Supplementary Material:
Social Motivations' Limited Impact on Habitual Behavior:
Tests of Social Media Engagement

XXXXXXX and XXXXXXXX

Preliminary Study

Data Cut Reasoning

For this dataset, we reasoned that we did not want any users included which may have been posting for a business, or in order to be an ‘influencer’ as this could include posts made by multiple individuals. As this research is focused on behavior of individuals, we do not want to include these kinds of users in our analysis, as these accounts may be run by multiple people at once (strategic teams, etc.). We thus included no users in this analysis who averaged more than 1,000 likes per post across all their *Instagram* posts. We did not have other information about these users, and therefore could not make more exclusions based on other account information. We relied on the premise of the scrape as a grassroots, user-generated contest to support the assumption that these remaining posters are discrete individual posters rather than business or influencer accounts. This was less of a concern with the *Facebook* studies below, as we were looking only at individual users’ accounts with more certainty in both cases.

Table 1-1.

Means, Standard Deviations, and Correlations on Participant Mean Level Data: Preliminary Study

	M	*SD*	1	2	3
1. Posting latency (seconds)	147,432	168,631	–		
2. Number of likes	247.36	241.52	-.03	–	
3. Comments	17.86	21.92	.07**	.65***	–-
4. Posting frequency	779.06	840.53	-.72***	-.01	-.11***

Note. All means are unstandardized values. Correlations were calculated using standardized values of each measure. $N = 1836$

$^*p < .05$. $^{**}p < .01$. $^{***}p < .001$

Post-Level Correlations

Likes and Comments: $r(1430358) = .26, p < .001$

Likes and Latency: $r(1430358) = .09, p < .001$

Comments and Latency: $r(1430358) = .22, p < .001$

Table 1-2.

Full Multilevel Model Predicting Latency to Post Again From Posting Frequency and Likes: Preliminary Study

	df	*B*	*p*	95% CI
Intercept	1831.00	10.95	<.001	10.85, 11.05
Likes	1.429 x 10^6	-0.01	.420	-0.01, 0.003
Posting Frequency	1795.00	-0.01	<.001	-0.01, -0.0006
Likes x Posting Frequency	1.429 x 10^6	0.01	<.001	0.0002, 0.01

Note. Estimates are unstandardized coefficients (*B*). Degrees of freedom (*df*) are calculated using the Satterthwaite method. CI = confidence interval.

Table 1-3.

Full Multilevel Model Predicting Latency to Post Again From Posting Frequency and Comment Rewards: Preliminary Study

	df	*B*	*p*	95% CI
Intercept	1825.00	10.89	< .001	10.8, 11.1
Comments	1.28 x 10^6	0.15	< .001	0.14, 0.15
Posting Frequency	1789.00	-0.01	< .001	-0.01, -0.00
Comments x Posting Frequency	1.4 x 10^6	0.01	< .001	0.00006, 0.01

Note. Estimates are unstandardized coefficients (*B*). Degrees of freedom (*df*) are calculated using the Satterthwaite method. CI = confidence interval.

Table 1-4.

Full Multilevel Model Predicting Latency to Post Again From Posting Frequency and Participant-Mean Centered Likes: Preliminary Study

	df	*B*	*p*	95% CI
Intercept	1829.00	10.95	<.001	10.89, 11.01
Likes (Participant Mean Centered)	1.429 x 10^6	-0.01	.235	-0.01, 0.000003
Posting Frequency	1795.00	-0.01	<.001	-0.01, -0.0006
Likes (Participant Mean Centered) x Posting Frequency	1.429 x 10^6	0.01	<.001	0.0000008, 0.01

Note. Estimates are unstandardized coefficients (*B*). Degrees of freedom (*df*) are calculated using the Satterthwaite method. CI = confidence interval.

This result is important because it replicated our main findings from the total-likes model, suggesting that non-habitual participants may compare themselves to their own past standards as well as to a more absolute standard of likes as social rewards, while habitual participants do not do so (hence the significant interaction term).

Table 1-5.

Full Multilevel Model Predicting Latency to Post Again From Posting Frequency and 2-Post Summed (Lagged) Likes: Preliminary Study

	df	*B*	*p*	95% CI
Intercept	1830.00	10.92	<.001	10.87, 10.97
Likes (2-Post Lag Sum)	1.421 x 10^6	0.01	<.001	0.00001, 0.01
Posting Frequency	1792.00	-0.01	<.001	-0.01, -0.0006
Likes (2-Post Lag) x Posting Frequency	1.421 x 10^6	0.01	<.001	0.0000005, 0.01

Note. Estimates are unstandardized coefficients (*B*). Degrees of freedom (*df*) are calculated using the Satterthwaite method. CI = confidence interval.

Table 1-6.

Full Multilevel Model Predicting Latency to Post Again From Posting Frequency and 5-Post Summed (Lagged) Likes: Preliminary Study

	df	*B*	*p*	95% CI
Intercept	1831.00	10.88	<.001	10.83, 11.03
Likes (5-Post Lag)	1.42 x 10^6	0.01	<.001	0.00003, 0.01
Posting Frequency	1790.00	-0.01	<.001	-0.01, -0.0006
Likes (5-Post Lag) x Posting Frequency	1.421 x 10^6	0.01	<.001	0.00000002, 0.01

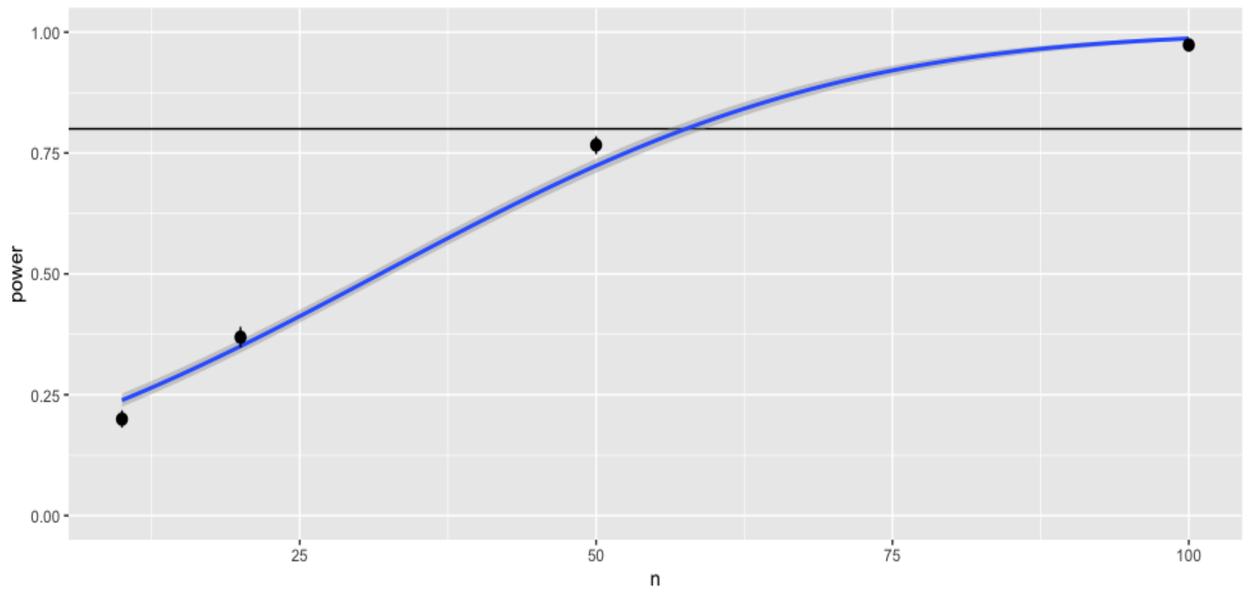
Note. Estimates are unstandardized coefficients (*B*). Degrees of freedom (*df*) are calculated using the Satterthwaite method. CI = confidence interval.

