



Attitude stability as a moderator of the relationships between cognitive and affective attitudes and behaviour

Mark Conner^{1*} , Frenk van Harreveld² and Paul Norman³

¹University of Leeds, UK

²University of Amsterdam, The Netherlands

³University of Sheffield, UK

Temporal stability is assumed to be an important basis for attitudes being strong predictors of behaviour, but this notion has been little tested. The current research reports tests of temporal stability in moderating the attitude–behaviour relationship, specifically in relation to cognitive attitude (i.e., evaluation implied by cognitions about an attitude object) and affective attitude (i.e., evaluation implied by feelings about the attitude object). In three prospective studies (Study 1: physical activity, $N = 909$; Study 2: multiple health behaviours, $N = 281$; Study 3: smoking initiation, $N = 3,371$), temporal stability is shown to moderate the cognitive and affective attitudes to subsequent behaviour relationship in two-, three-, and four-wave designs utilizing between- (Studies 1 and 3) and within-participants (Study 2) analyses and controlling for past behaviour. Effects were more consistent for affective attitudes (when affective and cognitive attitudes were considered simultaneously and past behaviour controlled). Moderation effects were attenuated, but remained significant, in three- and four-wave compared with two-wave designs. The findings underline the role of temporal stability as an indicator of strength and confirm the relative importance of affective over cognitive (components of) attitudes for predicting behaviour.

The stability of attitudes and their power to predict behaviour are two key-related aspects of attitude strength (Krosnick & Petty, 1995). Strong compared with weak attitudes are assumed to be better predictors of behaviour (Converse, 1995, p. xi; Krosnick & Petty, 1995, p. 3) and more likely to be temporally stable whether challenged or not (resistance vs. persistence; Krosnick & Petty, 1995). The temporal stability of an attitude is one important mechanism through which a strong attitude better predicts behaviour (sometimes labelled the prediction explanation; Fabrigar, MacDonald, & Wegener, 2005). As Schwartz (1978) highlighted, attitudes are unlikely to predict subsequent behaviour if they do not persist over the intervening time interval. Nevertheless, there have been comparatively few tests of the extent to which the temporal stability (persistence) of an attitude moderates the attitude–behaviour relationship. The current research provides three further tests of this moderating effect and the impact of assessing

This is an open access article under the terms of the Creative Commons Attribution License, which permits use, distribution and reproduction in any medium, provided the original work is properly cited.

*Correspondence should be addressed to Mark Conner, School of Psychology, University of Leeds, Leeds LS2 9JT, UK (email: m.t.conner@leeds.ac.uk).

temporal stability over different time periods (i.e., durations). In addition, the present research considers the distinction between cognitive and affective components of attitudes (subsequently referred to as cognitive and affective attitudes) in assessing these effects and whether controlling for past behaviour attenuates these effects.

Although temporal stability (intentions) has received a fair degree of attention as a moderator of the intention–behaviour relationship (Conner, Norman, & Bell, 2002; Sheeran & Abraham, 2003), there are relatively few tests of temporal stability (attitude) as a moderator of the attitude–behaviour relationship. Although individual differences in attitude stability have received some recent attention (Xu et al., 2020), there has been little focus on attitude stability as an attitude–behaviour moderator. Two early studies report temporal stability as a significant overall attitude–behaviour moderator in relation to oral contraception use (Davidson & Jaccard, 1979) and volunteering (Schwartz, 1978). In a meta-analysis, Cooke and Sheeran (2004) reported a significant effect of temporal stability on the attitude–behaviour relationship across three studies (one unpublished plus the two above) with an average effect size that was of medium-large magnitude.

According to the prediction explanation, more stable attitudes should better predict behaviour provided that the attitude remains the same from the point at which it is measured to the point in time at which the opportunity to act occurs (Schwartz, 1978). This explanation might be tested with a simple two-wave study design, with attitude measured at T1 and behaviour measured at T2 and temporal stability of attitude assessed between T1 and T2. However, such a design has three important methodological weaknesses. First, one of the measures used to assess stability is based on the measure of attitude used to predict behaviour (i.e., attitude_{T1} and stability_{T1-T2} measures both include attitude_{T1} and are so not independent). Second, one of the measures used to assess stability is assessed at the same time point as the measure of behaviour that is being predicted (i.e., stability_{T1-T2} and behaviour_{T2} include measures taken at T2), and this might lead to consistency biases, particularly if both are self-report measures. Third, the measure of attitude stability (i.e., stability_{T1-T2}) covers the time period after the measurement of the predictor (i.e., attitude_{T1}). This is also potentially problematic. This is because in predictive terms the key question is whether attitudes that have been identified as stable or not are then predictive of subsequent behaviour. A three-wave study with attitude measured at T1 and T2 and behaviour assessed at T3 (i.e., the design used by Schwartz, 1978 and Davidson & Jaccard, 1979) can address the second and third weaknesses, but not the first weakness. A four-wave study with attitude measured at T1, T2, and T3 and behaviour assessed at T4 can address all three weaknesses simultaneously. For example, such a design can assess whether stability measures that do not overlap with the attitude measure in the attitude–behaviour relationship moderate this relationship (e.g., using stability_{T1-T2} as a moderator of attitude_{T3}–behaviour_{T4}). In the present research, we examine each of these designs and provide a first test of a four-wave approach that provides the methodologically most rigorous test of the presumed relation between attitude stability on the one hand and the attitude–behaviour link on the other hand.

Another focus of the current research is on assessing stability moderation effects separately for cognitive and affective attitudes. This distinction between instrumental/cognitive versus experiential/affective components of attitudes is long established (Abelson, Kinder, Peters, & Fiske, 1982; Trafimow & Sheeran, 1998). The cognitive component of attitude (or cognitive attitude) is considered to be the evaluation implied by cognitions about an attitude object (Chaiken & Baldwin, 1981). Such cognitive attitude can be assessed by ‘harmful–beneficial’ or ‘worthless–valuable’ semantic differentials (Crites, Fabrigar, & Petty, 1994). The affective component of attitude (or affective

attitude) is considered to be the evaluation implied by feelings (or emotions) about an attitude object (Chaiken, Pomerantz, & Giner-Sorolla, 1995). Such affective attitude can be assessed by ‘unpleasant–pleasant’ or ‘unenjoyable–enjoyable’ semantic differentials (Crites et al., 1994). The Reasoned Action Approach (RAA; Fishbein & Ajzen, 2010) includes both components of attitude as part of an overall attitude, although many studies include measures of cognitive and affective attitudes as independent predictors of intention and behaviour (Conner, McEachan, Taylor, O’Hara, & Lawton, 2015; McEachan et al., 2016). A meta-analysis of the RAA (McEachan et al., 2016) reported that behaviour was more strongly related to affective ($r_+ = .30, k = 47$) than cognitive ($r_+ = .20, k = 47$) attitude. Interestingly, Conner and Norman (2021) reported more consistent moderation effects for temporal stability on the affective attitude–behaviour relationship compared with the cognitive attitude–behaviour relationship. In the present research, we examine the moderating effects for stability on both the cognitive attitude–behaviour and affective attitude–behaviour relationship in two-, three-, and four-wave designs. These effects are examined both individually and simultaneously.

The analyses reported here also examined the effects of controlling for past behaviour assessed after attitude stability (i.e., past behaviour at T2 in a three-wave design or T3 in a four-wave design) while testing whether attitude stability moderates the attitude–behaviour relationship. This is novel and was done in order to distinguish changes in attitude stability from changes in behaviour (e.g., in showing that stability_{T1-T2} is a moderator of attitude_{T3} – behaviour_{T4} it is important to show that this is not attributable to behaviour having changed over the same time period).

In the present research, we assessed the moderating effects of attitude stability on attitude–behaviour relationships across three studies that had two-wave (Study 1), three-wave (Study 2), or four-wave (Study 3) designs. The studies also varied in the behaviours and samples examined, and in the time delay over which attitude stability or the attitude–behaviour relationship was assessed. The aim was to assess the generality of any moderation effects for attitude stability across different designs, behaviours, and populations. In each study, we assessed moderation effects independently and simultaneously for cognitive attitude and affective attitude. We also assessed the effect of controlling for past behaviour on the stability moderation effects.

STUDY 1: PHYSICAL ACTIVITY

Study 1 focussed on physical activity. The current data on temporal stability have not been previously reported, although a previous paper reported the impact of inconsistency between cognitive and affective attitudes on the overall attitude–behaviour relationship in these data (Conner, Wilding, van Harreveld, & Dalege, 2020, Study 3). Several measures overlap between the two reports of this data, specifically, the measures of behaviour at T1 and T2 plus the measures of cognitive and affective attitudes at T1. In the earlier paper, the measures of cognitive and affective attitude were used to create a measure of inconsistency and ambivalence but were not used to predict behaviour. Several other measures not reported here were also taken (e.g., behavioural intentions; anticipated affect reaction; goal priority). The study was approved by the University of Leeds, UK ethical review committee. Copies of the full questionnaires (T1, T2) are available (see online appendix; data here: https://osf.io/74f6m/?view_only=c3038c0f07f84cda823bd26dda37b5fa).

