



**Static and Dynamic Social Norms on Recycling Behaviour: An Intervention and  
Maintaining Study**

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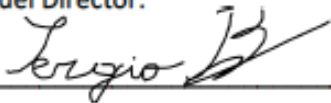
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Los aquí firmantes certificamos que el trabajo de grado elaborado por GABRIELA FERNANDA LÓPEZ CARRILLO titulado: STATIC AND DYNAMIC SOCIAL NORMS ON RECYCLING BEHAVIOUR: AN INTERVENTION AND MAINTAINING STUDY cumple con los estándares de calidad exigidos por El programa de psicología para la aprobación.

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**Abstract.**

Psychology has taken interest in finding effective ways to promote pro-environmental behaviors in society, different resources such as nudging and social norms have been increasingly studied in the field. This paper focuses on the use of dynamic and static social norms in the promotion of recycling behavior in a university of Bogotá, Colombia. It was of particular interest to design an intervention that allows to study its long-term effects and the contrast between static and dynamic social norms. Overall, results pointed to a positive short and long-term effect of social norms intervention compared to control group, about the difference between static and dynamic social norms, results were not definitive, this is further discussed and limitations are also exposed.

**Key words:** Static social norms, dynamic social norms, environmental psychology, environmental behavior.

**Resumen.**

La psicología se ha preocupado por encontrar métodos efectivos para promover comportamientos pro-ambientales en la sociedad, la investigación sobre recursos tales como el nudging y las normas sociales ha incrementado en la disciplina. Este trabajo se enfoca en el uso de las normas sociales dinámicas y estáticas para la promoción del comportamiento de reciclaje en una Universidad de Bogotá, Colombia. Fue de interés particular diseñar una investigación que permita estudiar los efectos a largo plazo y el contraste entre las normas sociales estáticas y dinámicas. En general, los resultados señalaron un efecto positivo a corto y a largo plazo de las intervenciones de normas sociales comparado con el grupo control, con respecto a las diferencias entre normas sociales estáticas y dinámicas, los resultados no fueron definitivos, esto es discutido a mayor detalle y las limitaciones del estudio son expuestas.

***Palabras clave:*** Normas sociales estáticas, normas sociales dinámicas, psicología ambiental, comportamiento medioambiental.

**Author's notes.**

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**Introduction**

The profound environmental crisis society's currently experiencing, has been mostly induced by human behaviour (Ceballos et al, 2015). Phenomena such as climate change, massive loss of biodiversity, global warming and pollution have alerted environmental scientists and government to the urgency of a shift before the consequences are disastrous and irreversible (UNEP, 2021). Biodiversity populations monitored by the World Wildlife Population (WWF) in 2020, have experienced a decline of 68% since 1975, Latin America and the Caribbean are in a far more critical state, these regions sustained a 94% loss in this period (Almod, Grooten & Peterson, 2020). Pollution is another prominent issue, out of the 260 million tons of plastic produced each year, 8 million tons end up in the ocean and have even been found in remote parts of the world from the Mariana Trench to the top of the Mount Everest (Thebault, 2019). About 60% of plastic produced since 1950 has ended up either in a landfill or on the natural environment (Geneva Environment Network & UNEP, 2021) plastic pollution has been further worsened by the use and disposal of personal

protective equipment in the context of the COVID-19 pandemic (Ammendolia, Saturno, Jacobs & Jambeck, 2021).

This is particularly alarming in the case of the inappropriate disposal of plastics. More than 80% of marine debris originates from human activity in land, especially in urban centers, and most of these correspond to mismanaged plastic waste (Jambeck et al, 2015). This imposes a serious environmental threat, since it could provoke choking and starvation in the wildlife, distribute potentially dangerous organisms and degrade into microplastics, which can be ingested by living beings, including humans. Plastic longevity is estimated to be of thousands of years and its degrading span appears to be way longer in the ocean and in polar ecosystems (Barnes, Galgani, Thompson, & Barlaz, 2009). In the case of Colombia, each household produces almost 4.5 kilograms of general waste daily. Every 24 hours, 6300 tons of waste are disposed only in Bogotá, of these residues, almost 60% corresponds to plastic waste (Greenpeace, 2019).

Recycling has been proposed to be one of the most feasible options to mitigate the environmental impact of plastics, this is due its public appeal and the environmental advantages in comparison to other ways of handling plastic waste, such as incinerating it or putting it in a landfill (Nkwachukwu, Ikenna & Albert, 2013). The recycling chain starts with the production of the plastic waste which can have a domestic, commercial or industrial origin. The residues are then retrieved, transported and put into bigger containers for its subsequent classification. At this point the different materials of the waste are separated and classified in classification plants, they are then transported to treatment. In the case of plastics, they are washed, ground into flakes, heated and extruded into new pellets in the treatment phase, these pellets are then sold to manufacturers for use in new products. Plastic recycling is paramount because the residues are put back into the production system rather

than creating toxic pollutants or environmental debris. Indeed, for every ton of plastic that is recycled, 5.7 cubic meters of landfill space is saved (Koop, 2021).

However, residues need to be disposed of adequately for the material to be recycled, in this sense, littering is a direct form of inadequate disposal of waste and can greatly hinder the way for plastic waste to be purposed into new economic activities. It can also take place through the incorrect disposal of the residues in the containers that are set for each type of material, because this causes them to be contaminated and not able to be incorporated in the recycling chain. Only 9% of the plastic created by humanity has been recycled and only 14% of the plastic is currently being collected to be recycled (UNEP, 2019). In Colombia, plastic recycling has increased gradually but still possess a challenge and is insufficient to face the global environmental emergency (WWF, 2020).

