to nudging predicated on the blanket assumption that people will generally choose to avoid effort is likely to

⁴ See <https://www.jasoncollins.blog/posts/megastudy-scepticism> for an interesting discussion of this issue.

be insufficient. Just as there is heterogeneity in preference for effort so there will be heterogeneity in the fit between people and techniques designed to prompt engagement or circumvent thinking (Bryan et al., 2021).

The evidence for the breadth of behaviours that can be influenced in the absence of awareness is on similarly shaky foundations. Much of subtle behaviour change-intervention is predicated on the questionable notion that we are often unaware of the reasons why we behave as we do. This view, frequently attributed to the seminal work of Nisbett and Wilson (1977), has led to the proliferation of claims about the power that subtle environmental cues can have on a range of behaviours (Bargh, 2017). While many of the studies on which these claims are based remain prominent in practitioners' handbooks and recommendations (e.g., the 'P' in the MINDSPACE acronym mentioned above stands for *priming*; Dolan et al., 2010), the academic literature is now much more sanguine about the reliability and relevance of this literature (Newell & Shanks, 2014, 2023; Ritchie, 2020). In large part this shift in opinion has been driven by failures to replicate studies that purported to find evidence for unconscious influences on our behaviour (e.g., O'Donnell et al., 2018; Shanks et al., 2013, 2015). At the very least, these studies raise flags about the importance of factors outside of our awareness influencing the higher-level cognitive activities of the kind usually targeted by nudges.

The major concern then is that the current theoretical underpinnings of nudges are based on literatures that are at worst outdated and irrelevant and at best admitting of much more nuanced interpretations. Our contention is that this misguided application of the cognitive-miser metaphor in attempting to understand 'why nudges work' has dominated—and paralysed—the current behavioural intervention approach. The main reason for this paralysis is that the way the metaphor has been applied is too vague and flexible and thus offers little in the way of clear predictions about when or why a technique might work.⁵

In order to overcome the 'do they/don't they work' question, we propose an alternative framework to understand how nudges *could* work in a world where people are active agents in determining their behaviour and not passive unthinking recipients of information who are buffeted around within a predetermined choice architecture.⁶

⁵ We stress that our argument should not be taken as necessarily implying that the cognitive miser metaphor, or indeed dual process perspectives more generally are inherently vague and flexible—some such theories do attempt to remedy this issue (see, e.g., Pennycook, 2018). However, our key claim is that the way these general perspectives have been applied in nudge theorizing is overly simplistic (for further discussion on these issues, see Newell et al., 2022; Newell & Shanks, 2023)

⁶ A counter to our claim here might be to argue that defaults, for example, work precisely because they act via an automatic 'unthink-

ing' channel. However, there is clear evidence that people can infer—explicitly—the intentions behind defaults (e.g., McKenzie et al., 2021). Our more general point is that the role of automaticity/unconscious processing in underpinning nudge techniques has been overstated, and that agency should be given broader consideration and appreciation.

The what and when but not the 'why'

Meta-analyses are useful tools for identifying the kinds of nudges that are effective, and the situations in which they are effective, but they shed little light on the reasons why techniques fail or succeed. For example, a meta-analysis by Jachimowicz and colleagues (2019) compared default nudges—where one option is preselected for people—across consumer choice, environmental, and health domains. They found that defaults have larger effects in consumer choice contexts than environmental contexts and stated that "we can only speculate about why this occurs. . . . Perhaps consumer preferences are less strongly held than preferences in other domains and environmental preferences more strongly" (p.176). This conclusion suggests that the domain of the default nudge is not really the important factor in its efficacy, but rather some other dimension (in this case, strength of preference) that offers greater explanatory power.

A similar conclusion can be drawn from a recent large scale meta-analysis of choice architecture interventions. Mertens and colleagues (2022) analyzed data from over 200 studies across a range of intervention techniques and domains concluding that overall, interventions promote behaviour change with a small to medium effect size (Cohen's $d = 0.45$). Following Münscher et al. (2016), they categorized techniques as targeting *decision information*, *decision assistance*, and *decision structure*. A key finding of the meta-analysis was that *structure* interventions, those which aim to make it simpler to choose 'better' options via the setting of defaults or removal of 'frictions', were more consistently effective at promoting behaviour-change than the *information* or *assistance* techniques. Mertens and colleagues speculate that the higher effectiveness of the decision-structure interventions may be due both to the lower demand on information processing of the structure relative to the information and assistance techniques and the fact that they are less likely to engage people in deliberative assessment of the goals and values relevant for a particular decision. To illustrate this last point, the authors suggest that nutritional labels—a popular decision information

Footnote 6 (continued)

ing' channel. However, there is clear evidence that people can infer—explicitly—the intentions behind defaults (e.g., McKenzie et al., 2021). Our more general point is that the role of automaticity/unconscious processing in underpinning nudge techniques has been overstated, and that agency should be given broader consideration and appreciation.

technique—are more effective for consumers who are already concerned about their health than those who are not. In essence, Mertens et al., argue that *information* and *assistance* techniques are likely to be more susceptible to the heterogeneity in values and goals that might be triggered when people are confronted with such interventions, thereby potentially weakening their overall effectiveness in the general population.

