Social Nudges for Behavior Change

Eytan Adar[1]*, Alessandro Acquisti[2]†, Daphne Chang[2]‡, and Erin Krupka[1]§

[1]*School of Information, University of Michigan*
[2]*Heinz College of Information Systems and Public Policy, Carnegie Mellon University*

Abstract

Nudges are the focus of attention for government and academics alike as tools by which to motivate privately- and socially-beneficial behavior. The recognition that different types of nudges might be more effective for different individuals has led to an increased interest in personalized nudges, where nudges are chosen specifically for an individual. In an experiment, we test the relative effectiveness of two "norm-nudges" against two "non-norm nudges." We further test whether a person familiar with the individual is better than a random guess at selecting nudges that are effective for another individual.

1 Introduction

"Nudges" appeal to policymakers and academics alike as tools by which to affect behavior without changing prices or choice sets. Its demonstrated effectiveness has led to the creation of "nudge units" in the United States, United Kingdom and the Australian government [49], which adopt nudges to improve the effectiveness of policies. The Organisation for Economic Cooperation and Development (OECD), an institution with international influence also recommend nudges when applying behavioral insights to improving public policy. Nudges are frequently leveraged to encourage a variety of privately-beneficial and socially-beneficial behavior, such as healthy eating [2, 18, 38, 40, 48], quit smoking [27, 47], organ donation [33], charitable giving [26, 34, 42, 45], and savings [13, 36, 46].

However, as prevalent as nudges are, little is known about the relative performances of these different nudges. The challenges are two folds. One, it is difficult to identify what the appropriate "control" ought to be when comparing the effectiveness of different types of nudges. Two, while one may perform meta-analysis across papers to test the effect of different nudges, the different contexts may interact with the nudges' efficacy as well. In addition, there is evidence of a "file drawer problem" in the academic study of nudges. In a meta-analysis, [19] find a nearly six times difference in estimated impact between

*E-mail: eadar@umich.edu
†E-mail: acquisti@andrew.cmu.edu
‡E-mail: daphnech@andrew.cmu.edu
§E-mail: ekrupka@umich.edu

the results from published papers and from Nudge Units' interventions. A head-to-head comparison of these nudges and finding significant or insignificant differences between treatments contributes toward mitigating publication bias in the nudges literature. Our primary goal is to test the relative effectiveness of different types of nudges. A secondary goal is to test whether every day individual would be able to identify nudges that would be more effective in nudging desired behavior relative to randomly assigned nudges. To learn about the relative effectiveness of different nudges, we test the relative impact of two "norm nudges" against two "non-norm nudge" in motivating individuals to engage in naturally aversive behavior.

Individuals intentionally avoid exposures to media sources that do not share their political inclinations, which contributes to echo chambers and political polarization [1, 31, 43]. Our target behavior is to encourage individuals to consume media that is not aligned with their political affiliation. We utilize a two-stage between-subject experiment. In the first stage, participants (our "A" participants) identify individuals in their network who do not share their political affiliation (our "B" participants). A participants have a chance to share articles that are not aligned with B's political identity through us via a mailing service. We ask A participants to report their beliefs of the effectiveness of the 4 possible emails B participants may see in getting B participants to interact with the email. The contents of the emails are identical except for the nudges used in each of them. The email may use a "Time Limit" nudge, a "Descriptive Norms" nudge, a "Personalization" nudge, or a "Reciprocity" nudge. Specifically, we utilize "Time Limit," a non-norm nudge that leverages scarcity, against another non-norm nudge that leverages personalization ("Personalization") and two frequently used norm-nudges nudges ("Descriptive Norms," "Personalization," and "Reciprocity").

If an A participant chooses to share a B participant's contact information with us, that B participant will either receive the email with the nudge that the A participant rates as most effective for the B (the *endogenously assigned nudge* treatment) or will receive a randomly assigned nudge (the *exogenously assigned nudge* treatment). The B participant then has the option to interact with the email.

We find that A participants believe that "Personalization," "Reciprocity," and "Descriptive Norms" are all more effective than the "Time Limit" nudge in getting B participants to interact with the email. We further find that A participants believe that the "Reciprocity" nudge is more effective relative to both "Personalization" and "Descriptive Norms" nudges. When the nudges are randomly chosen for B participants, A participants' intuition appear to be correct - "Reciprocity" is the most effective nudge. However, when the nudges are chosen specifically for B participants, there are no differences in the effectiveness of the non-social nudge and the three social nudges. We further find that humans are not better (than random selection) at identifying a nudge for someone they know. Overall, it is clear that obtaining significant behavior change through the use of nudges is still a very nuanced exercise.

In conclusion, our results suggest that individuals identify nudges that leverages social characteristics (e.g. "Personalization," "Reciprocity" and "Descriptive Norms") to be more effective a "Time Limit" nudge and that "Reciprocity" is the most effective nudge in motivating actual behavior. However, introducing human choice into the nudge as-

signment muddles its comparative strength. Overall, it is clear that obtaining significant behavior change through the use of nudges is still a very nuanced exercise.

