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The comparative effectiveness of persuasion, commitment and leader block strategies in motivating sorting

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ABSTRACT

Household waste management has become essential in industrialized countries. For the recycling programs to be a success, all citizens must comply with the developed residential procedures. Governmental bodies are thus dependent on as many people as possible adhering to the sorting systems they develop. Since the 1970s oil crisis, governments have called upon social psychologists to help develop effective communication strategies. These studies have been based on persuasion and behavioral commitment (Kiesler, 1971). Less common are studies based on developing participative communication (Horsley, 1977), a form of communication that relies on individuals to pass on information. After going through the main communication perspectives as they relate to the sorting of household waste, a comparative field study will be presented on the effectiveness of persuasive, committing and participative communication. Participative communication relied on users to pass along information to their neighbors. The results show that the participants who spread information in this way, along with those who made a commitment, changed their behavior to a greater degree than the other participants.

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1. Introduction

Economies in industrialized countries are based on high levels of resource consumption. About one third of these resources become waste. On average, each American citizen throws out about 1650 lbs of household waste per year (Toxic Action Center, 2012), and this output has only increased over the past 30 years. The environmental impact from this production and consumption has therefore also grown substantially.

This being the case, industrialized countries must face the formidable task of breaking the bond between economic growth and the environmental impact of this consumption and waste production. As a solution, governmental authorities have developed material reuse and energy conservation programs.

With these management programs, waste is no longer only the responsibility of the private sector, the individual household or person, but is now under the management of the government, and is definitively a responsibility of the public sector. It follows that if governmental authorities are in charge of household waste management, everyone must comply with the developed household procedures for these programs to be a success.

Residents must learn to sort waste, only placing waste in the bin when it complies with the specified guidelines. This requires more reflection on the part of the individual who wishes to get rid of his trash in the most rapid, simple and discrete way, and on the part of the citizen who participates in the collective sorting project. These two identities confront each other, and the individual's stance of indifference to the collective is set against citizen.

The officials involved rely on the greatest number of people participating in these waste sorting operations. Consequently, for over 30 years, regional communities and their partners have been communicating a great deal with their residents about sorting. Beginning during the energy crisis of the 1970s, head politicians called upon social psychologists to work on developing effective communication strategies for promoting waste sorting. The goal of our research is to test different methods of communication and influence in order to improve household waste sorting. This article will begin by laying persuasive, commitment and participative strategies that have been developed over the past several decades. Next, an applied research study will be presented on the long-term effects of communication strategies on waste sorting. In addition to persuasive communication strategies and those involving behavioral commitment, we will examine in depth the use of participative communication, in which the subjects become agents and the residents become citizens.

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2. Influence strategies and household waste management

2.1. Persuasive strategy

Persuasive communication is probably the strategy that seems to be most easily applicable to a large population. The effectiveness of rhetoric strategies has been scientifically tested time and again (Hovland et al., 1953). These strategies are based on the assumption that an individual's behavior is in line with his attitude. The goal in these communication activities is therefore to influence individuals' attitude positively towards sorting waste. The many governmental informational and awareness campaigns for household waste sorting are still primarily based on the persuasion method. So, in prescribing the "right act" and proscribing the "wrong act," these operations become an almost childish education, negating the accountability hoped for in the citizen. Like instructions given to a child by their parents, sorting instructions are often motivated only by moral explanation.

While the resident is informed about recyclable and non-recyclable waste, he still does not know why this waste is recyclable or not, and this information is also important so that he understands the meaning behind the requested behavior. The questions that surround the "whys" and "for-whats" of his acts places the individual in the middle of a representational void, while he would benefit from being rationally convinced of the effort that is asked of him. Indeed, the lack of information about separate collection defines an "expert system" that favors neither personal responsibility nor implication in a collective project.

Werner and Makela (1998) have shown that individuals who are strongly in favor of recycling are more likely to adopt and maintain their sorting practices in a sustainable way. Even so, several meta-analyses have found that average correlations between behavior and attitude are from 0.15 (Wicker, 1969) to 0.40 (Krauss, 1995). Interest/concern for the environment cannot account for more than 10% of the variance of ecological behaviors such as recycling Bamberg, 2003). Moreover, a meta-analysis of 94 studies from Webb and Sheeran (2006) showed that the relationship between the intention to complete a behavior and the actual completion of the behavior is very weak ($d = .65$).