Littering and the inadequate disposal of waste are some of the day-to-day individual behaviours that cause a monumental negative impact on the environment, besides, it is a largely deliberate act, meaning that people are aware of the negative connotation and effects of the action taking place (Keep America Beautiful, 2010). In other words, it refers to the throwing away or leaving behind of the waste in places different to bins that are specifically purposed for this which can happen actively, by intentionally throwing away the waste, or passively, by leaving it in a spot that was previously occupied (Sibley & Liu, 2003). Littering negatively impacts the environment because the residues can end up in rivers, forests, lakes or other ecosystems, causing pollution in waterways, bodies of water and soils. Also, it stops a recycling chain through which residues can be re-used or adapted to serve other purposes (CENN, 2021). This points us towards a need to create a public shift in the everyday behaviours that have a negative impact on the environment, such as the inadequate disposal of waste.

Psychology has taken interest in these issues since the 1960s. Environmental psychology is thus established as an interdisciplinary field that focuses on the interactions between human beings and the environment. It involves disciplines such as anthropology, sociology and architecture, and emphasizes the presence and influence of the physical environment on human beings' lives and wellbeing. Environmental psychology also contributed to the demonstration that human choice does not always follow people's knowledge of the effects of their actions or even their behavioral intentions since there are other situational or normative elements that may influence their behavior to a bigger extent (Bechtel, 2010). One of the main purposes of this discipline is to create theories and models that can predict environmentally relevant behaviours and creating and evaluating interventions to favor these pro-environmental or "green" behaviours (Klöckner, 2013).

Environmental behaviour is a term that involves all activities that, in any dimension, have an impact on the environment. Pro-environmental or "green" behaviour is one that seeks to protect or contributes to a healthy environment in any respect. The environmental problem includes phenomena that have implications in aesthetics, public health, and the protection and dignity of life (Krajhanzl, 2010).

Social norms interventions have received growing attention within the last few years as an effective policy tool in the pro-environmental psychology field. Social norms is understood as the grammar of social groups given that they are a system of norms that delimit which behaviour is acceptable or not, they are not a product of human design (Bicchieri, Muldoon, & Sontuoso, 2011). Social norms are based on a set of beliefs about relevant others' behaviours and behavioural expectations (Bicchieri & Xiao, 2009) and have been successfully used to promote the execution of pro-environmental behavior in different settings (Farrow, Grolleau, & Ibanez, 2017).

On this paper, some literature regarding the meaning and description of social norms, social norms based interventions and the difference between static and dynamic social norms will be presented. In this section, we will also expose some of the conceptual and methodological problems in the literature that led to the design of the study.

We plan to contribute to the environmental psychology field through a study that analyses the effects of dynamic and static social norms in the frequency and execution of a particular pro-environmental behavior: the proper disposal and recycling of residues within an educational institution in Bogotá, Colombia. In the design of the study, two methodological aspects were heavily taken into account due to some limitations found in the reviewed literature; the effective measurement of the effects of the intervention in the execution of observed behavior and time-span measurements that account for the effects after the intervention is suspended.

### **Literature Review**

As it was previously mentioned, littering is a behavioral issue that causes considerable harm to the environment. Targeted interventions of social norms have proven to be a promising and cost-effective strategies to tackle this kind of public-welfare related behavioral issues.

Social norms can be understood a set of “informal rules that govern behavior in groups and societies” (Bicchieri, Muldoon & Sontuoso, 2011), these rules are shared by a group of people each of which are relevant to each other in a certain context (Bicchieri, 2006).

Cognitively, social norms are based on first and second-order beliefs about other's behaviours, set expectations and their possible consequences. Thus, social norms depend on a group of people whose behaviour and approval are important for an agent (Bicchieri & Casas, 2019; Bicchieri & Xiao, 2009), this implies a behavioural co-regulation among peers.



Social norms are based on two kinds of mental constructs related to the notion of expectations, these expectations on others' behaviours and beliefs, will ultimately determine whether or not a particular behavior can be considered as a social norm within a group: descriptive expectations and normative expectations. First, *descriptive* expectations, are first order beliefs about what other agents from the relevant social group *do* in the considered situation. For instance, James has an empirical expectation that littering is accepted in his city if he believes that enough people inhabiting his city frequently litter. On the other hand, *normative* expectations are beliefs about what others think agents ought to do in a given situation. Contrary to descriptive expectations, normative expectations are second-order beliefs about what others *think* others *ought* to do, independently of whether they actually engage in those behaviours or not or if they even have those beliefs or not, this applies for both kind of expectations. For example, Jane has a normative expectation that littering is accepted in her city if she believes that enough people in the city do not mind others littering independently of whether enough people actually litter on a regular basis. Normative expectations can be limited to other's normative beliefs (e.g., believing that others think littering is or is not acceptable in this city) or include expectations about social sanctions/rewards (e.g., believing that others not only believe that littering is not acceptable but also are willing to socially punish those who do).