2 Literature

Recent interest in nudges has given rise to a rich literature that encompasses laboratory, field, and empirical studies that examine the influence of different types of nudges in different contexts. For example, [28] utilize two nudges that leverage social information about what others are doing (a "descriptive" norm) and what one ought to do (an "injunctive" norm) to increase the reuse of unwashed towels in a hotel room setting. This difference between "descriptive" norms and "injunctive" norms has been well-documented [4, 6, 9]. In another example, [33] leverage a nudge that makes organ donation the default to increase the percentage of organ donors.

However, despite the growing literature, little is known about the relative effectiveness of these different types of nudges. Part of the reason that it is difficult to identify an appropriate "control" when comparing across different types of nudges. Several studies examine the impact of the way that information is shared within the nudge. For example, [21] manipulate the gain-loss frames of a nudge to examine its impact on truthful responses and find that none of the framing treatments lead to significant differences in behavior. Such studies that manipulate the gain-loss frames of the nudges are informative in shedding light on the more effective way of implementing a type of nudge but do not test the impact across the types of nudges. There are studies that test the relative effectiveness of a few types of nudges. [44] compare the relative effectiveness of three different types of nudges in a task similar to that of a mail-in rebate form. They vary whether they inform participants about a previous cohort's redemption rate (a social information nudge), reminding participants about the deadline (a time limit nudge), or decreasing the effort it takes to receive the rebate (a decrease in transaction cost). They find that reducing transaction cost has a significant effect in decreasing overoptimism in mailing in a form for redemption. However, this is one of the few efforts to make direct comparison of the efficacy of these nudges.

Most work examining relative effectiveness of nudges utilizes systematic literature reviews. For example, [30] perform a comprehensive, systematic literature review that categorizes nudges by eight dimensions and perform a meta-analysis that compares the relative effectiveness of these nudges. Overall, they find mixed results on the effectiveness of nudges. In particular, they find that, overall, 62% of nudging treatments are significantly significant and that the efficacy of nudges depends the category and context of the nudge. [3] perform a systematic review examining the relative cost efficiency of nudges against traditional policies. They find that nudges are more successful than traditional incentives given the costs associated with each intervention. For example, they find that while traditional financial incentives lead to between $2.77 to $5.59 increase in savings contribution per $1 spent, and $14.58 increase in savings per $1 spent in education initiatives, the nudge intervention leads to $100 increase in savings contribution per $1 spent. They further underscore the importance of measuring relative effectiveness of

nudges explicitly.

In this paper, we test two types of norm-nudges, Reciprocity and Descriptive Norms against two types of non-norm nudges, Personalization and Time Limit. [6] define a norm-nudge as "a nudge whose mechanism of action relies on eliciting social expectations with the intent of inducing desirable behavior, under the assumption that individual preferences for performing the targeted behavior are conditional on social expectations." These nudges were chosen for the frequency they are used in marketing correspondences and solicitations. Reciprocity and Descriptive Norms are social influence tactics commonly used by practitioners [11]. Similarly, Personalization has been used in a variety of contexts [12, 39, 45]. Time Limit, a scarcity-based nudge, has also been widely utilized [35].

2.1 Descriptive norms

"Empirical expectations" is an individual's belief that a "sufficiently large subset of the [population] conforms to the [behavior in the specific situation]"[4]. That is, an individual will behave in a way that is consistent with what they believe or have observe what other people have done in the same situation. Nudges that uses descriptive norms directly leverage "Empirical expectations" by informing individuals about the behavior of most others. This form of nudge has been shown to be effective in interventions for littering [17], water conservation [28], and adaptation of sanitation habits [5]. Descriptive norms have also been shown in the laboratory to influence dictator decisions [10], lying behavior [7], and trust games [8].

2.2 Reciprocity

Reciprocity is a specific social norm where individuals feel obligated to repay debts [15] and nudges that utilizes reciprocity capitalize upon this need to repay debts to motivate individuals to engage in the desired behavior. Reciprocity nudges ought to take a specific form: They begin with a reminder or statement of the "debt," and end with an (implicit or explicit) request that would repay the debt [16]. Reciprocity has also been shown to influence cooperation [25], third-party punishment [24], and altruistic behavior [23]. Practitioners often leverage this social norm as a nudge by giving targeted individuals unsolicited debts to create a psychological sense of "indebted-ness," motivating the individual to return the favor, even if the favor was uninvited. For example, supermarkets give out free samples as a tactic to increase sales and charities often provide an unsolicited gift along with a request for a donation [16].

2.3 Personalization

In a marketing and communication context, personalization involves"incorporating recognization aspects of a person in the content information. This could be one typical feature, such as the target person's first name or it could be a set of features that in the specific configuration also has a similar probability to refer to the individual" [20]. Nudges leveraging personalization do so by drawing attention of the individual to the content, by

creating positive association through familiarity, and by making known that the content is for the individual (see [39] for a more thorough discussion). Personalization has been shown in general to increase the impact of messages related to advertisement [29] and health-related screening [32] (see [37] for a review).