Study 1

Power Analysis

To estimate power for our first two studies, we conducted 2,000 power simulations using fixed effects (beta) of 0.3, 0.3, and 0.2 for the main effect of prior post reactions, the main effect of habit strength, and the interaction between habit strength and prior post reactions, respectively. We examined participant *N*'s ranging from 20-100 and total post *N*'s from 300 to 1,500, as estimated based on pre-test data. See Fig. 2-1 for a plot of power estimates.

Figure 2-1 *Plot of Power Analysis: Study 1.*



Note. Power is estimated here based on sample sizes *N* = 20 to 100. Power of 80% or .8 is possible roughly around sample sizes > 54.

Participant Mean-Centered Results

We also conducted the primary analyses on participant mean-centered rewards in order to simulate results of a reward prediction error, reflecting more or less reward than standard for a particular participant (Perez & Dickinson, 2021). However, our estimate of standard rewards was obtained from only a week of observing participants' *Facebook* use and thus is not highly reliable, especially for users who post infrequently. For this reason, we did not include these analyses in the text.

Table 2-1.

Additional Means, Standard Deviations, and Correlations in Study 1 (participant-mean centered rewards included)

	N	*M*	*SD*	1	2	3	4	5	6
1. Posting latency	1,907	20.27	166.87	–					
2. Positive reactions (participant mean-centered)	1,907	0.00	4.83	.02	–				
3. Comments (participant mean-centered)	1,907	0.00	1.32	.03	.28**	–			
4. SRHI	122	3.17	1.39	-.31**	.08**	-.03	–		
5. Prior posting frequency	122	15.85	19.19	-.52**	.11**	.06**	.61**	–	
6. Reward motivation	117	4.37	2.19	.33**	.05*	.02	.25**	.04	–
7. Self-predicted response to social reward	117	4.30	2.54	.26**	-.02	-.02	.31**	.03	.65**

Note. All means are unstandardized values. Correlations were calculated using standardized values of each measure.

*$p < .05$. **$p < .01$.

Models for Participant Mean-Centered Rewards Using the Self-Report Habit Index (SRHI)

Positive Reactions. Estimation of the model (same as in text) revealed a significant interaction between the participant-mean-centered number of positive reactions on the prior post and SRHI, $B = 0.04$, 95% CI [0.02, 0.06], $p < .001$, $df = 1808.00$ (see Table 2-3). In this analysis, participant mean-centered positive reactions and the SRHI measure of habit strength were also significant predictors of between-post latencies. To graph the interaction, we plotted lines at the meaningful points (see text: the minimum of posting 2x/week versus daily posters of 7x/week, Figure 2-2). As predicted, users with weak habit strength reduced their latency until the next post when they received more positive reactions than typical, $B = -0.05$, 95% CI [-0.09, -0.01], $p = .017$. However, habitual users did not change their posting rate when they received greater numbers of positively valenced reactions, $B = 0.01$, 95% CI [-0.02, 0.03], $p = .626$.

Table 2-2.

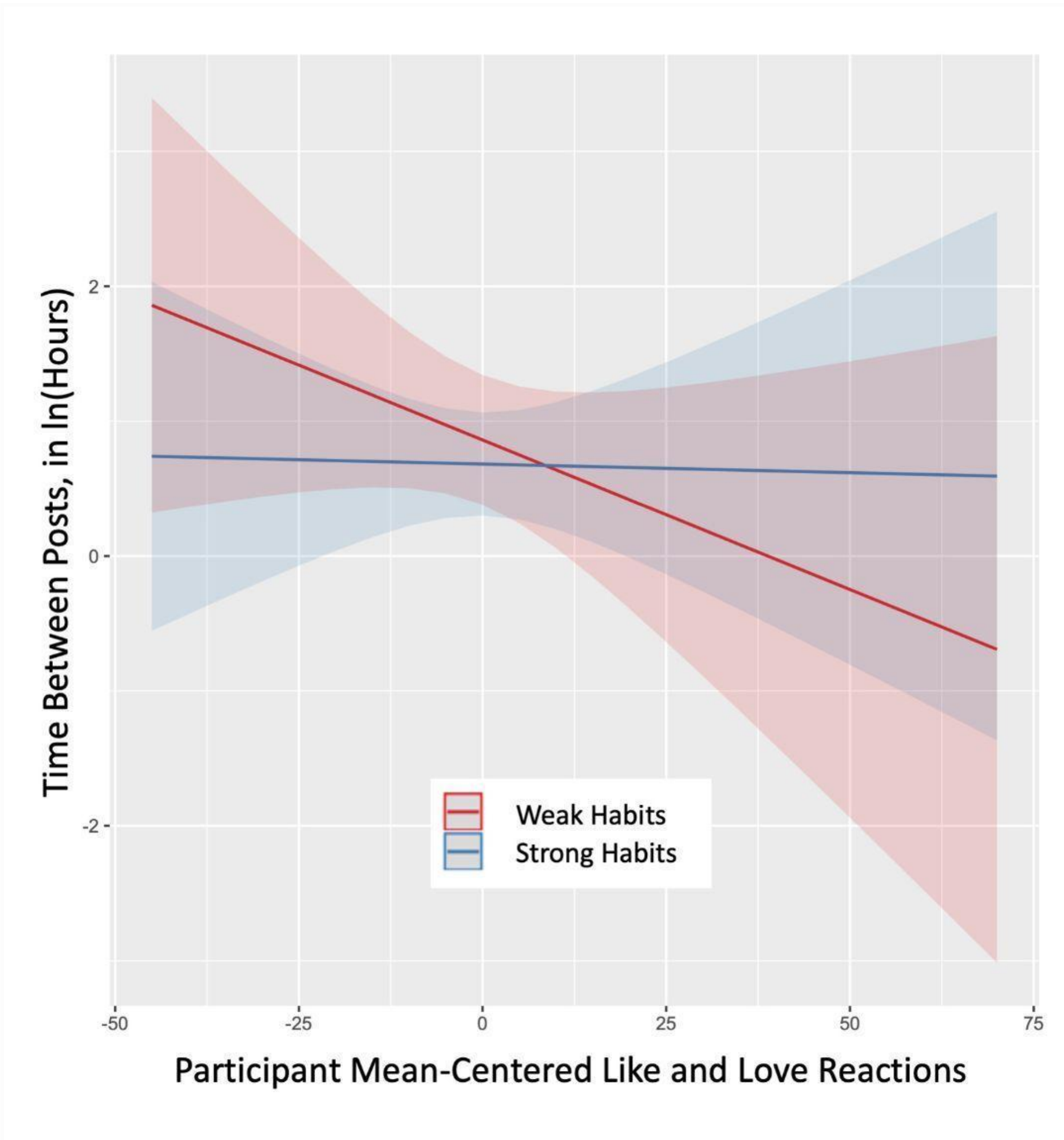
Multilevel Model Predicting Latency to Post Again From Habit Strength (SRHI) and Positive Reactions on Immediately Prior Post: Study 1