Some evidence related to the importance of the reference group for social norm interventions has been found in empirical research. For instance, the effect of social norms on pro-environmental behaviour is bigger when the agent belongs to, and feels identified with, the presented reference group (Lede, Meleady, & Seger, 2019) compared to a control, purely informational intervention. Therefore, it is relevant to consider the salience of social identity for stimulating people to engage in this behaviour. Reference group effect has been found to be independent from the perceived strength of the descriptive norm (Lima & Branco, 2018)

suggesting that careful consideration of the targeted social identity of social norms interventions is a key to successful interventions.

All in all, social norms are based on co-regulation principles in which people behave in a particular manner inasmuch as they perceive that enough people in relevant social groups actually behave that way (i.e., descriptive expectations) and expect others to do so (i.e., normative expectations), it is important to note that it is not clear what “enough” people is in order to constitute a social norm, since it could mean a particular percentage of the reference group or some specific members of the group could carry more influence within the group (Bichieri, 2016). This framework has proven to be successful in reducing or extinguishing undesirable behavior such as substance abuse (Scribner et al, 2011; Hancock & Henry, 2003; Pischke et al, 2021) or bullying in middle schools (Perkins, Craig & Perkins, 2011) by hindering previously established and undesirable norms, and, conversely, increasing desired behaviors such as donation (Croso, Handy & Shang, 2010) by creating new, more desirable norms. This suggests that intervening social norms could be a fruitful way to modify individual behaviour to align it with social welfare rather than individualistic gains.

A salient issue within social norm interventions is that descriptive norms manipulation may not match the lay perception of how often a target behaviour happens. In these cases, these manipulations are deemed less believable and, consequently, have a lesser effect (Loschelder, Siepelmeyer, Fischer & Rubel, 2019). This poses a paradox since, in order to make believable social norms manipulations, one should first change behaviour, making it a self-defeating endeavour. Sometimes, the use of static norms manipulations describing the frequency of a target behaviour in a single moment in time, may lead to undesirable results. For instance, in cases where the reported empirical frequencies of the target behaviour are not considered credible, social norms interventions have been shown to be less reliable and even

backfire (Loschelder, Siepelmeyer, Fischer & Rubel, 2019). In a replication made by Bohner & Schlüter (2014) of a study designed by Goldstein, Cialdini, and Griskevicius (2008) in which they placed messages redacted as social norms in order for the guests to reuse their towels, it was found that static descriptive norms showed a lesser effect than the standard messages not related to social norms. A possible explanation for this lies on the cultural differences among people from the United States and Germany: Europeans, compared to US citizens, would focus more in the normative aspect of the behaviour rather than in whether it is descriptively frequent or not. In response to these limitations, authors have proposed a modification to static norms manipulations. In classic static norms manipulations agents receive information about how many people, usually a comfortable majority, are currently engaging in the target behaviour (e.g. In 2021, most households in the UK try to recycle their plastic residues). On the contrary, in *dynamic* social norms interventions agents receive information about an increasing number of people engaging in the target behaviour with no indication that this is a dominant or widespread behaviour (e.g. “An increasing number of households in the UK try to recycle their plastic residues” as opposed to “most households in the UK try to recycle their plastic residues”) (Mortensen, Neel, Cialdini, Jaeger, Jacobson & Ringel, 2017). The fact that target behaviour is not claimed to be widespread or adopted by a large proportion of people makes dynamic norms interventions more subjectively believable than static norms and, therefore, more effective (Van Kleef, Gelfand & Jetten, 2019; Mortensen et al, 2017; Jones, 2009)

In this sense, it appears that static and dynamic social norms research is very promising for public policy formulation. It begs to be further studied and for the existing research to be replicated in different settings. However, research of static and dynamic social norms intervention on behaviours may suffer from several key limitations. First, a large proportion of research fails to directly observe behaviour in a natural setting, relying on

unobservable psychological phenomena such as intentions to behave in a certain way as a proxy. Although behaviour intention is, of course, linked to actual behaviour (Ajzen, 1991), intention-behaviour correlation is usually moderate at best (Hassan, Shiu, & Shaw, 2016), meaning that the predictions that are based on intention are not a good indicator of whether that intention will derive in a behavior. A related limitation is that behavioural intention might be subject to desirability biases as well as overly optimistic estimations of one's behaviours, making the effect of social norms interventions on *actual* behaviour uncertain and possibly overestimated, hence, here we will observe behaviour rather than behaviour intention using a field experiment. Finally, while literature suggests social norms manipulations are ways to modify group-level beliefs and culture, making it theoretically possible for sustained behavioural change despite discontinued interventions, it is not clear whether these effects are actually sustained over time (Chakravarty & Mishra, 2019).

As posed by Bicchieri, social norms deal with behaviors that derive from behavioral preferences, rather than intentions, this is another reason that renders the measurement of intention not as useful as one would expect not only for environmental interventions in general, but particularly for social norm-based interventions given that they imply conceptual contradiction with usual intention-based interventions since what is being measured is completely unarticulated from social norms theory.

Another recurring limitation in the research of environmental behaviours is the lack of information regarding the maintenance of interventions through time. This being one of the reasons why behavioural interventions haven't earned more credibility and appeal in the field, it has been shown that people initially respond to the intervention but their behaviour tends to decrease through time and more importantly, tends to go back to baseline once intervention is interrupted (Lehman & Geller, 2004). One of the strategies formulated by Lehman & Geller (2004) for behaviours such as recycling is to make maintenance the focus

of the research and creating interventions that facilitate rule governed behaviour on the long run. For instance, it has been proposed that dynamic social norms could facilitate behavioural change and maintenance due to changes in individuals' context, as the behaviour becomes more frequent within the group it is more believable and its presence is continuously reinforced. Similarly, dynamic norms are theorized to become embedded on individuals' behaviours and perception of others' behaviours, thus transforming the set of rules within a given group (Ribeiro, 2021; Ahmad, 2006).