Conclusions from studies on persuasive communication as applied to waste sorting are not in agreement. While several studies have observed a behavioral impact (Burn and Oskamp, 1986; Luyben and Bailey, 1979), others have found no effect (Timlett and Williams, 2008; Witmer and Geller, 1976).

Even so, Burn and Oskamp (1986) were able to improve sorting behavior in a sustainable manner, and defined the conditions of an effective persuasive communication. They recommend informing the individuals of the collective norms, illustrating the concrete behavior to adopt and to remind them of the results of their actions.

Even so, many works show that sustainable behavioral modifications could only be obtained with a form of communication that allows the individual to be involved (Witmer and Geller, 1976) and to participate actively (Ingram and Geller, 1975). Besides the numerous practical issues involved in the implementation of a persuasive message, it is maybe the theoretical rationality of the individual that limits the effectiveness of rhetorical strategies. Indeed, behavioral changes could do not result from a change of attitude.

2.2. Commitment strategy

A second communication strategy, drawn from commitment theory (Kiesler, 1971), recommends behavioral rather than rhetorical strategies. For commitment theorists, "acts carried out by individuals are the fundamental motors for the cognitive and behavioral process" (Louche and Lanneau, 2004, p. 1). Behavioral

strategies rely on the fulfillment of an act of free will (Kiesler, 1971). The committing strength of the act can vary depending on several factors (Kiesler, 1971; Joule and Beauvois, 1998):

Public acts have a greater impact on an individual's commitment than a private act that no one is aware of.

The more costly (in time, cognitions, etc.) the act is to the individual, the more he will commit to it.

The greater the consequences of the act to the individual, the more he will commit to it.

Repetition of the act also increases the individual's commitment.

An irreversible act leads to greater commitment than an act that can be undone.

The act must be completed with a sense of freedom to support the internal justifications of this behavior. Many manipulation techniques rely on the fulfillment of a committing act on several prosocial behaviors (Cialdini et al., 1978; Freedman and Frazer, 1966). While they allow for instantaneous behavior or attitude changes (Guéguen et al., 2010; Freedman and Frazer, 1966), their goal is not to lead to long-term or sustainable changes.

When attempting to obtain long term behavioral changes, the committing act takes the form of a declaration of intention. It can be a verbal commitment (Bachman and Katzev 1982), or a raised hand (Lewin, 1947), a promise (Geller et al., 1987), or the signature of an individual (Pallak and Cummings, 1976) or collective (Wang and Katzev, 1990) behavioral contract.

In their first experiment, Pallak and Cummings (1976) were able to reduce energy consumption by having their subjects sign a behavioral contract. This is the form most often implemented (Burn and Oskamp, 1986) and the one that offers the best results.

Many studies have shown that signing a behavioral contract can lead to both the immediate adoption of waste sorting as well as the long-term continuation of the practice (Cobern et al., 1995; Werner et al., 1995). Studies on verbal commitment did not, however, show any meaningful behavioral changes (Kulik and Carlino, 1987).

Pardini and Katzev (1983–1984) compared sorting behavior in subjects who committed, verbally or by signature, to sort their newspapers for 2 weeks. In the control group, the subjects attended an informational meeting on the importance of environmental protection. The results show that the subjects who engaged verbally or in written form recycled significantly more than the control group over the course of the 2 weeks. The researchers continued their measurements for 2 weeks beyond the original experimental agreement. They then observed that the subjects who had committed in written form continued the recycling longer over the course of 2 weeks than the subjects who engaged orally. A second experiment carried out by Katzev and Pardini, 1987–88) corroborates these conclusions.

Wang and Katzev (1990) compared the impact of incentive, persuasive, and commitment strategies on sorting practices. 67% of the subjects who had signed a behavioral contract sorted for the four experimental weeks, and 40% for the three post-experimental weeks. The results obtained for these two periods are better than those obtained with a collective commitment, an incentive strategy or with persuasive communication.

Nevertheless, all experiments of signature do not conclude to long time effects (Cobern et al., 1995; Pardini and Katzev, 1983–1984).

Despite the encouraging results obtained, the interest of researchers and the number of published works in behavioral strategies has been declining since the beginning of the 1980s.