	df	*B*	*p*	95% CI
Intercept	122.40	0.61	.003	0.21, 1.01
Positive reactions (participant mean-centered)	1808.00	0.01	.626	-0.02, 0.03
Self report habit index (SRHI)	88.58	-0.35	.033	-0.66, -0.03
Positive Reactions x SRHI	1808.00	0.04	< .001	0.02, 0.06
Mean positive reactions	293.70	0.00	.939	-0.03, 0.03

Note. Estimates are unstandardized coefficients (*B*). Degrees of freedom (*df*) are calculated using the Satterthwaite method. CI = confidence interval.

Figure 2-2.

Plot of the Interaction Between Self-Report Habit Index (SRHI) and Positive Reactions Predicting Latency to Post Again: Study 1



Comments. Echoing the results with emoji rewards, the predicted interaction was significant between habit strength (SRHI) and participant-mean-centered number of comments on the prior post, $B = 0.12$, 95% CI [0.02, 0.22], $p = .017$, $df = 1811.48$ (see Table 2-4). Greater habit strength was also a significant predictor of shorter between-post latency (more rapid posting), $B = -0.39$, 95% CI [-0.71, -0.08], $p = .015$, $df = 93.01$. Greater positive deviations from the mean number of comments received also predicted greater between-post latency (slower posting), $B = 0.10$, 95% CI [0.00, 0.20], $p = .046$, $df = 1811.48$.

Table 2-3.

Multilevel Model Predicting Latency to Post Again From Habit Strength (SRHI) and Comments on Immediately Prior Post: Study 1

	df	*B*	*p*	95% CI
Intercept	127.08	0.70	<.001	0.35, 1.06
Comments	1811.48	0.10	.046	0.00, 0.20
Self report habit index (SRHI)	93.01	-0.39	.015	-0.71, -0.08
Comments x SRHI	1811.48	0.12	.017	0.02, 0.22
Mean comments covariate	289.96	-0.08	.226	-0.20, 0.05

Note. Estimates are unstandardized coefficients (*B*). Degrees of freedom (*df*) are calculated using the Satterthwaite method. CI = confidence interval.

Models Using Participant Mean-Centered Rewards Using Frequency of Prior Posts as the Indicator of Habit Strength

Positive Reactions. Estimation of the above model using past post frequency as the indicator of habit strength revealed a marginally significant interaction between participant-mean centered number of positive reactions on the prior post and habit strength, $B = 0.02$, 95% CI [0.00, 0.05], $p = .057$, $df = 1820.00$, as well as a main effect for frequency, reflecting simply that greater prior numbers of weekly posts predicted lower latencies during the study week (see in-text Table 2-5).

Decomposition of the interaction revealed that, among participants who posted infrequently, greater numbers of positive reactions to their immediately prior post slightly, although not significantly, reduced the latency until the next post, $B = -0.01$, 95% CI [-0.04, 0.02], $p = .504$ (see Figure 2-3). In contrast, participants who posted daily or more often did not change their posting rates when they received greater numbers of positively valenced reactions, $B = -0.00$, 95% CI [-0.03, 0.03], $p = .927$.

Table 2-4.

Multilevel Model Predicting Latency to Post Again From Habit Strength (Prior Posting Frequency) and Positive Reactions on Immediately Prior Post: Study 1