The climatic crisis we as a society are going through and participating in, begs for all possible disciplines to contribute in the solution of these issues, psychology takes a very relevant part in these processes since a lot of the damage being done comes from modifiable behavior, especially if it is elicited by or accepted by the social conditions surrounding individuals. The present study aims to test the effects and differences in efficacy between dynamic and static norm interventions on an intervention centered around recycling behavior. The designed methodology takes into account the limitations found in literature. First, the intention-behaviour gap is going to be avoided by analyzing directly observed behaviour rather than self or other-reported behaviour. Also, we will test the maintenance power of implemented interventions by observing behaviour during a follow-up phase after the social norms intervention is discontinued.

## **Methods.**

### **Design.**

The study was conducted at the main cafeteria of the Medicine and Social Sciences campus of the Rosario University in Bogotá Colombia. The study consisted of a single blind pre-post field experiment with random assignment of conditions aimed at assessing the residue-disposal behaviours of participants.

Data collection lasted for three weeks during which the first week was the Baseline period with no intervention, the second week corresponded to the Intervention phase and in the Follow-up phase during the third week we observed the possible maintenance effect of the intervention after discontinuation of the intervention<sup>1</sup>. The three dependent variables are subsumed into the behavior of the correct disposition of the residues and are DV1: "Subject picks their residues from the table and throws them away in a bin" this dependent variable only considers whether the participant threw the residue in a bin and not if they separated it or disposed correctly of it, DV2: "Subject takes the residues towards the bin and appears to be contemplating where each material properly goes or is separating the materials.", this variable only takes into account whether the residues were separated but not if they were correctly separated, DV3: "Subject classifies and disposes adequately of the residues in their corresponding bins" corresponds to a correct execution of the behavior, meaning the participant disposed of each of the materials that correspond to their residues in the bin that is purposed to that kind of material (e.g. Plastic bottle in the white bin).

### **Sample.**

Given the fact that the observation was executed on all individuals sitting at the tables of the cafeteria, including students, professors, occasional visitors and non-academic staff in the School of Medicine and Health in Universidad del Rosario the sample was non-probabilistic by convenience. Since participants were directly observed and not contacted, sex and age were codified purely based on researcher's perception rather than direct report. The observation took place for three weeks, from Monday September 27<sup>th</sup> to Friday October 15<sup>th</sup>, from 9 am to 1 pm and 324 persons were observed. 187 participants were women and

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<sup>1</sup> All materials, data and an online preregistration can be viewed in:  
[https://osf.io/xsq65/?view\\_only=2a6bd0e6a1bd45fba55ed18db56ce456](https://osf.io/xsq65/?view_only=2a6bd0e6a1bd45fba55ed18db56ce456)

137 where men, participants' age ranged from 19 to 60. Given that we were interested in littering behaviour we excluded from analysis people who did not have any residue to dispose of. Hence, out of the original sample of 324 participants we excluded 100 participants for a final sample of 224 people (143 females, 81 males).

We were aware of the ethical implications of participants being unaware of the fact that they were being observed. This issue was taken into account from the beginning of the study's design and put under the university's ethics committee scrutiny (see OSF entry "ethics committee" for the document that led to the approval of the study). There was no informed consent due to the purely observational nature of the study, no personal information of the participants was collected since the only information gathered was apparent sex and age and the target behavior executed, thus guaranteeing the complete anonymity of the participants. Similarly, there were no risks linked to the intervention due to the fact that absolutely no psychological, physical, emotional or social variables were modified. The project was approved by the Habitat Department of the Universidad del Rosario early on.

### **Design of the intervention and observation tools.**

#### *Static and Dynamic Norms Intervention.*

The messages presented in the intervention were set to contain either static or dynamic social norms. Static social norms present descriptive and normative expectations about what the members of the reference group do and think others ought to do. These are presented in such a manner that the behaviour appears to be already the norm within the reference group. Dynamic social norms, on the other hand, contain similar information about what members of the reference group do and expect others to do that are presented in such a way that the behaviours appear to be gradually becoming a norm within the group.

In order to select the aspect and contents of the messages presented during the intervention, a survey was conducted to 20 students of the Medicine and Social Sciences faculty of the Rosario University, who were asked to pick within a number of differently redacted and designed signs, which social group (i.e. "students", "students from Universidad del Rosario" or "students from elite universities") they felt a stronger identification with. We also asked about the emotional reactions elicited by the different presented signs, the self-reported propensity to execute the behaviour mentioned in the messages, how clear was the difference between the dynamic and static norms presented in the signs and how believable they considered the contents of the messages to be (go to OSF "Survey for the message selection to see all the designed messages, the survey and the analysis for each of the options ). Finally, in order to identify whether the main aspects of the static and dynamic social norms were evident in the messages we elicited a written response whereby participants were asked to paraphrase what they believed the purpose of the messages was. Responses were descriptively analyzed by comparing means and interpreting the content of the open responses by a triangulated analysis. It was determined that "rosaristas" is the denomination that best represents the reference group surveyed students identify with, the messages selected can be seen in Fig. 1 and Fig. 2 for static and dynamic norms respectively and made the participants feel a stronger sense of group identification by 9,9% compared to the other messages, participants reported that they would be 10,45% more prone to turn off the lights if they saw the selected messages rather than messages with different designs and reference groups, the principal emotion elicited by this image was "enthusiasm" which was preferred twice as much as the other presented emotions; "anger", "joy", "frustration", "envy" and "indifference", between the selected messages, the dynamic social norm was considered to be 20% more believable than the static social norm. The messages were presented with instructions on the correct disposal of the residues classified by the colors of the bins.