2.4 Time Limit

Nudges that use time limit manipulates the perceived scarcity to encourage desired behavior. These nudges work by increasing the perceived value of the item or opportunity through limiting its availability [14] and capitalizing on individual's "scarce-is-good" heuristic [16]. Scarcity nudges have been shown to influence the efficacy of advertisements [22] and borrowing behavior [41].

3 Method

The study takes place in four stages. In Stage 1 and Stage 2, we collect information about the participant (who we will refer to as A) and about someone who the participant wants to share information with (who we will refer to as B). In Stage 3 and Stage 4, we reach out to B and observe his/her behavior.

3.1 Stage 1: A's self-disclosure

In Stage 1, we recruit subjects (As) from Amazon Mechanical Turk. We restrict participants to those residing in the U.S., have a HIT approval ratings of greater than 95%, and a total number of greater than 10,000 HITs approved. We also prevent subjects from retaking the survey.

After filling out the consent form, A fills out a survey questionnaire about themselves where he/she inform us about his/her political affiliation. A indicates whether he/she identifies as a Republican and a Trump Supporter, a Republican, a Democrat and a Trump Supporter, or a Democrat.

Then A answers a series of 4-political questions for himself/herself: 1) "Russia interfered in and influenced the 2016 election," 2) "Trump's refugee policy will keep citizens safer," 3) "Trump supporters are racists," and 4) "Obamacare is unconstitutional." For each of these questions, A may respond "I agree," "I disagree," and "I prefer not to answer."

3.2 Stage 2: A identifies and discloses for B

Afterward, A identifies and names someone that he/she knows (B) who does not share his/her political affiliation. For example, a Republican should be thinking of either a Democrat or a Democrat who is also a Trump supporter. Specifically, A is asked to identify someone for whom we would generate a list of suggested articles that relates to A's political perspective that A may choose to send to B. The email containing the articles would come from us and we assure A that the B that he/she identifies would never know that A gave us B's email addresses.

A then answer the same 4-question political survey for B. Specifically, for each of those questions, A may respond "B would agree," "B would disagree," and "B would prefer not to answer." Finally, A identifies B as either a "Friend," "Family," "Acquaintance," or "Co-worker."

3.3 Stage 3: A identifies the most effective nudge for B

Then A sees four possible email templates that may be sent to B. These emails utilize four different types of nudges. There are two non-norm nudges ("Time Limit" and "Personalization") and two norm-nudges ("Descriptive Norms" "Reciprocity"). The contents of the email templates are identical except for the nudges used in each template.

The "Time Limit" nudge reads:

> Subject: Read this now - special 3 day offer
>
> Hello!
>
> We are a team of researchers at the University of Michigan. Someone in our study on media consumption suggested that you might be interested in the following article:
>
> [Links to the articles]
>
> You may click through the each of the links to read more about each article.
>
> **Starting now, you have 3 days before these articles are no longer available to you!**
>
> Hope you find these articles to be informative!

The "Descriptive Norms" nudge reads:

> Subject: Many like you have read this
>
> Hello!
>
> We are a team of researchers at the University of Michigan. Someone in our study on media consumption suggested that you might be interested in the following article:
>
> [Links to the articles]
>
> You may click through the each of the links to read more about each article.
>
> **Many people have already participated in this study by reading these articles. The person that invited you has already done so, you should too!**
>
> Hope you find these articles to be informative!

The "Personalization" nudge reads:

> Subject: [B][1], this is for you
>
> Hello, **[B]**! We are a team of researchers at the University of Michigan. Someone in our study on media consumption suggested that you might be interested in the following article:

[1] In the "Personalization" nudges, the email is personalized with B's name.

[Links to the articles]

[B], you may click through the each of the links to read more about each article.

Many people have already participated in this study by reading these articles. The person that invited you has already done so, you should too!

[B], I hope you find these articles to be informative!

Finally, the "Reciprocity" nudge reads:

Subject: A friend specially picked this for you

Hello!

We are a team of researchers at the University of Michigan. Someone in our study on media consumption suggested that you might be interested in the following article:

[Links to the articles]

You may click through the each of the links to read more about each article.

The person that invited you have already spent time to choose these articles specifically for you and are waiting to see if you would read them!

Hope you find these articles to be informative!

For each of these possible nudges, A rates how likely he/she thinks each nudge would get B to interact with the email on a 5-point Likert scale with possible responses "very unlikely," "somewhat unlikely," "neither likely nor unlikely," "somewhat likely," and "very likely."

A then see the list of potential articles that he/she can send to B. For each article, he/she sees the title of the article, a short blurb about the content of the article, and the link to the original article. The exact articles that A sees are those that reflect A's self-reported political affiliation.[2] After seeing the available articles to send to B, A is randomly assigned to either the *exogenously assigned nudge* treatment or the *endogenously assigned nudge* treatment.

These treatments determine what type of email would be sent to B. In the *exogenously assigned nudge* treatment, one of the earlier email templates is randomly selected and shown to A. In the *endogenously assigned nudge* treatment, the email template chosen is the one that A rated as most likely to nudge B into interacting with the email.[3] A may then opt to share B's email address and to select the specific articles to send to B. If A chooses not to share B's email address, then we ask A to enter "email.for.experiments@gmail.com" (our email address for the experiment) in the text box instead.

