

Nudging for environmental sustainability. Behavioral insights from an on-field experiment #iNUDGEBarletta

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Abstract

Frame of the research: *The work delves into the contemporary debate surrounding Nudging, positioning itself as a contribution to the ongoing discussion. It specifically focuses on Nudging as a method to influence human behavior and mold decision-making processes. The paper seeks, by the real case study #NUDGEBarletta, to unravel the intricacies of this approach, shedding light on its impact in guiding individuals and shaping their choices.*

Purpose of the paper: *The #iNUDGEBarletta project turns Nudge's theories into operational, applying them in the field of environmental sustainability, to the management of littering in cities. The purpose is to educate citizens, so that, behaviors deemed socially responsible are internalized and become consolidated habits and conscious choices, rather than, actions implemented under threat of sanction which, presumably, stop being implemented at the same time as the coercive measure should be removed.*

Methodology: *The present study uses a simple form of context changes (gentle push), applied on waste collection tools, to examine the effectiveness of a nudge policy for reducing littering in cities.*

Findings and Results: *The simulation, based on real data from Barletta (Apulia, Italy) old town, confirms realistic impact on social behavior and responsibility about the topic and demonstrates the usefulness of nudge strategies to obtain desired actions from people, in order to efficiently manage the public thing and, in the specific, reduce the level of littering.*

Research limitation and Practical implications: *The paper offers a small research case based on small amount of funds and time, as experimental project, that could be subject of further studies and developments through the analysis of other real cases and empirical tests.*

Originality of paper: *This experiment is a real application of nudging strategies in the Public Administration and demonstrates how small contextual tricks can "kindly push" people to engage in healthier and more sustainable lifestyles.*

According to the researchers In Italy the potential of nudging is still little exploited, and the originality of the paper lies in proposing a new planning path to PA through which, relying on the use of Nudge, new solutions can be studied and the choices of the Administration directed towards the attitudes of its citizens.

Key words: *nudge for good; social sustainability; people behavior; communication strategies; public administration; gentle push; littering.*

1. Introduction

The world generates 2.01 billion tons of municipal solid waste annually, with at least 33 percent of that not managed in an environmentally safe manner, that means 0.74 kilograms waste generated per person per day. Looking forward, global waste is expected to grow to 3.40 billion tons by 2050, more than double population growth over the same period¹.

The amount of waste produced in Italy, as other nations in the Globe, increased from 486 kg per capita in 2015, to 505 kg per capita in 2020, and this data will continue to increase because of the accelerating resource exploitation, the increasing consumption and the population growth (Hoornweg, 2012).

In specific for this experiment, the amount of generated waste per capita in Puglia reached the 471, 4 kilograms per inhabitant in 2020, despite 467 kilograms per inhabitant in 2019². Cities in the specific, have a huge ecological footprint: they occupy only about three percent of the earth's surface, but they consume three quarters of global resources and are responsible for 75 percent of gas emissions³.

The occurrence of waste issue is linked to the littering and the trash disposing, where many people may not be aware that their behavior is not environmentally friendly in daily routines (Wee *et al.*, 2021; Xu *et al.*, 2021; Zhang and Wang, 2020). Indeed, littering is a potentially self-reinforcing problem, where it is demonstrated that visible garbage in public spaces invites individuals to litter more in these spaces themselves (Keizer *et al.*, 2011; Schultz *et al.*, 2013).

Coherently with this point of view, Scholars and policy makers have demonstrated that littering in urban environment reduces the perceived aesthetical quality of it by residents, as predictive for residents' place attachment and (Roda *et al.*, 2016; Brown and Raymond, 2006), diminishing efforts into caring for one's residential environment. For this reason, the adoption of a Waste Management System to defense the public spaces emerges as a key factor to improve the subjective experiences of municipalities residents, and at the same time the attractiveness for tourists.