Fig 1. Static social norm message



Fig 2. Dynamic social norm message

*Observation grid.*

The purpose of the observation grid was to systematically collect information about some participants sociodemographic variables, location of the participants, whether or not they were in a table with another person or more, whether the participants had residues with them when they sat in the tables, the state of the tables before the participants sat in it among others. The observation grid also included information about the period of the intervention and the three dependent variables (the participant picks her residues from the table, the participant appears to be figuring out where each of the residues go or separating the residues and the participant disposes correctly of the residues), the description of the variables included on the observation grid can be seen in Annex 1.

**Procedure**

The observation process was carried out for 3 weeks, for each of them participants where observed from 9 am to 1 pm from Monday to Friday at the main cafeteria at Quinta de Mutis campus (Universidad del Rosario). During the intervention week, dynamic norms, static norms or control conditions were randomly assigned beforehand to each of the tables with one condition per table for the rest of the week. Control tables had no message on them. Static social norms (Fig.1) and dynamic social norm (Fig. 2) messages were presented in each table during the time of the intervention. Information about participants sitting on the tables were registered by the main author using the observation grid described above.

The following are the hypothesis formulated based on information gathered from environmental and social psychology theory and literature.

- H1: The frequency of the DV1 and DV3 is significantly higher in the intervention phase than in the baseline.

- H2: The frequency of the DV1, DV2, DV3 is significantly higher in the dynamic social norm condition than in the static social norm condition
- H3: The execution frequency of the behaviour in DV1, DV2, DV3 is significantly higher in the intervention phase than in the maintenance phase.

### **Analysis.**

For each of the dependent variables (DV1; participant picks up their residues from the table, DV2; participant separates the residues; DV3; participant correctly disposes of their residues), two logistic regressions were run for condition (static norms, dynamic norms and control conditions) and study phase (baseline, intervention and follow-up) independently, number of people with them at the same table and whether the table was clean or not when the person sat down on it, as covariables.

### **Results.**

Six regression analyses were run for each of the dependent variables on the software R. For the independent variables of the moment of the intervention; baseline (intercept), intervention (tI), maintenance (tS), each variable was analyzed within the (intercept), static social norm (grupoE), dynamic social norm (grupoD). See the OSF entry for details.

#### *DV1: Phase analysis*

In the case of the first dependent variable (Subject picks their residues from the tables and throws them away in a bin) within the intervention period condition analyzes for each of the databases had different results. Results were not significant for the intervention phase (OR=0.477; IC (95%) [-0.789; 1.683],  $p=0.479$ ), or the maintenance phase (OR=-0.318; IC (95%) [-1.306; 0.670],  $p=0.529$ ). However, odds ratios suggest that there is higher frequency of the DV1 related to the intervention phase, and an even smaller than the baseline frequency of this dependent variable related to the maintenance phase. Although non-significant, these results are compatible with hypothesis 3 for DV1.

Phase analysis for DV1	
<i>Dependent variable:</i>	
Subject picks their residues from the tables and throws them away in a bin	
For complete database	
tI	0.447 (-0.789, 1.683) t = 0.709 p = 0.479
tS	-0.318 (-1.306, 0.670) t = -0.631 p = 0.529
sexoM	0.167 (-0.778, 1.113) t = 0.347 p = 0.729
PR2	1.550*** (0.608, 2.493) t = 3.223 p = 0.002
Constant	1.039*** (0.286, 1.791) t = 2.706 p = 0.007

*Note:* \*p<0.1; \*\*p<0.05; \*\*\*p<0.01  
Regression models were estimated with all IVs included at once

*Table 1. Phase analysis for dependent variable “subject picks their residues from the tables and throws them away in a bin”*

### DV1: Condition analysis.

Condition manipulation was not significant for DV1, in the dynamic social norm condition (OR= 0.62; IC (95%) [ -3.656; 4.908], p=0.775 ) and in the static social norm condition, (OR= 19.320; IC (95%) [-7,071.233; 7,109.873], p= 0.996). Although both odds ratios are positive, there appears to be a higher frequency of the execution of the behavior in the static social norm condition than in the dynamic social norm condition, results are not significant so no hypothesis can be confirmed or rejected.

Group effect analysis for DV1	
Dependent variable:	
obj1	
grupoD	0.626 (-3.656, 4.908) t = 0.287 p = 0.775
grupoE	19.320 (-7,071.233, 7,109.873) t = 0.005 p = 0.996
PR2	2.095 (-2.610, 6.800) t = 0.873 p = 0.383
sexoM	-1.490 (-5.937, 2.957) t = -0.657 p = 0.512
duracion	-0.001 (-0.005, 0.002) t = -0.790 p = 0.430
Constant	-3,081,431.000 (-10,729,844.000, 4,566,983.000) t = -0.790 p = 0.430
Note: *p<0.1; **p<0.05; ***p<0.01	

Table 2. Group analysis for dependent variable “subject picks their residues from the tables and throws them away in a bin”

## DV2: Phase analysis.

For the second dependent variable (Participant separates the residues), intervention phase was significant (OR=1.104; IC(95%)[ 0.317; 1.890], p= 0.006), this would confirm the effectiveness of the intervention and the hypothesis H1, however, the fact that maintenance phase resulted in a more frequent execution of the behavior represented the DV2, would lead to a rejection of the hypothesis H3. See table 3. for the complete report table.