[2]These articles are selected from AllSides.com that rates each article on media bias based on a combination of blind survey, third party data, community feedback, editorial review, and independent research. The chosen articles are featured articles on the site from sources that are rated as "Left-leaning" or "Right-leaning," thus balanced in the "intensity" of the bias. Multiple articles on the same topic are selected for each batch and specific articles are updated to be as relevant to current events as possible.

[3]In the event of a tie, one email template is randomly chosen to break the tie.

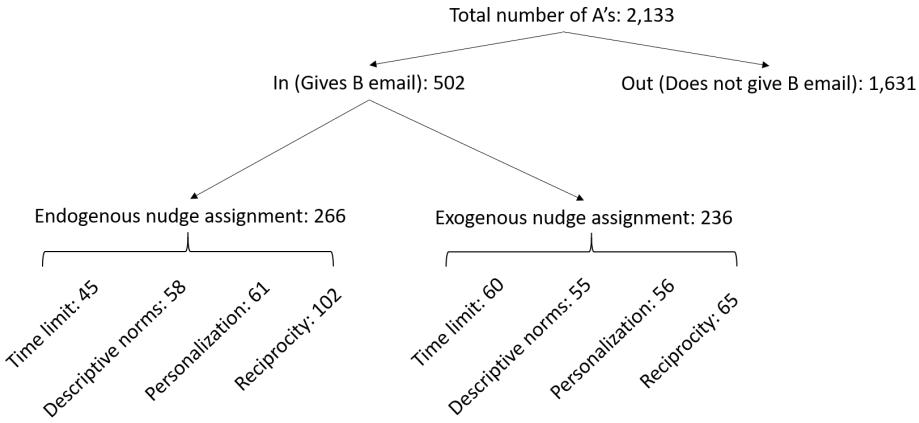

FIGURE 1: Number of A's and B's in each condition.

3.4 Stage 4: B receives the email and may interact with the email

B, the individual identified in Stage 2 by A, receives an email from us.[4] Depending on the condition that the A is in, B would either be assigned to the *exogenously assigned nudge* treatment or the *endogenously assigned nudge* treatment. In the *exogenously assigned nudge* treatment, the nudge in B's email is randomly chosen. In the *endogenously assigned nudge* treatment, the nudge in B's email is the one that A rated as most likely to get B to interact with the email.[5] B may then click on the links to go to the articles and/or complete the same 4-question political survey for himself/herself.

4 Results

A's earned $0.50 for participating in the study through MTurk. We recruited 2,133 A's from MTurk. Based on the emails given to us by the A's, we contacted 502 B's.[6] Of these B's, 266 were assigned to the *endogenously assigned nudge* treatment and 236 were assigned to the *exogenously assigned nudge* treatment. Figure 1 below presents the number of participants in each condition.

4.1 A's results

Recall that for each possible nudge, A rates the effectiveness that the nudge would have in influencing B to interact with the email. A do so by indicating on a Likert scale. Table 1 reports the percentages of A's who believed that the nudge would be "very unlikely," "somewhat unlikely," "neither likely nor unlikely," "somewhat likely," and "very likely"

[4]The email was sent from an experimenter's institution email address that uses the ".edu" extension.

[5]These are the same nudges that A saw when making his/her decision to send B articles.

[6]Emails that were given that were invalid or immediately recognizable as A's own email addresses were omitted from this set of contacts.

to be to get the identified B to read the articles. The modal rating for each nudge is highlighted.

TABLE 1
Percentages of A's ratings of effective likelihoods for each of the nudges.

	Very unlikely	Somewhat unlikely	Neither	Somewhat likely	Very likely
Time Limit	33.05%	23.44%	15.61%	19.97%	7.92%
Descriptive Norms	23.77%	24.19%	18.94%	26.30%	6.80%
Personalization	21.80%	21.66%	19.83%	28.46%	8.25%
Reciprocity	19.17%	20.82%	18.05%	31.46%	10.50%

These percentages suggest that As perceive that the "Time Limit" nudge to be least effective and that "Descriptive Norms," "Personalization," and "Reciprocity" nudges are equally effective. To test the significance of the difference, we perform an ordered probit regression of A's ratings for the effectiveness of each of the nudges on dummy variables for each of the nudges. The result of this regression is presented in Table 2, where the omitted category is "Time Limit."

TABLE 2
Ordered probit regression of A's ratings for the effectiveness on the different types of nudges.