To manage the effects of the impact of the waste production, it is well established that the most effective method of mediating the interests of both consumeristic societies and global sustainability is achieved through adequate resource and waste management techniques (Legarth, 1996; Pasqual and Souto, 2003; Ngoc and Schnitzer, 2009; Jegatheesan *et al.*, 2009). This aspect emerges by the centrality of the litter issue is clearly confirmed by the Objective 11 in Agenda 2030 that, at a political-institutional level, aiming at reducing the per capita pollution produced by cities, in particular with regard to air quality and waste management.

¹ World Bank, Trends in Solid Waste Management https://datatopics.worldbank.org/what-a-waste/trends_in_solid_waste_management.html

² Statista Research Department Municipal solid waste generated per capita in Italy in 2018-2020, by region, 2021. <https://www.statista.com/statistics/683114/per-capita-municipal-solid-waste-generated-in-italy-by-region/>

³ Goal 11: Make cities inclusive, safe, resilient and sustainable <https://www.un.org/sustainabledevelopment/cities/>

Thus, littering and cigarettes on the streets are two close consequences of poor waste management. Abandoned waste has always existed, but the dimensions have assumed currently the problem can be traced back to the increase in mobility in our societies and in the consumption outside the home, which led to waste to make its way into almost all environments (Krausmann *et al.*, 2018). Cigarette filters are the most littered item worldwide (Castaldi, 2020). It is estimated that roughly 4.5 of the 6 trillion cigarettes smoked across the world every year are discarded into the environment (Novotny and Slaughter, 2014). In addition to aesthetic concerns, cigarette littering poses a serious threat to the environment and human health, due to both their plastic elements and their toxic and carcinogen components. According to some studies, their source material never disappears (Novotny *et al.*, 2009).

From this perspective, the group attempted to define a useful strategy to lowering cigarette and littering in the streets by taking in exam the historic center of Barletta city in Apulia, Italy, the sixth city of the Region and an important tourist destination.

In Barletta, garbage disposals are an important urban problem, connected to high cleanup costs, decreased satisfaction with the neighborhood among residents, and reduced attractiveness for tourists. Moving from this consideration, to solicit responsible behavior from individuals in a sustainable key it needed to identify management strategies useful at keeping public spaces clean (Cialdini *et al.*, 1990).

Several studies have revealed that attitudes and beliefs to keep the environment clean do not necessarily translate into improved recycling behavior patterns (Corral-Verdugo, 2003; Diekmann and Preisendörfer, 2003; McCoy *et al.*, 2018). Indeed, scholars have adopted, over time, several well-established psychological theories to understand or to explain the bad attitude towards environmental issues:

1. the Rational Choice Theory (RCT) explains that people calculate the likely costs and benefits of any option before deciding (Riker, 1995; Goldthorpe, 1998; Best and Kneip, 2011), so the actor responds to information over an environmental issue and incentives deriving from the respect of underlying rules;
2. the Theory of Planned Behavior (TPB) assesses that perceived behavioral control over a due context influences the likelihood that an individual will attempt to carry out any action (Ajzen, 1991; Liu and Sibley, 2004);
3. the Theory of Hyperbolic Discounting (THD) states that the perceived payback period affects a choice, where a decision maker would tend to choose a small benefit in the short term over a large benefit in the long term, discounting the value of the latter (Groom *et al.*, 2005).

Since people are influenced by emotions, impulsivity and limited cognitive capacities (Simon 1955; Tversky and Kahneman 1974), the three theories above mentioned could turn out to be not adequate to explain because a decision to litter could reveal a *dilemma* (Kolodko *et al.*, 2016; Heuvel, 2019): even if most people prefer a clean environment and that certain standards could be considered, there is still a temptation to litter or to do other practices that are not in favor of the environment, because it

is easier - in that circumstance - to throw a litter on the street than to find out where a rubbish bin is located. Therefore, the dilemma is translated into a divergence between the pursuit of a public interest (environment protection) and the motivations, needs, attitudes and psychological profile of the single individual.

