



On the development, evaluation and evolution of health behaviour theory

Falko F. Sniehotta, Justin Presseau & Vera Araújo-Soares

To cite this article: Falko F. Sniehotta, Justin Presseau & Vera Araújo-Soares (2015) On the development, evaluation and evolution of health behaviour theory, Health Psychology Review, 9:2, 176-189, DOI: [10.1080/17437199.2015.1022902](https://doi.org/10.1080/17437199.2015.1022902)

To link to this article: <https://doi.org/10.1080/17437199.2015.1022902>



Published online: 06 Jul 2015.



Submit your article to this journal [↗](#)



Article views: 2323



View related articles [↗](#)



View Crossmark data [↗](#)



Citing articles: 6 View citing articles [↗](#)

COMMENTARY

On the development, evaluation and evolution of health behaviour theory

Falko F. Sniehotta*, Justin Presseau and Vera Araújo-Soares

*Fuse, Centre for Translational Research in Public Health and Institute of Health & Society,
Newcastle University, Baddiley-Clark Building, Richardson Road, Newcastle upon Tyne NE2 4AX,
UK*

(Received 1 February 2015; accepted 22 February 2015)

Behavioural science has advanced considerably over the past decade. Recent guidelines and methods for intervention development, reporting and evaluation (Bartholomew, Parcel, Kok, Gottlieb, & Fernández, 2011; Craig et al., 2008; Davidson et al., 2003; Hoffman et al., 2014; Moore et al., 2014) have provided a solid foundation for a more rigorous, replicable science and practice of behaviour change. Guidelines converge in highlighting the importance of a strong theoretical basis for designing and evaluating behavioural interventions, both, to optimise effects and to facilitate an understanding of why interventions do or do not work and in what circumstances. While there is consensus on the importance of theory, it is uncertain to what degree some of the popular theories of behaviour are fit for purpose. Many health behaviour theories have remained unchanged for decades despite limited evidence to date that interventions based on health behaviour theories are any more effective than interventions not based on theory (Prestwich et al., 2014). The lack of development in health behaviour theories may indicate that the mechanisms of testing and developing theory are not efficient.

In proposing that it is ‘time to retire the Theory of Planned Behaviour (TPB)’ (Sniehotta, Presseau, & Araújo-Soares, 2014) we aimed to further the debate initiated by Head and Noar (2014; Noar & Head, 2014) about the pressing need to clarify a process of formulating, testing and applying behavioural theory to deliver scientific progress. To achieve this, it would be helpful to agree on how and when to change or abandon theories that no longer accurately represent current knowledge. We focused on the TPB as an example of a theory that remains very popular despite its well-documented limitations, but the nature of this debate also extends to other popular social cognition models (cf. Rhodes, 2015; Schwarzer, 2015).

We highlighted the key limitations of the TPB, some of which have been raised before by others (French & Hankins, 2003; Greve, 2001; Ogden, 2003). We concluded that the set of prepositions that form the *conceptual core* of the TPB, including its mediation hypotheses and the sufficiency hypotheses are partially inaccurate and do not sufficiently account for established and useful knowledge about the determinants of

*Corresponding author. Email: falko.sniehotta@ncl.ac.uk

behaviour (change) and the conditions under which these determinants operate. In suggesting the retirement of the TPB, we fully advocate drawing on what we have learned from the theory and incorporating this knowledge into theories that provide a better match to empirical observations and greater utility for research and practice, as is indeed already happening (Hall, 2015; Rhodes, 2015; Schwarzer, 2015). We are not proposing theory proliferation for the sake of it. Rather, we wish to underscore the purpose of theory and inspire a debate about how this purpose can best be achieved.

In this response we address the points raised in comments to our initial editorial specifically about the TPB as well as wider issues about the nature, development, and evaluation and proliferation of health behaviour theories. We suggest possible explanations for the disagreement between scholars on popular theories that are not in line with current knowledge and discuss possible ways forward which may help to contribute to the discussion about how to overcome the immortality of health behaviour theories.

Reactions

Clearly, our editorial struck a note. Ten commentaries from leading international scholars confirmed this is a debate worth having and that views on the matter are both strong and diverse. We are grateful to the authors of these commentaries for their insightful reflections. On the whole, with few exceptions, commentators largely supported the idea of building on what we have learned with the TPB and moving on from it. While some authors offered opposition to our proposal (e.g., Ajzen, 2015; Armitage, 2015; Conner, 2015), others (re)iterated that retiring the TPB is long overdue (Ogden, 2015). Some commentators also took the opportunity to add further criticism to the TPB (Ogden, 2015; Rhodes, 2015; Trafimow, 2015) to the ones we listed.

One concern about our editorial raised by some was the potential risk of ‘throwing the baby out with the bathwater’ in retiring the TPB. We previously acknowledged the historical contributions of the TPB and its predecessors for the development of health behaviour science. To clarify our position, there is no doubt that ‘the TPB identifies some key predictors of health behaviours’ (Conner, 2015, p. x) and we agree that intention, perceived behavioural control (PBC), attitude and subjective norm are important predictors of behaviour and are potentially relevant to understand and change behaviour. We were also not suggesting that it would be inappropriate to study these constructs in their own right. Rather, we take issue with the proposed sufficiency of the combination of these constructs, and the veracity of the testable hypotheses about mediation of theory-external influences (all assumed to be fully mediated by TPB constructs; the *sufficiency hypothesis*) and theory-internal influences (e.g., the relationship between attitudes and behaviour is hypothesised to be mediated by intention; the *mediation hypotheses*).

Health behaviour theory has mostly served three main purposes: to educate students (Rhodes, 2015) and practitioners (Abraham, 2015), to inform behaviour change interventions and their evaluation (Abraham, 2015; Kok & Ruiter, 2014) and/or to guide cutting edge research by providing empirical hypotheses (Hall, 2015). What stands out from the commentaries is the considerable variability in opinion, language and conceptualisation of health behaviour theories, the designs used to test and apply them and the process of theory development.