This conclusion is important, albeit still constrained by the desire to compartmentalize interventions into automatic or deliberative boxes. Its importance lies in highlighting an underappreciated aspect of *why* different techniques might work—namely, the degree to which any attempt to change behaviour can be construed as a social interaction between the person who is attempting to invoke that change (the choice architect) and the person whose behaviour is being targeted (de Ridder et al., 2022; Krijnen et al., 2017; McKenzie et al., 2018; Sher et al., 2022).

But a meta-analytic approach can get us only so far in the pursuit of understanding why this interaction is important. This is partly because meta-analyses are limited by the quality of their inputs; failure to include studies that do not see the light of day because they did not ‘work’ (a publication bias) can lead to overestimates of the effectiveness of nudges. Indeed, critics argue that when statistically controlling for this problem, the purported effects found in the meta-analysis (Mertens et al., 2022) fully disappear or are at least substantially reduced (Maier et al., 2022; Szaszi et al., 2022). Such statistical debates notwithstanding, meta-analyses cannot reveal the reasons why different techniques might flourish or fail, because they only offer us a snapshot of what worked at some point in the (recent) past—thus limiting their ability to contribute to the “nudge theory” problem. To advance our understanding, we need to build theories that incorporate values, goals, and preferences and move away from the effort-avoiding, automaton passive-actor framing.

Cognitive misers versus active thinkers: Tipping the balance of agency

Nudge research has relied on the cognitive miser metaphor for a theoretical foundation, according to which systematic cognitive biases—a set of behaviours deviating from what researchers expect as optimal—arise due to people’s purported tendency for mental laziness (e.g., Kahneman, 2011; Thaler & Sunstein, 2009). Nudges supposedly exploit these biases, which serve as effortless System 1 pathways effecting effortful behaviour change. Although relying on this framework may be intuitively appealing as people’s phenomenological experiences often map onto the vague labels of the metaphor, the many shortcomings that we have reviewed

previously naturally raise the question of whether a better alternative exists.

Here we outline and argue in favour of such an alternative, which frames people as active thinkers whose aim is to understand their environments increasingly better in order to make better decisions (Szollosi & Newell, 2020). Under this view, people deviate from researchers’ expectations not because they are predisposed to be biased, but because their respective representations of the choice environment are misaligned—they do not construe the choice that they are facing similarly. A crucial difference from the prevailing view is that these misalignments (mistakes or biases) can be corrected: Representations can become better aligned through processes that we argue are responsible for the effects of existing nudges and that can be built on when designing future ones.

The reason as to why mistakes may appear pervasive and incorrigible⁷ is that they build representations in a substantial part from background knowledge that is stable over longer timeframes (e.g., common-sense cultural knowledge, material taught in schools). As such, the mistakes that they lead to can be similar across people and over extended time periods, which can give the appearance of pervasiveness if measured in sufficiently quick succession. However, just because a representation only changes over longer timeframes does not mean that it should be considered as an unchangeable feature of people’s decision-making processes (Szollosi et al., 2023).

Misaligned representations

To develop our perspective, we propose two types of representational (mis)alignment: cognitive and motivational. These map onto the idea that people can either construe the factual structure of a decision environment differently (cognitive) or they can think differently about the importance of a particular choice (motivational). From a cognitive standpoint, when people make mistakes on tasks often held up as examples of the biased nature of people’s cognition (Tversky & Kahneman, 1974) these mistakes could occur because participants construe the task differently from the experimenter—for instance, due to not having the requisite understanding of probabilistic principles (Koehler, 1996), or because they rely on other task-relevant information that the experimenter failed to consider (Sher & McKenzie, 2006). From the motivational standpoint, the mistakes could simply be a result of participants not finding the task particularly interesting or worthy to engage with at a more substantial level than responding randomly or superficially

⁷ See, for example: <https://www.theguardian.com/books/2015/jul/18/daniel-kahneman-books-interview>

(cf. Krefeld-Schwalb et al., 2024). Note that this is not a general tendency to be lazy, but an active inferential process about what they find interesting, and whether solving the task properly fits within their goals—some people may find it interesting to solve these tasks well.

These two ways in which representations can be misaligned are important for nudge research, as together they provide a more unified way to understand how interventions can work and points to a more robust framework for building them. Notably, this framing eschews many of the problems stemming from the cognitive miser metaphor: people are not predisposed to be cognitively lazy (although they can be when they are unmotivated) and biased (although they can make correctable mistakes). This is an improvement in the sense that it replaces the blanket assumptions of laziness and bias (which only specify tendencies) with the more concrete psychological concepts of motivation and understanding (which explain more clearly when we should expect more or less engagement and why). Another advantage is that this way, people's behaviour can be changed not by exploiting their biases, but through methods that treat them as actors with high agency.

These ideas dovetail with recent suggestions that we should consider people's agency when their behaviour is aimed to be changed, instead of assuming that they are merely being passively influenced by the choice architect (e.g., Banerjee et al., 2024; de Ridder et al., 2022; Hertwig & Grüne-Yanoff, 2017; Krijnen et al., 2017; Madsen et al., 2024; McKenzie et al., 2018; Sher et al., 2022). One example of this is the PreDICT framework (Krijnen et al., 2017) that holds that nudging is at least in part a social sensemaking endeavour in which the person's choice is the result of their (implicit) communication with the choice architect. Another is the boosting approach (Hertwig & Grüne-Yanoff, 2017) that aims to help people exercise their own agency by strengthening their existing competences or building new ones via simple interventions. Our approach builds on the same underlying idea and extends it by providing a unifying explanation for why the success of any attempt at behaviour change depends on the representations in both the choice architect and the decision-maker—and more specifically, by the *active steps* taken by both of them to bring these representations into alignment.