Phase analysis for DV2	
Dependent variable:	
Participant separates the residues For complete database	
tI	1.104*** (0.317, 1.890) t = 2.751 p = 0.006
tS	1.266*** (0.508, 2.024) t = 3.274 p = 0.002
sexoM	-0.098 (-0.769, 0.574) t = -0.284 p = 0.777
PR2	0.629* (-0.021, 1.280) t = 1.896 p = 0.058
Constant	-0.991*** (-1.658, -0.324) t = -2.913 p = 0.004

Note: \* p<0.1; \*\* p<0.05; \*\*\* p<0.01  
Regression models were estimated with all IVs included at once

Table 3. Phase analysis for dependent variable “Subject takes the residues towards the bin and appears to be contemplating where each material goes or is separating the materials.”

### DV2: Condition analysis.

In the case of DV2, results were significant for the Dynamic social norm condition, OR=3.587; IC (95%)[ 0.708; 6.466], p=0.015) and for the static social norm condition OR=3.374; IC (95%) [ 0.984; 5.763] ). Both results indicate a confirmation of the hypothesis H1, although small, the difference between frequencies of dynamic and static social norm conditions would imply a confirmation of the hypothesis H2, the dynamic social norms induced more pro-environmental behaviour than static ones.

Group effect analysis for DV2	
Dependent variable:	
Participant separates the residues	
grupoD	3.587** (0.708, 6.466) t = 2.442 p = 0.015
grupoE	3.374*** (0.984, 5.763) t = 2.767 p = 0.006
PR2	1.308 (-0.735, 3.352) t = 1.255 p = 0.210
sexoM	-0.092 (-2.543, 2.360) t = -0.073 p = 0.942
duracion	0.001 (-0.0002, 0.002) t = 1.603 p = 0.109
Constant	2,360,161.000 (-525,694.900, 5,246,017.000) t = 1.603 p = 0.109

Note: \*p<0.1; \*\*p<0.05; \*\*\*p<0.01  
Regression models were estimated with all IVs included at once

Table 4. Group analysis for dependent variable “Subject takes the residues towards the bin and appears to be contemplating where each material goes or is separating the materials.”

### DV3: phase analysis.

For the last variable, Participant correctly disposes of their residues, differences were not significant for the intervention phase (OR=0.477; IC (95%) [ 0,709; 1.683], p= 0.479), or the maintenance phase (OR=-0,318; IC (95%) [ -1.306; 0.670], p= 0.529). However, odds-ratios can be interpreted as there being an increase in DV3 behavior and the intervention phase, and a decrease of the behavior in the maintenance phase, although it is not possible to accept or reject the hypothesis due to the lack of significant results, this points us towards the direction of the hypothesis 3 for DV3 .

Phase analysis for DV3	
<i>Dependent variable:</i>	
Participant correctly disposes of their residues	
tI	0.447 (-0.789, 1.683) t = 0.709 p = 0.479
tS	-0.318 (-1.306, 0.670) t = -0.631 p = 0.529
sexoM	0.167 (-0.778, 1.113) t = 0.347 p = 0.729
PR2	1.550*** (0.608, 2.493) t = 3.223 p = 0.002
Constant	1.039*** (0.286, 1.791) t = 2.706 p = 0.007

*Note:* \* p<0.1; \*\* p<0.05; \*\*\* p<0.01  
Regression models were estimated with all IVs included at once

*Table 5. Phase analysis for dependent variable “Subject takes the residues towards the bin and appears to be contemplating where each material goes or is separating the materials.”*

### **DV3; Condition analysis.**

In the analyses of the social norms conditions, the dynamic social norm condition (OR=2.367; IC (95%) [ -0.211; 4.945], p= 0.072) proved to be significant for the DV3. For the static social norm condition, there was no significance, (OR=0.0.750; IC (95%) [ -0.1060; 2.5060], p= 0.417). The odds ratios indicate a significant superiority of the dynamic social norm over the control condition and the static social norm condition, this allows us to confirm the hypothesis H2.



Group effect analysis for DV3	
Dependent variable:	
Participant correctly disposes of their residues	
grupoD	2.367* (-0.211, 4.945) t = 1.799 p = 0.072
grupoE	0.750 (-1.060, 2.560) t = 0.812 p = 0.417
PR2	1.977* (-0.084, 4.038) t = 1.880 p = 0.061
sexoM	0.067 (-2.002, 2.137) t = 0.064 p = 0.950
duracion	0.001* (-0.0002, 0.002) t = 1.651 p = 0.099
Constant	2,169,643.000* (-405,254.400, 4,744,540.000) t = 1.651 p = 0.099

Note: \*p<0.1; \*\*p<0.05; \*\*\*p<0.01  
Regression models were estimated with all IVs included at once

Table 6. Group analysis for dependent variable “Subject takes the residues towards the bin and appears to be contemplating where each material goes or is separating the materials.”