This can be explained by the difficulties in measuring the effects of the different independent variables. Entry conditions (population, target behavior, tools, experimental length, etc.) can in fact vary considerably among experiments. This absence of homogene-

ity and consensus does not always allow for accurate comparison between different results (Geller, 1990). And even though the sustainable effects were brought to light, “no one has shown why commitment has this effect” (Werner et al., 1995, p. 198).

As with incentive strategies, commitment strategies additionally meet difficulties when being applied to society at large. Moreover, the number of people who refuse to participate in studies is only rarely mentioned in psychosocial literature (Burn and Oskamp, 1986; Pardini and Katzev, 1983). This absence of information is detrimental in evaluating the tested technique's effectiveness, but also in comparing the results from different studies.

Consequently, theorists fail to interpret these conflicting results, owing to the complexity and multiplicity of the factors involved. As an example, something as simple as the researcher's characteristics (age, sex, charisma, credibility, etc.) will inevitably influence the participation rates (Brownstein and Katzev, 1985).

Most theorists favor behavioral commitment strategy. However, they do not all define the notion of “commitment” in the same way. For some authors (Kiesler, 1971) commitment is an internal process. It has been defined as the internalization and self-accountability of an act, or a self-conversion. For others, commitment is a variable that exists outside the individual, in the objective conditions of the situation. For these authors, such observed behavioral changes would depend “[...] solely on factors arising from the situation itself,” (Joule and Beauvois, 1998, p. 53) and do not involve the individual's attitudes.

This last situational definition could seem reductionist, and it disregards the fact that individuals signed a behavioral contract, in which they committed to waste sorting practices. A theory that defines the individual as being committed only by objective situational characteristics does not allow interpretation of a situation where the individual pledges his commitment in writing.

Moreover, signing a contract is not an insignificant act. It is by definition a social event, going beyond the individual sphere and connecting the actor to the system. In social contract theories, like the Civil Code, the contract always places the individual in the social context. Declarations of intention in studies that led to sustained behavioral changes all come from this contractual principle. The written contract is simply its most developed, explicit and permanent form, due to the indelible mark left by the signature.

In studies on the lasting results of behavioral commitment, the latter is defined as an assertion of decision, informing the dialectic between the individual and the social context. The individual's commitment must be considered from this very social perspective.

In order to find studies that examine social commitment, we must turn to sociologists. They have considered commitment as it links the individual to the social context. It is defined as “an attitude or an orientation toward the organization which links or attaches the identity of the person to the organization” (Sheldon, 1971, p. 143). It is this important dimension of the dialectic between the individual and the social context that problematizes the behavioral commitment method as defined by social psychologists.

2.3. Participative strategy

Participative strategies have been very little explored, and are only rarely the main focus of articles (Hopper and Nielsen, 1991). However, as they rely on the active participation of individuals in the dissemination of information, they seem to be able to get around some of the limits of simple behavioral strategies.

We are indebted to Horsley (1977) for the first work on participative communication. In this student experiment, the subjects had to convince two other students to adopt different pro-environmental behavior. The measurement carried out 12 days later showed behavioral change in the subjects doing the convincing.

In a study of 200 people living in Claremont, Burn (1991) tested a new protocol in which the subjects promoted sorting behavior among their neighbors. The experimenters trained a group of eight volunteer residents in 4 h to have them participate in the study. Each of the volunteers was instructed to contact 10 of their neighbors.

The experiment was composed of two experimental conditions and one control condition. The “participative communication” condition ($n = 41$) was composed of the leaders and the individuals that they had contacted. In the “persuasive” condition ($n = 68$), the subjects received an informational booklet on the sorting instructions as well as garbage bags. There was no intervention with the control group ($n = 104$). Measurements were taken over a period of 12 weeks. The results showed that subjects engaged in “participative communication” had more substantial behavioral changes than the subjects in the “persuasive communication” group.

A similar study was conducted by Cobern et al. (1995) with residents from three neighborhoods of a suburb south of Memphis. An experimental condition was applied to each of the neighborhoods.

In the first condition ($n = 140$), the subjects signed a contract, committing to sorting their organic waste for the four following weeks. In a second group ($n = 171$), the subjects committed not only to sorting their waste for 4 weeks, but also to promoting the behavior among their neighbors. These leaders ($n = 40$) were recruited voluntarily and disseminated the information among 131 of their neighbors. Lastly, there was no intervention with the control group ($n = 163$).