How should theories be formulated?

In Table 1, we propose what we hope is a simple and uncontroversial set of criteria for *empirical health behaviour theories* to fulfil.

It is helpful to think of a theory as consisting of at least two elements: (1) a *theory core*, in which the explanatory concepts as well as their hypothesised relationships to each other and to the observations it aims to explain are defined (Bem & Looren de Jong, 1997; Hempel & Oppenheim, 1948) and (2) a *set of intended applications*, in which the phenomena the theory aims to explain and in what context, are clarified. A subset of the latter containing applications successfully tested in research could be seen as the set of *successful applications* of that theory (Balzer, Moulines, & Sneed, 1987; Westmeyer, 1992).

At first glance, the TPB has a reasonably well-defined theory core and the equations that express the hypothesised relationships between constructs are helpful for formalising

Table 1. Proposed criteria for empirical behaviour change theories.

Criteria	Explanation
<i>Core</i>	
1. Clarify the <i>explanandum</i>	Definition of the type of observations/behaviours the theory aims to explain should be provided.
2. Define constructs	Constructs should be defined as conceptually independent of the <i>explanandum</i> and of other theory constructs.
3. Relationships within theory	Relationships of constructs should be described as a conceptual nomological network of hypothesised relationships to facilitate the operationalisation of the theory in empirical applications (Campbell & Fiske, 1959).
4. Explanation	The nature of the causal explanation should be explicit (Bem & Looren de Jong, 1997; Hempel & Oppenheim, 1948).
5. Mechanisms	The mechanisms of action should be specified. Some theory constructs might not directly relate to the <i>explanandum</i> but indicate steps in a causal chain hypothesised to lead to behaviour change.
<i>Applications</i>	
6. Intended applications	The range of behaviour and behaviour change that the theory aims to explain as well as the circumstances under which the theoretical prepositions are assumed to apply should be explicitly stated.
7. Successful applications	Examples of evidence from empirical studies which support the theory's prepositions and hypotheses. New theories might not have many successful applications yet, but for established theories successful applications are a measure of how the degree of evidence supporting the theory.
<i>Context</i>	
8. Relationships to other theories	Descriptions of how constructs and hypotheses derived from the theory relate to those in other theories. This allows theory integration (Hagger, 2009) and comparative testing of theories against each other (Noar & Zimmerman, 2005).
9. Historical heritage	If applicable, the historical heritage of the theory should be explicit.
10. Historical differences	Differences between the theory and any theory it replaces should be explicit.

predictions (Ajzen, 1985). However, in his commentary, Ajzen (2015) formulates a position which differs from those original and highly specific formulations by stating ‘there is nothing in the TPB to preclude addition of new predictors’ (p. x). In fact, adding variables to any equation or function fundamentally alters the nature of the relationships expressed. The sufficiency hypothesis is a direct consequence of the equations used to express the TPB. Moving away from a formal theory specification endorses an interpretation of the TPB as a pragmatic, parsimonious set of useful explanatory constructs rather than a formal theory. With such a position there would be very little disagreement indeed. However, empirical research requires clarity of a theory core, otherwise, how can a theory be operationalised?

The TPB, like many psychological theories, lacks a clearly defined range of intended applications and this may explain some of the disagreement on the degree to which the theory is consistent with evidence. Ajzen (2015, p. x) describes the TPB as ‘meant to help explain and predict people’s intention and behaviour’. His references to systematic reviews of the TPB suggests that he agrees that any health-related behaviour as reviewed by McEachan, Conner, Taylor, and Lawton (2011) is an appropriate application of the TPB. However, various colleagues refer to the TPB as a theory of motivation that is more efficient in predicting and potentially changing behavioural intentions than behaviour (Abraham, 2015; Kok & Ruiter, 2014; Schwarzer, 2015). Moreover, Ajzen (2015) and Armitage (2015) suggest that changing beliefs is only efficient in unmotivated individuals. Indeed, Trafimow (2015) points out examples of successful experimental tests of the TPB, but these do not use behaviour as the outcome. The explanation of intention is seen as one of the TPB’s strengths and some argue that there are various successful applications TPB explaining intention (Trafimow, 2015). However, when considering the TPB as a theory of behaviour, the evidence is less supportive. The work by Orbell and Sheeran (1998) on the intention–behaviour gap and the prevalence of inclined abstainers highlights this discrepancy.

Gollwitzer and Oettingen (2015) suggested that one should not expect a social psychology theory such as the TPB to be directly applicable to actual behaviour outside of the lab without modification. It is true that the application of any theory requires certain adjustments that reflect the context and specific features of the behaviour and population under study as well as methodological constraints. Some variance in findings may be due to constraints introduced by theory, some due to the methods used and some due to the context of application. The TPB has long been used for applications to complex health behaviour (Sheeran, Abraham, & Orbell, 1999). Ajzen’s proposed selection of applications of the TPB deemed to be successful in areas of testicular self-examination (TSE) and condom use suggests that most researchers in the field are comfortable with applying social cognitive theories to applied problems. Health behaviours are complex and important, and applying theories of behaviour to health behaviours can contribute an important layer to the development of theory: how relevant would a social psychological theory be if it were not applicable outside of the lab?

Methods for testing the TPB and other theories

Researchers often attribute successful empirical applications to theory and attribute unsuccessful applications to methodology (Ogden, 2003). To clarify whether theory and/or method are driving observed findings, ideally a theory should be tested in a *multi-theory–multi-method* matrix (Westmeyer, 1992). A multi-theory approach suggests that

rather than testing whether observations are consistent with hypotheses made by a given theory (e.g., testing against an unspecified null hypothesis), progress in psychological science may be better achieved by testing two plausible but contradictory hypotheses against each other in the same study, facilitated by the principles summarised in Table 1. A multi-method approach provides opportunities for triangulating evidence and a theory has stronger empirical support if successful applications can be demonstrated over a range of methodological operationalisations.