Thus, fixing this *dilemma* is essential for addressing environmental challenges (Fischer *et al.*, 2012; Cowling, 2014). To pursue this goal, it is fundamental to assume that people choices often rely on social norms, personal beliefs, and arbitrary clues, all dependent on a specific situation, in which the public interest must be at the center of the individual's mindset.

Thus, the problem of waste management and littering can be understood primarily as a social behavior (Ceschiet *al.*, 2021) and from this perspective we started our project by analyzing data reached by an online interview, on consumers' behavior, perceptions about the problem of litter abandonment on the streets, and triggers that would encourage respondents to adopt better behavior toward this occurrence.

Established that people's decision-making processes are almost never guided by perfectly rational principles (Lunenborg, 2010), in this paper we will observe how much this happens and how much people are suspended between conflicting cognitive processes: rationality vs irrationality, social norms vs own mindset, value of public goods vs individual's interest (Bauer, 2022).

Existing literature suggests that there are four major policy options for dealing with problems of consumer waste and littering: a) prohibition or restriction, b) public education norms, persuasion, or appeals to emotion; c) tax or subsidy, intended to either substantially increase or decrease the cost of a behavior; and d) nudging, which involves the deployment of gentle push to encourage but not compel alternative behaviors. (Gunningham and Sinclair, 2017; Thaler and Sunstein, 2008; Rivers *et al.*, 2017).

Daniel Kahneman and Vernon Smith, exponents of Behavioral Economics and both Nobel Prize winner for Economics in 2002, were the first to deal with these issues and found that in the real world, economic agents act in a very different way from the rationality models of neoclassical economics, and they understood that, deviations from this rationality occur in a systematic and therefore predictable way (Tversky and Kahneman, 1974; Kahneman and Smith, 2002).

In order to explain real behaviors, it is not enough to focus on rationally relevant information, but it is necessary to try to reconstruct the mental model, used (sometimes unconsciously) by people to represent the decision-making context in which they act, going beyond, and trying to predict in advance the direction that will take the behavior of individuals (Johnson-Laird, 2012).

These theories, allows scholars and researchers to produce normative advice that can inform everyday life choices and that can direct them toward the best choice.

So, our analysis uses a similar approach by acting on this "predictable irrationality" (Watson, 2018), to make policies more effective, by directing the behavior of citizens, exposing them to more or less implicit stimuli given by particular expedient context (rather than operating through the

heavy-handed channel of legislation).

We acted, with the aim of reducing littering on city streets, through interventions that are increasingly defined as nudge, i.e., gentle pushes, aimed at directing people's minds to make certain decisions: nudge is necessary to support human choices in light of the limited rationality that distinguishes us. (Kahneman and Smith, 2002).

The purpose of our Nudge strategies is to educate people and to commute behaviors considered socially optimal, in internalized conscious choices and habits, rather than actions taken under threat of sanctions that, presumably, stop being implemented in the same moment in which the coercive measure is removed (Schmidt and Engelen, 2020).

So, we would demonstrate how subjective people's decisions about not to throw or discard their waste on the street, could depend on social context and how much this involves people, in correct social acting.

Thus, the following research questions were raised for nudging pro-environmental behavior:

RQ1: Can nudging be used by Municipalities to promote the reduction of littering behavior?

RQ2: How effective is nudging in reducing littering?

To address above research questions, the present article starts by presenting the concept of nudging in paragraph 2. Then we would give evidence to an experimental case conducted in a city placed in one of the most important Italian regions having a well-defined touristic vocation (paragraph 3). After that, paragraph 4 is presenting the finding of the experiment in accordance with the research questions. We cap this work with a discussion on the legitimacy of nudging as key lever for public decision-makers, underlying the limits of the work and the opportunities for further experiments (paragraph 5).

2. Theory and literature on nudging

According to some recent studies, nudging is considered a useful strategy to bring about context-specific behavior change, complementing traditional policy tools rather than replacing laws, regulations, and economic instruments.

