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The whole is larger than the sum of its parts: additive effects of SMS nudge bundles

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Public access to housing is a challenge for a large number of societies and follows a great number of limitations. Here, we test several SMS-interventions aiming at motivating people to get information on affordable loans for housing options actually available to them. We randomly assigned 6,247 people to receive an SMS inviting them to get information about government backed housing loans for which they were already eligible. SMSs followed one of 14 possible nudges including “simple” nudges (e.g., messages personalized with the recipient’s name or mentioning a social norm) and “bundled” nudges (combining personalization with another simple nudge). We observed SMS response rates (i.e., responding to sign up for receiving more information) according to which nudge was assigned. No other independent variable was considered. While most nudges were more effective than a control SMS, we observed significant variation across nudges on their ability to elicit responses from users. Combinations of multiple nudges were more successful in behavior elicitation than simple nudges. We discuss the possible implications of “single” or “bundled” SMS on response rates and as an effective tool of behavior change.

KEYWORDS

nudge, nudge+, loan access, housing access, decision-making

Introduction

Access to adequate housing was recognized by the Universal Declaration of Human Rights as part of the right to an adequate standard of living, and included in article 11.1 of the 1966 International Covenant on Economic, Social and Cultural Rights (UN General Assembly, 1948, 1966, 2022). Lacking appropriate housing has been linked to a number of negative outcomes such as poverty traps (OECD, 2021) and various health concerns (WHO, 2018). Yet, housing access has been steadily declining across the globe due to a series of macroeconomic, microeconomic, and societal factors (Wetzstein, 2017). While some of these factors follow world-wide trends such as rising prices and economic crises, some are more locally situated and are directly linked to individual decision-making, beliefs, and values (Ortiz and Johannes, 2018). Here, we provide a simple, choice-preserving intervention [a “nudge” (Thaler and Sunstein, 2008)] aimed at helping lift one particular individual-level barrier to housing access through a natural experiment approach. Specifically, we implement nudges aimed at facilitating information access on affordable housing loans.

One of the main barriers to housing access is a lack of individual financing which precludes people, especially those of lower socioeconomic status [SES], from accessing affordable mortgages and loans to finance their homes. Among the myriad factors precluding individuals such access, contributing factors include a lack of information

about possible loans and confusion about qualification conditions. In particular, Colombia's Fondo Nacional del Ahorro (a public financing institution) has available credit resources for low-SES citizens, a large portion of which remains unclaimed, partly because people in the target group for these loans remains unaware that they exist, do not know that they would be eligible for one such credit if they applied, or both. This leaves a large amount of public resources unused even though interest rates are markedly lower in FNA compared to private banks.

Consequently, we designed an SMS-based field experiment to determine which message framing better attracts attention to a public financial institution's offers of affordable loans destined to housing.¹ The communication and framing of messages has been shown to effectively influence a wide-berth of decisions including housing (Ortiz, 2019), saving (Rodríguez and Saavedra, 2015, 2019) and education (Castleman and Meyer, 2020). For this study, we sent a single SMS message per person to offer information about affordable housing loans offered by a public financial institution in Colombia (Fondo Nacional del Ahorro, FNA) to the recipient. Messages were experimentally manipulated to reflect one of several possible communication strategies (see Table 1). After sending the SMS we measured whether the recipient responded to the SMS requesting further information to express interest in this loan offer. While not directly translating into housing loan acquisition, this study shows a cost-effective and straightforward way to lift one barrier for housing access: lack of information one affordable, government-backed loans. Further research should identify and lift further barriers in that process such as completing paperwork correctly and on time or budgeting.