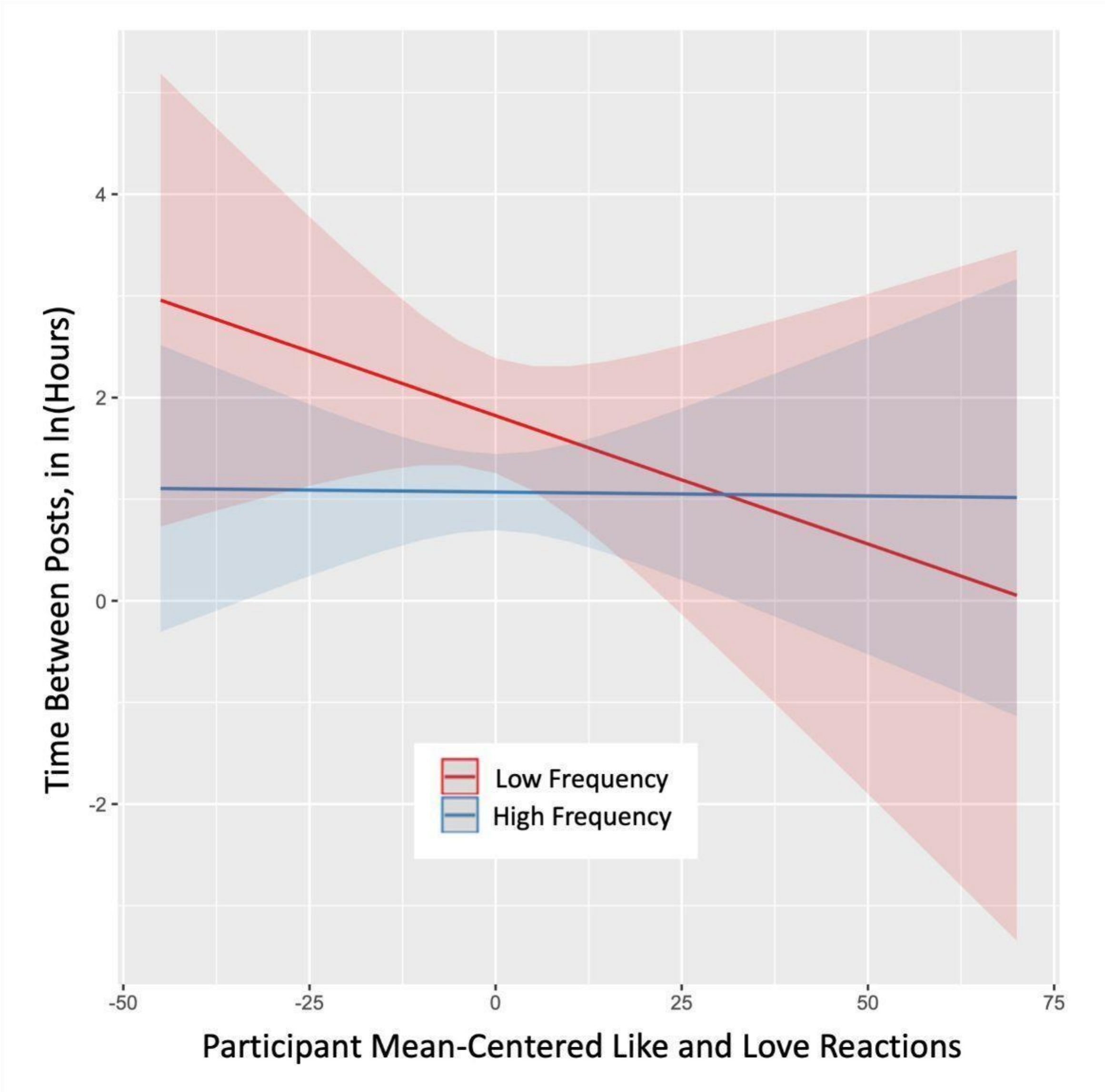
	df	*B*	*p*	95% CI
Intercept	130.50	0.75	<.001	0.40, 1.11
Positive reactions	1820.00	0.01	.457	-0.02, 0.04

Prior posting frequency	56.97	-0.71	< .001	-0.94, -0.48
Positive Reactions x Prior Posting Frequency	1820.00	0.02	.057	-0.00, 0.05
Mean Positive Reactions Covariate	392.30	-0.01	.634	-0.03, 0.02

Note. Estimates are unstandardized coefficients (*B*). Degrees of freedom (*df*) are calculated using the Satterthwaite method. CI = confidence interval.

Figure 2-3.

Plot of the Interaction Between Prior Posting Frequency and Positive Reactions Predicting Latency to Post Again: Study 1



Note. Latency (log hours) between posts as a function of past frequency of weekly posts and participant mean-centered quantity of positive reactions to the immediately prior post. For the plot, low frequency users were specified as posting 2x weekly, and high frequency ones as posting daily. Error bars represent 95% CIs.

Comments. As another measure of social rewards, the above models were computed using the participant mean-centered quantity of comments on the prior post as a predictor of posting latency. Echoing the results with emoji rewards, the predicted interaction effect was not significant when habit strength was assessed in terms of prior posting frequency (Table 2-6). Prior posting behavior remained a strong indicator of lower posting latency (high posting rates). The effect of number of participant mean-centered comments on the prior post also was not a significant predictor of between-post latencies (see Table 2-6).

Table 2-5.

Multilevel Model Predicting Latency to Post Again From Habit Strength (Prior Posting Frequency) and Comments on Immediately Prior Post: Study 1

	df	*B*	*p*	95% CI
Intercept	134.81	0.81	<.001	0.50, 1.13
Comments	1823.68	0.09	.065	-0.01, 0.19
Prior posting frequency	58.95	-0.74	< .001	-0.97, -0.51
Comments x Prior Posting Frequency	1823.68	0.04	.407	-0.05, 0.13
Mean Comments Covariate	379.18	-0.10	.071	-0.22, 0.01

Note. Estimates are unstandardized coefficients (*B*). Degrees of freedom (*df*) are calculated using the Satterthwaite method. CI = confidence interval.

Reactions Ratio Results

We also computed the analysis on social reactions using the ratio of positive to negative reactions (Tables 2-7 and 2-8) in order to evaluate the favorability of the reactions received.

However, perhaps because of the relatively few negative reactions, these analyses did not yield as clear results as those we report in the text with the more reliable measures of the number of positive emoji rewards and total comments received.

Table 2-6.

Multilevel Model with Reactions Ratio (Positive/Negative) and Self-Report Habit Index (SRHI), Predicting Between-Post Latency: Study 1.

	df	*β*	*p*
Intercept	67.01	0.31	.09
Positive:Negative Reactions Ratio	1829.16	0.35	.001
SRHI	88.66	-0.40	.01
Interaction	1271.63	0.28	<.001

Note. Reaction counts come from the post immediately prior to the focal post. Latency is the amount of time elapsed between that prior post and the focal post in log hours. Reaction ratio reflects counts of positive:negative reactions, and were standardized for analysis. Correlations (r) were conducted on the standardized values.

*p < .05 **p < .01

Table 2-7.

Multilevel Model with Comments Ratio (Positive/Negative) and SRHI Predicting Between-Post Latency: Study 1

	df	*β*	*p*
Intercept	46.90	-.18	.30

Positive:Negative Comments Ratio	1874.35	0.22	.39
Self-Reported Weekly Posts	57.76	-0.96	< .001
Interaction	1876.89	0.15	.43

Note. Comment counts come from the post immediately prior to the focal post. Latency is the amount of time elapsed between that prior post and the focal post in log hours. Comment ratio reflects counts of positive:negative comments, and were standardized for analysis. Correlations (*r*) were conducted on the standardized values.

$^{*}p < .05$ $^{**}p < .01$

Negative Reactions and Total Reactions

Given the low quantities of negative reactions, this measure was not very reliable, and we only report these results for completeness (see Table 2-8 and 2-9).

Table 2-8.

Means, SD, Correlations for Negative Reactions and Total (Positive + Negative) Reactions

				Bivariate correlations					
	N	*M*	*SD*	Latency	Positive reactions	Negative reactions	Total reactions	SRHI	Prior posting frequency
Negative reactions	1,907	0.15	0.83	.06*	.06**	--	.17**	-.07	-.06
Total reactions	1,907	3.34	7.99	.13**	.98**	.17**	--	-.32**	-.26**

Note. Higher numbers reflect longer latency, more reactions, stronger habits, and more self-reported weekly posts. Reaction counts are for the post immediately prior to the focal post. Latency is the amount of time elapsed between that prior post and the focal post in log hours. Reactions reflect greater numbers of emojis (standardized). Correlations were computed using the standardized values.