Research on the TPB has predominantly been a mono-theory mono-method endeavour. Specific guidelines describing how to construct TPB questionnaires (Ajzen, 2006; Francis et al., 2004) have been popular and have resulted in a body of evidence based on a narrow range of methodological operationalisations mostly focused on correlational research designs. Meta-analytic reviews of this correlational evidence have long been taken as supportive of the TPB (McEachan et al., 2011). However, the supportive evidence has not been invariant across methods and there are few successful applications of the TPB using other, more rigorous methods. Moreover, the TPB does not lend itself very well to comparative hypothesis testing due to the nature of its predictions. One would struggle to formulate plausible alternative hypotheses to the theoretical prediction: ‘People with a positive intention to act are more likely to act than those without such an intention’ (Greve, 2001).

Experimental tests of the TPB and behaviour change

We have argued that the TPB has failed experimental tests (Sniehotta, 2009; Sniehotta et al., 2014). While most commentators agreed, Ajzen made three arguments to support the TPB: (1) the TPB is not a theory of *behaviour change*, but a theory that *explains* intentions and behaviours, (2) 10 specific conditions need to be fulfilled to provide a valid experimental test of the TPB (noting that no previous negative tests have fulfilled these criteria) and (3) examples of applications satisfying these criteria do support the TPB. We address these arguments in turn below.

- (1) Ajzen (2015, p. x) states that the TPB is not a theory of behaviour change but can be a ‘useful framework’ to inform behaviour change interventions. If the TPB does not explain behaviour change, it implies the theory is immune to experimental tests that by definition require the element of change. The validity of such an immunity statement is questionable. Previously we referred to the TPB as ‘static’ and we are grateful to Ajzen (2015) and Schwarzer (2015) for pointing out that this terminology might be open to misunderstanding. Ajzen has repeatedly stated that experiences of behaviour can influence cognitions. Acknowledging that such a feedback process occurs without theorising *how* behaviour may shape cognitions leaves the TPB lacking the level of elaboration which would allow an explanation for behaviour change. One of the TPB’s contemporary’s, Bandura’s social cognitive theory (SCT; Bandura, 1997) offers a helpful level of theorising about these relationships based on reciprocal determinism and individual attributions. There is no reason why these links should remain unspecified in the seminal descriptions of the theory over decades when they are critical for the phenomena that the TPB aims to explain.
- (2) The TPB is a parsimonious theory with only four aggregate explanatory constructs. Ajzen proposes that 10 steps are required to ensure valid development

and evaluation of a TPB-based intervention [see Ajzen (2015) for the full description of these steps]. Roughly, these steps fall into two sets. The first set underscores the need for belief elicitation, development of intervention components and evaluation studies to ensure that an intervention produces ‘large changes in the targeted beliefs and that it does not have countervailing impact effects on unmentioned beliefs’ (Ajzen, 2015, p. x) and ‘appreciable significant impact on the aggregates of behavioural, normative and/or control beliefs’ (p. x). The practical implication of this first set of criteria is that one needs a fully powered trial to estimate the effect sizes of a draft intervention on various TPB components with a small margin of error before one can even consider the intervention as TPB-based. If the effects are not quite of a large enough magnitude, the implication is that one needs to go back, revise the intervention and run another fully powered trial to test for the effects on TPB mediators and so on. Given the funding and practicalities of applied research, it might be unreasonable to expect that this first set of criteria will often be met. Realistically, in practice, intervention developers and evaluators typically conduct careful, iterative piloting and development work with a view to running *one* large trial to simultaneously evaluate the effects on TPB cognitions and behaviour. As a result of these proposed steps, the TPB is insulated from trial null findings that might be attributed to a lack of sufficient effects on targeted beliefs rather than to the TPB itself.

The second set involves four steps required to address any evidence of intention–behaviour discrepancies (of which there is ample evidence across all applications of the TPB to health behaviours, cf. McEachan et al., 2011). The proposed steps require an intervener to make sure that ‘the beliefs accessible in the behavioural context do not differ substantially from the accessible beliefs [...] identified in the elicitation phase’, ‘that participants have the means, skills and other resources to perform the behaviour of interest’, ‘that all potential barriers to its performance have been removed’ and ‘that no unanticipated events or new information have led to revised intentions after the intervention has taken place’ (Ajzen, 2015, p. x). There are practical and conceptual implications for this second set of criteria. Most readers with first-hand experience of developing and evaluating health behaviour change interventions might find it difficult to see how they can continuously control the accessibility of people’s beliefs, or the occurrence of unanticipated events. It does not always seem feasible to expect interventions to remove all barriers or provide people with boundless resources. The TPB itself does little to suggest how one would go about achieving these criteria and does not provide any constructs to explain the underlying processes. The TPB does not theorise on the self-regulatory processes involved in overcoming barriers (although other theories do; cf. Hall, 2015; Schwarzer, 2015), on dealing with a lack of skills and resources or on maintaining positive cognitions and motivation over time or in response to new events. The TPB leaves these processes unspecified and, as a result, any behaviour change shown by following these steps might still not reflect the mechanisms described in the TPB.