Method

Sample

Prolific, an online platform for recruiting participants, was used to identify participants. In total, 1,007 participants completed the first (T1) questionnaire. A total of 909 (90% response rate) also completed a second (T2) questionnaire, four weeks later and were matched across time points. Participants completing questionnaires (T1 and T2) received £4.30 (\$6.03) in recompense for their time. Data were collected in May–June 2018. A total of 361 males and 540 females (8 missing), mean age 34.9 years ($SD = 10.81$), were included in the analyses. The included sample ($N = 909$) was not different from the excluded sample ($N = 98$) on cognitive attitude, affective attitude, or past behaviour as assessed at T1 ($ps > .43$).

Measures

Eight split semantic differential items tapping positive (e.g., ‘My engaging in the recommended levels of physical activity each week over the next month would be, *not at all useful-extremely useful*’; scored 1–7; useful, beneficial, healthy, valuable; $\alpha = .91, .90$ for T1 and T2, respectively) and negative (useless, harmful, unhealthy, worthless; scored 1–7, $\alpha = .88, .91$ for T1 and T2, respectively) cognitive reactions were used to measure cognitive attitude. Positive and negative reactions were averaged and the difference computed (i.e., mean positive evaluation – mean negative evaluation). Therefore, cognitive attitude scores ranged from –6 to +6. Eight split semantic differential items tapping positive (enjoyable, pleasurable, exciting, agreeable; scored 1–7, $\alpha = .91, .92$ for T1 and T2, respectively) and negative (unenjoyable, unpleasurable, boring, disagreeable; scored 1–7, $\alpha = .90, .90$ for T1 and T2, respectively) affective reactions were used to assess affective attitude. Positive and negative reactions were averaged and a difference computed (i.e., mean positive evaluation – mean negative evaluation). Therefore, affective attitude scores ranged from –6 to +6. Consistent with most studies on attitude stability (Xu et al., 2020), temporal stability was assessed based on the absolute change in attitude scores for an individual across time points. Here, stability was scored as [$12 - \text{absolute difference between attitude}_{T1} \text{ and attitude}_{T2}$] for cognitive attitude and affective attitude separately. Scores could range between 0 and 12 with higher scores indicating greater temporal stability.

Behaviour was assessed in the same way at T1 and T2 using both closed-ended (e.g., ‘How frequently did you engage in the recommended levels of physical activity each week over the last month?, *never – always*’, scored 1–7) and open-ended (e.g., ‘Over the past month, how many weeks did you engage in the recommended levels of physical activity?, *___ weeks*’) items. Each item was converted to a z-score and averaged within a time point to form a measure of past behaviour (T1, $\alpha = .80$) and subsequent behaviour (T2, $\alpha = .81$).

Analysis

Descriptive statistics (means and SDs) plus intercorrelations among all constructs were examined first. Our main hypothesis about the moderating effect of temporal stability on the attitude–behaviour relationship for cognitive and affective attitudes was tested using moderated multiple regression. Variables were entered as predictors of subsequent (T2) behaviour in two blocks: (1) attitude, stability, and the interaction between attitude and stability were entered, and (2) past behaviour was entered. The regression analyses

examined these effects for cognitive and affective attitudes separately and then in combination. The regressions used mean-centred scores to reduce multicollinearity problems (Aiken & West, 1991). Significant interaction terms were explored using simple slopes analyses (Aiken & West, 1991) by testing unstandardized regression slopes for cognitive or affective attitude (T1) at low (mean - 1 SD), mean, and high (mean + 1 SD) levels of attitude stability.

Results

Table 1 reports the means, standard deviations, and correlations between measures. All measures had reasonable variance. Cognitive attitude and affective attitude were slightly positive, and the stability of both cognitive and affective attitudes was high. Affective attitude and past behaviour were the strongest correlates of T2 behaviour, although cognitive attitude and the two stability measures were also significantly correlated with T2 behaviour.

Table 2 reports the moderated regression analyses to predict T2 behaviour. Testing the effects of cognitive attitude (steps A1, A2) and affective attitude (steps B1, B2) individually indicated that each measure of attitude was significantly predictive of T2 behaviour and significantly moderated by stability and that these effects, although attenuated, remained when controlling for past behaviour. Simple slope analyses indicated that as stability became greater, the effect of cognitive attitude ($B = 0.089$, $SE = 0.014$, $p = .001$; $B = 0.113$, $SE = 0.014$, $p < .001$; $B = 0.137$, $SE = 0.018$, $p < .001$ for low, moderate, and high levels of cognitive attitude stability, respectively) and affective attitude ($B = 0.089$, $SE = 0.011$, $p < .001$; $B = 0.128$, $SE = 0.008$, $p < .001$; $B = 0.167$, $SE = 0.011$, $p < .001$ for low, moderate, and high levels of affective attitude stability, respectively) on behaviour also increased. Testing the effects of cognitive attitude and affective attitude simultaneously (Table 2, steps C1, C2) indicated that only the influence of affective attitude on behaviour was significantly moderated by temporal stability and that this effect remained when controlling for past behaviour.

Discussion

Study 1 results indicated that temporal stability of cognitive attitude moderated the relationship of cognitive attitude to behaviour (Table 2, step A1), while temporal stability

Table 1. Study 1 means, standard deviations, and intercorrelation of measures ($N = 909$)

	B_{T2}	CA_{T1}	AA_{T1}	CA_{T1-T2}	AA_{T1-T2}	PB_{T1}
Behaviour at T2 (B_{T2})	1.000	0.272***	0.450***	0.148***	0.103**	0.654***
Cognitive Attitude T1 (CA_{T1})		1.000	0.517***	0.466***	0.134***	0.270***
Affective Attitude T1 (AA_{T1})			1.000	0.260***	0.232***	0.543***
CA Stability T1-T2 (CA_{T1-T2})				1.000	0.477***	0.139***
AA Stability T1-T2 (AA_{T1-T2})					1.000	0.113**
Past Behaviour T1 (PB_{T1})						1.000
<i>M</i>	0.053	3.709	1.252	10.835	10.620	0.016
<i>SD</i>	0.763	1.993	2.710	1.366	1.376	0.754

Note. * $p < .05$; ** $p < .01$; *** $p < .001$.

Table 2. Moderated linear regression of behaviour at T2 onto attitude, stability, attitude \times stability interaction, and past behaviour in Study 1 ($N = 909$)

Step/predictor	B	SE B	β
A1. Cognitive Attitude T1 (CA_{T1})	0.113	0.014	0.296***
CA Stability T1–T2 (CA_{T1-T2})	0.042	0.022	0.076
$CA_{T1} \times CA_{T1-T2}$	0.018	0.005	0.126***
A2. Cognitive Attitude T1 (CA_{T1})	0.045	0.012	0.119***
CA Stability T1–T2 (CA_{T1-T2})	0.026	0.017	0.047
$CA_{T1} \times CA_{T1-T2}$	0.011	0.004	0.078**
Past Behaviour T1 (PB_{T1})	0.630	0.026	0.622***
B1. Affective Attitude T1 (AA_{T1})	0.128	0.008	0.455***
AA Stability T1–T2 (AA_{T1-T2})	0.032	0.018	0.058
$AA_{T1} \times AA_{T1-T2}$	0.028	0.005	0.184***
B2. Affective Attitude T1 (AA_{T1})	0.041	0.008	0.145***
AA Stability T1–T2 (AA_{T1-T2})	0.028	0.015	0.050
$AA_{T1} \times AA_{T1-T2}$	0.021	0.004	0.137***
Past Behaviour T1 (PB_{T1})	0.574	0.030	0.567***
C1. Cognitive Attitude T1 (CA_{T1})	0.029	0.015	0.077
Affective Attitude T1 (AA_{T1})	0.119	0.010	0.423***
CA Stability T1–T2 (CA_{T1-T2})	–0.011	0.024	–0.020
AA Stability T1–T2 (AA_{T1-T2})	0.038	0.021	0.068
$CA_{T1} \times CA_{T1-T2}$	0.002	0.006	0.018
$AA_{T1} \times AA_{T1-T2A}$	0.028	0.006	0.183***
C2. Cognitive Attitude T1 (CA_{T1})	0.030	0.013	0.077
Affective Attitude T1 (AA_{T1})	0.031	0.009	0.109**
CA Stability T1–T2 (CA_{T1-T2})	–0.012	0.021	–0.022
AA Stability T1–T2 (AA_{T1-T2})	0.034	0.018	0.061
$CA_{T1} \times CA_{T1-T2}$	0.000	0.005	0.003
$AA_{T1} \times AA_{T1-T2}$	0.022	0.005	0.141***
Past Behaviour T1 (PB_{T1})	0.575	0.030	0.568***

