Article

Not peer-reviewed version

Testing the Effect of Cue Consistency on the Past Behavior-Habit-Physical Activity Relationship

Daniel J. Phipps * , Martin S Hagger , David Mejia , Kyra Hamilton

Posted Date: 23 April 2024

doi: 10.20944/preprints202404.1402.v1

Keywords: habit; physical activity; cues

 doi:10.20944/preprints202404.1402.v1

Article

Testing the Effect of Cue Consistency on the Past Behavior-Habit-Physical Activity Relationship

Daniel J. Phipps [1,2,*], Martin S Hagger [1,2,3,4], David Meija [5] and Kyra Hamilton [1,2,4]

[1] School of Applied Psychology, Griffith University, Australia
[2] Faculty of Sport and Health Sciences, University of Jyväskylä, Finland
[3] Psychological Sciences, University of California, Merced, California, USA
[4] Health Sciences Research Institute, University of California, Merced, USA
[5] College of Health and Human Performance, University of Florida, Florida, USA
* Correspondence: d.phipps@griffith.edu.au

Abstract: Habit theory suggests that behavior performed in the presence of consistent cues is a core ingredient for successful habit development, with the repeated presence of these consistent cues facilitating the activation of automatic responses in future. We tested this assumption in a sample of 68 undergraduate students who, at baseline, reported on their physical activity behavior over the past year then, two weeks later, responded to measures of cue consistency, habit, and physical activity performance over the previous two weeks. As expected, habit mediated the effects of past behavior on prospectively measured behavior. Moreover, the mediating effect of habit between past and future behavior was significantly stronger in those reporting undertaking physical activity at the same time of day, doing the same activity, and in the same mood. Consistent place, people, and part of routine did not moderate the effects of habit. Results provide formative evidence for a key assertion of habit theory, that consistent contextual and internal cues are a cornerstone of habitual development and action, but also indicate the importance of examining different forms of cues and their impact on the formation and enaction of habits as some cues over others may be more relevant.

Keywords: habit; physical activity; cues

Introduction

Research identifying the determinants of health behavior has largely been grounded in social cognition theory. That is, theories which assume behavior is the consequence of a deliberative, reasoned process, where an individual considers their beliefs relevant to their current environment and makes a decision as to whether to act [1]. Evidence using such theories, including prototypical models like the theory of planned behavior [2] and health action process approach [3], have generally demonstrated expected model effects in predicting behavior, as shown through meta-analysis [4,5]. Yet, despite non-zero effects, such theories have come under increasing criticism as reports consistently show only modest portions of variance in behavior is accounted for by the social cognition constructs, and changes in intention are not always matched with equivalent changes in actual behavior [6]. One prominent explanation for this shortfall of social cognition models in explaining behavior is that people's actions are unlikely to be determined solely by reasoned, deliberative processes. Instead, it is likely many day-to-day, frequently performed behaviors fall under the control of highly efficient, automatic processes [7].

Acknowledging the likelihood of automatic constructs as potential determinants of behavior, a dominant line of research in theory development has been on testing more integrated models of behavior that include constructs purported to assess automatic behavior in modelling alongside the belief based and intentional variables which represent social cognition [8–11]. One common construct used to represent automatic behavior in studies testing dual process and integrated models is *habit* [12–14]. Traditional definitions of habit are generally based around the relative frequency of behavior [15]. However, more contemporary theorical perspectives view habit as the degree to which

 doi:10.20944/preprints202404.1402.v1

a behavior is enacted automatically [12]. That is, without the need for significant conscious input, such as the consideration of potential benefits or outcomes of a behavior before making a decision to act.

The basis of such automatic actions is drawn from the overall conceptualization of the habit construct as a stimulus-response effect, based upon the connection between cues and contexts and actions in associative memory [7]. Thus, a key thread in contemporary habit theory is that the development and enactment of more automatically performed actions should be contingent on the presence of consistent environmental or internal contexts in which the behavior is repeatedly performed [16,17]. That is, a habit is formed when behavior is repeated in the presence of a stable internal (e.g., mood) or external cue (e.g., place, time, people), and the behavioral response becomes linked to the cue in associative memory. Once the cue and behavioral response become associated in memory, encountering that cue or context again should activate the learned stimulus-response effect, and thus be sufficient to trigger the action chains encouraging behavioral enactment with little or no conscious deliberation [7,18]. Meta-analytic evidence supports the effect of habit on behavior alongside social cognition constructs [11]. However, theoretical debate continues around the contextual or cue-based factors which influence the development and enactment of habitual behaviors.