Nudging is an approach that changes people's behavior by altering the decision-making environment to influence people's choices when they decide to behave in a certain way. Its implementation must be simple, inexpensive, and noncoercive (Thaler and Sustein, 2008). Nudging influences people's decisions to act without limiting their options or enforcing rules and regulations. Instead, it steers people's decisions in a desired direction by setting cues in the environment (Weßel *et al.*, 2019). Without depriving existing options, it can improve people's choices by changing the way they are presented in accordance with the options in context (McCoy, 2018; Schmidt and Engelen, 2020).

It is also important to understand how nudge works and, which kind of intervention could be adopted to pursue the desirable objectives.

To show up the first aspect (how nudge works), as defined by Thaler and Sunstein (2008), it “is any aspect of the choice architecture that alters people’s behavior in a predictable way *without forbidding* any options or *significantly changing their economic incentives*” (Thaler and Sunstein, 2008, p. 6; Osman, 2016).

The nudge was born just so, with the intent to leverage cognitive bias to influence, induce and persuade individuals to change their behavior, changing the architecture of their choices in an ethical, positive and beneficial way to society (Thaler and Sunstein, 2008).

The role of nudging as a new and original policy solution to pursue socially optimal goals has recently started being investigated by the behavioral economic literature (Beccchetti, 2016).

Nudge, it’s very important for governments that want to make social changes that based their result on people’s actions. Suppose for example that a government’s social policy agenda is to promote a healthier, wealthier, and happier population, but this one finds it hard to behave in ways that consistently meet these objectives (Osman, 2016; Godden, 2016).

This approach lays its foundations in the concept of *Libertarian Paternalism*, that creates a compromise between these two seemingly oxymoronic terms. While the first emphasizes the right to total freedom of decision of the individual, the second term alludes to a society that binds individuals to rules and patterns of decision-making imposed and predefined through laws, rules and prohibitions.

Thaler and Sunstein identify the term *Libertarian Paternalism* or, as Cass Sustain in “Why Nudge? The Politics of Libertarian Paternalism, 2014” used, “Soft Paternalism”, and described it as “actions of the government that attempt to improve people’s welfare by influencing their choices without imposing material costs on those choices... We can understand soft paternalism, thus defined, as including nudges” (Sustain, 2014, p. 58).

There are no prohibitions or deprivations imposed from above, but only small prods that stimulate us to make a more desirable decision, otherwise ignored because of the natural limits of human rationality (Thaler and Sunstein, 2003). Without depriving people of anything, they will have all the existing options at their disposal, but will change how the desired options are presented to them within the context (Schmidt and Engelen, 2020).

These studies are based on a constant accumulation of socio-scientific research showing how susceptible people are to cognitive bias (Haselton *et al.*, 2015), giving in to influences and their own emotions, making hasty and irrational decisions.

Lastly, it is also important to understand which kind of intervention is optimal, in order to ensure optimal effects. The interventions can be heuristic blockers (process-oriented, preventing cognitive errors by blocking or eliminating the irrational operations of mental shortcuts), heuristic triggers (outcome-oriented, activating mental shortcuts to a desirable goal) or informative (Barton and Gruene-Yanoff, 2015; Souza-Neto *et al.*, 2022). Beshears and Gino (2015) argue that nudges work in

three different ways:

- (a) by triggering intuitive thinking - arousing emotions, using biases, simplifying processes;
- (b) by stimulating reflective thinking - through shared assessments, creating opportunities to think about a decision, using planning prompts, encouraging broader thinking, reinforcing personal responsibility, encouraging consideration of conflicting evidence, using reminders; and
- (c) by bypassing both types of thinking - prescribing default options or building in automatic adjustments.