*$p < .05$ **$p < .01$

Means, SD for Positive and Negative Comments

Positive (M = 0.37, SD = 1.98) and negative comments (M = 0.05, SD = 0.39).

Table 2-9.

Multilevel Model with Negative Reactions and Self-Reported Weekly Posts Predicting Between-Post Latency: Study 1

	df	*β*	*p*
Intercept	45.64	-0.20	.24
Negative Reactions	1900.00	0.07	.36
Self-Reported Weekly Posts	56.61	-0.98	< .001
Interaction	1899.00	-0.01	.905

Note. Reaction counts come from the post immediately prior to the focal post. Latency is the amount of time elapsed between that prior post and the focal post in log hours. Negative reaction counts of emoji reactions were standardized for analysis. Correlations (r) were conducted on the standardized values.

*$p < .05$ **$p < .01$

Comment Model and Reward Motivation Covariates

These tables present the results included in the text in additional detail. These were excluded to reduce redundancy.

Table 2-10.

Multilevel Model Predicting Latency to Post Again From Prior Posting Frequency and Comments on Immediately Prior Post: Study 1

	df	*B*	*p*	95% CI
Intercept	137.36	0.74	< .001	0.42, 1.01
Comments	1500.60	0.08	.505	-0.10, 0.20
Prior Posting Frequency	57.92	-0.68	< .001	-0.91, -0.46
Comments x Prior Posting Frequency	1901.09	0.26	.128	-0.04, 0.29

Note. Estimates are unstandardized coefficients (*B*). Degrees of freedom (*df*) are calculated using the Satterthwaite method. CI = confidence interval.

Table 2-11.

Multilevel Model Predicting Latency to Post Again From Habit Strength (SRHI) and Positive Reactions on Prior Post with Reward Motivation as a Covariate: Study 1

	df	*B*	*p*	95% CI
Intercept	90.24	-0.38	.312	-1.10, 0.33

Positive reactions	1180.65	0.08	.126	-0.03, 0.28
Self report habit index (SRHI)	75.23	-0.50	.002	-0.81, -0.18
Reward motivation: Feedback matters	92.35	0.24	.003	0.08, 0.39
Positive Reactions x SRHI	1613.25	0.32	< .001	0.17, 0.46

Note. Estimates are unstandardized coefficients (*B*). Degrees of freedom (*df*) are calculated using the Satterthwaite method. CI = confidence interval.

Table 2-12.

Multilevel Model Predicting Latency to Post Again From Habit Strength (Prior Posting Frequency) and Positive Reactions on Prior Post with Reward Motivation as a Covariate: Study 1

	df	*B*	*p*	95% CI
Intercept	90.43	-0.18	.550	-0.83, 0.44
Positive reactions	1308.44	0.09	.246	-0.06, 0.25
Prior posting frequency	52.48	-0.67	< .001	-0.90, -0.44
Reward motivation: Feedback matters	88.19	0.21	.002	0.08, 0.34
Positive Reactions x Prior Posting Frequency	1724.98	0.32	< .001	0.15, 0.50

Note. Estimates are unstandardized coefficients (*B*). Degrees of freedom (*df*) are calculated using the Satterthwaite method. CI = confidence interval.

Simple Slopes: Reward Motivation in Study 1

Habit Strength

The simple slopes of the model in Table 2-11, corresponding to the levels of habit strength used in all Study 1 figure plots, are B = -0.35, 95% CI [-0.59, -0.11], p = .004, for weak habit users, showing the predicted sensitivity to rewards in this group of participants, and B = 0.12, 95% CI [-0.04, 0.28], p = .126, for strong habit users, replicating again the predicted weaker influence of rewards on between-post latency for this group of participants.

Prior Posting Frequency

The simple slopes of the model in Table 2-12 model, corresponding to the levels of habit strength used in all Study 1 figure plots, are B = -0.23, 95% CI [-0.43, -0.03], p = .023 for weak habit users, showing the predicted sensitivity to rewards in this group of participants, and B = -0.07, 95% CI [-0.23, 0.09], p = .371, for strong habit users, replicating again the predicted weaker influence of rewards on between-post latency for this group of participants.

Table 2-13.

To test whether habit insensitivity would remain after controlling for self-predictions, we recomputed the main multilevel (hierarchical) model including self-predicted responses to social rewards as a covariate. As anticipated, the interaction between habit strength (SRHI) and positive reactions remained significant, B = 0.32, 95% CI [0.17, 0.46], p < .001, df = 1609.75. In addition, the model revealed that, unexpectedly, self-predictions of faster posting in response to rewards were associated with longer latencies between posts, B = 0.21, 95% CI [0.09, 0.34], p = .001, df = 76.07 (see Table 2-13).

Multilevel Model Predicting Latency to Post Again From Habit Strength and Positive Reactions with Self-Predictions as a Covariate: Study 1

	df	B	*p*	95% CI
Intercept	74.06	-0.26	.395	-0.87, 0.32
Positive reactions	1209.92	0.11	.168	-0.04, 0.27
Self report habit index (SRHI)	74.73	-0.59	< .001	-0.90, -0.27
Self-Predicted response to social rewards	76.06	0.21	.001	0.09, 0.34
Positive Reactions x SRHI	1609.75	0.31	< .001	0.17, 0.46

Note. Estimates are unstandardized coefficients (*B*). Degrees of freedom (*df*) are calculated using the Satterthwaite method. CI = confidence interval.

Table 2-14.

We also recomputed the multilevel model including self-predicted responses to social rewards as a covariate in the main analyses, along with habit strength in terms of prior weekly posts, positive reactions, and their interaction. As anticipated, the interaction between reactions and prior weekly posts was still significant, $B = 0.32$, 95% CI [0.15, 0.49], $p < .001$, $df = 1740.27$. Unexpectedly, self-predictions of faster posting in response to social rewards were related to longer times between posts, $B = 0.14$, 95% CI [0.04, 0.25], $p = .009$, $df = 78.08$ (see Table 2-14).

Multilevel Model Predicting Latency to Post Again From Prior Posting Frequency and Positive Reactions with Self-Predicted Reward Response as a Covariate: Study 1

	df	B	*p*	95% CI
Intercept	92.39	0.10	.725	-0.45, 0.65
Positive reactions	1321.30	0.09	.262	-0.07, 0.24
Prior posting frequency	55.16	-0.66	< .001	-0.89, -0.42
Estimated response to social reward	78.09	0.14	.009	0.04, 0.25
Positive Reactions x Prior Posting Frequency	1740.72	0.32	< .001	0.15, 0.59

Note. Estimates are unstandardized coefficients (*B*). Degrees of freedom (*df*) are calculated using the Satterthwaite method. CI = confidence interval.