- (3) Ajzen argues that studies that fulfil the 10 criteria do support the TPB and identifies four studies of TPB-based interventions he considers to be good and successful applications of the TPB (Brubaker & Fowler, 1990; Jemmott, Jemmott, & Fong, 1998; Murphy & Brubaker, 1990; Sanderson & Jemmott, 1996). These

studies evaluated interventions on self-reported outcome measures of testicular self-examination, safer-sex and sexual abstinence. We analysed these studies using the Cochrane risk of bias tool (Higgins et al., 2011) and found that Murphy and Brubaker (1990) has a high risk of bias from methods used to assign participants to conditions, justify sample size in terms of statistical power and blinding of outcome assessors. Two had an unclear risk of bias due to limited information provided about the methodology (Brubaker & Fowler, 1990; Sanderson & Jemmott, 1996). While risk of bias is not atypical for social psychology studies from the 1990s, current international standards of conduct and reporting of trials advise to not rely heavily on evidence with a high risk of bias (Begg et al., 1996). The fourth study (Jemmott et al., 1998) shows lower risk of bias and also provides a longer term outcome at one year. Two of these studies evaluated interventions which were explicitly based on a combination of SCT (Bandura, 1997) and TPB (Jemmott et al., 1998; Sanderson & Jemmott, 1996) and in particular drawing on techniques from SCT. Thus, these studies do not provide a pure test of the TPB.

Most surprisingly, one of the four studies did not find that the TPB intervention resulted in changes in behaviour (Sanderson & Jemmott, 1996; only significant differences in subgroup analyses) and another study did not find any difference between TPB-based and non-TPB-based interventions on any TPB constructs measured post-test (Brubaker & Fowler, 1990). Jemmott et al. (1998) found short-term but not long-term effects for one of two outcomes (sexual abstinence) and longer-term effects for the other outcome (condom use). In two of these four studies, the authors explicitly stated doubts in their conclusions about the validity of the TPB. Indeed, Murphy and Brubaker (1990) concluded that ‘though the theory-based message was the most effective means of encouraging TSE performance, the theoretical model does not seem to adequately explain its effectiveness’ (p. 462). These four studies highlighted as successful application of the TPB are not particularly convincing examples in support of the theory and if anything, further highlight its limitations.

Is more research on the TPB needed?

Armitage’s (2015) call for a consolidated programme of research across groups to conduct additional tests of the TPB offers a radical counter-position to our call for disinvestment in the theory. He refers to the example of the Large Hadron Collider (LHC) project built by the European Organization for Nuclear Research with collaborations from scientists worldwide. To our mind, the LHC reference might have been somewhat misleading. The LHC was built to enable the scientific community to test hypotheses that were not previously testable in individual laboratories. The recommendations for the utilisation of the TPB in intervention research might be complicated and cumbersome, but there is nothing in the TPB which would have prevented its testing. Indeed, since our editorial was published, various authors have told us that they have conducted experimental tests of the TPB and failed to submit these for publication or received rejections from journals. We do not share the view of the need for additional TPB-based interventions, but if such studies are to be conducted, it would help the evidence-base considerably to register these trials and publish protocols prior to data analysis to counter any potential file-drawer issues. While we sympathise with the call for collective action,

the point of our editorial was precisely that given what we know now about the TPB, it might be time to invest our limited available resources into theoretical approaches which are in line with current knowledge and/or have higher utility for research and practice.

Retire or extend the TPB?

Some commentators argued that many of the problems of the TPB could be solved or improved upon by extending rather than retiring the TPB (Ajzen, 2015; Conner, 2015). We are grateful for the opportunity to clarify what we perceive to be a possible misunderstanding. We do agree that the TPB can be extended in a way that circumvents or weakens *some* of the criticisms we summarised. However, cumulative science requires a clearly defined theory core and modifications should result in changes in the formulation of the TPB. For a viable extension of a theory, authors should first formalise the extended theory, or a version or variant of a theory (cf. Rhodes, 2015) and then test it. Once an extended or modified theory is shown to be superior, its predecessor can be retired. The established knowledge specified in the predecessor theory is thus inherently embodied in the extended theory. Through clear theory formulation and rigorous testing we could achieve more rapid progress and, using the words of Hall (2015), the intermediate more-likely-to-be-forgotten-than-forced-to-retire theories would make a considerable and lasting contribution to the understanding of human behaviour. Five types of extensions have been discussed.

First, the TPB can be extended by splitting its explanatory variables into sub-components, e.g., attitudes into affective and cognitive attitudes (Ajzen, 2015; Conner, 2015). This extension is mostly relevant for correlational studies that aim to improve the statistical predictive utility of the theory; it might be less relevant for intervention studies assuming that most applications of the TPB to intervention development would address both kinds of attitudes. Such extensions do not conflict with any of the main TPB hypotheses. However, they would not address any of the criticisms we listed about the TPB either.

Second, one can extend the TPB by adding variables external to the theory (Conner, 2015). Such an extension would involve the identification of variables outside the TPB which consistently and across a range of applications add explanatory power. Such an extension would violate its sufficiency hypothesis and would conflict with its mathematical foundations. If the scientific community agreed that there is evidence supporting such an extension, this could support the case for retiring the TPB in favour of TPB plus 'x'. This would ensure that in science, education and practice, the agreed knowledge is provided by a state-of-the-art theory. Head and Noar (2014; Noar & Head, 2014) provide an excellent discussion of the difficulties and opportunities in developing such an extension.

Third, one can extend the TPB by adding mediation hypotheses, often in combination with one of the previous two options. One of the best-researched examples concerns the role of anticipated regret as an additional predictor in the TPB. A systematic review with meta-analysis (Sandberg & Conner, 2008) concluded that anticipated regret predicts intention over and above attitude, subjective norm and PBC and predicts behaviour over and above intention and PBC. The nature of these arguments precisely and remarkably resembles the arguments that led to the retirement of the theory of reasoned action (TRA; Fishbein & Ajzen, 1975). In both developments, one additional variable was added which was hypothesised to explain both intention and behaviour independently of the

explanatory variables in the theory. In the case of adding PBC, this led to a retirement of the TRA and the emergence of the TPB (Ajzen, 1985). However, in the case of anticipated regret, it led to absolutely no consequences in the development of the TPB.