In order to ensure optimal effects, it is fundamental to adopt one of the following techniques (Wee, 2021):

- Prompting: using non-personalized information to promote or raise awareness of a particular good practice. The information suggested to promote pro-environmental behavior is knowledge information (e.g., knowledge about environmental protection, current environmental information, existing environmental problems) and social norms information (e.g., what others do or have done for the environment);
- Sizing: changing the size or quantity of the object. Some of the suggestions for environmentally friendly purposes are increasing the size of the wastebasket to encourage recycling, decreasing the size of the general bin to encourage waste separation, decreasing the size of the plate to reduce food waste, etc.;
- Proximity: facilitates or hinders access to behavioral options. It is suggested to make environmentally friendly settings the default (e.g., double-sided printing, no straw, cutlery only on request) and to change the placement of environmentally friendly products or objects so that they are close to people (e.g., place sustainable food or energy-saving products at consumers' eye level, place recycling bins next to the exit door);
- Priming: placing cues in the environment to influence subconscious decisions, tapping into people's subconscious and trigger their subconscious responses that lead to environmentally friendly behavior (e.g., footprints that might encourage people to walk in the desired direction and use the stairs or organic produce section).
- Presentation: changing the visual design or presentation of the object. It is suggested that the presentation of environmentally friendly objects or tools can be changed or redesigned to attract people's attention to adopt or consume them (e.g., changing the appearance of the waste basket, changing the packaging of the sustainable food).

Nudge tools can be applied to a thousand areas of collective life: from nutrition to urban traffic management, from struggle to tax evasion up to a more conscious relationship with the environment, by reducing the use of water (Ferraro and Price, 2013) or electricity (Allcott, 2011) for example.

The study of this applied strategy starts from a very particular perspective that is rooted in 2 key principles: the rejection of the axioms of rational decision theory (Simon, 1997) and the idea that human irrationality depends in a systematic way on small contextual arrangements that can be modified to promote better choices without changing the constraints

available to those who choose. Analyzing recent and different study, it's possible defined that, *changes to the physical environment* are one of the most important policies able to have a significant impact on individuals' choices, as in the example of increasing the share of cycling in Denmark, Germany and Netherlands (Pucher and Buehler, 2008), or resizing plate and portion for reducing food waste (Rolls *et al.*, 2002; Freedman and Brochado, 2010).

3. Experimental design & methodology

Based on theoretical considerations, we designed a pilot intervention, leveraging on descriptive social norms and reducing cognitive effort in properly waste disposing. With the project #iNUDGEBarletta we turn into operational the Nudge theories, by applying them in the field of environmental sustainability in particular to the city of Barletta in Apulia that, like many other Italian cities, suffers from a strong problem of waste abandonment (littering).

The project objective is to reduce the number of cigarettes and waste abandoned on the street. The verification place taken into consideration is the historic center of Barletta in the part that extends from Piazza Marina along Via Mura San Cataldo, up to the Covo delle Sirene (620 square meters).

The design simulation was possible with the cooperation, in the operational intervention group of: Municipality; Bar.S.A s.p.a, company participated by the City of Barletta for separate waste collection; SGmetal, individual enterprise in the manufacture of objects made from iron, copper and other metals; Retake Barletta, movement of citizens that deals with clean up and promotes civic sense and Dr. Irene Ivoi, industrial designer of circular strategies.

We measured data of waste management and littering from 02 September 2021 to 13 September 2021, through reports, photos and results in terms of garbage bags and cigarettes collected.

Therefore, in order to evaluate the effectiveness of our Nudging policy, the longitudinal technique of the before-after was chosen, that is, comparing the perceptions of cleanliness of the urban context before and after the application of the Nudging strategies.

From a methodological point of view, the experiment followed the following steps:

1. survey;
2. baseline;
3. nudging;
4. checking & comparing

3.1 Survey

Among the several methodologies used to observe the behavior of individuals, we have selected the best method based on the following general parameters:

- specific feasibility constraints, arising from the COVID-19 emergency measures to contain the epidemic⁴;
- observer biases and errors, due to the influence of cognitive biases of social proof, or other nature, on respondents' choices⁵ (Amble and Bui, 2011). In the face-to-face questionnaire administration, the lack of certainty of anonymity and the face-to-face relationship between interviewer and respondent, could potentially cause a bias with respect to the truthfulness of the answers, only for the manner in which the questions are posed (question wording), or, for other parameters within the scope of the interviewer-interviewee interaction (Schuman and Presser, 1996).