Simple Slopes: Self-Predictions

Habit Strength (SRHI)

The simple slopes of the model in Table 2-13, corresponding to the levels of habit strength used in all Study 1 figure plots, are B = -0.36, 95% CI [-0.61, -0.11], p = .003, for weak habit users, showing the predicted sensitivity to rewards in this group of participants, and B = 0.11, 95% CI [-0.05, 0.27], p = .168, for strong habit users, replicating again the predicted weaker influence of rewards on between-post latency for this group of participants.

Prior Weekly Posts

The simple slopes of the model in Table 2-14, corresponding to the levels of habit strength used in all Study 1 figure plots are B = -0.23, 95% CI [-0.43, -0.03], p = .022 for weak habit users, showing the predicted sensitivity to rewards in this group of participants, and *B* = -0.08, 95% CI [-0.24, 0.08], *p* = .348, for strong habit users, replicating again the predicted weaker influence of rewards on between-post latency for these participants.

Longer Lag Models

These models expand the post-level lag of Positive Reactions from the immediately prior post (reported in the text) to 2 and 5 posts prior to the focal post.

Table 2-15.

Multilevel Model of 2-Post (Summed) Lagged Positive Reactions and Self-Reported Weekly Posts Predicting Between-Post Latency: Study 1.

	df	*β*	*p*
Intercept	140.28	1.86	< .001
Positive Reactions (2-Post Lag)	1106.88	0.43	< .001
Self-Reported Weekly Posts	72.85	-1.23	< .001
Interaction	1747.10	0.16	.03

Note. Estimates are unstandardized coefficients (*B*). Degrees of freedom (*df*) are calculated using the Satterthwaite method. CI = confidence interval.

Table 2-16.

Multilevel Model with 5-Post (Summed) Lagged Positive Reactions and Self-Reported Weekly Posts Predicting Between-Post Latency: Study 1.

	df	*β*	*p*
Intercept	40.42	0.04	.86

Positive Reactions (5-Post Lag)	1327.07	0.45	< .001
Self-Reported Weekly Posts	44.60	-1.33	< .001
Interaction	1038.01	0.16	.12

Note. Estimates are unstandardized coefficients (*B*). Degrees of freedom (*df*) are calculated using the Satterthwaite method. CI = confidence interval.

To examine the interaction, we checked the simple slopes for the different posting frequencies in the 5-post lag model. Contrary to our expectations, the simple slopes were positive and significant except at the lowest prior posting frequency (where it is positive but nonsignificant), suggesting that at the 5-prior-post level, almost all users post more rapidly when they receive *lower* quantities of reactions on these posts.

Study 2

May 20, 2007 Analysis to Test for Artifacts

Table 3-1 shows the results of our multilevel model testing whether our results were an artifact of the study design. Specifically, we tested posting rates on a randomly chosen date a month later than the platform change (May 20, 2007). The failure to find the predicted effect on this date suggests that our results are not an artifact of, for example, regression toward the mean.

Table 3-1.

Results of Multilevel Regression Model Predicting Latency Between Facebook Posts As A Function of Past Posting Frequency During the 2 Months Around A Facebook Platform Change: Study 2

	df	*β*	*p*	95% CI
Intercept	8,728	12.74	<.001	12.68,12.81
Frequency of past posts (habit strength)	3,752	0.02	<.001	-0.026, -0.022
Timing of change (0 = before, 1= after)	42,320	-0.06	0.07	-0.13, 0.006
Frequency of Prior Posts x Timing of Change	41,530	0.001	0.16	-0.0004, 0.002

Note. Estimates are the non-standardized coefficients (β) of the terms in the multilevel model predicting latency between posts (log seconds). Number of past posts is a participant-level variable, and timing of the platform change is a group-level variable (value of 0 before May 20, 2007 at 12am, value of 1 after this date). Degrees of freedom were calculated using the Satterthwaite method.

May 19, 2007 Analysis to Test for Artifact

Table 3-2 shows the results of another multilevel model testing whether our results were an artifact of the study design. They test posting rates on a randomly chosen date a month minus a day later than the platform change (May 19, 2007). Again, the results reported in the text are supported by our failure to find the predicted effect on this date.

Table 3-2.

Results of Multilevel Regression Model Predicting Latency Between Facebook Posts As A Function of Past Posting Frequency During the 2 Months Around A Facebook Platform Change: Study 2

	df	*β*	*p*	95% CI
Intercept	8,821	12.74	<.001	12.67, 12.81
Frequency of past posts (habit strength)	3,774	-0.02	<.001	-0.026, -0.022
Timing of change (0 = before, 1= after)	42,230	-0.06	.08	-0.13, 0.007
Frequency of Prior Posts x Timing of Change	41,550	0.001	.14	-0.0003, 0.002

Note. Estimates are the non-standardized coefficients (β) of the terms in the multilevel model predicting latency between posts (log seconds). Number of past posts is a participant-level variable, and timing of the platform change is a group-level variable (value of 0 before May 19, 2007 at 12am, value of 1 after this date). Degrees of freedom were calculated using the Satterthwaite method.

May 21, 2007 Analysis

Table 3-3 shows the results of a third multilevel model testing whether our results were an artifact of the study design. They test posting rates on a randomly chosen date a month minus a day later than the platform change (May 19, 2007). Again, we failed to find the predicted effect on this date.

Table 3-3.

Results of Multilevel Regression Model Predicting Latency Between Facebook Posts As A Function of Past Posting Frequency During the 2 Months Around A Facebook Platform Change: Study 2

	df	*β*	*p*	95% CI
Intercept	8,438	12.75	<.001	12.68, 12.81
Frequency of past posts (habit strength)	3,667	-0.024	<.001	-0.027, -0.022
Timing of change (0 = before, 1= after)	42,340	-0.07	.06	-0.14, 0.02
Frequency of Prior Posts x Timing of Change	41,500	0.001	.12	-0.0003, 0.0002