Fourth, and probably more relevant for intervention research, is the identification of moderators within the TPB (Conner, 2015). Understanding the circumstances under which theoretical hypotheses apply is relevant to shape the set of intended applications of a theory and to formulate hypotheses for experimental research. Any consistent moderator evident across applications would help to develop theory in a meaningful way. Abraham (2015) highlights the utility of conducting a theory-informed needs assessment prior to theory selection. To make the most of such an assessment, it would be important to understand the circumstances under which theoretical hypotheses and explanations apply. Ajzen (2015) and Armitage (2015) suggest that the TPB is less useful in those who are already motivated, which highlights an inherent range of intended application of the TPB.

Finally, the TPB variables have been integrated in other theoretical approaches (Hagger, 2009), as a motivational component together with volitional self-regulatory approaches such as planning (Armitage, 2015; Darker, French, Eves, & Sniehotta, 2010; Schwarzer, 2015) or as a reflective process in reflective/impulsive dual process models (Armitage, 2015; Pesseau et al., 2014; Sheeran, Gollwitzer, & Bargh, 2013; Strack & Deutsch, 2004). These applications presume that the TPB as a theory of human behaviour is insufficient, but they make use of the knowledge we have gathered over past decades about TPB constructs. This demonstrates that it is possible to move on to more evolved theories without forgetting or dismissing what research using the TPB has taught us.

Extending theory is an important option for progress in behaviour change science. The research strategy of extending the TPB is not new (Conner & Armitage, 1998) but has so far failed to progress the theory. Most promising extensions conflict with the TPB and it is no longer helpful to acknowledge these limitations without modifying the formal theory (Head & Noar, 2014).

How can we progress theory more effectively?

Most of the commentators agreed with the main premise of our editorial. Yet, they describe it as courageous (Schwarzer, 2015), bold (Hall, 2015) and even harsh (Armitage, 2015). There is no harshness implied. As both Hall (2015) and Rhodes (2015) emphasised, it is a badge of honour for a theory if peers discuss its retirement. It implies that the theory had once been a standard, previously setting a benchmark for the field. However, the TPB is no longer a defensible or useful standard and de facto, large proportions of the field have moved on as reflected by the majority of commentaries. Even Ajzen (2015) acknowledges that the prediction of behaviour from intention and PBC is 'fraught with potential problems' (p. x). This debate resembles key motives described in the emperor's new clothes: everybody sees the problem but we have created a culture of not calling it what it is. Scientific debate benefits the field and should not by any means be perceived as personal.

This debate has illustrated the appetite for re-establishing momentum in the development of behavioural theory (Hall, 2015). A few encouraging implications transpire as follows.

Accelerating cycles for theory innovation

Stagnation in theorising is not in the interest of a science that seeks to understand a phenomenon as important and exciting as human behaviour. An acceleration of innovation cycles is required. Behaviour change science should not be too conservative and risk averse. It would be helpful to give new, creative hypotheses and theories a chance in the peer review system (cf. Hall, 2015; Rhodes, 2015). It seems likely that those who have experience with interventions in practice and research could make invaluable contributions in translating their experience in novel theoretical hypotheses. It would help to demand that any new theories clearly define the theory core and range of intended applications (see Table 1). Any new theory suggesting new hypotheses that can be tested against hypotheses from established theories should be embraced (Noar & Zimmerman, 2005). To make a significant contribution to the field, a theory does not need to explain all behaviours. Theories with more specific scope, for example, explaining aspects of behavioural maintenance or multiple behaviour change would create considerable progress in research and practice.

Rigorous experimental tests

In the past, theorising was often dominated by a correlational mind-set. Before moving to experimental studies, health psychologists frequently conducted a programme of correlational research to identify promising variables for experimental studies. There is a risk that correlational thinking can hinder theory development. Viable theoretical ideas might not be brought to experimental tests because they fail the insufficient correlational test of their incremental predictive utility over and above a standard theory (see Trafimow, 2015). The key question for health behaviour theory is not how many predictors one needs to predict behaviour; the key question is what to do to bring about change. Health behaviour theory should be able to explain how combinations or sequences of behaviour change strategies can be optimised, how interventions can be matched to individual features and how one prioritises and/or sequences strategies in behaviour change interventions. These answers are more likely to come from intervention research using a range of methods such as factorial designs (Staunton, Gellert, Knittle, & Sniehotta, in press); N-of-1 randomised controlled trials (Sniehotta, Presseau, Hobbs, & Araújo-Soares, 2012) or between subject RCTs with process evaluation (Gillison et al., 2015). Based on an experimental approach, evidence about the viability of the theory or hypothesis will emerge more quickly, thereby allowing the field to move forward (Hall, 2015).

Theory development as a social consensus process

The emergence, popularity and decline of a theory do not only depend on empirical evidence. Theories differ so much in the nature of their explanation that it is not always possible to directly compare evidence. It might be helpful to understand the evolution of theory as a complex social process where groups explicitly or implicitly agree on certain standards. Scholars may become affiliated with a theory because they have developed the expertise and track record around that theory and because this expertise has been influential for their previous success. Not all researchers will agree about the empirical validity of theories and we have no intention to limit freedom of choice. Most behavioural research is funded by the tax payer and the tax payer expects scientists to strive for improvement and innovation. It might be worth reflecting on the degree to which it is beneficial to build research programmes and research careers on a single un-

adapted theory. It might create a disincentive for embracing progress. The field of health behaviour change seems to have accepted the principle of ownership of theories. We owe the originators of the theories we use gratitude, but as a scientific community we need to accept responsibility for the development of these theories. If we sit back, watch and wait for the originator to decide where to go with the theory, we lose control over the progress of our science.

Theories and methods for intervention development

Translational evidence-based science covers the process from discovery to application (and back to discovery; Craig et al., 2008). While the three previous points addressed the discovery end of the process, the relevance of behaviour change science depends on the degree to which the knowledge gathered through basic and applied research can feed into education and application. A theory that inspires researchers to test novel hypotheses has its important place in the process but might not necessarily be as useful as a theory that guides intervention development. A useful theory to guide intervention development and evaluation in practice will be measured by its ability to reflect what is known about key principles of behaviour change and to inform decisions about inclusion, exclusion, tailoring and sequencing of theory-based behaviour change strategies and evaluation protocols which capture the hypothesised theoretical mechanisms (Abraham, 2015; Moore et al., 2014).