Our approach overlaps to some extent with taxonomical models of behaviour change (e.g., Duckworth et al., 2018; Michie et al., 2005, 2011) that identify similar factors as essential precursors for behaviour change. While these models are useful orientational tools for basic and applied research alike, the present approach complements these frameworks by providing an explanation as to how these psychological factors work and how they can lead to behaviour change. As we argued above, such an understanding is vital for us to understand why and when nudges might work

or might stop working—an understanding that taxonomical approaches cannot (and do not purport to) provide. We contend that an increased focus on representational alignment can offer fertile ground for further theoretical development.

Nudging thinkers by aligning representations

The active thinker framing of the researcher–participant relationship readily applies to the choice-architect–decision-maker relationship as well. Specifically, when the default behaviour of a decision-maker is considered suboptimal by the choice architect, it can be the result of the decision-maker's different factual understandings of the decision environment, their motivation to achieve different goals in that environment, or a mixture of both. What needs to happen for behaviour change to occur is for the relevant aspects of the representation to become better aligned between the architect and the decision-maker—a process that can occur via a range of different pathways.

Although representational alignment develops primarily through relatively slow and effortful means such as education and the broader cultural transmission of knowledge, there are simpler, low-cost pathways through which nudges can increase it albeit by a much more limited extent. Such interventions can influence behaviour through three main pathways (illustrated on Fig. 1): (a) they can work by serving as *reminders* of behavioural goals that the decision-maker already had but momentarily forgot about; (b) they can work through the *persuasion* of the decision-maker that the recommended behaviour is beneficial for them; and (c) they can work by *implying threat* to the decision-maker if they do not follow the recommendations of the choice architect.

A choice architect can use any nudge to influence the decision-maker's behaviour when their representations are highly aligned, both at the cognitive and motivational levels (green region on Fig. 1). As the most likely source of unaligned behaviour under such conditions is that inattention temporarily misaligned representations, any nudge can remind the decision-maker of their previously set goals. The domain of healthy food choice provides good examples (e.g., Bucher et al., 2016). In this case, we can expect nudges to work when the decision-maker agrees with the choice architect on what a healthy choice is and wants to generally eat healthy, but temporarily forgets about this (perhaps not strongly formed) goal. From this perspective we can also derive the expectation that such a nudge will not work when representations are misaligned either cognitively or motivationally. For example, if the decision-maker does not share the representation of what constitutes healthy or unhealthy food, or what effects the consumption of those foods might have on their health, we should not expect this type of nudge to influence their behaviour. Similarly, independent from whether they share the representation at the