Note. step 1a $\Delta F(1, 902) = 72.03, p < .001, \Delta R^2 = .074$; step 2a $\Delta F(2, 900) = 5.54, p = .004, \Delta R^2 = .004$; step 3a $\Delta F(1, 899) = 575.35, p < .001, \Delta R^2 = .357$; step 1b $\Delta F(1, 901) = 228.55, p < .001, \Delta R^2 = .202$; step 2a $\Delta F(2, 899) = 17.73, p < .001, \Delta R^2 = .030$; step 3a $\Delta F(1, 898) = 371.99, p < .001, \Delta R^2 = .225$; step 1c $\Delta F(2, 900) = 115.63, p < .001, \Delta R^2 = .204$; step 2c $\Delta F(4, 896) = 9.203, p < .001, \Delta R^2 = .031$; step 3c $\Delta F(1, 895) = 373.62, p < .001, \Delta R^2 = .225$.

** $p < .01$; *** $p < .001$.

of affective attitude moderated the relationship of affective attitude to behaviour (Table 2, step B1), and these effects remained significant when controlling for past behaviour (Table 2, steps A2, B2). In particular, higher compared with lower levels of stability were matched by stronger attitude–behaviour relationships. However, when both measures of attitude were entered simultaneously, there were only significant effects for affective attitude on behaviour and only the affective attitude–behaviour relationship was moderated by (affective) attitude stability (Table 2, step C1), and this significant effect remained when controlling for past behaviour (Table 2, step C2).

As noted in the introduction, two-wave designs have a number of weaknesses with respect to testing the effects of temporal stability of attitude. Study 2 therefore employed a three-wave design that allowed us to address some of these weaknesses. Study 2 also examined effects across a group of behaviours in a within-participants design. This is

similar to examining repeated within-person associations between cognitions and behaviour over time (Inauen, Shrout, Bolger, Stadler, & Scholz, 2016), but applies this perspective to associations within participants across behaviours (Schüz, Brick, Wilding, & Conner, 2020).

STUDY 2: MULTIPLE HEALTH BEHAVIOURS

Study 2 focussed on multiple health behaviours. The current data on temporal stability have not been previously reported, although a previous paper reported predicting behaviour from Reasoned Action Approach variables (Conner, McEachan, Lawton, & Gardner, 2017). Several measures overlap between the two reports of these data, specifically, the measures of behaviour at T2 and T3 plus the measures of cognitive and affective attitudes at T2. In the earlier paper, the power of cognitive and affective attitude to predict behaviour controlling for RAA variables was reported, although the impact of stability was not investigated. Other measures were also taken but are not reported here (e.g., intentions; norms, perceived behavioural control). Full copies of the questionnaires (T1, T2, T3) are available as an online appendix (data here: https://osf.io/74f6m/?view_only=c3038c0f07f84cda823bd26dda37b5fa). The study received approval from the University of Leeds, UK ethical review committee.

Method

Sample

Participants based in England were recruited (e.g., local newspaper advert, Local Government newsletter, internet advert) to complete paper and pencil questionnaires three times (with approximately 1 month between questionnaires). Respondents were sent gift vouchers (£20, approximately \$30) on completion of the third questionnaire. A total of 385 participants completed the T1 questionnaire and 281 of these provided complete data across three time points and were included in the analyses. The final sample included 103 males and 178 females with a mean age 39.0 years ($SD = 10.81$). The 281 analysed respondents (with 3,173 participant–behaviour data points) did not differ from the 104 excluded on measures of cognitive attitude, affective attitude, or past behaviour (T1; $ps > .13$).

Measures

For each of 14 health behaviours (eat five fruit and vegetables per day; wear a helmet when riding a bicycle; take recommended levels of physical activity; exercise regularly; eat a low fat diet; take vitamin supplements; brush teeth twice a day; floss teeth daily; binge drinking; drink more than the recommended daily limits of alcohol; smoking; using illegal drugs; exceeding the posted speed limit when driving; drinking and driving), participants completed the measures detailed below.

Questions were rescored such that higher values represented more positive views (protective health behaviours) or more negative views (risk health behaviours). *Cognitive attitude* was assessed by two items at T1 and T2 (e.g., 'Eating a low fat diet over the next four weeks would be: harmful–beneficial, worthless–valuable'; mean $r = .34$; scored 1–7). *Affective attitude* was assessed by two items (e.g., 'Eating a low fat diet over the next four weeks would be: unpleasant–pleasant, unenjoyable–enjoyable'; mean $r = .44$; scored 1–7).

at T1 and T2. Similar to Study 1, temporal stability was computed as $[6 - \text{absolute difference between attitude}_{T1} \text{ and attitude}_{T2}]$ for cognitive attitude and affective attitude separately. Scores could range between 0 and 6 with higher scores indicating greater temporal stability. *Behaviour* was measured at each time point (T1, T2, T3) by single items assessing number of days the behaviour was engaged in (e.g., 'On how many days in the past four weeks have you eaten a low-fat diet?'; higher scores indicated more healthy behaviour; i.e., more protection and fewer risk health behaviours).

Analyses

Means, *SDs*, and correlations were analysed in SPSS (version 20, SPSS Inc., Chicago, USA). HLM was used to perform the main regression analyses (version 7, SS1) predicting behaviour (T2 or T3) from cognitive and affective attitude (T1 or T2) plus stability (cognitive and affective attitude; T1-T2) and their interaction plus past behaviour (T1 or T2) across all behaviours. The first set of analyses predicted T2 behaviour from T1 attitudes, stability (T1-T2), their interaction plus past behaviour (T1), that is, stability assessed over the same time period as the attitude-behaviour relationship. The second set of analyses predicted behaviour at T3 from attitudes at T2, stability (T1-T2), their interaction plus past behaviour (T2), that is, stability assessed over the period before the attitude-behaviour period. The first set of analyses parallel those of Study 1, while the second set of analyses extend those of Study 1 by separating the stability measure from the measure of behaviour and partially separating it from the measure of attitude. The 14 behaviours were clustered within individuals, and this was controlled for by using Hierarchical Linear Modeling (HLM7; Raudenbush & Bryk, 2002). The use of random effects allowed for variation across behaviours within individuals. The data were structured in a two-level hierarchy. At level 1 was the within-person variation that is the focus here. At level 2 was any between-person variability. Predictor variables (attitude and stability measures) were centred around the group mean. This approach to analysing data on multiple behaviours has been taken in a number of studies (Conner et al., 2017). For each model, from the population average model with robust standard errors we report unstandardized coefficients, standard errors, and betas. We did not test differences between individual behaviours. Where an interaction was significant ($p < .05$), this was decomposed using simple slopes with free online software (Model 1 for interactions among level 1 variables) at <http://www.quantpsy.org/interact/hlm2.htm>. Otherwise, the analyses were conducted in a similar way to those reported for Study 1.

Results

Means, standard deviations, and correlations among variables are reported in Table 3. All measures had reasonable variance. Cognitive and affective attitude were positive, and stability of both cognitive and affective attitudes was high. Behaviour (T2 or T3) was most strongly correlated with past behaviour (T1 or T2), affective attitude (T1 or T2), and cognitive attitude (T1 or T2), although the stability measures were also significant correlates.

Table 4 reports the moderated (multi-level) regression analyses. The regressions to predict T2 behaviour (left-hand column) parallel those used in Study 1 and mostly show similar findings. The effects of cognitive attitude (Table 4, steps A1, A2) and affective attitude (Table 4, steps B1, B2) examined individually indicated that each measure of

Table 3. Study 2 means, standard deviations, and intercorrelation of measures (N = 3,173 from 281 participants)

	B _{T3}	B _{T2}	CA _{T2}	AA _{T2}	B _{T1}	CA _{T1}	AA _{T1}	CA _{T1-T2}	AA _{T1-T2}
Behaviour T3 (B _{T3})	1.000	0.833***	0.427***	0.474***	0.786***	0.410***	0.466***	0.212***	0.071***
Behaviour T2 (B _{T2})		1.000	0.467***	0.535***	0.820***	0.436***	0.488***	0.240***	0.067***
Cognitive Attitude T2 (CA _{T2})			1.000	0.484***	0.453***	0.693***	0.418***	0.406***	0.041*
Affective Attitude T2 (AA _{T2})				1.000	0.513***	0.411***	0.757***	0.295***	0.171***
Behaviour T1 (B _{T1})					1.000	0.492***	0.549***	0.260***	0.092***
Cognitive Attitude T1 (CA _{T1})						1.000	0.475***	0.474***	0.059***
Affective Attitude T1 (AA _{T1})							1.000	0.290***	0.226***
CA Stability T1-T2 (CA _{T1-T2})								1.000	0.216***
AA Stability T1-T2 (AA _{T1-T2})									1.000
M	4.730	4.740	6.240	4.810	4.660	6.210	4.780	5.510	5.214
SD	2.247	2.205	1.139	1.784	2.256	1.196	1.800	0.774	0.972

Note. * $p < .05$; ** $p < .01$; *** $p < .001$.