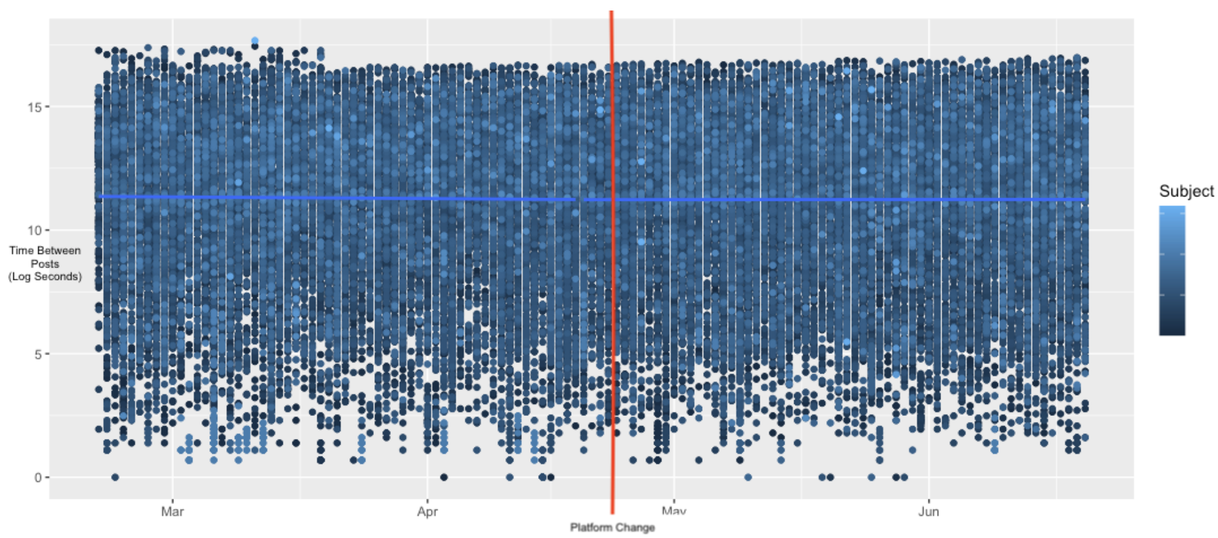
Note. Estimates are the non-standardized coefficients (β) of the terms in the multilevel model predicting latency between posts (log seconds). Number of past posts is a participant-level variable, and timing of the platform change is a group-level variable (value of 0 before May 21, 2007 at 12am, value of 1 after this date). Degrees of freedom were calculated using the Satterthwaite method.

Regression Discontinuity Analysis

Finally, a regression discontinuity analysis was performed. A 2nd order polynomial form was chosen to allow for changing posting rates over time and a flexible functional form. For both the high and the low frequency users with the distinction between these being determined by the distribution of the data), there was a significant reduction in posting rates at the 'cut' point (D = .23, p = .009 for low frequency users, D = .68, p = .003 for high frequency). However, the high frequency users adjust their behavior over time by returning to an increased posting rate, while the low frequency users establish a new posting rate that is relatively stable.

Figure 3-1.

Posting Rates by Day and User Over Time for the Period February 20 -- June 20, 2007 in the New Orleans Facebook Dataset: Study 2



Note. Y axis includes the time between posts in log seconds. Color of dots is participant/subject number from the first to post during the study's observation period to the last (dark to light). Red line is the date of the platform change. Blue line indicates the aggregate posting rate across all users during the periods displayed. As this rate remains relatively constant, it appears that users are not defecting from the platform as a result of preferences. Instead, they return to their regular usage rates after adjusting to the discontinuity.

Additional Analyses: Dichotomous Habit Strength; Self and Other Posts

The specific platform changes should have disrupted posting to others' walls more than to one's own wall. Thus, we conducted analyses to test its impact on users' own wall posting. As anticipated, the disruption did not influence the rate of this posting in the same ways as posts to others' walls (see Table 3-5) or the combined measure of all wall posts (reported in the text). Eliminating these posts from the analysis also achieved the same result as the combined measure (see Table 3-5).

Table 3-4.

Results of Multilevel Regression Model Predicting Latency Between Facebook Posts on One's Own Wall As A Function of Past Posting Frequency During the 2 Months Around A Facebook Platform Change

	df	*β*	*p*
Intercept	180.92	14.33	< .001
Frequency of past posts (habit strength)	38.56	-0.1	< .001
Timing of change (0 = before, 1= after)	237.48	-0.83	.15
Frequency of Prior Posts x Timing of Change	215.93	0.11	.12

Note. Estimates are the non-standardized coefficients (β) of the terms in the multilevel model predicting latency between posts (log seconds). Number of past posts is a participant-level variable, and timing of the platform change is a group-level variable (value of 0 before April 20, 2007 at 12am, value of 1 after this date). Degrees of freedom were calculated using the Satterthwaite method.

Table 3-5.

Results of Multilevel Regression Model Predicting Latency Between Facebook Posts on Other Users' Walls As A Function of Past Posting Frequency During the 2 Months Around A Facebook Platform Change

	df	*β*	*p*
Intercept	8,028	12.81	< .001
Frequency of past posts (habit strength)	3,431	-0.026	< .001
Timing of change (0 = before, 1= after)	39,110	-0.17	< .001
Frequency of Prior Posts x Timing of Change	38,400	0.002	.001

Note. Estimates are the non-standardized coefficients (β) of the terms in the multilevel model predicting latency between posts (log seconds). Number of past posts is a participant-level variable, and timing of the platform change is a group-level variable (value of 0 before April 20, 2007 at 12am, value of 1 after this date). Degrees of freedom were calculated using the Satterthwaite method.

Study 2a: Survey

Below are results not included in the text concerning users' self-predictions of how they would react to changes in rewards. These essentially duplicate the data collected in Study 1, and thus are only reported here. In addition, we report here the Study 2a data on self-predicted responses to cues (also reported in text) in order to represent their relation to other variables assessed in the survey.

These *Facebook* users (Study 2A) were sampled from MTURK. An additional 6 users were removed for unfinished surveys, and 2 other users were eliminated for extreme outlier values. Our a-priori power analysis was performed in G*Power, finding that for a moderate effect size, Cohen's $f^2 = .15$, a minimum of 55 participants was needed to achieve power greater than 80%.

Additional Measures

Self-Predicted Response to Social Rewards (and Negative Social Feedback)

Users self-predicted posting rates given positive or negative social feedback in two separate questions: “Imagine that you get positive [negative] reactions or comments from others on a Facebook post. How would this impact your next posts?” (1 = *I wouldn’t post again for a long time;* 4 = *it wouldn’t change how I posted;* 7 = *I would post again almost immediately*).

Reward Responsiveness (Carver & White, 1994)

This measure was composed of 8 questions (alpha = .86).

Devices Used

Participants indicated numerically how many devices with which they use *Facebook*.

Social Media Habit Scale (Meier et al., 2016)

This second measure of habit strength was composed of 3 questions (alpha = .81).

Facebook Use

Participants indicated the number of hours spent on *Facebook* per week, as well as the numbers of friends they had on *Facebook*.

Table 3A-1.