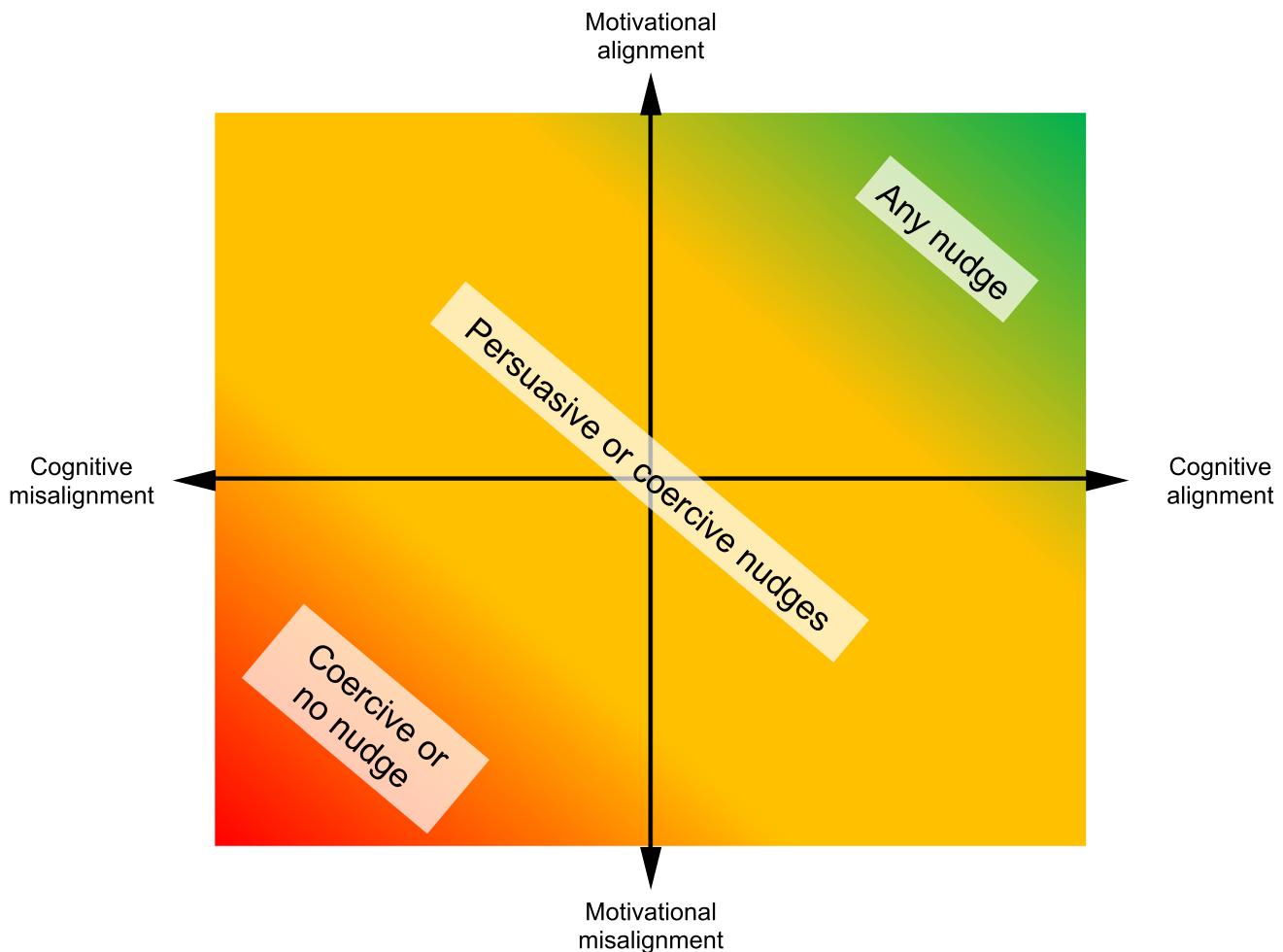


Fig. 1 Illustrative classification of the types of nudges that can be expected to work under varying degrees of representational alignment. (Colour figure online)

cognitive level, we should also not expect nudges to work when the decision-maker does not think that healthy eating behaviour is important or is a desirable goal.

In these latter cases, when representational alignment is somewhat lower (orange region on Fig. 1), a way in which nudges can still work is by persuading the decision-maker. Examples of this include employer recommendations for pension schemes or health insurance providers (Benartzi et al., 2017). These nudges can work through increasing either cognitive or motivational alignment. For example, cognitively, they can make the decision-maker recognise and address a mistaken or neglected aspect of their representation (e.g., by trusting that the choice architect making the recommendation had their best interest in mind when they did not have time to evaluate every option—or, when there is no trust or when the stakes are high, by prompting a more detailed evaluation of the options). Motivationally, such nudges can make people recognise the importance of a problem that they previously may not have considered a

problem (e.g., by making younger people aware of the existence and importance of pension schemes).

When the level of representational alignment is low (red region on Fig. 1)—because the decision-maker strongly disagrees on facts, importance, or both—only nudges that imply threat can work. For example, sending personalised letters about unpaid taxes (e.g., Hallsworth et al., 2017) can imply an immediate threat of legal action (compared with when those letters are more generically phrased). In other cases, when the nudge cannot be interpreted as a threat and representational content is not shared, the nudge will fail to work. For example, most food choice nudges cannot evoke a threatening interpretation and as such will not overcome such strong misalignment of representations when they exist.

The limits of nudges

Understanding how nudges work through representational alignment also illuminates the limits of what they can be

expected to achieve. Specifically, it identifies the limits of nudges as people's actual understanding of and/or goals within their environments. Although these might sound self-evident or trivial concerns, as representational content and motivation is determined by a multitude of factors (e.g., cultural knowledge, people's own knowledge and experiences, situational elements) the space of shared representational content between choice architects and decision-makers quickly diminishes with increasing representation variability. This is particularly relevant for representations about contentious or personally important issues that nudges are often aimed at (e.g., health, financial, environmental behaviours), because they can and do vary greatly across people both at cognitive and motivational levels.

Another limit this view highlights is for meta-analytic (Mertens et al., 2022) and large-scale experimental (Milkmann et al., 2021) methods in nudge research, as foreshadowed earlier. This is because these methods can only show a snapshot of how effectively a nudge *currently* works, but when the representations that underlie the behaviour change, the nudge might stop working generally. Note that this criticism holds irrespective of how well-conducted the meta-analysis was (cf. Maier et al., 2022; Szaszi et al., 2022). For example, imagine that using the currently available best meta-analytic technique we estimate that a specific nudge

has a reliably medium effect size on healthy food choice. In what sense should we expect this nudge to work generally? People a couple hundred years ago would have found such nudges meaningless, as their representation of their choice environment primarily centred around finding and consuming any available food. People a couple hundred years from now might represent their environment differently for other reasons: Perhaps new research will have identified other types of food as healthy and unhealthy, or perhaps medicine will have advanced to a degree where diseases resulting from unhealthy food can be cured with ease.

These somewhat outlandish examples illustrate the transient nature of people's representations well, and—more relevant for practitioners aiming to change current-day behaviour—it is not hard to think of representations that have changed on much shorter time frames (e.g., the rapidly changing views on the benefits of mask use, lockdowns, or vaccinations during the COVID-19 pandemic; cf. Madsen et al., 2024). In none of these cases should we expect the nudge to have the same effect it once produced in a mega-study or meta-analysis under the different respective representations. Instead, under the view we outlined, the results of mega-studies and meta-analyses can only be taken into consideration after the possibility of representational

Table 1 Hypothetical examples of representational misalignment across popular domains of nudging