Dependent variable: A's ratings of the effectiveness of each nudge	
Descriptive Norms	0.175***
	(0.020)
Personalization	0.265***
	(0.022)
Reciprocity	0.376***
	(0.022)
Constant cut1	-0.495***
	(0.028)
Constant cut2	0.128***
	(0.027)
Constant cut3	0.597***
	(0.027)
Constant cut4	1.596***
	(0.035)
Observations	8,532

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

The coefficients on all three dummy variables are significant (p-values < 0.01 for all three). A unit increase in "Descriptive Norms" leads to a 0.175 increase in the log odds of higher effectiveness rating, holding all else constant. Similarly, a unit increase in "Personalization" and "Reciprocity" leads to a 0.265 increase and a 0.376 increase in the log odds of higher effectiveness rating, respectively. As believe that all three of

these nudges would be more likely than "Time Limit" in getting their identified Bs to interact with the email. Wald tests testing for equality of these coefficients find that these coefficients are all significantly different from each other (p-values < 0.01). Further, As anticipate that the "Reciprocity" nudge would be more likely than "Personalization" or "Reciprocity" nudges in getting Bs to interact with the email (Wald tests for "Descriptive Norms" vs. "Reciprocity" and "Personalization" vs. "Reciprocity" report p-values < 0.01 for both comparisons).[7]

Result 1. *A's judge "Personalization," "Descriptive Norms" and "Reciprocity" to be more effective in influencing their identified B's relative to the "Time Limit" nudge. Of the three more effective nudges, A's judge the "Reciprocity" nudge to be the most effective in influencing B's to interact with the email.*

4.2 B's results

Recall that if A chooses to share B's email, then B will receive an email with one of the four nudges. These nudges may either be nudges that A believes would be the most effective in getting B to interact with the email (the *endogenously assigned nudge* treatment) or a randomly assigned nudge (the *exogenously assigned nudge* treatment).

B's interaction with the email is coded as: "did nothing," "opened the email," "clicked on a link," "started the 4-question political survey," "finished the 4-question political survey."[8][9] 362 (76.69%) B's did nothing, 95 (20.13%) B's opened the email, 8 (1.69%) B's clicked on a click, 6 (1.27%) B's started the 4-question political survey, and 1 (0.21%) B's finished the survey.[10] For the remainder of the paper, we identify B's as either "did nothing" or "opened email."

First, we consider the *exogenously assigned nudge* treatment, where B's receive randomly assigned nudges. Table 3 presents the result of a probit regression of the dummy variable for B opening the email on dummy variables for the different types of nudges. The omitted variable in this regression is the "Time Limit" nudge. "Reciprocity" appears to significantly increases the likelihood of getting B to interact with the email relative to "Time Limit" (p-value <0.10). "Reciprocity" also significantly increases the likelihood of B opening the email relative to both "Descriptive Norms" and to "Personalization" (Wald tests, p-values 0.0480 and 0.0638, respectively).

Result 2. *When the nudge is exogenously assigned, B's are significantly more likely to open the email when the email includes a "Reciprocity" nudge relative to when the email includes either the "Time Limit" nudge, the "Descriptive Norms" nudge, or the "Personalization" nudge.*

[7] T-tests pairwise comparisons of these nudges find that As rate "Reciprocity" to be more effective than either the "Descriptive Norms" nudge (p-value < 0.01) and the "Personalization" nudge (p-value < 0.01).

[8] Emails were mailed and B's interactions were tracked using a mail merge service (Yet Another Mail Merge).

[9] B's actions are coded using their last interaction with the email, thus a B who is coded as having "clicked on a link," is also one who "opened the email."

[10] Of the 502 email addresses, 16 B's did not have articles selected for them and 14 B's were found to share the same IP address as A's. We choose to err on the conservative side and drop these B's from the analysis for this section leaving us a total of 472 B's.

TABLE 3
Probit regression of B opening the email on the different types of nudges in the *exogenously assigned nudge* condition.

Dependent variable: Dummy variable for B opening the email	
Descriptive Norms	-0.062
	(0.279)
Personalization	-0.046
	(0.287)
Reciprocity	0.452*
	(0.263)
Constant	-0.883***
	(0.199)
Wald tests: P-values	
Descriptive Norms vs. Personalization	0.9557
Descriptive Norms vs. Reciprocity	0.0480
Personalization vs. Reciproctiy	0.0638
Observations	219

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Next, we consider the case where B's receive nudges that are chosen specifically for them. In this *endogenously assigned nudge* treatment, the nudge that B receives is the nudge that A believes will be the most effective in getting B to interact with the email. Table 4 presents the probit regression of the dummy variable for B opening the email on dummy variables for the different nudges, with "Time Limit" as the omitted category. We find that no single nudge is better relative to the "Time Limit" nudge in getting B's to open the email. Further, when performing Wald tests to test for equality of coefficients, we also find that no nudge outperforms the other in getting B's to open the email.

Result 3. *When the nudge is endogenously assigned, B's do not differ in their likelihoods of opening the email across the different nudges relative to "Time Limit." Further, these nudges do not differ in their impact on B's in getting B's to open the email.*

4.2.1 Do A's identification add anything?

Thus far, it appears that "Reciprocity" is the most effective nudge at increasing the likelihood that B's would interact with the email relative to the other three nudges. Based on the results in Section 4.1, A appears to rate "Reciprocity" as being the most effective nudge among all 4 nudges. Another test of this is to examine whether the frequency that A's B-specific nudge choices differ from nudges that are randomly assigned for B. Table 5 presents a series of probit regressions regressing a dummy variable for whether the email uses that specific type of nudge (listed above each column) on whether that nudge has been randomly assigned or that the A believes that nudge to be the most effective for B. We see

TABLE 4
Probit regression of B opening the email on the different types of nudges in the *endogenously assigned nudge* condition.