In all cases SMS were designed to offer information about the possibility to access an affordable housing loan at no cost to the recipient. Different communication strategies were added to the control message reflecting different ways to motivate behavior. Message manipulations followed a number of well-known findings in the decision sciences literature and social psychology. First, the *self-image* intervention follows social identity theory (Tajfel, 1982) suggesting that highlighting the recipient's social identity as a homeowner, a valued social identity, may motivate people to seek information more so than the simple offering of information. The *time pressure* intervention draws from literature on heuristic reasoning (Tversky and Kahneman, 1981) and time pressure (Wu et al., 2022) suggesting that having little time to analyze information may favor lower risk aversion. We reasoned that this might increase willingness to obtain information about paths to buying a home in spite of potential risks associated with the purchase (e.g., financial risk of taking a home loan or the time and resources spent on actually applying for the loan). The *social norm* intervention follows large literature on social norms and how behaviors observed by valued peers are used as benchmarks to model future behavior (Cialdini et al., 1991; Bicchieri, 2012; John et al., 2024). Both *geographical location* and *subsidy* interventions were designed to make it easier, and therefore more attractive, to gain access to a home either by proximity (*geographical location* condition) or by diminishing the financial cost of the loans (*subsidy* condition).

¹ This project resulted from a decision sciences consulting initiative between the authors and the FNA during the first half of 2018.

TABLE 1 Sent SMS for each communication strategy.

Communication strategy	SMS text
Control	Your savings at FNA could be the down payment for your own home. Would you like to know more? Please write "YES" if so.
Personalization	[Recipient's first name] your savings at FNA could be the down payment for your own home. Would you like to know more? Please write "YES" if so.
Self-image	Become a homeowner! Your savings at FNA could be the down payment for your own home. Would you like to know more? Please write "YES" if so.
Time pressure	Don't waste your time! Your savings at FNA could be the down payment for your own home. Would you like to know more? Please write "YES" if so.
Social norm	Your savings at FNA could be the down payment for your own home. In 2017 we financed XXXX clients like you. Would you like to know more? Please write "YES" if so.
Geolocation	Your savings at FNA could be the down payment for your own home in [recipient's city of residence]. Would you like to know more? Please write "YES" if so.
Family	Your savings at FNA could be the down payment for your own family home. Would you like to know more? Please write "YES" if so.
Subsidy	Your savings at FNA could be the down payment for your own home. There are subsidies available for you. Would you like to know more? Please write "YES" if so.
Personalization + Self-image	[Recipient's first name] become a homeowner! Your savings at FNA could be the down payment for your own home. Would you like to know more? Please write "YES" if so.
Personalization + Time pressure	[Recipient's first name] don't waste your time! Your savings at FNA could be the down payment for your own home. Would you like to know more? Please write "YES" if so.
Personalization + Social norm	[Recipient's first name] your savings at FNA could be the down payment for your own home. In 2017 we financed XXXX clients like you. Would you like to know more? Please write "YES" if so.
Personalization + Geographical location	[Recipient's first name] your savings at FNA could be the down payment for your own home in [recipient's city of residence]. Would you like to know more? Please write "YES" if so.
Personalization + Family	[Recipient's first name] your savings at FNA could be the down payment for your own family home. Would you like to know more? Please write "YES" if so.
Personalization + Subsidy	[Recipient's first name] your savings at FNA could be the down payment for your own home. There are subsidies available for you. Would you like to know more? Please write "YES" if so.

Original Spanish texts available in [Supplementary material](#).

Finally, we reasoned that reminding that a home could benefit not only the recipient but also their families could attract recipient's attention (*family condition*).

While reviewed literature leads us to hypothesize that proposed communication strategies can motivate people to seek information about home loans, there is little direct evidence of what happens if several of these strategies are deployed in the same individual message. On the other hand, prior literature has amply shown that personalizing SMS, that is, adding information directly linked to the recipient such as their name or last name, consistently increases response interest (Kaniewska-Sęba and Pilarczyk, 2014; Trespalacios and Perkins, 2016; Li and Liu, 2017). On the other hand, an overlooked and potentially fruitful related question is the potential interaction between personalization and other communication strategies. Bundling multiple communication strategies in the same SMS (e.g., adding the recipient's name plus mentioning the socially valued identity of being a home owner) may have a more potent effect than deploying each strategy separately (e.g., adding the recipient's name and mentioning the home owner identity in a subsequent message). This bundling approach is somewhat similar to nudge+ strategies (Banerjee and John, 2021; Banerjee and Picard, 2023; Banerjee et al., 2023a,b; Dold and Lewis, 2023) according to which interventions that elicit both automatic and reflective processes tend to improve effectiveness. While nudge bundling does not necessarily recruit reflection, it does rely on the claim that recruiting multiple psychological processes may increase intervention effectiveness. Moreover, since our dependent variable corresponds to seeking more information from a trustworthy source (i.e., the Fondo Nacional del Ahorro) we take our intervention to reflect main principles of nudge+ approaches leveraging more heuristic processing to favor reflection and informed decision-making. On the other hand, it is possible that different strategies may cancel each other out even if both separately are effective. Hence, here we systematically test the interaction effect of personalization strategy with all proposed strategies described above.