		Domain			
			Financial behaviour	Health behaviour	Climate behaviour
Cognitive factors	CA's representation	People don't save enough for retirement.	Fatty foods lead to negative health outcomes.	Reducing carbon emissions mitigates climate change.	
	DM's representation	"I've already saved enough." "I've got other assets, so I don't need to save more." "I don't know what options I have to save for retirement." "I don't know what the best choice is to save for retirement."	"Fatty foods are healthy to eat." "What counts as 'fatty food'?" "I don't trust dieticians." "People can't really know what foods are unhealthy to eat."	"Recycling is really important for reducing emissions." "There are things other than emission reduction that we can do to mitigate climate change." "Climate change is not real." "People like it a little warmer anyway."	
Motivational factors	CA's representation	People should save enough to support them through retirement.	People should avoid fatty foods at all costs.	People should make sacrifices to achieve a lower carbon footprint.	
	DM's representation	"People should work even when they're older." "I should enjoy life while I can." "It isn't important to keep up my lifestyle once I retire." "I really want to buy this expensive watch."	"People shouldn't focus only on health." "I should enjoy life while I can." "It's not important to me to be healthy." "I really want to have dessert."	"Individual actions are less important than structural change." "I worked hard to be able to go on holiday overseas." "People's quality of life shouldn't decrease as a result of mitigating climate change." "Driving a big car gives me pleasure."	

Note. CA = choice architect; DM = decision-maker

misalignment is accounted for (e.g., by monitoring representational change over time, or documenting current differences between cultures).

Practical consequences for future research

Our theoretical reassessment of how and why nudges can be expected to work has far-reaching practical relevance for future nudge research and potentially even for broader behaviour change research. There are two main ways in which we can deploy this theory in practice: (1) assessing representational alignment and (2) developing nudges based on that assessment. By improving the fit between the choice architect's and the decision-maker's representation, both of these steps can aid in developing better interventions. Table 1 shows examples of the first step of this process: identifying the representational misalignment of the choice architect and the decision-maker in popular domains of nudging. We expand on one of these examples—the example about financial decisions—below to illustrate how considering the extent of representational alignment can help derive expectations about when and what kind of nudges could work best.

Assessing the extent of the target population's representational misalignment can serve as a useful starting point. This could proceed through asking a sample of people we aim to nudge about both the cognitive and motivational aspects of their representation (e.g., via a survey and/or relatively unstructured interviews, but in some cases, we can infer important dimensions on a theoretical basis), with the aim of identifying whether they share the underlying representation of the decision problem and how important they consider the choice.

For pension decisions, we may identify as the most relevant cognitive dimensions for people's decisions whether people understand how pension funds work and how feasible it would be for them to make contributions. That is, decision-makers might have a clear understanding of the various funds and schemes they could contribute to or they might not—and similarly they may or may not think that they have sufficient income to make contributions. Note that the idea that they have a decent understanding of options and the means to contribute (i.e., that their representation of the factual side of the problem is the same as the choice architect's) is often implicit in how nudges are currently developed.

On the motivational side, personal importance of retirement saving and the reasons underpinning that goal might be important dimensions. For example, some of the people who do not share this goal with the choice architect may not want to save because they have not thought about it in detail, while others may think it is too far in the future and they can start later, or have a different conception about how much

is 'enough' for retirement (see Table 1; Goldin et al., 2020). Note, again, that the assumption that the decision-maker's goal is in alignment with the architect's goal is often implicit in current nudge development.

With the extent of representational alignment assessed, we can now start selecting particular nudges to use. From our earlier discussion we know that the more the representations align the more we can expect nudges to work. For people with highly aligned representations—those who understand how pensions work, have the means, and want to contribute—any type of nudge would work, since if they are not already contributing it is presumably due to inattention. For people misaligned in their factual understanding—for example, if they do not have the relevant information—persuasive nudges might work. For example, employer ranking of various pension fund options could help people gather more information for their choice. People misaligned on other dimensions—people who do not have the means or specifically do not want to contribute—likely cannot be influenced through nudges unless they have coercive implications (such as government mandated enrolment). The other examples in Table 1, relating to health and climate-related behaviours show how misalignments in those domains can lead to nudge failures. For instance, if one believes that recycling is a primary contributor to reducing carbon emissions—a common factual misconception (Wynes et al., 2020)—then behavioural efforts to mitigate will be misplaced.

There are several possible extensions of this method. One relatively easy idea is to transfer the knowledge gained from developing nudges for a target population this way to another population by using clustering-based methods (e.g., Deetlefs et al., 2019). For instance, we can identify and measure the frequency of various representational clusters in our initial population and how well our various nudges worked for each of them. This can help estimate how effective the nudge might be in another population after only measuring the representational base rates. Another extension could be to individually develop nudges for people who are not aligned. Although the more generic nudges considered above might work for most of them, people often have immensely variable reasons for diverging from the understanding of the choice architect. While this extension can make the method more costly, increasing the resolution of understanding regarding these individual reasons could also increase the efficacy of the nudges (cf. Bryan et al., 2021; Osman et al., 2020). Lastly, misalignment can also be the result of the choice architect's inaccurate representation of the problem situation (cf. Hallsworth, 2023). As such, they should keep in mind that they might learn something new from the people they are attempting to nudge and consider the use of methods that enable them to recognise if their understanding of the decision environment is mistaken.

Conclusion

Developing nudges through the lens of representational alignment can help with anticipating what kind of nudges could work and for whom, and when and why they might not work or stop working. This is in stark contrast with prevalent approaches which often overlook, or simply assume a high representational alignment, and thus tend to explain discrepancies away by disparaging people's cognitive capacities. An increased focus on balancing the agency between people and choice architects—an acknowledgement that people think—may bring us closer to achieving both theoretical and practical progress.

Acknowledgments We thank Adrian Camilleri and Omid Ghasemi for illuminating discussions and comments on an earlier version of this paper.