Despite theoretical assertions of the potential role of cue consistent contexts in the development of habits, empirical evidence supporting such effects is limited. For example, a seminal study in habit development found cue self-selection for a health behavior was associated with the development of stronger habits for that behavior over time [16], yet since this study there has been a dearth of research investigating the effects of different forms of cues on habit development and enactment. For example, the predominant measure of cue consistency breaks down potential consistent factors associated with habit into behavior at consistent times, places, or parts of routine, as part of the same activity, when in the same mood, or with the same people [19]. Yet, other than the original test of this measure in a cross-sectional study associating different forms of cue consistency and physical activity, little research discerning the differential effects of cue types has been undertaken. This study by Pimm et al. showed a significant zero-order correlation between habit strength and the enactment of behavior at a consistent time of day, with consistent people, as a consistent activity, at the same part of one's routine, in the same location, and in a consistent mood, while constant time, people, and part of routine were associated with self-reported behavior, and consistent activities, place, and mood were not [19]. Such findings provide preliminary evidence in support for the value of consistent cues in habit development, but also indicate potential differential effects in how each form of consistent cue may translate into actual behavior.

Further, the interpretation of effects in the research by Pimm et al. is notably limited by the study's cross-sectional design. Specifically, a fundamental element of habit theory is that habit should mediate the relationship between past and future behavior. That is, habits are theorized to form on the basis of past behavioral experiences occurring in the presence of stable cues. Then, once formed, the encountering of these cues should in turn activate the associated habitual response, thus increasing the frequency of behavior. A fundamental issue therefore with testing the relationship between cues, habits, and behavior in cross-sectional data is it is difficult to distinguish between the effects, for example as a cross-sectional relationship between habits and behavior could be indicative of both the effect of past behavior on habit development, or the effects of habit in encouraging behavior. Thus, while previous research and theory indicates a link between habit, cues, and behavior, the use of longitudinal or prospective designs is required to provide more in-depth tests of habit theory, such as the extent to which habit mediates the past behavior-future behavior relationship and how different forms of consistent cues may influence both the development and enaction of habits.

The Current Study

In the current study, we sought to investigate whether the effects of past behavior on prospectively measured behavior were mediated by habits, and the extent to which the mediating

 doi:10.20944/preprints202404.1402.v1

effect of habit is dependent on engaging in behavior in the presence of consistent cues or contexts. For this study, we tested a key health behavior, engaging in physical activity according to current guidelines. Specifically, we hypothesized that habit would mediate the effects of past behavior on future behavior, as past behavior would predict habit, while habit would in turn predict prospectively measured behavior. Further we hypothesized that, in the presence of consistent cues (i.e., time of day, activity, people, part of routine, place, and mood), the effects of past behavior on habit, and of habit on prospectively measured behavior would be stronger, as compared to when physical activity behavior was enacted in the presence of inconsistent cues. In contrast, we expected that when behavior was reported as occurring in the presence of inconsistent cues, the past behavior to behavior effect not accounted for by habit would be stronger, as continuing behavior would likely be accounted for by non-automatic constructs.

Method

Participants and Procedure

Participants were recruited for course credit from a U.S. university between March and June, 2023. At baseline, 138 participants completed measures of past behavior on an online survey hosted on the Qualtrics platform. Participants were then emailed two weeks later to provide measures of habit, cue consistency, and prospectively measured behavior. However, 70 participants did not respond to requests for data. Thus, the final sample consisted of 68 participants (*M* age = 20.82, *SD* age = 3.10, 58 female, 24 male, 2 non-binary). Attrition analysis indicated the included sample did not significantly differ from those who did not respond to requests for follow-up data in terms of their age, $t(136) = 2.60$, $p = .338$, $d = .07$, or gender, $\chi^2(2) = 4.78$, $p = .092$. All procedures were approved by the University of California Merced Institutional Review Board.

Measures

All survey items are available in Table 1.

Past Behavior. Past behavior was assessed using three items (e.g., In the past year, how often did you meet the physical activity guidelines each week?), each scored on a 7-point Likert type scale (e.g., [1] Never to [7] Always)[20].

Habit. Habit was assessed using the behavioral automaticity subscale of the self-reported habit index [21,22]. The scale consisted of four items (e.g., Meeting the physical activity guidelines each week is something I do without having to consciously remember), each scored on a 7-point Likert scale anchored [1] Strongly Disagree to [7] Strongly Agree.