Table 4. Moderated linear regression of behaviour onto attitude, stability, attitude \times stability, and past behaviour in Study 2 ($N = 3,173$; 281 participants)

Step/Predictor	Predicting B_{T2}			Predicting B_{T3}		
	B	SE B	β	B	SE B	β
A1 Cognitive Attitude (CA)	1.017	0.042	0.550***	1.040	0.045	0.527***
CA Stability T1–T2 (CA_{T1-T2})	0.486	0.069	0.172***	0.325	0.066	0.113***
CA \times CA_{T1-T2}	0.457	0.037	0.314***	0.423	0.041	0.227***
A2 Cognitive Attitude (CA)	0.224	0.033	0.121***	0.151	0.031	0.077***
CA Stability T1–T2 (CA_{T1-T2})	0.181	0.045	0.064***	0.004	0.038	0.001
$CA_{T2} \times CA_{T1-T2}$	0.224	0.033	0.154***	0.081	0.027	0.044**
Past Behaviour (PB)	0.727	0.016	0.747***	0.800	0.015	0.782***
B1 Affective Attitude (AA)	0.630	0.023	0.515***	0.618	0.025	0.492***
AA Stability T1–T2 (AA_{T1-T2})	0.045	-0.045	-0.020	-0.032	0.046	-0.014
AA \times AA_{T1-T2}	0.216	0.023	0.190***	0.137	0.022	0.120***
B2 Affective Attitude (AA)	0.073	0.020	0.058***	0.051	0.019	0.041**
AA Stability T1–T2 (AA_{T1-T2})	0.000	0.028	0.000	0.012	0.027	0.005
AA \times AA_{T2-T2}	0.121	0.016	0.107***	0.062	0.015	0.054***
Past Behaviour (PB)	0.755	0.016	0.776***	0.811	0.015	0.793***
C1 Cognitive Attitude (CA)	0.700	0.047	0.379***	0.721	.055	0.365***
Affective Attitude (AA)	0.397	0.027	0.325***	0.388	.030	0.309***
CA Stability T1–T2 (CA_{T1-T2})	0.278	0.069	0.099***	0.169	.064	0.059**
AA Stability T1–T2 (AA_{T1-T2})	-0.010	0.042	-0.004	-0.003	.044	-0.001
CA \times CA_{T1-T2}	0.312	0.035	0.214***	0.309	.043	0.166***
AA \times AA_{T1-T2}	0.149	0.021	0.131***	0.092	.021	0.081***
C2 Cognitive Attitude (CA)	0.190	0.033	0.103***	0.128	.032	0.047***
Affective Attitude (AA)	0.040	0.019	0.033*	0.037	.019	0.029
CA Stability T1–T2 (CA_{T1-T2})	0.120	0.043	0.043**	-0.020	.039	-0.007
AA Stability T1–T2 (AA_{T1-T2})	0.002	0.028	0.001	0.018	.026	0.008
CA \times CA_{T1-T2}	0.153	0.026	0.105***	0.052	.026	0.028
AA \times AA_{T1-T2}	0.099	0.015	0.087***	0.060	.014	0.053***
Past Behaviour (PB)	0.717	0.018	0.737***	0.790	.017	0.772***

Note. For predicting B_{T2} , CA = CA_{T1} , AA = AA_{T1} , PB = B_{T1} ; step A1 Deviance = 12,761.7; step A2 Deviance = 10,344.5; step B1 Deviance = 12,757.0; step B2 Deviance = 10,342.0; step C1 Deviance = 12,391.9; step C2 Deviance = 10,248.9. For predicting B_{T3} , CA = CA_{T2} , AA = AA_{T2} , PB = B_{T2} ; step A1 Deviance = 13,022.5; step A2 Deviance = 10,418.6; step B1 Deviance = 12,990.0; step B2 Deviance = 10,394.2; step C1 Deviance = 12,683.0; step C2; Deviance = 10,362.6.

* $p < .05$; ** $p < .01$; *** $p < .001$.

attitude was significantly predictive of T2 behaviour and was significantly moderated by stability, and that these effects remained significant when controlling for past behaviour (T1). Simple slope analyses indicated that as stability increased from low to moderate to high the effect of cognitive attitude ($B = 0.670$, $SE = 0.0404$, $p < .001$; $B = 1.017$, $SE = 0.0418$, $p < .001$; $B = 1.364$, $SE = 0.0588$, $p < .001$ for low moderate and high levels of cognitive attitude stability) and affective attitude ($B = 0.403$, $SE = 0.0344$, $p < .001$; $B = 0.630$, $SE = 0.0232$, $p < .001$; $B = 0.857$, $SE = 0.0332$, $p < .001$ for low moderate and high levels of affective attitude stability) on T2 behaviour also increased. Testing the effects of cognitive attitude and affective attitude simultaneously (Table 4, step C1) indicated that, unlike in Study 1, the influence of both cognitive attitude and affective

attitude on T2 behaviour was significantly moderated by temporal stability. In addition, both of these attitude by temporal stability interactions remained significant when also controlling for past behaviour (T1; Table 4, step C2).

The regressions to predict T3 behaviour (Table 4, right-hand column) differ from the above analyses in using a measure of stability taken before the time period for the attitude–behaviour relationship (T2–T3), but overlapping in the use of the T2 attitude measures. The findings broadly parallel those reported above and for Study 1, although the moderating effects for attitude stability were attenuated. The effects of cognitive attitude (Table 4, steps A1, A2) and affective attitude (Table 4, steps B1, B2) individually indicated that each measure of attitude was significantly predictive of T3 behaviour and each was significantly moderated by stability, and that these effects remained when controlling for past behaviour (T2). Simple slope analyses indicated that as stability increased from low to moderate to high the effect of cognitive attitude ($B = 0.710$, $SE = 0.0463$, $p < .001$; $B = 1.040$, $SE = 0.0458$, $p < .001$; $B = 1.370$, $SE = 0.0638$, $p < .001$ for low moderate and high levels of cognitive attitude stability) and affective attitude ($B = 0.485$, $SE = 0.0348$, $p < .001$; $B = 0.618$, $SE = 0.0253$, $p < .001$; $B = 0.751$, $SE = 0.0317$, $p < .001$ for low moderate and high levels of affective attitude stability) on T3 behaviour also increased. Testing the effects of cognitive attitude and affective attitude simultaneously (Table 4, steps C1, C2) indicated that the effects of both cognitive attitude and affective attitude on behaviour were significantly moderated by attitude stability, but that only the affective attitude by stability interaction remained significant when controlling for past behaviour (T2).

Discussion

The results from Study 2 broadly parallel those of Study 1 using a within-participants design across multiple health behaviours. Temporal stability of cognitive attitude moderated the relationship of cognitive attitude to behaviour (Table 4, step A1), while affective attitude stability moderated the impact of affective attitude to behaviour (Table 4, step B1), and these effects remained when controlling for past behaviour (Table 4, steps A2, B2). In particular, higher compared with lower levels of stability were associated with stronger impacts of cognitive or affective attitude on behaviour. This pattern of findings was replicated in both the two-wave design (i.e., predicting T2 behaviour; Table 4, left-hand column) that parallels Study 1 and the three-wave design (i.e., predicting T3 behaviour; Table 4, right-hand column), although the moderation effects were attenuated in the latter design.

A potential weakness of Study 2 was the relatively low correlation between the pairs of items tapping cognitive attitudes and tapping affective attitudes (i.e., potentially low internal reliability). However, repeating the analyses using single-item measures (i.e., harmful-beneficial for cognitive; unpleasant-pleasant for affective) indicated very similar findings.