Therefore, the research team preferred to use the technique of retrospective interviews, through the use of a questionnaire created through Google Forms, to be submitted online and filled out anonymously.

The survey was conducted over a period of time from 28/08/2021 to 07/09/2021, by posting a link through:

1. the personal Instagram page, of Rossella Piccolo;
2. sending to a Whatsapp *broadlist* of Barletta's citizens only;
3. sending via Whatsapp to direct contacts not resident in Barletta but who often frequent the historic center of the city.

To get a clear idea of the response rate to this questionnaire it was necessary to estimate the Redemption, calculated on the number of users reached through the three aforementioned channels, equal to 15.05%, as shown in the Tab. 1.

Tab. 1: Redemption rate

Channels	Contact
Personal Instagram profile @rossella_piccolo_	1.369* * No sampling criteria
Broadlist Whatsapp	105* * Residents in Barletta. Convenience champion
Direct contact Collaborator 1: 20 Collaborator 2: 40	Total: 60* * Non-residents in Barletta. Sample reasoned on the basis of the "knowledge of the Historic Center"
Total	=1.369+105+60=1.534
Redemption rate	=231 / 1.534 = 15, 05%

Source: Our elaboration

⁴ LAW-DECREE July 23, 2021, No. 105- Urgent measures to deal with the COVID-19 epidemiological emergency and the safe exercise of social and economic activities.

LAW No. 106 of July 23, 2021- Conversion into law, with amendments, of Decree-Law No. 73 of May 25, 2021, on urgent measures related to the COVID-19 emergency, for businesses, labor, youth, health and territorial services.

⁵ Social proof is an informational influence. Receiving information about how others behave (social proof) leads to greater compliance among people. <https://www.behavioraleconomics.com/resources/mini-encyclopedia-of-be/social-proof/>

From questionnaire (Tab. 2), were collected 231 valid interviews, whose composition is defined as follows:

- based on gender: 69.7% are women while 30.3% are men;
- based on age: 38.5% between 17-25 years; 30.7% between 41-60 years; 24.2% between 26-40 years; the complement, divided between under 16 and over 60, is equal to 6.6%;
- based on citizenship: 87% are citizens of Barletta, 13% only visitors who periodically visit the historic city center.