Cue Consistency. Cue consistency for physical activity was assessed using a modified version of the Pimm cue consistency scale [19], asking participants to record whether they engaged in physical activity at the same time of day, in the same mood, with the same people, in the same place, at the same part of their routine, or doing the same activity. Responses were scored on a 7-point Likert scale anchored [1] Strongly Disagree to [7] Strongly Agree. However, for the purpose of moderation analysis, responses above the scale mid-point (i.e., a rating that of agree or strongly agree that cues were consistent) were coded as enacting the behavior with a consistent cue, while responses at or below the scale midpoint (i.e., a rating of strongly disagree, disagree, or neither agree nor disagree that cues were consistent) were categorized as inconsistently enacted with each cue.

Behavior. Physical activity behavior was assessed using three items (e.g., In the two weeks, how often did you meet the physical activity guidelines each week?), each scored on a 7-point Likert type scale (e.g., [1] Never to [7] Always)[20].

 doi:10.20944/preprints202404.1402.v1

Table 1.

Items	Response Options
In the past year, to what extent did you meet the physical activity guidelines each week?	
In the past year, how often did you meet the physical activity guidelines each week?	[1] A small extent to [7] A large extent
In the past year, I met the physical activity guidelines each week?	[1] Never to [7] Always
	[1] False to [7] True
Meeting the physical activity guidelines each week is something…	
… I do automatically.	[1] Strongly Disagree to [7] Strongly Agree
… I do without having to consciously remember.	[1] Strongly Disagree to [7] Strongly Agree
… I do without thinking.	[1] Strongly Disagree to [7] Strongly Agree
… I start to do before I realize I'm doing it.	[1] Strongly Disagree to [7] Strongly Agree
Each time I start to engage in moderate or vigorous physical activity ….	
… it is the same time of the day.	[1] Strongly Disagree to [7] Strongly Agree
… I am around the same people.	[1] Strongly Disagree to [7] Strongly Agree
… I do the same type of activity.	[1] Strongly Disagree to [7] Strongly Agree
… I am in the same part of my routine.	[1] Strongly Disagree to [7] Strongly Agree
… I am in the same place.	[1] Strongly Disagree to [7] Strongly Agree
… I am in the same mood.	[1] Strongly Disagree to [7] Strongly Agree
In the two weeks, to what extent did you meet the physical activity guidelines each week?	
In the two weeks, how often did you meet the physical activity guidelines each week?	[1] A small extent to [7] A large extent
In the two weeks, I met the physical activity guidelines each week?	[1] Never to [7] Always
	[1] False to [7] True

 doi:10.20944/preprints202404.1402.v1

Data Analysis

Data were fitted to a bootstrapped PLS-SEM model with 10,000 iterations using the SmartPLS 4 software, with survey items for each scale used as indicators for latent constructs. Estimates between high and low cue consistency groups were compared using bootstrapped multi-group analysis with 10,000 iterations [23].

Results

Zero order correlations and descriptive statistics for each variable are presented in Table 2. In the total sample, the model predicted 47.3% of the variance in behavior, with past behavior predicting behavior both directly, and with an effect mediated through habits. Despite the expected stronger effects of past behavior on habit in those reporting consistent cues, the moderating effect of cues did not reach the statistical significance threshold for any given cue. However, the effect of habit on behavior was stronger in those who reported undertaking physical activity at a consistent time of day, in a consistent mood, and as a consistent activity. Consequently, the mediation effect of habit between past and future behavior was significantly stronger in those undertaking physical activity at consistent time of day, in a consistent mood, and as a consistent activity. In contrast, the effect of past behavior on prospectively measured behavior not accounted for by habit was stronger in those reporting inconsistent time, activity, and mood cues for exercise. All parameter estimates are presented in Table 2.

Table 2.

	1	2	3	4	5	6	7	8	9
1. Past Behavior	-								
2. Activity Consistency	.21	-							
3. Mood Consistency	.03	.34**	-						
4. People Consistency	.29*	.53***	.45***	-					
5. Place Consistency	.23	.72***	.46***	.52***	-				
6. Time Consistency	.36**	.57***	.36**	.56***	.59***	-			
7. Routine Consistency	.26*	.86***	.37**	.65***	.75***	.65***	-		
8. Habit	.58***	.25*	.18	.41***	.24*	.35**	.30*	-	
9. Behavior	.60***	.11	.10	.27*	.14	.44***	.19	.62***	-
Mean	3.51	5.03	3.79	4.15	4.99	4.15	4.69	3.19	3.23
SD	1.60	1.56	1.60	1.73	1.58	1.72	1.66	1.57	1.77

Table 3.