Funding The support of the Australian Research Council (DP190101076; DP190101675) is gratefully acknowledged.

Availability of data, code, and materials Not applicable.

Declarations

Conflicts of interests The authors declare none.

Ethics approval Not applicable.

Consent to participate Not applicable.

Consent for publication Not applicable.

References

- Banerjee, S., Grüne-Yanoff, T., John, P., & Moseley, A. (2024). It's time we put agency into Behavioural Public Policy. *Behavioural Public Policy*. <https://doi.org/10.1017/bpp.2024.6>
- Bargh, J. (2017). *Before you know it: The unconscious reasons we do what we do*. Simon & Schuster.
- Van Bavel, J. J., Baicker, K., Boggio, P. S., Capraro, V., Cichocka, A., Cikara, M., ..., & Willer, R. (2020). Using social and behavioural science to support COVID-19 pandemic response. *Nature Human Behaviour*, 4(5), 460–471. <https://doi.org/10.1038/s41562-020-0884-z>
- Benartzi, S., Beshears, J., Milkman, K. L., Sunstein, C. R., Thaler, R. H., Shankar, M., ..., & Galing, S. (2017). Should governments invest more in nudging? *Psychological Science*, 28(8), 1041–1055. <https://doi.org/10.1177/0956797617702501>
- Bergquist, M., Thiel, M., Goldberg, M. H., & van der Linden, S. (2023). Field interventions for climate change mitigation behaviors: A second-order meta-analysis. *Proceedings of the National Academy of Sciences*, 120(13), e2214851120. <https://doi.org/10.1073/pnas.2214851120>
- Bryan, C. J., Tipton, E., & Yeager, D. S. (2021). Behavioural science is unlikely to change the world without a heterogeneity revolution. *Nature Human Behaviour*, 5(8), 980–989. <https://doi.org/10.1038/s41562-021-01143-3>
- Bucher, T., Collins, C., Rollo, M. E., McCaffrey, T. A., De Vlieger, N., Van der Bend, D., ..., & Perez-Cueto, F. J. (2016). Nudging consumers towards healthier choices: A systematic review of positional influences on food choice. *British Journal of Nutrition*, 115(12), 2252–2263. <https://doi.org/10.1017/S0007114516001653>
- Cai, C. W. (2020). Nudging the financial market? A review of the nudge theory. *Accounting & Finance*, 60(4), 3341–3365. <https://doi.org/10.1111/acfi.12471>
- Chater, N., & Loewenstein, G. (2023). The i-frame and the s-frame: How focusing on individual level solutions has led behavioral public policy astray. *Behavioural & Brain Sciences*, e147. <https://doi.org/10.1017/S0140525X22002023>
- Chater, N. (2018). Is the Type 1/Type 2 distinction important for behavioral policy? *Trends in Cognitive Sciences*, 22(5), 369–371. <https://doi.org/10.1016/j.tics.2018.02.007>
- de Ridder, D., Kroese, F., & van Gestel, L. (2022). Nudgeability: Mapping conditions of susceptibility to nudge influence. *Perspectives on Psychological Science*, 17(2), 346–359. <https://doi.org/10.1177/1745691621995183>
- Deetlefs, J., Bateman, H., Dobrescu, L. I., Newell, B. R., Ortmann, A., & Thorp, S. (2019). Engagement with retirement savings: It's a matter of trust. *Journal of Consumer Affairs*, 53, 917–945. <https://doi.org/10.1111/joca.12208>
- Dolan, P., Hallsworth, M., Halpern, D., King, D., & Vlaev, I. (2010). *MINDSPACE: Influencing behaviour for public policy*. Cabinet Office <http://www.instituteforgovernment.org.uk/sites/default/files/publications/MINDSPACE.pdf>
- Duckworth, A. L., Milkman, K. L., & Laibson, D. (2018). Beyond willpower: Strategies for reducing failures of self-control. *Psychological Science in the Public Interest*, 19(3), 102–129. <https://doi.org/10.1177/1529100618821893>
- Embrey, J. R., Donkin, C., & Newell, B. R. (2023). Is all mental effort equal? The role of cognitive demand-type on effort avoidance. *Cognition*, 236, 105440. <https://doi.org/10.1016/j.cognition.2023.105440>
- Embrey, J. R., Mason, A., & Newell, B. R. (2024). Too hard, too easy, or just right? The effects of context on effort and boredom aversion. *Psychonomic Bulletin & Review*. <https://doi.org/10.3758/s13423-024-02528-x>
- Evans, J. St. B. T., & Stanovich, K. E. (2013). Dual-process theories of higher cognition: Advancing the debate. *Perspectives on Psychological Science*, 8(3), 223–241. <https://doi.org/10.1177/17459162460685>
- Goldin, J., Homonoff, T., Patterson, R., & Skimmyhorn, W. (2020). How much to save? Decision costs and retirement plan participation. *Journal of Public Economics*, 191, 104247. <https://doi.org/10.1016/j.jpubeco.2020.104247>
- Hallsworth, M. (2022). Making sense of the “do nudges work?” Debate. *Behavioral Scientist*. <https://behavioralscientist.org/making-sense-of-the-do-nudges-work-debate/>
- Hallsworth, M. (2023). A manifesto for applying behavioural science. *Nature Human Behaviour*, 7(3), 310–322. <https://doi.org/10.1038/s41562-023-01553-3>
- Hallsworth, M., List, J. A., Metcalfe, R. D., & Vlaev, I. (2017). The behavioralist as tax collector: Using natural field experiments to enhance tax compliance. *Journal of Public Economics*, 148, 14–31. <https://doi.org/10.1016/j.jpubeco.2017.02.003>
- Hertwig, R., & Grüne-Yanoff, T. (2017). Nudging and boosting: Steering or empowering good decisions. *Perspectives on Psychological Science*, 12(6), 973–986. <https://doi.org/10.1177/1745691617702496>
- Inzlicht, M., Shenhar, A., & Olivola, C. Y. (2018). The effort paradox: Effort is both costly and valued. *Trends in Cognitive Sciences*, 22(4), 337–349. <https://doi.org/10.1016/j.tics.2018.01.007>