Study 2 adds to Study 1 in supporting the idea that temporal stability of cognitive or affective attitude moderates the impact of cognitive or affective attitude on behaviour and that this pattern remains when controlling for past behaviour. However, Study 2 suggests that when using the stronger three-wave design, considering both cognitive and affective attitude simultaneously, and controlling for past behaviour, it is affective attitude that is moderated by a measure of temporal stability. In addition, Study 2 shows that the moderating effect of attitude stability on the attitude–behaviour relationship was attenuated when stability was assessed over a time period (T1–T2) that did not

completely overlap with the time period over which the attitude–behaviour was assessed (T2–T3). However, this comparison was potentially compromised by the fact that this looked at the attitude–behaviour relationship over different time periods (i.e., T1–T2 vs. T2–T3) because attitudes were not assessed at T3. Study 3 was intended to address this and other weaknesses by focussing on the attitude–behaviour relationship across a single time period (T3–T4) but assessing attitude stability across three different time periods (T1–T2, T2–T3, and T3–T4). The first of these analyses separates out the stability measure (stability T1–T2) completely from the attitude–behaviour relationship (T3–T4), whereas the second analysis (stability T2–T3) overlaps with one of the analyses in Study 2 and the third analysis (stability T3–T4) overlaps with analyses reported in both Study 1 and Study 2.

STUDY 3: ADOLESCENT SMOKING

The initiation of smoking in adolescents was the focus of Study 3. The current data on temporal stability have not been previously reported but are part of a larger randomized controlled trial testing implementation intentions as an intervention to reduce smoking initiation that did not examine the effects of attitudes (Conner et al., 2019), and a previous paper reported the impact of inconsistency between cognitive and affective attitudes on the overall attitude–behaviour relationship in these data (Conner et al., 2020, Study 2). These earlier reports focussed on a different measure of smoking and on an evaluative measure of attitude when the sample of adolescents were older. Therefore, there is no overlap in the measures used here and in the earlier reports. The effect of intervention condition was controlled for here and did not moderate any of the relationships reported. Other measures not reported here were also taken (e.g., behavioural intentions; perceived behavioural control). The full questionnaires are available as an online appendix and full data can be found here: https://osf.io/74f6m/?view_only=c3038c0f07f84cda823bd26dda37b5fa. The study received ethical approval from University of Leeds, UK (Faculty of Medicine).

Method

Sample

Adolescents in the UK in 45 different schools took part in the study by completing annual questionnaires. Questionnaires were completed anonymously but matched via a personal code. Data were collected at five time points, although here we report data from the first four time points when adolescents were aged 11–12 (T1), 12–13 (T2), 13–14 (T3), and 14–15 (T4) years. Self-reported smoking at T4 was predicted from attitude and past behaviour measures at T3 and stability of attitude measures between T1 and T2, T2 and T3, or T3 and T4 (each 12 months apart). There were 3,371 participants who completed all measures at all time points. Compared with those we were unable to be matched across time points ($N = 3,475$), those who were matched had a less positive cognitive attitude towards smoking at T1, $F(1, 6,811) = 31.45, p < .001$; less positive affective attitude at T1, $F(1, 6,823) = 39.78, p < .001$; and were not as likely to be smokers at T1, $F(1, 6,845) = 102.71, p < .001$. There were 1,596 boys and 1,774 girls in the final sample.

Measures

Cognitive attitude towards smoking was assessed at each time point by two items ('For me smoking would be...'; '*harmful-beneficial*', '*foolish-wise*'; $r = .47, .68, .69, .73$ for T1 to T4, respectively). Affective attitude was assessed at each time point by three items ('For me smoking would be...'; '*unpleasant-pleasant*', '*unenjoyable-enjoyable*', '*not fun-fun*'; $\alpha = .87, .92, .91, .93$ for T1 to T4, respectively). Items were scored 1-5 with higher scores indicating more positive views of smoking. Temporal stability was computed as [$4 - \text{absolute difference between attitude}_{T1}$ and attitude_{T2}] for cognitive attitude and affective attitude separately, that is, stability T1-T2, T2-T3, or T3-T4. Scores could range between 0 and 4 with higher scores indicating greater temporal stability. Self-reported behaviour was assessed at T3 (past behaviour) and T4 (behaviour) with a checklist (Tick the one that best applies to you: 'I have never smoked'; 'I have only tried smoking once'; 'I used to smoke sometimes, but I never smoke cigarettes now'; 'I sometimes smoke cigarettes now, but I don't smoke as many as one a week'; 'I usually smoke between one and six cigarettes a week'; 'I usually smoke more than six cigarettes a week'). This was coded 0 (never smoked) for the first response and 1 (any smoking) for all other responses as is common in the smoking area.

Analyses

First, means, SDs, and the intercorrelations among variables were examined. Our main prediction was tested using moderated logistic regression analysis (i.e., moderating effect of temporal stability on the cognitive attitude-behaviour and affective attitude-behaviour relationships and the effects of controlling for past behaviour), similar to the procedure used in Study 1 and Study 2. All analyses predicted T4 behaviour from attitudes at T3, attitude stability, interactions between attitude and stability plus past behaviour (T3). The three sets of analyses used either T1-T2 stability, T2-T3 stability, or T3-T4 stability. Simple slopes analyses were again used to explore any significant interaction terms.

Results

Table 5 reports the means, standard deviations, and correlations among measures. All measures had reasonable variance. Cognitive and affective attitude were negative, and stability of both cognitive and affective attitudes was high. Affective attitude, cognitive attitude, and past behaviour were the strongest correlates of T4 behaviour. Stability of cognitive ($r_s = .14$ to $.47$) and affective ($r_s = .18$ to $.44$) attitudes showed some degree of consistency across time points.

The moderated regression analyses to predict T4 behaviour from attitudes at T3 plus our different measures of stability (i.e., T1-T2, T2-T3, T3-T4), their interaction plus past behaviour (T3) is reported in Table 6. In relation to using stability between T3-T4 (i.e., a two-wave design), testing the effects of cognitive attitude (steps A1, A2) and affective attitude (steps B1, B2) individually indicated that each measure of attitude was significantly moderated by stability and that these effects remained when controlling for past behaviour (Table 6, right-hand panel). Simple slopes analyses indicated that as stability increased from low to moderate to high the effect of cognitive attitude ($B = 1.194, SE = 0.105, p < .001$; $B = 1.714, SE = 0.132, p < .001$; $B = 2.233, SE = 0.170, p < .001$ for low, moderate, and high levels of cognitive attitude stability) and affective attitude ($B = 0.817, SE = 0.061, p < .001$; $B = 1.300, SE = 0.074, p < .001$; $B = 1.781,$

Table 5. Descriptive data and intercorrelation of measures in Study 3 (N = 3371)

	B _{T4}	CA _{T3}	AA _{T3}	PB _{T3}	CA _{T1-T2}	AA _{T1-T2}	CA _{T2-T3}	AA _{T2-T3}	CA _{T3-T4}	AA _{T3-T4}
Behaviour T4 (B _{T4})	1.000	0.248***	0.361***	0.621***	-0.149*	-0.214***	-0.259**	-0.300***	-0.342***	-0.404***
Cognitive Attitude T3 (CA _{T3})		1.000	0.733***	0.355***	-0.179***	-0.218***	-0.757***	-0.557***	-0.515***	-0.355***
Affective Attitude T3 (AA _{T3})			1.000	0.424***	-0.191***	-0.305***	-0.586***	-0.727***	-0.419***	-0.474***
Past Behaviour T3 (PB _{T3})				1.000	-0.180***	-0.238***	-0.323***	-0.346***	-0.279***	-0.310***
CA Stability T1-T2 (CA _{T1-T2})					1.000	0.597***	0.389***	0.277***	0.118**	0.121***
AA Stability T1-T2 (AA _{T1-T2})						1.000	0.364***	0.390***	0.141***	0.182***
CA Stability T2-T3 (CA _{T2-T3})							1.000	0.716***	0.471***	0.342***
AA Stability T2-T3 (AA _{T2-T3})								1.000	0.374***	0.436***
CA Stability T3-T4 (CA _{T3-T4})									1.000	0.693***
AA Stability T3-T4 (AA _{T3-T4})										1.000
M	0.218	1.111	1.247	0.145	3.876	3.781	3.868	3.754	3.818	3.695
SD	0.413	0.397	0.644	0.352	0.404	0.557	0.413	0.587	0.501	0.696

Note. *p < .05; **p < .01; ***p < .001.