	Past Behavior to Behavior	Past Behavior to Habit	Habit to Behavior	Habit Mediation
Whole Sample	.37 (.004)	.58 (<.001)	.40 (.003)	.23 (.008)
Activity				

 doi:10.20944/preprints202404.1402.v1

Consistent	.26 (.069)	.59 (<.001)	.50 (.001)	.30 (.006)
Inconsistent	.82 (<.001)	.54 (.074)	.02 (.917)	.01 (.939)
p Difference	.025	.494	.035	.046
Mood				
Consistent	.14 (.420)	.61 (<.001)	.73 (<.001)	.44 (<.001)
Inconsistent	.57 (<.001)	.58 (<.001)	.13 (.483)	.08 (.511)
p Difference	.045	.437	.009	.018
Routine				
Consistent	.42 (.018)	.65 (<.001)	.33 (.083)	.22 (.111)
Inconsistent	.17 (.458)	.35 (.420)	.52 (.010)	.18 (.432)
p Difference	.817	.273	.754	.476
People				
Consistent	.42 (.035)	.64 (<.001)	.33 (.131)	.21 (.158)
Inconsistent	.34 (.064)	.47 (.006)	.47 (.004)	.14 (.150)
p Difference	.616	.197	.691	.484
Time				
Consistent	.08 (.624)	.64 (<.001)	.70 (<.001)	.44 (<.001)
Inconsistent	.60 (<.001)	.50 (.008)	.09 (.649)	.04 (.687)
p Difference	.013	.243	.007	.008
Place				
Consistent	.31 (.042)	.58 (<.001)	.45 (.005)	.26 (.015)
Inconsistent	.63 (.001)	.52 (.015)	.16 (.396)	.08 (.521)
p Difference	.079	.434	.114	.130

Discussion

The current study sought to test whether the mediating effect of habit on the past behavior to future behavior relationship was moderated by the presence of consistent cues or contexts for behavioral enactment in a key health behavior, engaging in physical activity. In line with our hypotheses, habit mediated the effects of past behavior on future behavior in the whole sample model. Such a finding is consistent with previous research [8,11,24], as well as theories that habit formation is likely dependent on past behavioral experience, and once formed habits promote the continuation of the behavior through the activation of stimulus-response triggered actions [7,12]. Further in line with the hypotheses, the effect of past behavior on prospectively measured physical activity was not entirely accounted for through habit, as past behavior remained a significant predictor of behavior. These effects are also expected in line with integrated models, as the influence of past behavior on future behavior is likely also modeled through other, non-habitual effects, such as intention or affect which have also demonstrated significant effects on physical activity in prior research [25–27].

We also tested the hypothesis that the mediating effect of habit on the past behavior to future behavior relationship should be stronger in the presence of consistent cues. That is, that the development of habit should be contingent on the frequent co-occurrence of a behavior and a cue, allowing for the cue and action to become linked in associative memory. And, once this link is formed, the sustained presence of that cue, either externally or internally, should increase the likelihood of behavior occurring habitually as a stimulus-response effect resulting from the perception of the cue. Results in this regard were partially in line with expectations, as the indirect effect of past behavior on prospectively measured behavior via habit was significantly stronger in participants reporting engaging in physical activity at the same time, as the same activity, and in the same mood. However,

 doi:10.20944/preprints202404.1402.v1

in contrast to our hypotheses, engaging in physical activity in the same place, with the same people, and at the same part of one's routine did not significantly moderate the mediating effect of habit, despite effects in the expected direction. These effects present a unique contribution of this research, indicating that while cues are likely an important element in promoting habit development and enaction, not all forms of cues appear to have equal impact in this regard. While future research is needed to confirm these findings, they may have notable implications for intervention, particularly in that many habit formation and disruption strategies to date are based upon the formation or removal of cues to alter habitual behaviors [28].