Concluding remarks

Many disciplines are involved in behaviour change, and many of them share the methods and approaches that psychologists use. Among the unique contributions of psychology is the depth of theoretical understanding of behaviour and behaviour change. There is a risk of floundering in the habitual use of outdated theories while losing this core strength of the discipline. But the future is bright: new integrative theories are emerging with authors that encourage and embrace real and lasting adaptation. Developing accurate and sufficiently comprehensive models of health behaviour is therefore an imperative that has implications for behavioural research, education and practice. The outside world is increasingly interested in – and indeed waiting for – these models. The scientific community collectively holds a great deal of responsibility to do their very best to optimise methods of theory development in a way that mirrors recent improvements in methods for the development, reporting and evaluation of interventions (Bartholomew et al., 2011; Craig et al., 2008; Davidson et al., 2003; Hoffman et al., 2014; Moore et al., 2014).

We remain committed to our suggestion that it is time to retire the TPB. However, given the apparent level of disagreement on how to interpret the science around the TPB and the adamant commitment of its proponents to the theory, there is a chance that we will retire before the TPB does. That is a healthy indicator of a pluralistic scientific community. We are confident, however, that the majority of the field has and will continue to move forward and embrace an agenda of evidence-based and theoretically grounded science and practice of behaviour change.

Acknowledgement

The authors wish to thank Niina Kolehmainen and Stephan Dombrowski for their helpful comments on a previous version of the manuscript.

Disclosure statement

No potential conflict of interest was reported by the authors.

Funding

FFS is funded by Fuse, the Centre for Translational Research in Public Health, a UKCRC Public Health Research Centre of Excellence. Funding for Fuse from the British Heart Foundation, Cancer Research UK, Economic and Social Research Council, Medical Research Council and the National Institute for Health Research, under the auspices of the UK Clinical Research Collaboration, is gratefully acknowledged.

References

- Abraham, C. (2015). Mapping modifiable mechanisms in health promotion research: A commentary on Sniehotta, Presseau, and Araújo-Soares. *Health Psychology Review*, 9(2), 160–164. doi:[10.1080/17437199.2014.905967](https://doi.org/10.1080/17437199.2014.905967)
- Ajzen, I. (1985). From intentions to actions: A theory of planned behavior. In J. Kuhl & J. Beckmann (Eds.), *Action control: From cognition to behavior* (pp. 11–39). Berlin, Heidelberg, New York, NY: Springer-Verlag.
- Ajzen, I. (2006). *Constructing a theory of planned behavior questionnaire*. Retrieved February 15, 2015, from <http://people.umass.edu/aizen/>
- Ajzen, I. (2015). The theory of planned behaviour is alive and well, and not ready to retire: A commentary on Sniehotta, Presseau, and Araújo-Soares. *Health Psychology Review*, 9(2), 131–137. doi:[10.1080/17437199.2014.883474](https://doi.org/10.1080/17437199.2014.883474)
- Armitage, C. J. (2015). Time to retire the theory of planned behaviour? A commentary on Sniehotta, Presseau and Araújo-Soares. *Health Psychology Review*, 9(2), 151–155. doi:[10.1080/17437199.2014.892148](https://doi.org/10.1080/17437199.2014.892148)
- Balzer, W., Moulines, C. U., & Sneed, J. D. (1987). *An architectonic for science: The structuralist approach*. Dordrecht: Reidel.
- Bandura, A. (1997). *Self-efficacy: The exercise of control*. New York, NY: Freeman.
- Bartholomew, L. K., Parcel, G. S., Kok, G., Gottlieb, N. H., & Fernández, M. E. (2011). *Planning health promotion programs: An intervention mapping approach* (3rd ed.). San Francisco, CA: Jossey-Bass.
- Begg, C., Cho, M., Eastwood, S., Horton, R., Moher, D., Olkin, I., ... Stroup, D. F. (1996). Improving the quality of reporting of randomized controlled trials: The CONSORT statement. *JAMA*, 276, 637–639. doi:[10.1001/jama.1996.03540080059030](https://doi.org/10.1001/jama.1996.03540080059030)
- Bem, S., & Looren de Jong, H. (1997). *Theoretical issues in psychology*. London: Sage.
- Brubaker, R. G., & Fowler, C. (1990). Encouraging college males to perform testicular self-examination: Evaluation of a persuasive message based on the revised theory of reasoned action. *Journal of Applied Social Psychology*, 20, 1411–1422.
- Campbell, D. T., & Fiske, D. W. (1959). Convergent and discriminant validation by the multitrait-multimethod matrix. *Psychological Bulletin*, 56(2), 81–105. doi:[10.1037/h0046016](https://doi.org/10.1037/h0046016)
- Conner, M. (2015). Extending not retiring the theory of planned behaviour: A commentary on Sniehotta, Presseau and Araújo-Soares. *Health Psychology Review*, 9(2), 141–145. doi:[10.1080/17437199.2014.899060](https://doi.org/10.1080/17437199.2014.899060)
- Conner, M., & Armitage, C. J. (1998). Extending the theory of planned behavior: A review and avenues for further research. *Journal of Applied Social Psychology*, 28, 1429–1464. doi:[10.1111/j.1559-1816.1998.tb01685.x](https://doi.org/10.1111/j.1559-1816.1998.tb01685.x)
- Craig, P., Dieppe, P., Macintyre, S., Michie, S., Nazareth, I., & Petticrew, M. (2008). Developing and evaluating complex interventions: The new medical research council guidance. *BMJ*, 337, a1655. doi:[10.1136/bmj.a1655](https://doi.org/10.1136/bmj.a1655)
- Darker, C. D., French, D. P., Eves, F. F., & Sniehotta, F. F. (2010). An intervention to promote walking amongst the general population based on an ‘extended’ theory of planned behaviour: A waiting list randomised controlled trial. *Psychology & Health*, 25, 71–88. doi:[10.1080/08870440902893716](https://doi.org/10.1080/08870440902893716)