The measurements taken showed that participative communication caused sorting behaviors to improve not only during the experimental period, but that these behaviors were sustained 1 year after the study. The subjects in this group increased their sorting frequency in the four experimental weeks, but also during the two post-experimental measurements.

While the rare participative communication experiments (Nielsen and Ellington, 1983) have shown sustainable behavioral changes, “(...) it remains unclear exactly which social psychological principle is responsible for its success” (Burn, 1991, p. 625).

While it is difficult to provide a satisfactory interpretation of behavioral changes in individuals who signed the contract, it is even riskier to attempt to interpret the results from the subjects on the participative communication side. Many possible perspectives must be considered here.

Commitment theory (Kiesler, 1971) can be used to interpret the leaders' changes (Cobern et al., 1995). Promotional behavior does indeed fulfill all of the characteristics of a committing act. While encouraging their neighbors to change their habits, the leaders engaged in a binding, explicit and relatively costly public act that allowed them to fully engage with these behaviors through their neighbors. (Geller, 1990). What is more, the relative organizational freedom of their participation gave the subjects internal justification of their behavior.

While participation can be considered a committing act, it still seems simplistic to sum up the processes involved solely through the behavioral commitment method. The theory of self-perception (Bem, 1972) can also help us interpret the process of influence at play here. According to this theory, while promoting sorting behavior to his neighbors, the individual would perceive himself as “the type of person who...”. This self-identification would lead him to act in a way that maintains this perception of himself.

Social image, and “social incentives” (Cook and Berrenberg, 1981) could play a role in the behavioral changes of this subjects. On the one hand, when sorting is seen as a citizen act, a responsible or ecological act, it can provoke feelings of gratitude in neighbors, and produce a new motivation for change. Indeed, environmentally friendly behavior is socially valued and rewarding (Félonneau and Becker, 2008) and the social visibility of sorting plays an essential role in its adoption (Barr et al., 2003). On the other hand, social rep-

utation (Emler, 1990) can also be called into question if the individual is not exemplary in his or her sorting practices after having solicited his or her neighbors.

It is also possible that after having repeatedly explained the sorting instructions to their neighbors, the leaders learned them more quickly and thoroughly than the other subjects. Their numerous conversations also helped them develop new reasons and motivations for correctly sorting waste.

Moreover, these results obtained with participative communication are difficult to interpret because the subjects of participative communication experiments do not all play the same role. The subjects who passed on information are distinguished from the subjects that they contact. This distinction is just as obvious from a theoretical standpoint as from a practical one. On the one hand, the methods used affect the two populations differently. On the other hand, the effectiveness of participative communication can depend on the numerical distribution of subjects between leaders and neighbors contacted.

3. Goal of study and hypothesis

The purpose of our study is not to bring to light any particular psychosocial process that will explain the influential factors observed in participative communication, or in the other communication strategies presented. It is rather to take these communication strategies from different theoretical methods and test them, and to compare the results obtained from each of them.

As we have seen, incentive strategies do not seem to bring about sustainable changes. We will therefore test persuasive, commitment and participative communication.

We have our population take an active role in the experimental protocol of the participative communication, and thus our work aligns itself with the tradition of applied research in social psychology as defined by Weyant (1986). We developed three hypotheses that we set out to test experimentally.

Hypothesis 1. We hypothesized that the subjects who signed a behavioral contract would change their sorting behavior to a greater degree than subjects experiencing a persuasive communication.

Under the framework of participative communication, the behavioral changes of the contacted subjects by the subject-leaders have never, to our knowledge, been measured. The results from these two populations have been separately analyzed here.

Hypothesis 2. With commitment psychology, we expect the subjects who were led participative communication to modify their practice to a greater degree than those who signed a behavioral contract (Geller, 1990; Cobern et al., 1995).

Members of a group that offer a new behavioral model can be sources of information and promote learning. It has been shown, for example, that students will promptly stop leaving their soda cans in the street after having seen another student put his can in a bin (Geller, 1990).

Hypothesis 3. It is hypothesized that the subjects contacted by their neighbors will modify their sorting behavior to a greater degree than the subjects who experience a persuasive communication given by a researcher.

4. The study

4.1. Participants

The study was carried out in a student population living in four buildings on a university campus in a French city. These sites were

chosen for their homogeneity, from the people to the structure of the premises and the surrounding environment. Each of the buildings was randomly assigned an experimental condition. In total, 111 students, 44 women and 67 men, with an average age of 21.2 ($\sigma = 2.3$ years) took part in the study.