It is also important to consider that, on closer examination of these mediation effects, even where a significant mediation effect was observed, the results are not totally in line with theory. Specifically, from theory one would expect past behavior to be a stronger predictor of habit in those who reported undertaking the behavior in the presence of consistent cues, given the stability of these cues should be considered a theoretical pre-requisite to habit development [18]. Yet, in the current data while the past behavior to habit pathway was stronger when cues were consistent in each case, this moderating effect was small and fell short of the criteria for statistical significance for each cue. Thus, in each case where the mediation effect of habit was stronger in the presence of consistent time, mood, and activity cues, this significant effect could mostly be attributed to these cues showing a strong moderation effect of the habit to behavior pathway.

On the surface, such a finding may seem to contest the theoretical assumption that consistent cues are necessary for habit development. However, there are also several other plausible explanations for the observed pattern of findings. For example, in light of the trend of stronger effects for past behavior on habit in the presence of all cues, it is also plausible that the current effects may be explained as consistency in no one cue is adequate to facilitate habit development with strong effects. For example, simply being active at the same time is insufficient for a habit to form, but one may also need to be active at the same time, doing the same activity, and in the same place for that activity to become habitual. However, due to the modest sample in the current study, we are unable to test these numerous potential moderating effects between cue types, and future research with larger samples is required. Alternatively, given habits are highly stable over time [29,30], and the design of the current study did not require any change or alternation of behavior, it may be that the effect of consistent cues had only small effects on exercise habits as for many participants such habits were likely to already be firmly established. While such explanations are plausible, future research is likely needed to investigate the effect of cue consistency in contexts were habit change or the formation of new habits is likely (e.g., moving to college, legislative changes)[30–32].

We also observed stronger effects of past behavior on prospectively measured behavior when behavior was not enacted in the presence of consistent time, mood, and activity cues. While this effect is somewhat inconsistent with data from past behavior by frequency measures of the habit construct [33], it is likely in the current data that the residual effect of past behavior on future behavior beyond habit represents non-habitual constructs such as intention. Thus, extending on habit findings, it is likely that while consistent cues encourage habitual action, acting in inconsistent settings and contexts requires more intensive cognition, thus increasing the likelihood of making a considered decision [31,32,34,35]. However, as such intentional and belief-based constructs were not included in the tested model, such an explanation remains speculative. Future research may also seek to directly assess the effect of inconsistent cues on the role of intentions on behavior alongside habits.

Strengths, Limitations, and Future Directions

While the current study presents a valuable contribution to integrated behavior change model research seeking to understand when habitual processes likely occur, it is inherently not without its limitations. Firstly, the current study made use of brief self-reported scales for both past behavior and behavior. While similar scales have shown acceptable evidence for their validity in terms of correlations with observational measures or more intensive survey designs [20,36], self-reported measures of behavior by their nature are at risk of biased or inaccurate responding. Future research may seek to replicate these findings using more objective, observational measures of behavior, such

 doi:10.20944/preprints202404.1402.v1

as heart rate monitors, pedometers, or accelerometers. Further, the current study made use of a prospective, two-wave design. While the prospective design allows for a better test of mediational effects, it does not allow for assertions of causality. Future research may seek to test similar models using longitudinal designs, for example by assessing habit development alongside cue consistency in the wake of major context changes where new habits are likely to be developing.

Conclusions

The current study sought to test the extent to which the presence of consistent cues increased the strength of the mediating effect of habit on the relationship between past behavior and future behavior for physical activity. As expected, the indirect effect of past behavior on future behavior via habit was stronger when behavior was enacted at the same time of day, in the same mood, and as the same activity, although no moderating effect was observed for consistent place, people, or part of routine. Current findings support habit theory, while also providing additional evidence signposting the potential efficacy of cue-based habit change strategies, particularly those focusing on time, activity, or mood. However, future research is required to investigate how cues may affect habit development in longitudinal research, particularly in how cues may co-occur and in contexts where significant habit change or development may be expected.