## Discussion.

The field experiment detailed in this paper aimed to study the effects of a pro-environmental intervention based on social norms. We expected to determine the difference in effect between static and dynamic social norm interventions and its maintenance of these after the intervention was interrupted. For this, we executed a field study during a three-week period observation in the Rosario University. During the intervention week, messages were randomly put in the tables, some with static social norms, some with dynamic social norms and some control tables that had no messages on them. We also observed intervention maintenance for one week after discontinuing the intervention.

The aim was to answer some of the gaps in the literature regarding social norms. We expected to discover the maintenance effects of an intervention based on social norms by observing the target behaviours before, during and after the intervention was put in place. Moreover, we aimed to surpass the intention-behaviour gap issue by analyzing the observed behaviour rather than using intention-measuring tools.

We hypothesized that for the first dependent variable, "*Subject picks their residues from the tables and throws them away in a bin*", the frequency of the behaviour would be higher during the intervention than in the baseline and also higher for the dynamic social norm condition than the static social norm condition. This was confirmed only descriptively in the analysis since the results were not. Results follow Loschelder, Siepelmeyer, Fischer & Rubel, 2019 in posing that dynamic social norms have a higher probability of eliciting the desired behaviour compared to static social norms. This was also the case for the phase analysis, correlation was higher descriptively for the intervention phase than for the maintenance phase.

For the second dependent variable, "*Subject takes the residues towards the bin and appears to be contemplating where each material goes or is separating the materials*", the hypothesis predicting that the execution of the behaviour would be significantly higher for the intervention phase than for the baseline was confirmed. Furthermore, the execution of the behaviour was significantly higher in the maintenance phase compared to baseline and intervention phases. This finding is very interesting and shines a light into one of the main gaps in the literature. Since social norms end up becoming embedded in the expectation and behaviour of the reference social group, this increases the frequency of the behaviour for the subsequent subjects, further establishing its existence within the group (Bicchieri & Casas, 2019; Bicchieri & Xiao, 2009). However, this suggests that our intervention has an impact on separating residues but not on the decision to dispose of them in the first place. Perhaps it is

an issue of what these people believe it means to dispose correctly of their residues, they may believe the correct choice is to leave the residues to be taken care of by the cleaning staff who are more knowledgeable. Another possible explanation is the intervention works solely on people who are already favorable to disposing of their residues but not on those who do not want to dispose of them at all. In this sense it is important to take into account that cultural practices and individual attitudes do interact and alter the effects of social norms-based interventions (Callaghan, Nkwi, Mackie, & Shakya, 2020).

The hypothesis predicting that dynamic social norms condition would have a significantly larger effect than the static social norms condition was also confirmed. Also, both the static and dynamic social norm condition were significantly higher than the control group. This confirms the existing literature arguing that an intervention based on social norms is more effective than standard environmental messages (Goldstein, Cialdini & Griskevicius, 2008) and that dynamic social norms have a higher probability of eliciting the desired behaviour since this behaviour does not need to be evident or already established as a social norm (Loschelder, Siepelmeyer, Fischer & Rubel, 2019). Although, here, control condition did not present a purely informational message but rather no message at all. Implications of this decision are discussed in the limitation section.

For the third dependent variable, *"Subject classifies and disposes adequately of the residues in their corresponding bins"* the dynamic social norm intervention was significantly higher than for the other condition. However, for the phase analysis, results were not significant, this may be due to a recent change in the colors of the bins assigned for each type of residues in Colombia (Canecas de Reciclaje, 2021). Prior to January 2021, residues were assigned in the following manner; non-recyclable residues had to be put in green containers, paper and cardboard residues on the grey bins, plastics were assigned the blue containers and glass residues were put in white containers. The categorization after 2021 changed to the

color white for all recyclable residues, black for non-recyclable residues and green for organic residues. It is the easily understandable that due to a recent and somehow drastic change in the assignation of the colors for each of the residues, and even with the indications written on the messages, subjects were confused or thought that the previous categorization was still on rule.

There are some explanations, mainly linked to culture and social practices that could explain the lack of effect for some of the hypothesis in the intervention, particularly for the ones that have been widely accepted in the field such as the positive effects of an intervention on social norms compared, and the bigger efficacy of the dynamic social norms interventions compared to the static social norms. A possible explanation is linked to the notion of civic capital (Ordoñez, 2021), which is defined as the shared and long-lasting set of beliefs that allow a social group to surpass the “free rider” issue. This means that trough values and beliefs the social group surpasses the rational-selfish tendency of the human being to prioritize his own wellbeing and individual benefits by not cooperating even if cooperating implies a more wellbeing for the whole group. Trust is a very important determinant of the level of social capital within a group, this is due to the fact when agents trust each other, they are going to act based on the assumption that there is going to be reciprocity from the other members of the group. The depreciation of the civil capital is thus explained mainly through situational elements such as social and economic issues, historical events that cause a high level of distrust among civilians and the perception of the moral adequateness of some behaviours that are not pro-social. It is then not surprising that in the Bogotá case, civilians have a very low level of trust in each other and consequently, civil capital, which diminishes the potential for the social execution of pro-social or pro-environmental behaviours. Dovidio & Gaertner, 2010, propose that in order to create a social environment that facilitates the existence of trust among members, social representations must be taken into account, for

agents perceive themselves to be constantly executing a cultural performance that create a narrative of themselves and the world around them. In this sense, cultural elements have to be a present element in social norms research, particularly in the Colombia case, pro-social and pro-environmental behaviour interventions can hardly flourish in a context where distrust and individual interests are historically and socially established as the norm through processes such as narratives. It is important to note that the information relating to civic capital is analysing phenomena on a macro scale and our research focused on a small group that had an institutional identity in common. In this sense it is unclear whether the described situation for civic capital in Bogotá applies to the Universidad del Rosario institutional context but if it does, this has major implications for interventions and research of static and dynamic social norms in Colombia even for institutional contexts.