4.2. Procedure

The two-step study took place over a period of 6 weeks.

First, all subjects, except those in the “neighbor” group, were approached either while entering their residence or in door-to-door solicitation. The researcher presented himself to them as a communications officer carrying out a study on waste sorting. Depending on conditions, the interviews lasted from 1 to 5 min.

Due to the collection method used in the residences, it was not possible to visually monitor the presence/absence of bags or waste bins. The focus will therefore be on the subjects’ accounts, and a questionnaire was designed to measure their behavior. In order to get pre-experimental measurements, the interview began with this questionnaire in all of the experimental conditions.

All subjects were contacted over the phone 6 weeks after the first communication. This second interview provided the experimental measurements. Initially, post-experimental measurements were planned for 6 weeks later but finally done about 6 and 7 weeks later.

4.3. Materials

The questionnaire: A questionnaire was designed to measure the subjects’ sorting behavior. It is presented in Fig. 1. It distinguished between the quantitative and qualitative aspects of sorting. One item, presented on a Likert scale, asked subjects about their sorting practice frequency. Sorting quality was measured using a list of fourteen waste items, among those that best represent our population’s consumption. Subjects had to say which bin they used most often for each waste item.

The informational brochure: An A5 format brochure was used to remind the subjects of their instructions. It contained institutional information, and was clearly presented.

The behavioral contract: A behavioral contract was designed based on the characteristics of a committing act. It is presented in Fig. 2. In signing it, the subjects agree to follow the sorting instructions over the following 6 weeks. The contract was nominative; the instructions were clear and explicit; the freedom in choosing to follow the instructions was explicitly mentioned. The subjects signed two copies of the agreement, one of which was kept by the researcher to give a public dimension to the institutional commitment (Pardini and Katzev, 1983–1984).

4.4. Experimental conditions

Four experimental conditions were defined, along with one control condition.

C0: Control Condition ($n = 26$).

The control group subjects responded to a questionnaire and were informed that they would be contacted after 6 weeks to respond second time to the questionnaire on waste sorting.

In all of the experimental conditions, the interview started with the researcher giving the subject the questionnaire. Moreover, all participants responded a second time to the questionnaire on waste sorting 6 weeks after intervention.

C1: “Persuasive Communication Condition” ($n = 24$).

The subjects were presented with a sorting instructions brochure from the city of Rennes. The subjects were reminded of the instructions, with particular emphasis on the sorting errors seen in their personal questionnaire responses. They were asked to pay special attention to their sorting practices over the next weeks,

Where do you put these waste items? (Circle your answer for each item)

PVC water bottle	<i>Green can</i>	<i>yellow can</i>	<i>other</i>
soda can	<i>Green can</i>	<i>yellow can</i>	<i>other</i>
milk carton	<i>Green can</i>	<i>yellow can</i>	<i>other</i>
newspaper	<i>Green can</i>	<i>yellow can</i>	<i>other</i>
bacon container	<i>Green can</i>	<i>yellow can</i>	<i>other</i>
crème fraîche container	<i>Green can</i>	<i>yellow can</i>	<i>other</i>
plastic bag	<i>Green can</i>	<i>yellow can</i>	<i>other</i>
food can	<i>Green can</i>	<i>yellow can</i>	<i>other</i>
plastic fruit container	<i>Green can</i>	<i>yellow can</i>	<i>other</i>
yogurt container	<i>Green can</i>	<i>yellow can</i>	<i>other</i>
batteries	<i>Green can</i>	<i>yellow can</i>	<i>other</i>
laundry detergent bottle	<i>Green can</i>	<i>yellow can</i>	<i>other</i>
envelope	<i>Green can</i>	<i>yellow can</i>	<i>other</i>

Fig. 1. Qualitative items.

Participation Charter	
Everyone in the building commits	
This charter is part of a pilot operation on selective sorting carried out in collaboration with our building's residents. We are working together to evaluate the progress we can make in our waste sorting. This charter is not mandatory, and our participation demonstrates our awareness of environmental issues.	
I commit to sort my waste for the next 6 weeks.	
Name:	Building:
Room:	Signature:

Fig. 2. Behavioral contract.

and were informed that they would be contacted by phone after 6 weeks for another interview about their sorting practices. And finally, to be clear, this persuasive communication condition was designed based on recommendations specified by Burn and Oskamp (1986).