Methods

Experimental design

We randomly assigned every recipient to one of each of the experimental conditions (see Table 1). Randomization was done by the authors using the Microsoft Excel RAND function and assigning random numbers to all chosen participants. Prior to randomization, each experimental condition was assigned a number ranging from 1 to 14. Random assignment of experimental conditions was then communicated to FNA communications and marketing department to send experimentally designed SMS to each participant in the chosen database. All SMS were simultaneously sent on November 22nd 2018. Half of them were sent in the morning (9 AM, Colombian time) and the other half in the afternoon (2 PM, Colombian time). We monitored SMS response during the following 2 weeks following SMS reception. All SMS instructed participants to answer "yes" to the SMS if they were

interested in housing loans.² All affirmative responses received up to 2 weeks after having sent the SMS were coded as 1, any negative response or no response at all were coded as 0. This dummy-coded variable is the only DV in our study.

Sample

We sent a single SMS to 2,982 people, all of whom were previously enrolled at the FNA. As part of the enrolment process, and as a component of FNA's privacy and personal data terms and conditions, each FNA participant was informed and consented to have their personal data be used in studies aligned with FNA's mission (FNA, 2024). To ensure that we would not induce false expectations as to whether recipients could actually get a loan or have access to subsidies, we included only individuals already in the FNA's main database whose profile included complete information and who actually fulfilled all eligibility criteria for loans and subsidies, as well as those who lived in cities where there was a sufficient affordable housing offer were contacted. While further information about the sample is not readily available, traditionally, citizens in the Fondo Nacional del Ahorro are low-middle class with relatively stable employment and who live in family houses or rent their homes rather than own them.

Ex post-facto power analysis of the collected sample suggests an observed power of $\beta \approx 1$ for the implemented analysis and observed effect sizes.³

Empirical strategy

We fitted a single logistic multiple regression with affirmative response to the SMS as a binary dependent variable (Y_i), Personalization as a dummy variable (β *Personalization*) reflecting whether SMS was personalized or not. All other experimental conditions were assigned into a single IV variable (β *conditions*) which interacted with Personalization (see Equation 1 and Table 2).

$$Y_i = \beta \text{ Personalization} * \beta \text{ conditions} + \varepsilon \quad (1)$$

To ensure robustness of results we fitted a similar models including all available covariates, namely, at what time of day SMS was sent (at 8 AM or at 2 PM, β *time*) and the city of residence of the recipient (β *city*) (see Equation 2 and Table 2).

$$Y_i = \beta \text{ Personalization} * \beta \text{ conditions} + \beta \text{ time} + \beta \text{ city} \varepsilon \quad (2)$$

Results

Results suggest that while Personalization in and of itself does not have a significant effect it does greatly improve the effect of all other experimental manipulations (see Table 2). While most simple effects of nudges have significant effects with relatively

2 This was, of course, explicitly free of charge (see Table 1).

3 See the project's OSF repository (https://osf.io/mgwck/?view_only=d47b435a568146f78d63b9f810e507d2) for translated materials, raw data and complete data analysis scripts.

TABLE 2 Logistic regressions results.