- Jachimowicz, J. M., Duncan, S., Weber, E. U., & Johnson, E. J. (2019). When and why defaults influence decisions: A meta-analysis of default effects. *Behavioural Public Policy*, 3(2), 159–186. <https://doi.org/10.1017/bpp.2018.43>
- Kahneman, D. (2011). *Thinking, fast and slow*. Farrar, Straus & Giroux.
- Koehler, J. J. (1996). The base rate fallacy reconsidered: Descriptive, normative, and methodological challenges. *Behavioral and Brain Sciences*, 19(1), 1–17. <https://doi.org/10.1017/S0140525X00041157>
- Krefeld-Schwalb, A., Sugerman, E. R., & Johnson, E. J. (2024). Exposing omitted moderators: Explaining why effect sizes differ in the social sciences. *Proceedings of the National Academy of Sciences*, 121(12), e2306281121. <https://doi.org/10.1073/pnas.2306281121>
- Krijnen, J. M., Tannenbaum, D., & Fox, C. R. (2017). Choice architecture 2.0: Behavioral policy as an implicit social interaction. *Behavioral Science & Policy*, 3(2), i–18. <https://doi.org/10.1353/bsp.2017.0010>
- Madsen, J. K., de Wit, L., Ayton, P., Brick, C., de Moliere, L., & Groom, C. J. (2024). Behavioral science should start by assuming people are reasonable. *Trends in Cognitive Sciences*, 28(7), 583–585. <https://doi.org/10.1016/j.tics.2024.04.010>
- Maier, M., Bartoš, F., Raihani, N., Shanks, D. R., Stanley, T. D., Wagenmakers, E. J., & Harris, A. J. (2024). Exploring open science practices in behavioural public policy research. *Royal Society Open Science*, 11(2), 231486. <https://doi.org/10.1098/rsos.231486>
- Maier, M., Bartoš, F., Stanley, T. D., Shanks, D. R., Harris, A. J., & Wagenmakers, E. J. (2022). No evidence for nudging after adjusting for publication bias. *Proceedings of the National Academy of Sciences*, 119(31), e2200300119. <https://doi.org/10.1073/pnas.2200300119>
- McKenzie, C. R., Sher, S., Leong, L. M., & Müller-Trede, J. (2018). Constructed preferences, rationality, and choice architecture. *Review of Behavioral Economics*, 5(3/4), 337–360. <https://doi.org/10.1561/105.00000091>
- McKenzie, C. R., Leong, L. M., & Sher, S. (2021). Default sensitivity in attempts at social influence. *Psychonomic Bulletin & Review*, 28, 695–702. <https://doi.org/10.3758/s13423-020-01834-4>
- Mertens, S., Herberz, M., Hahnel, U. J., & Brosch, T. (2022). The effectiveness of nudging: A meta-analysis of choice architecture interventions across behavioral domains. *Proceedings of the National Academy of Sciences*, 119(1), e2107346118. <https://doi.org/10.1073/pnas.2107346118>
- Michie, S., Johnston, M., Abraham, C., Lawton, R., Parker, D., & Walker, A. (2005). Making psychological theory useful for implementing evidence based practice: A consensus approach. *BMJ Quality & Safety*, 14(1), 26–33. <https://doi.org/10.1136/qshc.2004.011155>
- Michie, S., Van Stralen, M. M., & West, R. (2011). The behaviour change wheel: A new method for characterising and designing behaviour change interventions. *Implementation Science*, 6(1), 1–12. <https://doi.org/10.1186/1748-5908-6-42>
- Milkman, K. L., Gromet, D., Ho, H., Kay, J. S., Lee, T. W., Pandilowski, P.,, & Duckworth, A. L. (2021). Megastudies improve the impact of applied behavioural science. *Nature*, 600(7889), 478–483. <https://doi.org/10.1038/s41586-021-04128-4>
- Mols, F., Haslam, S. A., Jetten, J., & Steffens, N. K. (2015). Why a nudge is not enough: A social identity critique of governance by stealth. *European Journal of Political Research*, 54(1), 81–98. <https://doi.org/10.1111/1475-6765.12073>
- Müncher, R., Vetter, M., & Scheuerle, T. (2016). A review and taxonomy of choice architecture techniques. *Journal of Behavioral Decision Making*, 29(5), 511–524. <https://doi.org/10.1002/bdm.1897>
- National Academies of Sciences, Engineering, and Medicine. (2015). *Improving diagnosis in health care*. The National Academies Press.
- Newell, B. R., & Shanks, D. R. (2014). Unconscious influences on decision making: A critical review. *Behavioral and Brain Sciences*, 37(1), 1–19. <https://doi.org/10.1017/S0140525X12003214>
- Newell, B. R., Lagnado, D. A., & Shanks, D. R. (2022). *Straight choices: The psychology of decision making*. Psychology Press.
- Newell, B. R., & Shanks, D. R. (2023). *Open Minded: Searching for Truth about the Unconscious Mind*. MIT Press.
- Nisbett, R. E., & Wilson, T. D. (1977). Telling more than we can know: Verbal reports on mental processes. *Psychological Review*, 84(3), 231–259. <https://doi.org/10.1037/0033-295X.84.3.231>
- O'Donnell, M., Nelson, L. D., Ackermann, E., Aczel, B., Akhtar, A., Aldrovandi, S., ..., & Zrubka, M. (2018). Registered replication report: Dijksterhuis and van Knippenberg (1998). *Perspectives on Psychological Science*, 13(2), 268–294. <https://doi.org/10.1177/1745691618755704>
- Osman, M., McLachlan, S., Fenton, N., Neil, M., Löfstedt, R., & Meder, B. (2020). Learning from behavioural changes that fail. *Trends in Cognitive Sciences*, 24(12), 969–980. <https://doi.org/10.1016/j.tics.2020.09.009>
- Pennycook, G. (2018). A perspective on the theoretical foundation of dual process models. In W. De Neys (Ed.), *Dual process theory 2.0* (pp. 5–27). Routledge.
- Ritchie, S. (2020). *Science fictions: How fraud, bias, negligence, and hype undermine the search for truth*. Metropolitan Books.
- Schmidtko, K. A., & Vlaev, I. (2020). Nudge theory. In D. Ragin & J. Keenan (Eds.), *Handbook of research methods in health psychology* (pp. 414–427). Routledge.
- Shanks, D. R., Newell, B. R., Lee, E. H., Balakrishnan, D., Ekelund, L., Cenac, Z., ..., & Moore, C. (2013). Priming intelligent behavior: An elusive phenomenon. *PLOS ONE*, 8(4), e56515. <https://doi.org/10.1371/journal.pone.0056515>
- Shanks, D. R., Vadillo, M. A., Riedel, B., Clymo, A., Govind, S., Hickin, N., Tamman, A. J. F., & Puhlmann, L. (2015). Romance, risk, and replication: Can consumer choices and risk-taking be primed by mating motives? *Journal of Experimental Psychology: General*, 144(6), e142–e158. <https://doi.org/10.1037/xge0000116>
- Sher, S., & McKenzie, C. R. (2006). Information leakage from logically equivalent frames. *Cognition*, 101(3), 467–494. <https://doi.org/10.1016/j.cognition.2005.11.001>
- Sher, S., McKenzie, C. R., Müller-Trede, J., & Leong, L. (2022). Rational choice in context. *Current Directions in Psychological Science*, 31(6), 518–525. <https://doi.org/10.1177/09637214221120387>
- Simmons, J., Nelson, L., & Simonsohn, U. (2022). *Meaningless means #1: The average effect of nudging is d = .43*. <http://datacolada.org/105>
- Szaszi, B., Palinkas, A., Palfi, B., Szollosi, A., & Aczel, B. (2018). A systematic scoping review of the choice architecture movement: Toward understanding when and why nudges work. *Journal of Behavioral Decision Making*, 31(3), 355–366. <https://doi.org/10.1002/bdm.2035>
- Szaszi, B., Higney, A., Charlton, A., Gelman, A., Ziano, I., Aczel, B., & Tipton, E. (2022). No reason to expect large and consistent effects of nudge interventions. *Proceedings of the National Academy of Sciences*, 119(31), e2200732119. <https://doi.org/10.1073/pnas.2200732119>
- Szollosi, A., & Newell, B. R. (2020). People as intuitive scientists: Reconsidering statistical explanations of decision making. *Trends in Cognitive Sciences*, 24(12), 1008–1018. <https://doi.org/10.1016/j.tics.2020.09.005>