C2: "Commitment Communication" Condition ($n = 20$).

In this group, after being given the informational brochure, the subjects were asked if they would like to sign the contract. The researcher read it with them, and made it clear that their participation was completely voluntary. If the subject agreed to participate, he or she signed two copies of the contract, kept one, and the researcher kept the second one. As in the previously described condition, the subjects were informed that they would be contacted after 6 weeks.

Two experimental conditions were based on participative communication:

C3: "Leader" Condition ($n = 13$).

After receiving the brochure, subjects in this group were asked if they would be willing to pass information onto their neighbors.

The terms of this assignment were specified: the subjects were to give the questionnaire to their neighbors, and present them with the brochure, while reminding them of the sorting instructions. In the end, they would remind their neighbors that they would be contacted 6 weeks later by telephone. If the subjects agreed to be leaders, they were given the amount of documents (questionnaires and informational brochures) they deemed necessary and were informed that the researcher would call them in the next few days to collect the questionnaires filled out by the neighbors they contacted.

C4: "Neighbor" Condition ($n = 28$).

This group consists of the neighbors contacted by the leaders. The exact framework and sequence of events with these subjects is consequently not known. As with all of the other subjects, we contacted by telephone to answer the questionnaire on waste sorting. Moreover, this talk informs us of the progress of discussion with neighbors. This telephone interview also allowed for information on how the interviews went with the "participants."

Not everyone who was contacted agreed to participate in the study. Two people refused to participate in persuasive communication (8%) or to promote sorting among their neighbors (15%). One person refused to sign the behavioral contract (5%). There is no discernible difference between the acceptance rates that were obtained in the four experimental conditions or the control condition ($F(4) = 11.267$, NS).

5. Results

The initial sorting practices are presented in Table 1 and general results of the study can be seen in Table 2.

A repeated measures variance analysis allowed the comparison of the results from the application of the different communication strategies. There was a simple effect and an interaction effect for each of the two variables. On one side there is the effect from the experiment: the sorting frequency increased ($F(1,106) = 32.941$,

Table 1
Initial correct practices of sorting (in percentage of participants).

Grass	Correct answers (%)
Batteries	97.3
Milk carton	88.3
Newspaper	88.3
Soda can	87.4
Yogurt container	85.6
Bacon container	82
Crème fraîche container	78.4
Plastic bag	73.9
Food can	73.9
Envelope	69.4
PVC water bottle	68.5
Aluminum container	50.5
Laundry detergent bottle	49.5
Plastic fruit container	48.6

$p < .01$) and the number of errors decreased ($F(1, 106) = 54.906$, $p < .01$) between the pre-experimental and experimental measurements. The analysis also shows that the frequency ($F(4, 106) = 4.406$, $p < .01$) and the quality of sorting ($F(4, 106) = 2.551$, $p < .05$) did not change in the same way in all of the experimental conditions.

5.1. Persuasive strategy

Persuasive communication did not allow for a significant increase in sorting frequency among the subjects ($t(23) = -3.71$, NS) in our two measurements. However, the subjects did make less sorting errors ($t(23) = -3.462$, $p = .001$ (unilateral)). There is not a significant difference between these subjects and those in the control group, either in frequency ($F(1, 48) = .371$, NS), or in sorting quality ($F(1, 48) = 2.553$, NS).

5.2. Behavioral strategy

The subjects who signed the contract changed their sorting frequency ($t(19) = -4.254$, $p = .000$ (unilateral)) and their sorting quality ($t(19) = -3.812$, $p = .001$ (unilateral)). The increase in their sorting practices differs from the control condition subjects ($F(1, 44) = 9.750$, $p < .01$) and those in the Persuasion condition ($F(1, 42) = 14.591$, $p < .01$). However, the improvement in quality is not significantly different from the control condition ($F(1, 44) = 2.023$, NS) and the Persuasion condition ($F(1, 48) = 2.553$, NS).

This can thus partially validate the first hypothesis, in which committed subjects improve their frequency more than the subjects in the Persuasion condition. Indeed, while the declared sorting frequency improved between the two measurements, the results show no decrease in the number of sorting errors. These results therefore require careful interpretation.