References

1. Strack, F.; Deutsch, R. Reflective and Impulsive Determinants of Social Behavior. *Personality and social psychology review* **2004**, *8*, 220–247, doi:10.1207/s15327957pspr0803_1.
2. Ajzen, I. The Theory of Planned Behavior. *Organizational behavior and human decision processes* **1991**, *50*, 179–211, doi:10.1016/0749-5978(91)90020-T.
3. Schwarzer, R.; Luszczynska, A. How to Overcome Health-Compromising Behaviors: The Health Action Process Approach. *European Psychologist* **2008**, *13*, 141–151, doi:10.1027/1016-9040.13.2.141.
4. McEachan, R.R.C.; Conner, M.; Taylor, N.J.; Lawton, R.J. Prospective Prediction of Health-Related Behaviours with the Theory of Planned Behaviour: A Meta-Analysis. *Health Psychology Review* **2011**, *5*, 97–144, doi:10.1080/17437199.2010.521684.
5. Zhang, C.-Q.; Zhang, R.; Schwarzer, R.; Hagger, M.S. A Meta-Analysis of the Health Action Process Approach. *Health Psychology* **2019**, *38*, 623, doi:10.1037/hea0000728.
6. Sniehotta, F.F.; Presseau, J.; Araújo-Soares, V. Time to Retire the Theory of Planned Behaviour. *Health psychology review* **2014**, *8*, 1–7, doi:10.1080/17437199.2013.869710.
7. Hagger, M.S. Redefining Habits and Linking Habits with Other Implicit Processes. *Psychology of Sport and Exercise* **2020**, 101606, doi:10.1016/j.psychsport.2019.101606.
8. Phipps, D.J.; Hagger, M.S.; Hamilton, K. Predicting Sugar Intake Using an Extended Theory of Planned Behavior in a Sample of Adolescents: The Role of Habit and Self-control. *Brain and Behavior* **2023**, e3200.
9. Phipps, D.J.; Rhodes, R.E.; Jenkins, K.; Hannan, T.E.; Browning, N.; Hamilton, K. A Dual Process Model of Affective and Instrumental Implicit Attitude, Self-Monitoring, and Sedentary Behavior. *Psychology of Sport and Exercise* **2022**, 102222, doi:10.1016/j.psychsport.2022.102222.
10. Phipps, D.J.; Hannan, T.E.; Rhodes, R.E.; Hamilton, K. A Dual-Process Model of Affective and Instrumental Attitudes in Predicting Physical Activity. *Psychol Sport Exerc* **2021**, *54*, 54, doi:10.1016/j.psychsport.2021.101899.
11. Hagger, M.S.; Hamilton, K.; Phipps, D.J.; Protogerou, C.; Zhang, C.-Q.; Girelli, L.; Mallia, L.; Lucidi, F. Effects of Habit and Intention on Behavior: Meta-Analysis and Test of Key Moderators. *Motivation Science* **2023**, *9*, 73–94, doi:10.1037/mot0000294.
12. Gardner, B. Habit as Automaticity, Not Frequency. *European Health Psychologist* **2012**, *14*, 32–36, doi:10.1037/e544772013-003.
13. Neal, D.T.; Wood, W.; Quinn, J.M. Habits—A Repeat Performance. *Current Directions in Psychological Science* **2006**, *15*, 198–202, doi:10.1111/j.1467-8721.2006.00435.x.
14. Wood, W.; Rünger, D. Psychology of Habit. *Annual review of psychology* **2016**, *67*, 289–314, doi:10.1146/annurev-psych-122414-033417.
15. Ouellette, J.A.; Wood, W. Habit and Intention in Everyday Life: The Multiple Processes by Which Past Behavior Predicts Future Behavior. *Psychological bulletin* **1998**, *124*, 54, doi:10.1037/0033-2909.124.1.54.