Dependent variable: Dummy variable for B opening the email	
Descriptive Norms	0.155
	(0.293)
Personalization	0.413
	(0.280)
Reciprocity	0.075
	(0.266)
Constant	-0.859***
	(0.225)
Wald tests: P-values	
Descriptive Norms vs. Personalization	0.3032
Descriptive Norms vs. Reciprocity	0.7335
Personalization vs. Reciprocity	0.1234
Observations	253

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

that a significantly lower number of "Time Limit" nudges is chosen in the *endogenously assigned nudge* treatment relative to the *exogenously assigned nudge* treatment (p-value <0.05). In contrast, a significantly larger number of "Reciprocity" nudges is chosen in the *endogenously assigned nudge* treatment relative to the *exogenously assigned nudge* treatment (p-value <0.01). This suggests that when A's are identifying the "Time Limit" nudge to be less effective and the "Reciprocity" nudge to be more effective.

A's appears to be correctly identifying effective and ineffective nudges. Further, the "Reciprocity" nudge appears to have a greater relative influence on B's in the *exogenously assigned treatment*, yet not outperform other nudges in the *endogenously assigned treatment*. It is possible that A's prior knowledge of their identified B's increase the effectiveness of nudges in the *endogenously assigned treatment* over the *exogenously assigned treatment*. To test this, we perform another series of probit regressions testing whether, for each of the nudges, B is more likely to open the email in the *exogenously assigned nudge* treatment or the *endogenously assigned nudge* treatment. The results of these regressions are shown in Table 6 ("Endogenous" is either 0 or 1).

For the most part, there does not appear to be a difference in the impact of nudges on B's when the nudges are exogenously assigned and when the nudges are endogenously assigned. The exception is in the case of the "Personalization" nudge when it is marginally more likely that B's would interact with the email in the (p-value <0.10). This means that when "Personalization" is used on a B because the A believes "Personalization" is the most effective nudge for B, B is more likely to interact with the email relative to when the

TABLE 5
Probit regressions of the type of nudge in the email on whether the nudge is exogenously assigned or endogenously assigned.

Dependent variable: Dummy variable for whether the email uses the nudge				
	(1) Time Limit	(2) Descriptive Norms	(3) Personalization	(4) Reciprocity
Endogenous	-0.286**	-0.166	0.027	0.346***
	(0.132)	(0.127)	(0.127)	(0.122)
Constant	-0.700***	-0.628***	-0.729***	-0.643***
	(0.093)	(0.091)	(0.094)	(0.091)
Observations	1,888	1,888	1,888	1,888

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

nudge is randomly assigned.

TABLE 6
Probit regressions of B opening the email on whether the nudge is exogenously assigned or endogenously assigned.

Dependent variable: Dummy variable for B opening the email				
	(1) Time Limit	(2) Descriptive Norms	(3) Personalization	(4) Reciprocity
Endogenous	0.024	0.241	0.483*	-0.353
	(0.301)	(0.271)	(0.266)	(0.224)
Constant	-0.883***	-0.945***	-0.929***	-0.431**
	(0.200)	(0.195)	(0.207)	(0.172)
Observations	94	112	112	154

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Result 4. *When "Personalization" is endogenously assigned, it is marginally more effective in getting B to open the email relative to when the same nudge is randomly assigned.*

5 Discussion

In this research, we investigated the relative effectiveness of two "norm-nudges" against two "non-norm nudges" in motivating individuals to interact with an email containing non-politically aligned news by using a two-stage study. We further test whether individuals can identify the most effective nudge for an individual they know.

We find that, on average, individuals judge nudges with social aspects, regardless of whether it is a "norm-nudge" (e.g. "Reciprocity" or "Descriptive Norms") or "non-norm nudge" ("Personalization"), to be more effective than a nudge with no social aspects ("Time Limit") in influencing their identified recipients to interact with the email. These individuals also appear to differentiate between the different types of nudges. In particular,

there is evidence that they identify the "Reciprocity" nudge to be the most effective in influencing their chosen recipients to engage in interacting with our emails.

We further find some evidence that the most effective nudge is different when the nudge was chosen randomly and assigned exogenously for the individual and when the nudge was chosen by the individual for that specific recipient. We find that the recipients are significantly more likely to open the email when the email includes a "Reciprocity" nudge relative to the other nudges the nudge was randomly assigned. However, when the nudge is endogenously assigned, there are no differences in the relative effectiveness of these nudges. We further find some evidence that "Personalization," may be more effective when it is the nudge that has been specifically chosen for a recipient relative to when it is randomly selected.

We set out with two goals in this study. The first is to provide a head-to-head test of the relative effectiveness of nudges that hold constant the context in which the nudges are used. We find some evidence that some nudges are more effective than others. Specifically, nudges that leverage social aspects of the interaction (e.g. "Personalization," "Reciprocity," and "Descriptive Norms") is more effective than the one that does not ("Time Limit"). But it is unclear whether of these more effective nudges there is a particular nudge that consistently outperforms the other.