5.3. Participative strategy

5.3.1. Leaders

As had been expected in hypothesis 2, the leaders increased their sorting practices ($t(12) = -2.668$, $p < .05$ (unilateral)) but also

Table 2
Means and standard deviations on sorting frequency and quality for the different pre-experimental and experimental conditions.

Condition	Sorting frequency				Sorting quality			
	Pre-experimental		Six weeks later		Pre-experimental		Six week later	
	M	SD	M	SD	M	SD	M	SD
Persuasion ($n = 24$)	4.833	.917	4.875	.947	.744	.117	.848	.134
Commitment ($n = 20$)	4.15	1.725	5.4	.94	.775	.123	.868	.091
Leaders ($n = 13$)	4.231	1.739	5.615	.506	.758	.156	.939	.064
Neighbors ($n = 28$)	4.535	1.551	5.179	1.124	.753	.127	.824	.137
Control ($n = 26$)	4.461	1.605	4.76	1.37	.701	.153	.742	.126

reduced their number of sorting errors ($t(12) = -5.500$, $p = .000$ (unilateral)). In terms of frequency, these subjects distinguish themselves significantly from the control group ($F(1, 37) = 5.286$, $p < .05$) and from the Persuasion condition ($F(1, 35) = 8.433$, $p < .01$). They do not, however, distinguish themselves in frequency from the Commitment condition ($F(1, 31) = .076$, NS). In terms of quality, the leaders improved more than the control condition ($F(1, 37) = 10.494$, $p < .01$), the Commitment condition ($F(1, 31) = 4.838$, $p < .05$), and the Neighbor condition ($F(1, 39) = 5.492$, $p < .05$). There was not, however, any observed difference between these subjects and the Persuasion condition. Our hypothesis 2 is thus only partially validated as well.

5.3.2. Neighbors

Lastly, it was predicted that the subjects in the Neighbor condition would improve their sorting more than the subjects in the Persuasion condition. While the subjects did actually improve their sorting frequency ($t(27) = -2.555$, $p < .01$ (unilateral)), they did not improve it more than those in the control condition ($F(1, 52) = 1.762$, NS) and Persuasion condition ($F(1, 50) = 3.615$, NS). They also improved their sorting quality ($t(27) = -2.553$, $p = .008$ (unilateral)), but here again the results were no different than with the control conditions ($F(1, 52) = .626$, NS) and Persuasion conditions ($F(1, 50) = .634$, NS). As was expected, the subjects in the Neighbor conditions improved their sorting practices, but no more than those in the Persuasion condition. These results do not allow the validation of our hypothesis 3.

6. Discussion

The purpose of this study was to compare the efficiency of different communication strategies in household waste sorting. As Weyant (1986) has shown, when applied research is used, independent variables are often too complex to isolate the factors and to understand the importance of each one. In that respect, applied research is used less to develop theories than to test different forms of intervention. It is a logical extension of a discipline that examines the individual and his or her behavior in social contexts. This study will thus provide different possible interpretations for the study's results.

The first observation to make is on the very observable superiority of the behavioral strategy over the persuasive communication. These results corroborate those already found in many similar studies (Pardini and Katzev, 1983–1984; Burn and Oskamp, 1986; Werner et al., 1995).

In the experimental condition, the subjects who took on the role of promotion agent among their neighbors modified their behavior considerably. After the end of the study they sorted their waste more than beforehand, and especially made less sorting errors. This modification in quality is what distinguishes them from the individuals experiencing other forms of communication.

The model of genetic influence (Moscovici, 1979) can offer a theoretical lens through which to analyze the leader's behavioral changes. It describes how individuals are active in creating norms

and participating in a group's dynamic, and the factors at play. Moscovici argues that influences are diffused and omnipresent; that place, time and social context are constructed from every person's participation. He defines the individual as neither submissive, nor alone, nor isolated. As an object of study, influence is redefined in contrast with "classic" models of influence. Influence is not considered as a unilateral exercise but fits into the constant transactions between different present elements. The distinction disappears between source and target and each element simultaneously becomes subject and object of the influence. Influence, therefore, can no longer be summed up simply by situations of persuasion and manipulation but is made up of all interactions. This model allows us to consider an often neglected phenomenon which could help shed light on our results: self-conversion (Laurens and Moscovici, 2005).