- Davidson, K. W., Goldstein, M., Kaplan, R. M., Kaufmann, P. G., Knatterud, G. L., Orleans, C. T., ... Whitlock, E. P. (2003). Evidence-based behavioral medicine: What is it and how do we achieve it? *Annals of Behavioral Medicine*, 26, 161–171. doi:[10.1207/S15324796ABM2603_01](https://doi.org/10.1207/S15324796ABM2603_01)
- Fishbein, M., & Ajzen, I. (1975). *Belief, attitude, intention, and behavior: An introduction to theory and research*. Reading, MA: Addison-Wesley.
- Francis, J. J., Eccles, M. P., Johnston, M., Walker, A., Grimshaw, J., Foy, R., ... Bonetti, M. (2004). *Constructing questionnaires based on the theory of planned behaviour: A manual for health service researchers*. Newcastle upon Tyne: University of Newcastle upon Tyne.
- French, D. P., & Hankins, M. (2003). The expectancy-value muddle in the theory of planned behaviour – And some proposed solutions. *British Journal of Health Psychology*, 8(1), 37–55. doi:[10.1348/135910703762879192](https://doi.org/10.1348/135910703762879192)
- Gillison, F., Stathi, A., Reddy, P., Perry, R., Taylor, G., Bennett, P., ... Greaves, C. (2015). Processes of behavior change and weight loss in a theory-based weight loss intervention program: A test of the process model for lifestyle behavior change. *International Journal of Behavioral Nutrition and Physical Activity*, 12, 2. doi:[10.1186/s12966-014-0160-6](https://doi.org/10.1186/s12966-014-0160-6)
- Gollwitzer, P. M., & Oettingen, G. (2015). From studying the determinants of action to analysing its regulation: A commentary on Sniehotta, Presseau and Araújo-Soares. *Health Psychology Review*, 9(2), 146–150. doi:[10.1080/17437199.2014.919511](https://doi.org/10.1080/17437199.2014.919511)
- Greve, W. (2001). Traps and gaps in action explanation: Theoretical problems of a psychology of human action. *Psychological Review*, 108, 435–451. doi:[10.1037/0033-295X.108.2.435](https://doi.org/10.1037/0033-295X.108.2.435)
- Hagger, M. S. (2009). Theoretical integration in health psychology: Unifying ideas and complementary explanations. *British Journal of Health Psychology*, 14, 189–194. doi:[10.1348/135910708X397034](https://doi.org/10.1348/135910708X397034)
- Hall, P. A. (2015). Re-establishing momentum in theory development: A commentary on Sniehotta, Presseau and Araújo-Soares. *Health Psychology Review*, 9(2), 172–175. doi:[10.1080/17437199.2014.896080](https://doi.org/10.1080/17437199.2014.896080)
- Head, K. J., & Noar, S. M. (2014). Facilitating progress in health behaviour theory development and modification: The reasoned action approach as a case study. *Health Psychology Review*, 8(1), 34–52. doi:[10.1080/17437199.2013.778165](https://doi.org/10.1080/17437199.2013.778165)
- Hempel, C. G., & Oppenheim, P. (1948). Studies in the logic of explanation. *Philosophy of Science*, 15, 135–175. doi:[10.1086/286983](https://doi.org/10.1086/286983)
- Higgins, J. P. T., Altman, D. G., Gøtzsche, P. C., Moher, D., Oxman, A. D., Savović, J., ... Sterne, J. A. C. (2011). The Cochrane collaboration's tool for assessing risk of bias in randomised trials. *BMJ*, 343, d5928. doi:[10.1136/bmj.d5928](https://doi.org/10.1136/bmj.d5928)
- Hoffman, T. C., Glasziou, P. P., Boutron, I., Milne, R., Perera, R., Moher, D., ... Michie, S. (2014). Better reporting of interventions: Template for intervention description and replication (TIDieR) checklist and guide. *BMJ*, 348, g1687.
- Jemmott, J. B., Jemmott, L. S., & Fong, G. T. (1998). Abstinence and safer sex HIV risk-reduction interventions for African American adolescents: A randomized controlled trial. *JAMA*, 280, 1529–1536. doi:[10.1001/jama.279.19.1529](https://doi.org/10.1001/jama.279.19.1529)
- Kok, G., & Ruiter, R. A. C. (2014). Who has the authority to change a theory? Everyone! A commentary on Head and Noar. *Health Psychology Review*, 8(1), 61–64. doi:[10.1080/17437199.2013.840955](https://doi.org/10.1080/17437199.2013.840955)
- McEachan, R. R. C., Conner, M., Taylor, N. J., & Lawton, R. J. (2011). Prospective prediction of health-related behaviours with the theory of planned behaviour: A meta-analysis. *Health Psychology Review*, 5(2), 97–144. doi:[10.1080/17437199.2010.521684](https://doi.org/10.1080/17437199.2010.521684)
- Moore, G., Audrey, S., Barker, M., Bond, L., Bonell, C., Hardeman, W., ... Baird, J. (2014). *Process evaluation of complex interventions: Medical research council guidance*. London: MRC Population Health Science Research Network.
- Murphy, W. G., & Brubaker, R. G. (1990). Effects of a brief theory-based intervention on the practice of testicular self-examination by high school males. *Journal of School Health*, 60, 459–462. doi:[10.1111/j.1746-1561.1990.tb05977.x](https://doi.org/10.1111/j.1746-1561.1990.tb05977.x)
- Noar, S. M., & Head, K. J. (2014). Mind the gap: Bringing our theories in line with the empirical data – A response to commentaries. *Health Psychology Review*, 8, 65–69. doi:[10.1080/17437199.2013.855593](https://doi.org/10.1080/17437199.2013.855593)