16. Lally, P.; Van Jaarsveld, C.H.; Potts, H.W.; Wardle, J. How Are Habits Formed: Modelling Habit Formation in the Real World. *European journal of social psychology* **2010**, *40*, 998–1009.
17. Lally, P.; Gardner, B. Promoting Habit Formation. *Health Psychology Review* **2013**, *7*, 137–158, doi:10.1080/17437199.2011.603640.
18. Orbell, S.; Verplanken, B. The Automatic Component of Habit in Health Behavior: Habit as Cue-Contingent Automaticity. *Health psychology* **2010**, *29*, 374, doi:10.1037/a0019596.
19. Pimm, R.; Vandelanotte, C.; Rhodes, R.E.; Short, C.; Duncan, M.J.; Rebar, A.L. Cue Consistency Associated with Physical Activity Automaticity and Behavior. *Behavioral Medicine* **2016**, *42*, 248–253.
20. Hamilton, K.; White, K.M.; Cuddihy, T. Using a Single-Item Physical Activity Measure to Describe and Validate Parents' Physical Activity Patterns. *Research quarterly for exercise and sport* **2012**, *83*, 340–345, doi:10.1080/02701367.2012.10599865.
21. Gardner, B.; Abraham, C.; Lally, P.; de Bruijn, G.-J. Towards Parsimony in Habit Measurement: Testing the Convergent and Predictive Validity of an Automaticity Subscale of the Self-Report Habit Index. *International Journal of Behavioral Nutrition and Physical Activity* **2012**, *9*, 102, doi:10.1186/1479-5868-9-102.
22. Verplanken, B.; Orbell, S. Reflections on Past Behavior: A Self-Report Index of Habit Strength. *Journal of Applied Social Psychology* **2003**, *33*, 1313–1330, doi:10.1111/j.1559-1816.2003.tb01951.x.
23. Ringle, Christian M; Wende, S.; Becker, J.M. *SmartPLS 4*; SmartPLS: Oststeinbek, 2022;
24. Sas, S.; D.J., Phipps.; Hagger, M.; Hamilton, K. The Mediating Role of Automaticity and Intention on Past to Future Bootcamp Attendance. *Australian psychologist* **2023**, 1–8, doi:10.1080/00050067.2023.2210759.
25. Browning, N.; Phipps, D.J.; Rhodes, R.E.; Hamilton, K. Testing the Moderative Role of Affect Divergence in Predicting Physical Activity. *Psychology of Sport and Exercise* **2023**, doi:10.1016/j.psychsport.2023.102538.
26. Chevance, G.; Bernard, P.; Chamberland, P.E.; Rebar, A. The Association between Implicit Attitudes toward Physical Activity and Physical Activity Behaviour: A Systematic Review and Correlational Meta-Analysis. *Health psychology review* **2019**, *13*, 248–276, doi:10.1080/17437199.2019.1618726.
27. Hagger, M.S.; Chatzisarantis, N.L.D.; Biddle, S.J.H. A Meta-Analytic Review of the Theories of Reasoned Action and Planned Behavior in Physical Activity: Predictive Validity and the Contribution of Additional Variables. *Journal of sport and exercise psychology* **2002**, *24*, 3–32, doi:10.1123/jsep.24.1.3.
28. Gardner, B.; Rebar, A.; Lally, P. Habit Interventions. In *The Handbook of Behavior Change.*; Hagger, M.S., Cameron, K., Hamilton, K., Hankonen, N., Lintunen, T., Eds.; Cambridge University Press, 2020.
29. Hamilton, K.; Phipps, D.J.; Loxton, N.; Modecki, K.L.; Hagger, M.S. Reciprocal Relations between Past Behavior, Implicit Beliefs, and Habits: A Cross-Lagged Panel Design. *Journal of Health Psychology* **2023**, doi:10.1177/13591053231164492.
30. Phipps, D.J.; Hannan, T.; Hamilton, K. A Cross-Lagged Model of Habits, Implicit Attitudes, Autonomous Motivation, and Physical Activity during COVID-19. *Psychology, Health & Medicine* **2022**, 1–12, doi:10.1080/13548506.2022.2151634.
31. Verplanken, B.; Roy, D. Empowering Interventions to Promote Sustainable Lifestyles: Testing the Habit Discontinuity Hypothesis in a Field Experiment. *Journal of Environmental Psychology* **2016**, *45*, 127–134, doi:10.1016/j.jenvp.2015.11.008.
32. Verplanken, B.; Walker, I.; Davis, A.; Jurasek, M. Context Change and Travel Mode Choice: Combining the Habit Discontinuity and Self-Activation Hypotheses. *Journal of Environmental Psychology* **2008**, *28*, 121–127.
33. Wood, W.; Neal, D.T. The Habitual Consumer. *Journal of Consumer Psychology* **2009**, *19*, 579–592.
34. Danner, U.N.; Aarts, H.; De Vries, N.K. Habit vs. Intention in the Prediction of Future Behaviour: The Role of Frequency, Context Stability and Mental Accessibility of Past Behaviour. *British Journal of Social Psychology* **2008**, *47*, 245–265, doi:10.1348/014466607X230876.
35. Haggar, P.; Whitmarsh, L.; Skippon, S.M. Habit Discontinuity and Student Travel Mode Choice. *Transportation research part F: traffic psychology and behaviour* **2019**, *64*, 1–13, doi:10.1016/j.trf.2019.04.022.
36. Loftfield, E.; Yi, S.; Immerwahr, S.; Eisenhower, D. Construct Validity of a Single-Item, Self-Rated Question of Diet Quality. *Journal of nutrition education and behavior* **2015**, *47*, 181–187, doi:10.1016/j.jneb.2014.09.003.