The method of self-conversion maintains that a source of influence can also be a target of influence. While carrying out a study on the sustainable effects of commitment in preventing household waste, Dupré (2009) noticed that recruited leaders for door-to-door communication operations had considerably modified their behavior not only in waste prevention but more generally their eco-citizen practices. "Influence sources" were ultimately more influenced than their "targets." These observations corroborated Baker's (1983) analysis on the effects of propaganda carried out by members of the Moon sect. He stresses that the strategies used by the members of this organization were not effective in their recruitment of new followers, but in the reinforcement of the beliefs of the proselytes themselves. A few fundamental studies provide support for these field observations (Laurens and Moscovici, 2005; Sherif, 1947). It has also been shown that role-playing in social learning was a good way to sustainably change behavior. The model of genetic influence adds several possible interpretations of such changes in the individual's practices. In addition to the auto-influence hypothesis, the concept of participation as defined by Moscovici and Doise (1992) can illustrate the essential relationship of influences that ties the individual to the social structure. Indeed, participation "defines an interior relationship of men who think, decide and act in the community and under its impulse, but also for it and in its name. Besides participation, man has no identity" (Moscovici and Doise, 1992, p. 75).

The results are encouraging, yet they could invite caution. Our measurements did not come from direct observation of the subjects' actions, but from their accounts. We cannot deny the possible differences between the real and the stated behavior of the subjects. Indeed, several studies have highlighted significant differences between self-reported sorting behavior and real behavior. Most studies on sorting practices, however, measure self-reported behavior (Purcell and Magette, 2010; Ando and Gosselin, 2005, etc.). Moreover, our data collection method allowed us to control the social desirability that tends to bias participant responses.

Finally, it was expected that the subjects contacted by their neighbors would change their behavior more than subjects contacted by an official communications officer. Our results do not support this. However, "the motivation to accept or refuse an innovation is very influenced by the networks which surround the individual" (Darley and Beniger, 1981, p. 152). It was therefore expected that these subjects would change their sorting practices especially after observing their leaders' behavior, just as when Geller (1990) showed that students would immediately stop leaving their soda cans in the street after seeing another student put his or her can in a bin. This process of imitation, central in the process of informational circulation was the reason why we expected to obtain different results.

7. Conclusion

To conclude, the results have shown that commitment strategies led individuals to change their sorting practices, while participative communication led to the best results. When the results are interpreted through the lens of a strictly situational theory, one loses the active dimension of the subject's commitment when they sign a contract or they actively participate in the spreading information.

In our study, the leaders were not only subjects, but had an active role in the procedure itself; they were actors, like in a play, and participation "[...] refers to this elementary and instant relationship in which one passes from a passive to an active state of activity. The individuals are no longer pawns on a checkerboard moving only according to stipulated regulation, nor are they spectators at a play. They are free to modify the rules, and vary the play's dialogue or plot" (Moscovici and Doise, 1992, p. 74). This participation was an essential factor of changes observed in our study.

Finally, we remind the reader that studies on this form of communication are very rare, while the arguments in favor of its development are abundant. Compared with other similar methods, participative communication seems to offer more promising results. It could reduce governmental cost, by using citizens themselves to spread information. Such methods could easily be assimilated with current similar policies. Indeed, citizen participation is progressively taking hold in the public sphere and changing social engagement as we know it. When government officials ask for citizen participation, which responds to the bilateral need of individuals and society, this introduces horizontality into a vertical system, suggesting a reinvention of the "City" by the citizens. It seems, then, that in waste management, public authorities would benefit greatly from involving users rather than simply educating them about the proper methods. In household waste management, it is citizen action that benefits everybody, controlling the environmental and economic impact. In this regard, users can be made responsible in several ways. In addition to participating in disseminating information, as tested here, consulting before deciding, transferring responsibility of a communal composter, or the choice of a collective goal (e.g. reduction of waste by X% in a neighborhood) are possibilities that merit testing. Moreover, for exploratory purposes, measurements could be taken on the active identify of individuals when they participate. Indeed, identifying the role in which an individual acts favorably towards controlled waste management could help in developing communications and intervention.

Additionally, while the three communication and influence procedures that were tested in our study are based on very different theoretical approaches, this does not mean that they are necessarily contradictory when applied. For example, Joule et al., 2008 experimented binding communication which is a combination of persuasion and commitment. Their results conclude more effects with this combination than commitment or persuasion alone.

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