	Dependent variable	
	Affirmative response	
	Simple model	Covariate model
	(1)	(2)
Personalization	0.0001 (1.039)	0.0001 (1.109)
	$t = 0.0001$	$t = 0.0001$
	$p = 1.000$	$p = 1.000$
Family	1.476** (0.373)	1.528*** (0.376)
	$t = 3.954$	$t = 4.066$
	$p = 0.0001$	$p = 0.00005$
Geographic location	0.796 (0.421)	0.797 (0.421)
	$t = 1.890$	$t = 1.894$
	$p = 0.059$	$p = 0.059$
Self-image	1.652*** (0.363)	1.696*** (0.365)
	$t = 4.547$	$t = 4.643$
	$p = 0.00001$	$p = 0.00001$
Social norm	1.090 (0.391)	1.156* (0.393)
	$t = 2.787$	$t = 2.944$
	$p = 0.006$	$p = 0.004$
Subsidy	1.726*** (0.364)	1.825*** (0.366)
	$t = 4.746$	$t = 4.990$
	$p = 0.00001$	$p = 0.00000$
Time pressure	1.093 (0.398)	1.193* (0.401)
	$t = 2.748$	$t = 2.976$
	$p = 0.007$	$p = 0.003$
Personalization × Family	25,707.400*** (1.086)	10,383.290*** (1.148)
	$t = 23,677.560$	$t = 9,048.095$
	$p = 0.000$	$p = 0.000$
Personalization × Geographic location	58,455.810*** (1.101)	24,934.790*** (1.175)
	$t = 53,082.840$	$t = 21,219.740$
	$p = 0.000$	$p = 0.000$
Personalization × Self-image	21,916.210*** (1.085)	9,675.324*** (1.148)
	$t = 20,205.230$	$t = 8,429.855$
	$p = 0.000$	$p = 0.000$
Personalization × Social norm	28,353.440*** (1.096)	12,138.850*** (1.162)
	$t = 25,871.710$	$t = 10,448.880$
	$p = 0.000$	$p = 0.000$
Personalization × Subsidy	22,618.240*** (1.080)	9,467.930*** (1.142)
	$t = 20,950.590$	$t = 8293.547$
	$p = 0.000$	$p = 0.000$
Personalization × Time pressure	19,819.030*** (1.104)	7,635.466*** (1.150)

(Continued)

TABLE 2 (Continued)

	Dependent variable	
	Affirmative response	
	Simple model	Covariate model
	(1)	(2)
Constant	$t = 17,947.990$	$t = 6639.157$
	$p = 0.000$	$p = 0.000$
	0.063 (0.286)	0.051 (0.392)
	$t = 0.221$	$t = 0.130$
	$p = 0.826$	$p = 0.897$

* $p < 0.00384615384615385$; ** $p < 0.000769230769230769$; *** $p < 7.69230769230769e-05$. Coefficients were transformed to odds to ease interpretation. All reported SEs are robust errors. Alpha levels were adjusted for multiple comparisons.

small effect sizes between 0.7 and 1.7 in odds, the Personalization X nudge interaction consistently shows considerably larger effect sizes and significant effects (all odds > 19,000) suggesting great interactive effects of personalization with other framing nudges. Further, all effects are of similar magnitude and direction when adding available covariates: city of residence and time (AM or PM) in which SMS were sent. No other covariate was made available by FNA.

Discussion

The main aim of this study was to test the effect of different SMS frames in recipient information seeking behavior concerning home loans, with a view to increasing the odds of better financial health and more efficient allocation of public resources. Overall results follow prior literature suggesting that SMS tailored via nudge-based communicative strategies have a positive effect on seeking information compared to a control SMS (Cárdenas et al., 2022; Dibner-Dunlap, n.d.).^{4,5}

Moreover, our results suggest a previously ill-understood possibility. While most studies systematically manipulate and test only one nudge at a time (DellaVigna and Linos, 2022; Mertens et al., 2022), here we systematically pair different nudges (i.e., Geolocation, Time Pressure, Family, Social Norms and Subsidy) with a Personalization nudge. This allowed us to empirically test interaction effects of all nudges with Personalization showing a distinct pattern of results: the effects of strategies pairs (i.e., Personalization coupled with another communication strategy) were mostly stronger than single communication strategies. In the most striking example of this, the Geolocation intervention on its own *decreased* responses whereas the Geolocation and Personalization interaction *increased* responses the most out of all considered conditions, significantly more than the Personalization interaction on its own (see Table 2). This is a repeated finding: pairing nudge interventions together led to a greater result than single strategies separately. We believe this study shows the

4 Cárdenas, G. J., Juan, S., Li, J., Héctor, N., Rosas, O., Ramos, S., et al. (2022). ¿Los SMS nudges promueven la salud financiera? (unpublished)

5 Dibner-Dunlap, A. (n.d.). SMS Nudges to Build Savings. (unpublished)

promise of multiple, coordinated messaging strategies as a way to bolster behavior change with minimum costs. To be sure, SMS interventions are quite readily applied at a minimum cost, our study suggests the possibility to maximize SMS effectiveness while keeping costs almost identical. Moreover, this approach shows promising ways to make trustworthy information more readily available to traditionally underserved communities, therefore facilitating autonomous decision-making.