Table 6. Moderated logistic regression of behaviour at T4 onto attitude, stability, attitude × stability interaction, and past behaviour in Study 3 (N = 3,371)

Step/predictor	Stability T1–T2		Stability T2–T3		Stability T3–T4	
	OR	95% CI	OR	95% CI	OR	95% CI
A1. Cognitive Attitude T3 (CA _{T3})	4.013***	3.182, 5.060	6.090***	4.271, 8.682	5.521***	4.260, 7.156
CA Stability (CA _{Tx-Ty})	0.582***	0.482, 0.704	0.423***	0.321, 0.559	0.276***	0.234, 0.326
CA _{T3} × CA _{Tx-Ty}	0.990	0.661, 1.483	2.132***	1.747, 2.601	2.615***	2.176, 3.143
A2. Cognitive Attitude at T3 (CA _{T3})	1.770***	1.366, 2.292	2.474***	1.581, 3.871	2.075***	1.509, 2.852
CA Stability (CA _{Tx-Ty})	0.765*	0.604, 0.968	0.679*	0.499, 0.925	0.301***	0.251, 0.362
CA _{T3} × CA _{Tx-Ty}	0.904	0.560, 1.460	1.528***	1.206, 1.937	2.008***	1.662, 2.426
Past Behaviour T3 (PB _{T3})	34.619***	23.329, 45.519	31.451***	24.616, 40.185	29.028***	23.379, 36.042
B1. Affective Attitude at T3 (AA _{T3})	3.076***	2.660, 3.558	3.547***	2.921, 4.308	3.641***	3.146, 4.213
AA Stability (AA _{Tx-Ty})	0.586***	0.505, 0.680	0.593***	0.497, 0.708	0.338***	0.299, 0.381
AA _{T3} × AA _{Tx-Ty}	1.248**	1.074, 1.450	1.440***	1.301, 1.595	2.005***	1.814, 2.216
B2. Affective Attitude at T3 (AA _{T3})	1.844***	1.544, 2.203	2.065***	1.612, 2.645	2.163***	1.813, 2.581
AA Stability (AA _{Tx-Ty})	0.716***	0.598, 0.857	0.755*	0.606, 0.940	0.348***	0.304, 0.400
AA _{T3} × AA _{Tx-Ty}	1.180+	0.980, 1.421	1.274***	1.115, 1.456	2.020***	1.795, 2.273
Past Behaviour T3 (PB _{T3})	29.792***	22.601, 39.271	28.234***	22.091, 36.086	26.891***	21.546, 33.561
C1. Cognitive Attitude T3 (CA _{T3})	1.168	0.857, 1.593	1.868**	1.225, 2.846	1.629**	1.177, 2.255
Affective Attitude T3 (AA _{T3})	2.804***	2.303, 3.413	2.730***	2.141, 3.481	2.824***	2.327, 3.427
CA Stability (CA _{Tx-Ty})	0.850	0.736, 1.226	0.746	0.525, 1.060	0.705**	0.572, 0.870
AA Stability (AA _{Tx-Ty})	0.602***	0.499, 0.727	0.682**	0.540, 0.862	0.397***	0.340, 0.463
CA _{T3} × CA _{Tx-Ty}	0.742	0.484, 1.137	1.451***	1.183, 1.779	1.294*	1.061, 1.578
AA _{T3} × AA _{Tx-Ty}	1.294**	1.102, 1.520	1.258***	1.101, 1.438	1.789***	1.578, 2.027
C2. Cognitive Attitude T3 (CA _{T3})	0.828	0.575, 1.191	1.131	0.650, 1.965	0.920	0.612, 1.382
Affective Attitude T3 (AA _{T3})	1.990***	1.557, 2.542	1.988***	1.460, 2.705	2.145***	1.697, 2.710
CA Stability (CA _{Tx-Ty})	1.110	0.812, 1.518	1.006	0.657, 1.539	0.738*	0.576, 0.946
AA Stability (AA _{Tx-Ty})	0.685	0.544, 0.861	0.755+	0.563, 1.014	0.402***	0.334, 0.483

Continued

Table 6. (Continued)

Step/predictor	Stability T1-T2		Stability T2-T3		Stability T3-T4	
	OR	95% CI	OR	95% CI	OR	95% CI
CA _{T3} × CA _{Tx-Ty}	0.706	0.416, 1.197	1.171	0.890, 1.539	0.993	0.795, 1.240
AA _{T3} × AA _{Tx-Ty}	1.265*	1.031, 1.552	1.203*	1.010, 1.434	1.984***	1.713, 2.297
Past Behaviour T3 (PB _{T3})	30.419***	23.010, 40.213	28.754**	22.412, 36.412	27.349***	21.843, 34.243

Note. For left-hand column, stability measures are for T1-T2: step A1 $\Delta\chi(3) = 262.5, p < .001, \Delta\text{Nagelkerke } R^2 = .113$; step A2 $\Delta\chi(1) = 874.3, p < .001, \Delta\text{Nagelkerke } R^2 = .320$; step B1 $\Delta\chi(3) = 429.2, p < .001, \Delta\text{Nagelkerke } R^2 = .167$; step B2 $\Delta\chi(1) = 755.6, p < .001, \Delta\text{Nagelkerke } R^2 = .267$; step C1 $\Delta\chi(6) = 421.16, p < .001, \Delta\text{Nagelkerke } R^2 = .178$; step C2 $\Delta\chi(1) = 751.8, p < .001, \Delta\text{Nagelkerke } R^2 = .269$. For middle-hand column, stability measures are for T2-T3: step A1 $\Delta\chi(3) = 383.5, p < .001, \Delta\text{Nagelkerke } R^2 = .183$; step A2 $\Delta\chi(1) = 1010.0, p < .001, \Delta\text{Nagelkerke } R^2 = .271$; step B1 $\Delta\chi(3) = 518.4, p < .001, \Delta\text{Nagelkerke } R^2 = .099$; step B2 $\Delta\chi(1) = 916.2, p < .001, \Delta\text{Nagelkerke } R^2 = .047$; step C1 $\Delta\chi(6) = 528.0, p < .001, \Delta\text{Nagelkerke } R^2 = .183$; step C2 $\Delta\chi(1) = 902.0, p < .001, \Delta\text{Nagelkerke } R^2 = .268$. For right-hand column stability measures are for T3-T4: step A1 $\Delta\chi(3) = 791.0, p < .001, \Delta\text{Nagelkerke } R^2 = .219$; step A2 $\Delta\chi(1) = 1,198.7, p < .001, \Delta\text{Nagelkerke } R^2 = .272$; step B1 $\Delta\chi(3) = 1,103.7, p < .001, \Delta\text{Nagelkerke } R^2 = .295$; step B2 $\Delta\chi(1) = 1,062.9, p < .001, \Delta\text{Nagelkerke } R^2 = .229$; step C1 $\Delta\chi(6) = 1,115.0, p < .001, \Delta\text{Nagelkerke } R^2 = .299$; step C2 $\Delta\chi(1) = 1,054.6, p < .001, \Delta\text{Nagelkerke } R^2 = .226$.

* $p < .10$; ** $p < .01$; *** $p < .001$.

$SE = 0.099, p < .001$ for low, moderate, and high levels of affective attitude stability) on T4 behaviour also increased. Testing the effects of cognitive attitude and affective attitude simultaneously indicated that while both cognitive and affective attitude effects on T4 behaviour were moderated by stability (Table 6, step C1), only affective attitude was significantly moderated by stability controlling for past behaviour (Table 6, step C2).

In relation to using stability T2–T3 (i.e., a three-wave design), a similar pattern of results emerged although with many of the moderation effects attenuated. Nevertheless, the effects that were significant in the earlier analysis remained so in this analysis (Table 6, middle panel), that is, both cognitive and affective attitude effects on T4 behaviour were moderated by stability. Simple slopes analyses indicated that as stability increased from low to moderate to high the effect of cognitive attitude ($B = 1.473, SE = 0.158, p < .001$; $B = 1.788, SE = 0.179, p < .001$; $B = 2.102, SE = 0.206, p < .001$ for low, moderate, and high levels of cognitive attitude stability) and affective attitude ($B = 1.045, SE = 0.085, p < .001$; $B = 1.264, SE = 0.098, p < .001$; $B = 1.482, SE = 0.118, p < .001$ for low, moderate, and high levels of affective attitude stability) on T4 behaviour also increased. Testing the effects of cognitive attitude and affective attitude simultaneously indicated that while both cognitive and affective attitude effects on T4 behaviour were moderated by stability (Table 6, step C1), only affective attitude was significantly moderated by when also controlling for past behaviour (Table 6, step C2).

In relation to using stability T1–T2 (i.e., a four-wave design), again a similar pattern of results emerged, although there was no longer a significant cognitive attitude by stability interaction and the effects for affective attitude by stability were attenuated (Table 6, left-hand panel). Simple slopes analyses indicated that as stability increased from low to moderate to high the effect of affective attitude ($B = 1.002, SE = 0.069, p < .001$; $B = 1.129, SE = 0.074, p < .001$; $B = 1.256, SE = 0.099, p < .001$ for low, moderate, and high levels of affective attitude stability) on T4 behaviour also increased. Testing the effects of cognitive attitude and affective attitude simultaneously also indicated that only affective attitude was significantly moderated by affective attitude stability (Table 6, step C1) and this effect remained when controlling for past behaviour (T3; Table 6, step C2). This pattern of findings was replicated when using T2 past behaviour.