- Szollosi, A., Donkin, C., & Newell, B. R. (2023). Toward nonprobabilistic explanations of learning and decision-making. *Psychological Review*, 130(2), 546–568. <https://doi.org/10.1037/rev0000355>
- Thaler, R. H., & Sunstein, C. R. (2009). *Nudge: Improving decisions about health, wealth, and happiness*. Penguin.
- Thomson, K. S., & Oppenheimer, D. M. (2022). The “effort elephant” in the room: What is effort, anyway? *Perspectives on Psychological Science*, 17(6), 1633–1652. <https://doi.org/10.1177/17456916211064896>
- Tversky, A., & Kahneman, D. (1974). Judgment under uncertainty: Heuristics and biases: Biases in judgments reveal some heuristics of thinking under uncertainty. *Science*, 185(4157), 1124–1131. <https://doi.org/10.1126/science.185.4157.1124>
- World Bank Group. (2015). *World Development Report 2015: Mind, society, and behavior*. <https://openknowledge.worldbank.org/handle/10986/20597>
- Wynes, S., Zhao, J., & Donner, S. D. (2020). How well do people understand the climate impact of individual actions? *Climatic Change*, 162, 1521–1534. <https://doi.org/10.1007/s10584-020-02811-5>

Publisher's Note Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.

Springer Nature or its licensor (e.g. a society or other partner) holds exclusive rights to this article under a publishing agreement with the author(s) or other rightsholder(s); author self-archiving of the accepted manuscript version of this article is solely governed by the terms of such publishing agreement and applicable law.