Our second goal is to test whether individuals are better than random assignment at identifying the most effective nudge for an individual. Since different types of nudges work in different ways, it stands to reason that individuals may be differently susceptible to the same nudge and that someone who knows them may be able to make a personalized nudge choice that would be more effective than a random selection. Our results suggest that this may be the case.

However, there are limitations to our study. First, to make head-to-head comparisons, we control the context in which the nudges are used. However, it is possible that these nudges are context-dependent and their effectiveness may vary by the associated content and by the nudged behavior. Second, it is evident from our results that even among the more effective nudges, the extent to which it is effective may vary. However, the current design of our study does not allow us to explicitly tease out what makes a nudge effective. Overall, it is evident from this study that there is yet much to learn about what exactly makes a nudge effective.

Our findings have a broader impact. It contributes to our understanding of the impact of nudges and may help explain the mixed results in the effectiveness of nudges. It suggests that in cases where little is known about the specific recipients and where social influences may be leveraged, such as fundraising and charity drives, a "reciprocity" nudge may be the most effective in motivating action.

References

[1] Bakshy, E., Messing, S., and Adamic, L. A. (2015). Exposure to ideologically diverse news and opinion on facebook. *Science*, 348(6239):1130–1132.

[2] Belot, M., James, J., and Nolen, P. (2016). Incentives and children's dietary choices: A field experiment in primary schools. *Journal of health economics*, 50:213–229.

[3] Benartzi, S., Beshears, J., Milkman, K. L., Sunstein, C. R., Thaler, R. H., Shankar, M., Tucker-Ray, W., Congdon, W. J., and Galing, S. (2017). Should governments invest more in nudging? *Psychological science*, 28(8):1041–1055.

[4] Bicchieri, C. (2005). *The grammar of society: The nature and dynamics of social norms*. Cambridge University Press.

[5] Bicchieri, C., Ashraf, S., Das, U., Delea, M., Kohler, H.-P., Kuang, J., McNally, P., Shpenev, A., and Thulin, E. (2018). Phase 2 project report. social networks and norms: Sanitation in bihar and tamil nadu, india.

[6] Bicchieri, C. and Dimant, E. (2019). Nudging with care: The risks and benefits of social information. *Public choice*, pages 1–22.

[7] Bicchieri, C., Dimant, E., Sonderegger, S., et al. (2019). It's not a lie if you believe it: On norms, lying, and self-serving belief distortion. Technical report.

[8] Bicchieri, C. and Mercier, H. (2013). Self-serving biases and public justifications in trust games. *Synthese*, 190(5):909–922.

[9] Bicchieri, C. and Mercier, H. (2014). Norms and beliefs: How change occurs. In *The complexity of social norms*, pages 37–54. Springer.

[10] Bicchieri, C. and Xiao, E. (2009). Do the right thing: but only if others do so. *Journal of Behavioral Decision Making*, 22(2):191–208.

[11] Caraban, A., Karapanos, E., Gonçalves, D., and Campos, P. (2019). 23 ways to nudge: A review of technology-mediated nudging in human-computer interaction. In *Proceedings of the 2019 CHI Conference on Human Factors in Computing Systems*, pages 1–15.

[12] Castleman, B. L. and Page, L. C. (2015). Summer nudging: Can personalized text messages and peer mentor outreach increase college going among low-income high school graduates? *Journal of Economic Behavior & Organization*, 115:144–160.

[13] Choi, J. J., Laibson, D., and Madrian, B. C. (2009). Reducing the complexity costs of 401 (k) participation through quick enrollment. In *Developments in the Economics of Aging*, pages 57–82. University of Chicago Press.

[14] Cialdini, R. B. (2001). The science of persuasion. *Scientific American*, 284(2):76–81.

[15] Cialdini, R. B. (2004). The science of persuasion. *Scientific American Mind*, 14(1):70–77.

[16] Cialdini, R. B. (2007). *Influence: The psychology of persuasion*, volume 55. Collins New York.

[17] Cialdini, R. B., Reno, R. R., and Kallgren, C. A. (1990). A focus theory of normative conduct: recycling the concept of norms to reduce littering in public places. *Journal of personality and social psychology*, 58(6):1015.

[18] Dayan, E., Bar-Hillel, M., et al. (2011). Nudge to nobesity ii: Menu positions influence food orders. *Judgment and Decision making*, 6(4):333–342.

[19] DellaVigna, S. and Linos, E. (2020). Rcts to scale: Comprehensive evidence from two nudge units. Technical report, Working Paper, UC Berkeley.

[20] Dijkstra, A. (2008). The psychology of tailoring-ingredients in computer-tailored persuasion. *Social and personality psychology compass*, 2(2):765–784.

[21] Dimant, E., van Kleef, G. A., and Shalvi, S. (2020). Requiem for a nudge: Framing effects in nudging honesty. *Journal of Economic Behavior & Organization*, 172:247–266.

[22] Eisend, M. (2008). Explaining the impact of scarcity appeals in advertising: The mediating role of perceptions of susceptibility. *Journal of Advertising*, 37(3):33–40.