Future directions of this field of research should prioritize the contextual and cultural contingencies of the social groups that are going to be subject to an intervention, for it has been proven that social norms do not work as a generic instruction that works similarly for every group. In the Colombian context research should pay attention to the ways in which the significance and relevance individuals assign to the common good interact with social norms interventions. On the other hand, difficulties related to the observation process should be taken into account beforehand.

Finally, it is important to take into account the limitations of this investigative project. Firstly, control groups in this research consisted of tables with no message on them better control condition would have presented generic informational messages such as “Dispose correctly of your residues.”. Given the fact that social norms appear to pose an advantage in comparison to other mechanisms of presenting information that asks the community to engage in a behavior, it was very probable that social norms would work when being compared this control condition rather than to our no-manipulation condition.. Future studies

would be interesting to compare them to a message of this nature that does not reference social norms.

It is also important to note that some of the results that did not fully align with the initially proposed hypothesis could be explained through some of the limitations of the research. Firstly, the sample was not big enough to possess the power to accurately assess intervention's effect, this was due mainly to the fact that the University was still not at its full capacity after the COVID 19 pandemic and the sample was not as big as initially predicted. An option was to elongate the duration of each of the phases but that would make some of the observation weeks clash with vacations or the ending of the semester, which would have altered the results. This limitation was aggravated by the fact that several of the participants had to be excluded from the analysis since they did not have residues with them at the tables.

Similarly, the fact that some participants left the premises with their residues is difficult to interpret since it is not possible to determine whether they correctly disposed of them or not. We used 2 alternative databases to account for this limitation; a database that analyzed these participants as having executed the behaviors, an "optimist database", and a "pessimist database" that analyzed the results as if the participants did not execute the behaviors. The purpose of this procedure was to contemplate whether the original regression analysis was impacted by the lack of information in said samples. Results in the analyses heavily caused variations in the interpretation (see OSF entry "different databases" for the script and the results for the alternative databases), suggesting that our conclusions might be influenced by these unknown data points. Future research should try to control this limitation that can be present in any field research focused on recycling behaviour.

It is also important to note, that we were unable to make sure that the participants effectively paid attention to the messages, they were placed on top of the tables in the cafeteria but this place is usually full of different advertisements, information regarding

institutional news and can get very crowded. This is another limitation that should be taken into account for future research since it is possible that participants did not actually pay attention to manipulation messages. While limiting the scope of our results this is to be expected in an ecologically valid field experiment such as this one.

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## Annexes.

### Annexe 1.

Rejilla 3 (En caso de la comida)

	código	tipo	explicación
sujeto	de 1 a infinito	Ordinal	Se cataloga al sujeto con un numero dependiendo se su orden de llegada siendo 1 la primera persona que se registro en el día x.
Sexo aparente	M= masculino F=femenino D: Dificil de determinar	Categórico	Sexo que se intuye por la mera apariencia del sujeto.
Edad aparente	de 1 a infinito	Ordinal	Es la edad aproximada del sujeto
Mesa	de A1 a D5	Categórico	
Hora de llegada	De a 10 am a 1pm	Numérico	Hora de llegada del individuo
Hora de salida	De 10 am a 1 pm	Numérica	Hora en la que el individuo se retira de la mesa
Residuos en la mesa (envolturas,	0= No hay Basura 1= Hay basura	Categórico	Estado de la mesa en el momento en que una persona o personas se sientan en la mesa donde se encuentra la intervención.

servilletas) (REM)			
Posesión de residuos (PR)	0= No visibles    1= 1 visible 2= 2 o más visibles	Categórico	La persona tiene consigo residuos que trajo a la mesa.
pct. obj 1	0 = La persona no dispone de alguno los residuos en los contenedores. 1 = La persona dispone de todos los residuos en los contenedores.	Categórico	La persona quita todos los residuos de la mesa y los lleva consigo hacia los contenedores.
cpt obj 2	0= La persona no parece reflexionar en qué contenedor van los residuos 1= La persona parece reflexionar en qué contenedor van los residuos.	Categórico.	La persona parece haber pensado en qué contenedor va cada residuo, ya sea que se queda un momento en frente de los contenedores o que separa los residuos al desecharlos.
cpt obj 3	0= La persona clasifica incorrectamente los residuos    1= La persona clasifica correctamente	Categórico	La persona clasifica los residuos de manera adecuada

t	b= línea de base i= intervención    s= seguimiento	Categorico	Fase de la prueba en la cual se hace la observación.
grupo	e= estática d=dinámica c=grupo control	Categorico	Tipo de norma social utilizada.
Fecha	dd/mm/año	fecha	Fecha de la recolección de datos
Número de personas en el grupo (NPG)	de 0 a infinito	Ordinal	Se tiene en cuenta la cantidad de personas que se encuentran en la mesa del sujeto observado. De lo cual, cero significa que la persona se encontraba sola.
Distancia mesa-contenedor (DMC)			Dato no observado en tiempo real.
Comentarios			Registrar cosas inusuales e identificar sujetos