Discussion

The results from Study 3 show some parallels those of Study 1 and Study 2. This was particularly the case in relation to the two- and three-wave designs with temporal stability moderating the impact of both cognitive and affective attitude on behaviour when considered independently and simultaneously. In particular, higher compared with lower levels of stability were associated with stronger impacts of cognitive and affective attitude on behaviour. It was only when cognitive and affective attitude were considered simultaneously and past behaviour was controlled for that just the affective attitude by stability interaction was significant. In the three-wave design, these moderation effects were attenuated with no significant moderation effect for stability on the cognitive attitude–behaviour relationship when considered independently or simultaneously with affective attitude. The moderation effect for stability on the affective attitude–behaviour relationship was also attenuated in the four-wave design, although it remained significant when considered independently or simultaneously with cognitive attitude and controlling for past behaviour or not (effect only marginally significant when considered independently and controlling for past behaviour).

GENERAL DISCUSSION

Across three studies, the present research shows consistent findings in relation to temporal stability (persistence) moderating the attitude–behaviour relationship (i.e., more stable attitudes were associated with stronger attitude–behaviour relationships). Importantly, the findings were robust across two-, three-, and four-wave designs. This suggests that the three methodological weaknesses identified for two-wave tests of this moderation effect in the introduction do not fully account for any stability moderation effect on the attitude–behaviour relationship. The current findings replicate previous studies (Davidson & Jaccard, 1979; Schwartz, 1978) in showing that the temporal stability of attitudes moderates the attitude–behaviour relationship: more stable attitudes are better predictors of behaviour. This was the case across three studies with different behaviours, populations, time periods, and designs (between vs. within). The current findings therefore extend previous work in showing that similar effects are observed in two-, three-, and four-wave designs that address different potential methodological problems in overlaps between measures of stability and attitude. They also extend previous work in showing similar effects for cognitive and affective attitudes examined independently but that the stability moderation effects are more consistent for affective compared with cognitive attitudes when examined simultaneously. Finally, they also extend previous work in showing most of these effects remain when controlling for past behaviour suggesting that reduced attitude stability was not simply attributable to behaviour change occurring before the attitude–behaviour relationship was assessed.

The more consistent moderation effects of temporal stability found for affective compared with cognitive attitudes are worth further comment. For example, the moderating effect of temporal stability for cognitive attitudes was generally not present when also assessing the temporal stability of affective attitudes plus past behaviour or indeed in the study design with the fewest weaknesses (i.e., four-wave design in Study 3). As noted in the introduction, various studies and reviews show stronger effects for affective compared with cognitive attitudes (Conner et al., 2015; McEachan et al., 2016), supporting the idea of affective attitudes being the stronger predictor of behaviour. In addition, the one previous study looking at the simultaneous moderating effects of cognitive versus affective attitude stability also reported more consistent effects for the latter (Conner & Norman, 2021). This further supports the dominance of affective over cognitive attitudes in predicting behaviour, particularly when such affective attitudes are stable. Future studies should seek to confirm these findings in a broader range of behaviours beyond the health domain and also in measures of overall attitude based on cognitive and affective components or alternative measures (e.g., bad–good, negative–positive semantic differentials). Tests in behaviours where one might expect a priori that cognitive attitudes would be more important (e.g., saving money, energy, or water; purchasing product brands for environmental reasons) would be particularly useful in this regard. The reason for more consistent moderation effects for the stability of affective attitude is not entirely clear. Affective attitudes are known to be more accessible (Verplanken, Hofstee, & Janssen, 1998) and more based in direct experience with the attitude object (Millar & Millar, 1996) perhaps leading to stronger moderating effects for stability. In partial support of the direct experience idea, it has been shown that affective attitudes are stronger mediators of the effects of past behaviour on behaviour (Conner, 2020).

In the present paper, we have focussed on the role of affective and cognitive attitudes, in line with earlier work (Conner & Norman, 2021). This is consistent with a recent focus

on the two as independent predictors of intentions and behaviour within the RAA (Conner et al., 2015, 2017), but different from the more traditional perspective that focuses on the overarching attitude (Breckler, 1994). The relatively strong correlation between cognitive and affective attitudes would appear to be consistent with them being reflective indicators of an overall attitude. In contrast, their differential relationship to behaviour such as shown here and in other studies (Conner et al., 2017) and the fact that they can be independently manipulated (Carfora, Caso, & Conner, 2016) would appear to be more consistent with them being formative indicators of an overall attitude. Recent work in which attitudes are conceptualized as networks (Dalege et al., 2016) is agnostic about whether to conceptualize attitudes at the overall level or at the level of cognitive and affective components. We believe the present results are important regardless, as they indicate that the stability of affective evaluations is more influential when it comes to predicting behaviour than the stability of cognitive evaluations. Relatedly, future research could explore the extent to which the effect of various other moderators of the attitude–behaviour relationship (e.g., attitude importance; Howe & Krosnick, 2017; see also Glasman & Albarracín, 2006) have their effect (i.e., are mediated) through effects on attitude stability. In addition, subsequent research could usefully focus on resistance to persuasion as an important determinant of stability of attitudes over time (Tormala, 2008).

A further issue for future studies to address is the time intervals over which measures are taken. This may be important in relation to the time interval over which attitude stability is assessed, or over which the attitude–behaviour relationship is assessed (e.g., the attitude–behaviour relationship may be attenuated over longer time periods if attitudes are more likely to change over longer time periods). In the current research, this was matched (i.e., same time interval for both) but varied between one month (Study 1, Study 2) and one year (Study 3). Although attitude stability over very short periods of time may be relatively trivial, stability over longer time periods may be indicative of attitudes that persist (remain stable) long into the future (and so more likely to continue to moderate attitude–behaviour relationships). However, relatively little is known about this issue and it is only one of a number of related issues that could be explored in future research. One important question for future research to address is how important is the time interval between when attitude stability is assessed and when the attitude–behaviour relationship is assessed in four-wave designs.

The present research has a number of strengths and weaknesses. In relation to strengths, the consistent pattern of findings across the three studies in different populations, behaviours, designs, and time intervals supports the generalizability of the findings. There are also a number of weaknesses. First, the focus on self-reported behaviour may have opened the research to consistency biases and the findings would be strengthened by use of more objective behavioural measures (for both behaviour and past behaviour). Second, the effects of cognitive and affective attitudes on behaviour were examined without controlling for other key predictors such as social norms, perceived behavioural control and behavioural intentions as specified by models such as the RAA. For example, previous reviews of the RAA have suggested that affective attitudes may have both direct and indirect (via behavioural intentions) effects on behaviour, whereas cognitive attitudes may only have an indirect effect (via behavioural intentions; McEachan et al., 2016). Future research might usefully test whether, for example, the stability of cognitive attitudes consistently moderates their relationship to behavioural intentions. Third, our tests were correlational and would be strengthened by studies showing similar effects based on manipulations of attitude stability. Fourth, our measure of attitude

stability, although consistent with the most commonly used measure, is not the only measure that could be used (e.g., based on within-person correlations).

Insight into what attitude (in)stability does to the translation of attitudes into behaviour is of increasing relevance in a society where opinions seem to change faster than ever. The present research demonstrates that the stability of cognitive and affective attitudes influences the impact of such attitudes on behaviour, that is, more stable cognitive and affective attitudes are stronger predictors of behaviour. When considered simultaneously, it was the affective attitude–behaviour relationship that was more consistently moderated by stability. These effects were consistent across different studies examining different behaviours in different populations using both between- and within-participants designs and examining these effects over two-, three-, and four-wave designs, and also controlling for past behaviour.

Conflicts of interest

All authors declare no conflict of interest.

Author contributions

Mark T. Conner (Conceptualization; Data curation; Formal analysis; Funding acquisition; Methodology; Writing – original draft; Writing – review & editing) Frenk van Harreveld (Formal analysis; Writing – original draft; Writing – review & editing) Paul Norman (Conceptualization; Writing – original draft; Writing – review & editing).

Data availability statement

The data for each study are available online.