[23] Fehr, E. and Fischbacher, U. (2003). The nature of human altruism. *Nature*, 425(6960):785–791.

[24] Fehr, E. and Fischbacher, U. (2004). Third-party punishment and social norms. *Evolution and human behavior*, 25(2):63–87.

[25] Fehr, E., Fischbacher, U., and Gächter, S. (2002). Strong reciprocity, human cooperation, and the enforcement of social norms. *Human nature*, 13(1):1–25.

[26] Fraser, C. and Hite, R. E. (1989). The effect of matching contribution offers and legitimization of paltry contributions on compliance. *Journal of Applied Social Psychology*, 19(12):1010–1018.

[27] Giné, X., Karlan, D., and Zinman, J. (2010). Put your money where your butt is: a commitment contract for smoking cessation. *American Economic Journal: Applied Economics*, 2(4):213–35.

[28] Goldstein, N. J., Cialdini, R. B., and Griskevicius, V. (2008). A room with a viewpoint: Using social norms to motivate environmental conservation in hotels. *Journal of consumer Research*, 35(3):472–482.

[29] Hirsh, J. B., Kang, S. K., and Bodenhausen, G. V. (2012). Personalized persuasion: Tailoring persuasive appeals to recipients' personality traits. *Psychological science*, 23(6):578–581.

[30] Hummel, D. and Maedche, A. (2019). How effective is nudging? a quantitative review on the effect sizes and limits of empirical nudging studies. *Journal of Behavioral and Experimental Economics*, 80:47–58.

[31] Iyengar, S. and Hahn, K. S. (2009). Red media, blue media: Evidence of ideological selectivity in media use. *Journal of communication*, 59(1):19–39.

[32] Jensen, J. D., King, A. J., Carcioppolo, N., and Davis, L. (2012). Why are tailored messages more effective? a multiple mediation analysis of a breast cancer screening intervention. *Journal of Communication*, 62(5):851–868.

[33] Johnson, E. J. and Goldstein, D. (2003). Do defaults save lives?

[34] Kogut, T. and Ritov, I. (2005). The "identified victim" effect: An identified group, or just a single individual? *Journal of Behavioral Decision Making*, 18(3):157–167.

[35] Lynn, M. (1991). Scarcity effects on value: A quantitative review of the commodity theory literature. *Psychology & Marketing*, 8(1):43–57.

[36] Madrian, B. C. and Shea, D. F. (2001). The power of suggestion: Inertia in 401 (k) participation and savings behavior. *The Quarterly journal of economics*, 116(4):1149–1187.

[37] Murthi, B. and Sarkar, S. (2003). The role of the management sciences in research on personalization. *Management Science*, 49(10):1344–1362.

[38] Rozin, P., Scott, S., Dingley, M., Urbanek, J. K., Jiang, H., and Kaltenbach, M. (2011). Nudge to nobesity i: Minor changes in accessibility decrease food intake. *Judgment and Decision Making*, 6(4):323–332.

[39] Sahni, N. S., Wheeler, S. C., and Chintagunta, P. (2018). Personalization in email marketing: The role of noninformative advertising content. *Marketing Science*, 37(2):236–258.

[40] Schwartz, J., Riis, J., Elbel, B., and Ariely, D. (2012). Inviting consumers to downsize fast-food portions significantly reduces calorie consumption. *Health Affairs*, 31(2):399–407.

[41] Shah, A. K., Mullainathan, S., and Shafir, E. (2012). Some consequences of having too little. *Science*, 338(6107):682–685.

[42] Small, D. A., Loewenstein, G., and Slovic, P. (2007). Sympathy and callousness: The impact of deliberative thought on donations to identifiable and statistical victims. *Organizational Behavior and Human Decision Processes*, 102(2):143–153.

[43] Stroud, N. J. (2010). Polarization and partisan selective exposure. *Journal of communication*, 60(3):556–576.

[44] Tasoff, J. and Letzler, R. (2014). Everyone believes in redemption: Nudges and overoptimism in costly task completion. *Journal of Economic Behavior & Organization*, 107:107–122.

[45] Team, B. I. (2013). Applying behavioural insights to charitable giving. *London: Cabinet Office*.

[46] Thaler, R. H. and Benartzi, S. (2004). Save more tomorrow™: Using behavioral economics to increase employee saving. *Journal of political Economy*, 112(S1):S164–S187.

[47] Volpp, K. G., Troxel, A. B., Pauly, M. V., Glick, H. A., Puig, A., Asch, D. A., Galvin, R., Zhu, J., Wan, F., DeGuzman, J., et al. (2009). A randomized, controlled trial of financial incentives for smoking cessation. *N Engl J Med*, 360:699–709.

[48] Wansink, B., Painter, J. E., and North, J. (2005). Bottomless bowls: why visual cues of portion size may influence intake. *Obesity research*, 13(1):93–100.

[49] Whitehead, M., Jones, R., Howell, R., Lilley, R., and Pykett, J. (2014). Nudging all over the world: Assessing the global impact of the behavioural sciences on public policy. Economic and Social Research Council.