While consistently more effective, we believe communication strategies are to be handled cautiously. Indeed, observed effectiveness is presumably due to communication strategies not contradicting one another and being sufficiently subtle to not cause cognitive overload, both of them fitting within a single short SMS. We expect that contradicting strategies or adding too many strategies into a single communication to have inconsistent or even adversarial results. Future research should explore boundary conditions of these findings. Specifically, whether providing extra communications harnesses the power of availability by making the reasons in favor of seeking information more salient and thus heuristically stronger than the reasons against seeking information. On the contrary, providing more reasons could get people into reflective mode, thereby putting them in a decision-making attitude that promotes the search for further information.

Our results are compatible with highly heterogeneous literature in Decision Sciences (Bryan et al., 2021) suggesting that identical nudges can have vastly dissimilar results according to contextual, cultural or personal variables. We hope to contribute to this discussion by pointing to potential, and sometimes surprising, interactions between different nudge interventions. Both academics and practitioners would benefit from systematically testing these interactions in order to both better understand underlying causes of decision and more effectively leverage this knowledge in applied nudges.

We close by pointing out a few limitations of this study. Our intervention was limited to only the first of a longer process of acquiring a home through affordable, government-sponsored loans. The entire process is very complex and includes multiple stages, each of which presents challenges of its own. However, we believe results show the power of cost-effective nudge interventions for motivating information-seeking relevant to financial decision-making. Indeed, implementing designed SMS had an approximate cost of 100 USD (400.000 COP) as estimated by FNA (2018), for a dramatic increase in interest in their housing products.

It should be said, however, that the impact of the increase in information seeking may not translate into the request of a housing loan. While seeking information reveals an intention to obtain housing, several possible obstacles along the way may result in an intention-behavior gap (Conner and Norman, 2022) in this context. For instance, the information provided may be too technical or complex; the decision of which financial vehicle to apply for may also be complicated; the application process may require many steps and grueling paperwork; and the submission process may present difficulties of its own (e.g., if documents must be physical or are received only in person).

We hope future research develops and tests similar nudges to accompany and facilitate every step of the process that middle- and lower-class individuals have to go through to have a home of their own.

Data availability statement

The datasets presented in this study can be found in online repositories. The names of the repository/repositories and accession number(s) can be found in the article/[Supplementary material](#).

Ethics statement

Ethical approval was not required for the studies involving humans because this research was carried out as part of the Fondo Nacional del Ahorro business-as-usual communication strategy and data collection would have been carried out regardless of presented research. Therefore, Fondo Nacional del Ahorro decided to forgo IRB review. The studies were conducted in accordance with the local legislation and institutional requirements. Written informed consent for participation was not required from the participants or the participants' legal guardians/next of kin in accordance with the national legislation and institutional requirements. As part of the enrolment process, and as a component of FNA's privacy and personal data terms and conditions, each participant provided informed consent for having their personal data be used in studies aligned with FNA's mission.

Author contributions

SB: Conceptualization, Formal analysis, Investigation, Methodology, Writing – original draft, Writing – review & editing. JPB: Conceptualization, Investigation, Methodology, Project administration, Validation, Writing – review & editing.

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Conflict of interest

This project resulted from a decision sciences consulting initiative between the authors and the FNA during the first half of 2018. The authors did not receive any payment for this work and therefore there is no related financial conflict of interest. Furthermore, other than being authorized to publish the present study, the authors no longer have any professional or personal link to FNA or its subsidiaries. The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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Supplementary material

The Supplementary Material for this article can be found online at: <https://www.frontiersin.org/articles/10.3389/fcomm.2024.1298607/full#supplementary-material>

Data analysis scripts are available online at: https://osf.io/mgwck/?view_only=d47b435a568146f78d63b9f810e507d2

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