- Noar, S. M., & Zimmerman, R. S. (2005). Health behavior theory and cumulative knowledge regarding health behaviors: Are we moving in the right direction? *Health Education Research*, 20, 275–290. doi:[10.1093/her/cyg113](https://doi.org/10.1093/her/cyg113)
- Ogden, J. (2003). Some problems with social cognition models: A pragmatic and conceptual analysis. *Health Psychology*, 22, 424–428. doi:[10.1037/0278-6133.22.4.424](https://doi.org/10.1037/0278-6133.22.4.424)
- Ogden, J. (2015). Time to retire the theory of planned behaviour?: One of us will have to go! A commentary on Sniehotta, Penseau and Araújo-Soares. *Health Psychology Review*, 9(2), 165–167. doi:[10.1080/17437199.2014.898679](https://doi.org/10.1080/17437199.2014.898679)
- Orbell, S., & Sheeran, P. (1998). 'Inclined abstainers': A problem for predicting health-related behaviour. *British Journal of Social Psychology*, 37, 151–165. doi:[10.1111/j.2044-8309.1998.tb01162.x](https://doi.org/10.1111/j.2044-8309.1998.tb01162.x)
- Penseau, J., Johnston, M., Heponiemi, T., Elovainio, M., Francis, J. J., Eccles, M. P., ... Sniehotta, F. F. (2014). Reflective and automatic processes in healthcare professional behavior: A dual process model tested across multiple behaviors. *Annals of Behavioral Medicine*, 48, 347–358. doi:[10.1007/s12160-014-9609-8](https://doi.org/10.1007/s12160-014-9609-8)
- Prestwich, A., Sniehotta, F. F., Whittington, C., Dombrowski, S. U., Rogers, L., & Michie, S. (2014). Does theory influence the effectiveness of health behavior interventions? Meta-analysis. *Health Psychology*, 33, 465–474. doi:[10.1037/a0032853](https://doi.org/10.1037/a0032853)
- Rhodes, R. E. (2015). Will the new theories (and theoreticians!) please stand up? A commentary on Sniehotta, Penseau and Araújo-Soares. *Health Psychology Review*, 9(2), 156–159. doi:[10.1080/17437199.2014.882739](https://doi.org/10.1080/17437199.2014.882739)
- Sandberg, T., & Conner, M. (2008). Anticipated regret as an additional predictor in the theory of planned behaviour: A meta-analysis. *British Journal of Social Psychology*, 47, 589–606. doi:[10.1348/014466607X258704](https://doi.org/10.1348/014466607X258704)
- Sanderson, C. A., & Jemmott, J. B. (1996). Moderation and mediation of HIV-prevention interventions: Relationship status, intentions, and condom use among college students. *Journal of Applied Social Psychology*, 26, 2076–2099. doi:[10.1111/j.1559-1816.1996.tb01788.x](https://doi.org/10.1111/j.1559-1816.1996.tb01788.x)
- Schwarzer, R. (2015). Some retirees remain active: A commentary on Sniehotta, Penseau and Araújo-Soares. *Health Psychology Review*, 9(2), 138–140. doi:[10.1080/17437199.2014.898407](https://doi.org/10.1080/17437199.2014.898407)
- Sheeran, P., Abraham, C., & Orbell, S. (1999). Psychosocial correlates of heterosexual condom use: A meta-analysis. *Psychological Bulletin*, 125(1), 90–132. doi:[10.1037/0033-2909.125.1.90](https://doi.org/10.1037/0033-2909.125.1.90)
- Sheeran, P., Gollwitzer, P. M., & Bargh, J. A. (2013). Nonconscious processes and health. *Health Psychology*, 32, 460–473. doi:[10.1037/a0029203](https://doi.org/10.1037/a0029203)
- Sniehotta, F. F. (2009). An experimental test of the theory of planned behaviour. *Applied Psychology: Health and Well-Being*, 1, 257–270. doi:[10.1111/j.1758-0854.2009.01013.x](https://doi.org/10.1111/j.1758-0854.2009.01013.x)
- Sniehotta, F. F., Penseau, J., & Araújo-Soares, V. (2014). Time to retire the theory of planned behaviour. *Health Psychology Review*, 8(1), 1–7. doi:[10.1080/17437199.2013.869710](https://doi.org/10.1080/17437199.2013.869710)
- Sniehotta, F. F., Penseau, J., Hobbs, N., & Araújo-Soares, V. (2012). Testing self-regulation interventions to increase walking using factorial randomized N-of-1 trials. *Health Psychology*, 31, 733–737. doi:[10.1037/a0027337](https://doi.org/10.1037/a0027337)
- Staunton, L., Gellert, P., Knittle, K., & Sniehotta, F. F. (2015). Perceived control and intrinsic vs. extrinsic motivation for oral self-care: A full factorial experimental test of theory-based persuasive messages. *Annals of Behavioral Medicine*, 49, 258–268. doi:[10.1007/s12160-014-9655-2](https://doi.org/10.1007/s12160-014-9655-2)
- Strack, F., & Deutsch, R. (2004). Reflective and impulsive determinants of social behaviour. *Personality and Social Psychology Review*, 8, 220–247. doi:[10.1207/s15327957pspr0803_1](https://doi.org/10.1207/s15327957pspr0803_1)
- Trafimow, D. (2015). On retiring the TRA/TPB without retiring the lessons learned: A commentary on Sniehotta, Penseau and Araújo-Soares. *Health Psychology Review*, 9(2), 168–171. doi:[10.1080/17437199.2014.884932](https://doi.org/10.1080/17437199.2014.884932)
- Westmeyer, H. (1992). *The structuralist program in psychology: Foundations and applications*. New York, NY: Springer.