References

- Abelson, R. P., Kinder, D. R., Peters, M. D., & Fiske, S. T. (1982). Affective and semantic components in political person perception. *Journal of Personality and Social Psychology*, *42*, 619–630. <https://doi.org/10.1037/0022-3514.42.4.619>
- Aiken, L. S., & West, S. G. (1991). *Multiple regression: Testing and interpreting interactions*. Newbury Park, CA: Sage.
- Breckler, S. J. (1994). A comparison of numerical indices for measuring attitudinal ambivalence. *Educational and Psychological Measurement*, *54*, 350–365. <https://doi.org/10.1177/0013164494054002009>
- Carfora, V., Caso, D., & Conner, M. (2016). Randomized controlled trial of "messaging intervention" to increase fruit and vegetable intake in adolescents: Affective versus instrumental messages. *British Journal of Health Psychology*, *21*, 937–955. <https://doi.org/10.1111/bjhp.12208>
- Chaiken, S., & Baldwin, M. W. (1981). Affective-cognitive consistency and the effect of salient behavioral information on the self-perception of attitudes. *Journal of Personality Social Psychology*, *41*, 1–12. <https://doi.org/10.1037/0022-3514.41.1.1>
- Chaiken, S., Pomerantz, E. M., & Giner-Sorolla, R. (1995). Structural consistency and attitude strength. In R. E. Petty & J. A. Krosnick (Eds.), *Attitude strength: Antecedents and consequences* (pp. 387–412). Mahwah, NJ: Lawrence Erlbaum Associates.
- Conner, M. (2020, February). Experiential and instrumental attitudes and health behaviors. Paper presented at the meeting of Social and Personality Health Network, New Orleans, LO.

- Conner, M., Grogan, S., West, R., Simms-Ellis, R., Scholtens, K., Sykes-Muskett, B., . . . Siddiqi, K. (2019). Effectiveness and cost-effectiveness of repeated implementation intention formation plus anti-smoking messages on adolescent smoking initiation: A cluster randomized controlled trial. *Journal of Consulting and Clinical Psychology, 87*, 422–432. <https://doi.org/10.1037/ccp0000387>
- Conner, M., McEachan, R., Lawton, J., & Gardner, P. (2017). Applying the reasoned action approach to understanding health protection and health risk behaviors. *Social Science and Medicine, 195*, 140–148. <https://doi.org/10.1016/j.socscimed.2017.10.022>
- Conner, M., McEachan, R., Taylor, N., O'Hara, J., & Lawton, J. (2015). Role of affective attitudes and anticipated affective reactions in predicting health behaviors. *Health Psychology, 34*, 642–652. <https://doi.org/10.1037/hea0000143>
- Conner, M., & Norman, P. (2021). Predicting long-term healthy eating behaviour: Understanding the role of cognitive and affective attitudes. *Psychology & Health*, <https://doi.org/10.1080/08870446.2020.1832675>
- Conner, M., Norman, P., & Bell, R. (2002). The theory of planned behavior and healthy eating. *Health Psychology, 21*, 194–201. <https://doi.org/10.1037/0278-6133.21.2.194>
- Conner, M., Wilding, S., van Harreveld, F., & Dalege, J. (2020). Cognitive-affective inconsistency and ambivalence: Impact on the overall attitude-behavior relationship. *Personality and Social Psychology Bulletin, 47*(4), 673–687. <https://doi.org/10.1177/0146167220945900>
- Converse, P. E. (1995). Foreword. In R. E. Petty & J. A. Krosnick (Eds.), *Attitude strength: Antecedents and consequences* (pp. xi–xvii). Mahwah, NJ: Erlbaum.
- Cooke, R., & Sheeran, P. (2004). Moderation of cognition-intention and cognition-behaviour relations: A meta-analysis of properties of variables from the theory of planned behaviour. *British Journal of Social Psychology, 43*, 159–186. <https://doi.org/10.1348/0144666041501688>
- Crites, S. L., Fabrigar, L. R., & Petty, R. E. (1994). Measuring the affective and cognitive properties of attitudes: Conceptual and methodological issues. *Personality and Social Psychology Bulletin, 20*, 619–634. <https://doi.org/10.1177/0146167294206001>
- Dalege, J., Borsboom, D., van Harreveld, F., van den Berg, H., Conner, M., & van der Maas, H. L. J. (2016). Toward a formalized account of attitudes: The Causal Attitude Network (CAN) model. *Psychological Review, 123*, 2–22. <https://doi.org/10.1037/a0039802>
- Davidson, A. R., & Jaccard, J. J. (1979). Variables that moderate the attitude-behavior relation: Results of a longitudinal survey. *Journal of Personality and Social Psychology, 37*, 1364–1376. <https://doi.org/10.1037/0022-3514.37.8.1364>
- Fabrigar, L. R., MacDonald, T. K., & Wegener, D. T. (2005). The structure of attitudes. In D. Albarracín, B. T. Johnson, & M. P. Zanna (Eds.), *The handbook of attitudes* (pp. 79–124). London, UK: Routledge.
- Fishbein, M., & Ajzen, I. (2010). *Predicting and changing behavior: The reasoned action approach*. New York, NY: Psychology Press.
- Glasman, L. R., & Albarracín, D. (2006). Forming attitudes that predict future behavior: A meta-analysis of the attitude-behavior relation. *Psychological Bulletin, 132*, 778–822. <https://doi.org/10.1037/0033-2909.132.5.778>
- Howe, L. C., & Krosnick, J. A. (2017). Attitude strength. *Annual Review of Psychology, 68*, 327–351. <https://doi.org/10.1146/annurev-psych-122414-033600>
- Inauen, J., Shrout, P. E., Bolger, N., Stadler, G., & Scholz, U. (2016). Mind the gap? An intensive longitudinal study of between-person and within-person intention-behavior relations. *Annals of Behavioral Medicine, 50*, 516–522. <https://doi.org/10.1007/s12160-016-9776-x>
- Krosnick, J. A., & Petty, R. E. (1995). Attitude strength an overview. In R. E. Petty & J. A. Krosnick (Eds.), *Attitude strength: Antecedents and consequences* (pp. 1–24). Mahwah, NJ: Erlbaum.
- McEachan, R., Taylor, N., Harrison, R., Lawton, R., Gardner, P., & Conner, M. (2016). Meta-analysis of the Reasoned Action Approach (RAA) to understanding health behaviors. *Annals of Behavioral Medicine, 50*, 592–612. <https://doi.org/10.1007/s12160-016-9798-4>

- Millar, M. G., & Millar, K. U. (1996). The effects of direct and indirect experience on affective and cognitive responses and the attitude—Behavior relation. *Journal of Experimental Social Psychology*, *32*, 561–579. <https://doi.org/10.1006/jesp.1996.0025>
- Raudenbush, S. W., & Bryk, A. S. (2002). *Hierarchical linear models: Applications and data analysis methods*. London, UK: Sage.
- Schüz, B., Brick, C., Wilding, S., & Conner, M. (2020). Socioeconomic status moderates the effects of health cognitions on health behaviors: Two multi-behavior studies. *Annals of Behavioral Medicine*, *54*, 36–48. <https://doi.org/10.1093/abm/kaz023>
- Schwartz, S. H. (1978). Temporal instability as a moderator of the attitude-behavior relationship. *Journal of Personality and Social Psychology*, *36*, 715–724. <https://doi.org/10.1037/0022-3514.36.7.715>
- Sheeran, P., & Abraham, C. (2003). Mediator of moderators: temporal stability of intention and the intention—behavior relationship. *Personality and Social Psychology Bulletin*, *29*, 205–215. <https://doi.org/10.1177/0146167202239046>
- Tormala, Z. L. (2008). A new framework for resistance to persuasion: The resistance appraisals hypothesis. In W. D. Crano & R. Prislin (Eds.), *Attitudes and attitude change* (pp. 213–234). New York, NY: Psychology Press.
- Trafimow, D., & Sheeran, P. (1998). Some tests of the distinction between cognitive and affective beliefs. *Journal of Experimental Social Psychology*, *34*, 378–397. <https://doi.org/10.1006/jesp.1998.1356>
- Verplanken, B., Hofstee, G., & Janssen, H. J. W. (1998). Accessibility of affective versus cognitive components of attitudes. *European Journal of Social Psychology*, *28*, 25–35. [https://doi.org/10.1002/\(SICI\)1099-0992\(199801/02\)28:1<23:AID-EJSP843>3.0.CO;2-Z](https://doi.org/10.1002/(SICI)1099-0992(199801/02)28:1<23:AID-EJSP843>3.0.CO;2-Z)
- Xu, M., Brinol, P., Gretton, J. D., Tormala, Z. L., Rucker, D. D., & Petty, R. E. (2020). Individual differences in attitude consistency over time: The personal attitude stability scale. *Personality and Social Psychology Bulletin*, *46*, 1507–1519. <https://doi.org/10.1177/0146167220908995>

Received 19 February 2021; revised version received 29 April 2021