Correlations, Means, and Standard Deviations: Study 2a

	M	*SD*	Self predicted response to negative social feedback	Self-predicted response to social rewards	Self-Predicted Response to platform change	Prior posting frequency	SR BAI	Social media habit scale	Reward responsiveness	*Facebook* use (hours /week)
Social media habit scale	1.90	1.33	.21**	.21**	.16*	.28**	.66**			
Facebook use (hours/ wk)	9.81	3.72	-.11	-.05	-.17**	-.11	-.11	-.17**		
Reward responsiveness	6.19	1.28	.12	.24**	.22**	.16*	.05	-.09		
Facebook friends	406.28	453.20	.08	.17**	.09	.15*	.11	.13*	.23**	.16*

Note. Predicted response to rewards and cues are both on 1-7 scales with higher scores reflecting less time (latency) between posts (i.e., more rapid posting). Past posting frequency is a raw count of users' average weekly posts. Self-report behavioral automaticity index (SRBAI) is a 4-item, 5-point scale, with higher numbers reflecting greater automaticity (habit strength). * $p < .05$, ** $p < .01$

Table 3A-2.

Correlations, Means, and Standard Deviations: Study 2a

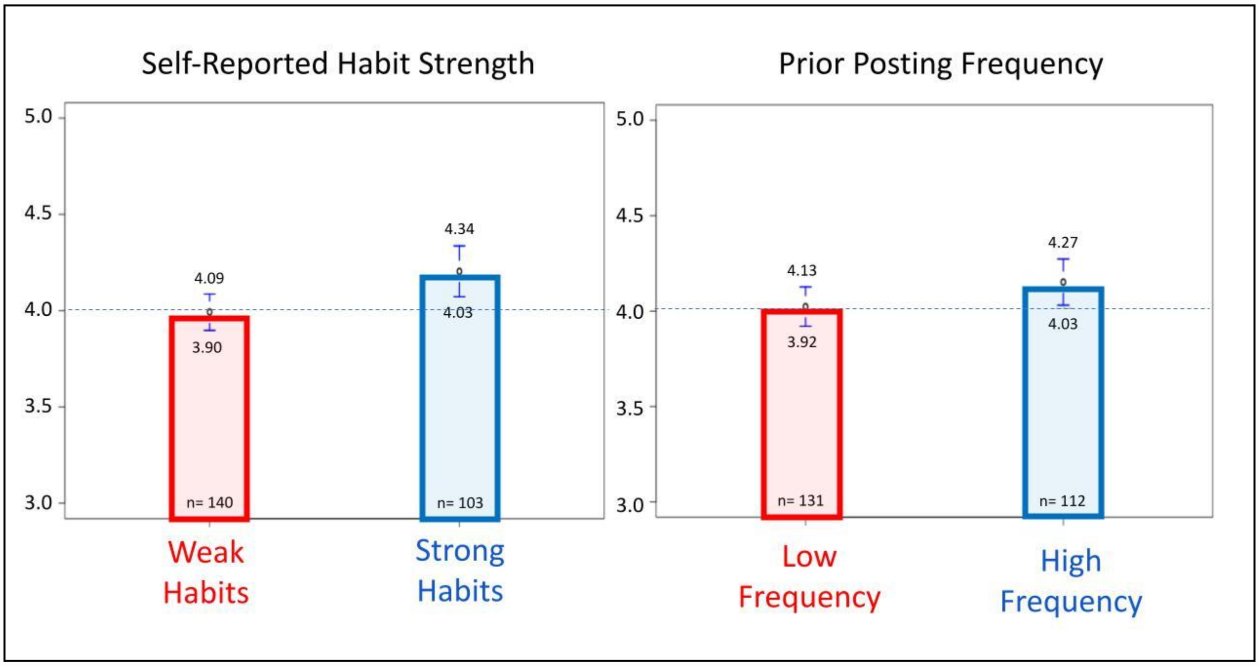
	M	*SD*	Self-Predicted response to negative social feedback	Self-Predicted response to social rewards	Self-Predicted response to platform changes	Prior posting frequency
Self-Predicted response to negative social feedback	3.30	1.30				
Self-predicted response to social rewards	4.89	1.13	-.01			
Self-predicted response to platform changes	4.08	.62	.23**	.30**		
Prior posting frequency	14.41	9.82	.36**	.11	.13*	
SRBAI	2.66	1.55	.23**	.27**	.19**	.38**

Note. Predicted response to rewards and cues are both on 1-7 scales with higher scores reflecting less time (latency) between posts (i.e., more rapid posting). Past posting frequency is a raw count of users' average weekly posts. Self-report behavioral automaticity index (SRBAI) is a 4-item, 5-point scale, with higher numbers reflecting greater automaticity (habit strength). * $p < .05$, ** $p < .01$

A regression analysis revealed that frequency of past posting influenced anticipated responses to the platform change, such that participants who had posted more frequently in the past also anticipated that they would post faster given the design change, $B = 0.008$, $t(241) = 2.07$, $p = .04$. In a separate regression, stronger self-reported behavioral automaticity (SRBAI) was associated with predictions of posting faster after the design change, $B = 0.08$, $t(241) = 3.08$, $p = .002$. To illustrate how these survey predictions diverged from Study 2 participants' actual engagement, we computed *t*-tests comparing the prediction ratings to the scale midpoint of 4, "*I would not change my posting behavior*." Contrary to the actual findings of Study 2, more frequent posters predicted a higher score than the scale midpoint, expecting to post more quickly, $M = 4.15$, *95%* CI = [4.03, 4.27], $t(111) = 2.48$, $p = .01$, whereas low frequency posters predicted that the change would have no effect, $M = 4.02$, 95% CI = [3.92, 4.13], $t(130) = 0.43$, $p = .66$ (see Figure 5). Comparable effects were obtained using SRBAI as the indicator of habit strength. In summary, these findings suggest that frequent, habitual postersusers expected their engagement to increase given the design change as much or more than less frequent, non-habitual postersusers.

Figure 3A-1

Predictions of Latency to Post After Platform Changes as A Function of Habit Strength; Study 2a



Note. Participants' self predictions on a 7-point scale on which higher numbers represent faster posting after the platform change. Error bars indicate the 95% confidence interval (CI) for each mean. Weak/strong habit groupings are based on a mean split (for display purposes) of prior posting frequency (right) and a mean split of self-report behavioral automaticity (SRBAI; left).

To illustrate how these survey predictions diverged from Study 2 participants' actual engagement, we computed *t*-tests comparing the prediction ratings to the scale midpoint of 4, "*I would not change my posting behavior.*" Contrary to the actual findings of Study 2, more frequent posters predicted a higher score than the scale midpoint, expecting to post more quickly, $M = 4.15$, *95%* CI = [4.03, 4.27], $t(111) = 2.48$, $p = .01$, whereas low frequency posters predicted that the change would have no effect, $M = 4.02$, 95% CI = [3.92, 4.13], $t(130) = 0.43$, $p = .66$

(see Figure 3A-2). Comparable effects were obtained using SRBAI as the indicator of habit strength.