Tab. 2: Questionnaire Structure

Items	Item's description	Scale	Modalities
101_Gender	Gender	Dichotomic	(1) M; (2) F
202_Age	Age	Ordinal	(1) <16; (2) 17-25; (3) 26-40; (4) 41-60; (5) >60
303_Citizen	Are you a citizen of the city of Barletta?	Dichotomic	(1) Yes; (2) No
404_Freq_visit	If not, how often do you visit the city?	Ordinal	(1) Never Been; (2) <2 times/month; (3) >2 times/month; (4) 1+ times/week
505_Overall	Overall, how do you judge the quality of the environment and the cleanliness of the city of Barletta?	Ordinal	(1) Terrible; (2) Bad; (3) Sufficient; (4) Good; (5) Excellent
606_Center_clean	How clean do you think the historic center of the city of Barletta is?	Ordinal	(1) Terrible; (2) Bad; (3) Sufficient; (4) Good; (5) Excellent
707_Causes	If you think the historic center is not clean, where do you think the cause of dirt comes from the most?	Dichotomic	(1) Citizen's; (2) PA's
808_Rel_waste	How much the abandonment of waste in the historic center of Barletta is relevant?	Ordinal	(1) Not at all; (2) Quite; (3) Enough; (4) Very; (5) Relevant
909_Rel_butts	How much the dispersion of cigarette butts on the streets of the historic center is relevant?	Dichotomic	(1) Yes; (2) No
1010_Health_overall	In your opinion, what percentage of people's health directly depends on the quality of the environment in which they live?	Ordinal	(1) 0-20%; (2) 20-40%; (3) 40-60%; (4) >60%
1111_Health_own	How much do you think this problem could be relevant to your personal sphere?	Ordinal	(1) Not at all; (2) Quite; (3) Enough; (4) Very; (5) Relevant
1212_Tourism_affect	How much do you think this problem could affect tourism in the city?	Ordinal	(1) Not at all; (2) Quite; (3) Enough; (4) Very; (5) Relevant
1313_Tourism_fix	Do you think that a cleaner and more well-kept historic center could be a strong point for the city's tourism?	Dichotomic	(1) Yes; (2) No
1414_Informed	Do you think that citizens are sufficiently informed about waste management methods?	Dichotomic	(1) Yes; (2) No
1515_ProEnv_Behav	How do you, as a citizen/visitor, act on a daily basis so as not to fuel the problem?	Open question	
1616_Sat01_NumBins	What is your degree of satisfaction with the number of waste bins in the historic centre?	Ordinal	(1) Terrible; (2) Bad; (3) Sufficient; (4) Good; (5) Excellent
1717_Sat02_Dist_Capac	What is your degree of satisfaction with the distance between them and their capacity?	Ordinal	(1) Terrible; (2) Bad; (3) Sufficient; (4) Good; (5) Excellent
1818_Sat03_Visibility	What is your degree of satisfaction with their visibility and aesthetics?	Ordinal	(1) Terrible; (2) Bad; (3) Sufficient; (4) Good; (5) Excellent
1919_Sat04_CigBins	Are there containers for the collection of cigarette butts in the historic centre?	Dichotomic	(1) Yes; (2) No
2020_Sat05_CollTools	Do you think that the waste collection tools are sufficient in reference to the influx of people in the section of the historic centre?	Dichotomic	(1) Yes; (2) No
2121_Sat06_Merchants	Do you think that the merchants of the historic center carry out a correct cleaning of the areas surrounding their business?	Trichotomic	(1) Yes; (2) Not enough; (3) No
2222_Beh01_Trash	You've just finished eating your sandwich, you have to throw away the paper, but walking around you can't find any trash. How do you behave?	Dichotomic	(1) For; (2) Against
2323_Beh02_FullTrash	You found the trash, but it's already too full. How are you doing?	Dichotomic	(1) For; (2) Against
2424_Beh03_Cigarette	You have just finished smoking your cigarette. How are you doing?	Dichotomic	(1) For; (2) Against
2525_Beh04_Cocktail	What a nice refreshing cocktail! Unfortunately it's already finished. How are you doing?	Dichotomic	(1) For; (2) Against
2626_Beh05_UncivFriend	Your uncivilized friend/colleague throws a handkerchief on the floor. How are you doing?	Dichotomic	(1) For; (2) Against
2727_Beh06_NearestBin	If there was a sign telling you how soon you could find the nearest trash can, do you think it would encourage you to reach it?	Dichotomic	(1) For; (2) Against
2828_Bel01_NumBasket	Do you think that a greater number of baskets could help discourage wrong behavior?	Dichotomic	(1) Yes; (2) No
2929_Bel02_BinLitUp	If the bins were lit up, would you find them easier, particularly in the dark?	Dichotomic	(1) Yes; (2) No
3030_Bel03_PresColl	Do you think that a greater presence of waste collectors for the city during the day and evening would discourage wrong behaviour?	Dichotomic	(1) Yes; (2) No
3131_Involment	Would you like it if we took action on this problem? If yes, can we count on you?	Dichotomic	(1) Yes; (2) No

Source: Our elaboration

This proposed research does not follow any pattern suggested by the scientific reading, but was structured according to the cognitive needs of the Municipality of Barletta. Thanks to the questionnaire submitted it was possible to study the behavioral ethnography of the subjects (Jessor *et al.*, 1996) gathering implicit information such as:

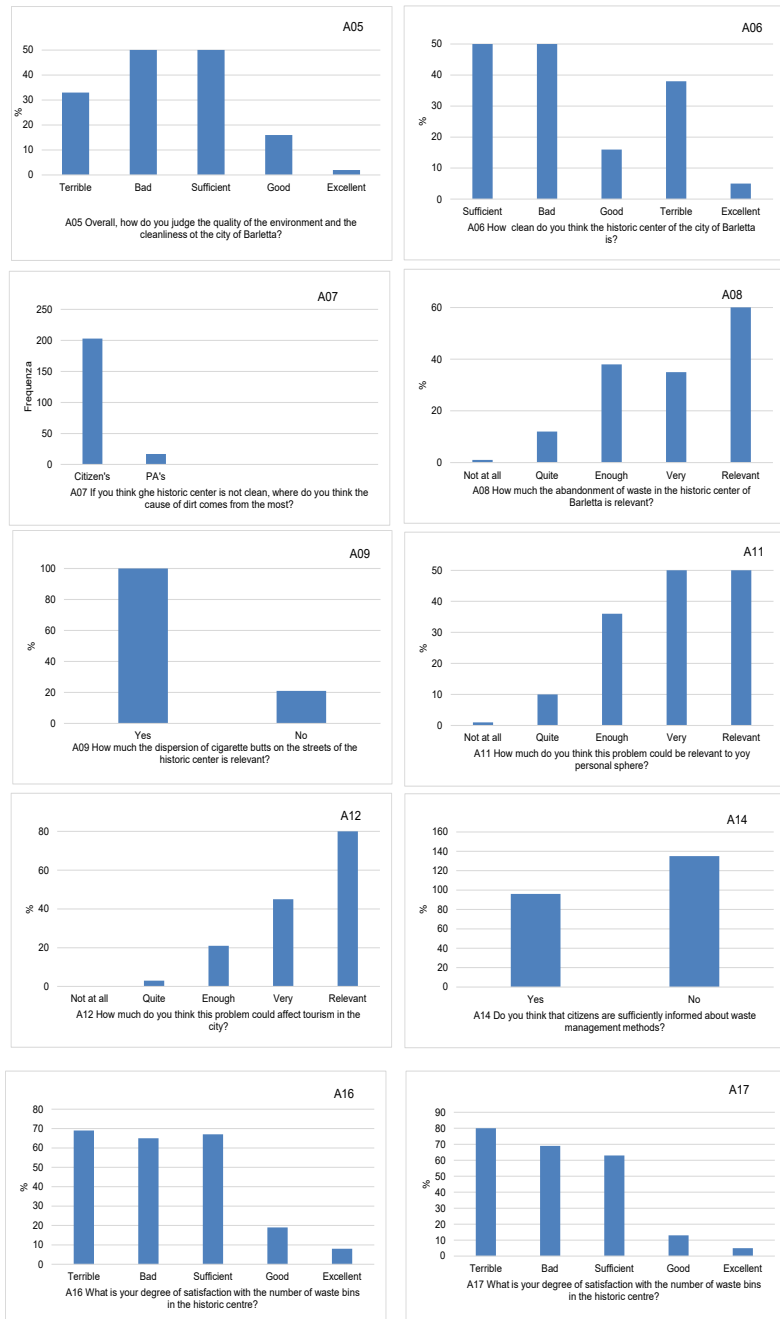
1. the perception of respondents regarding the general state of the environment (perception of the level of cleanliness, state of collection tools, perception of the problem) - 14 Items: 5, 6, 7, 8, 9, 11, 12, 14, 16, 17, 18, 19, 20, 21;
2. the attitude and the behavior of respondents towards the problem - 6 Items: 22, 23, 24, 25, 26, 27;
3. the triggers that would encourage respondents to adopt the desired behavior - 3 Items: 28m 29, 30;
4. the potential citizens' involvement in order to sort out the application of nudging strategy to the issue of reducing garbage and collecting cigarette butts - 1 Item: 31.

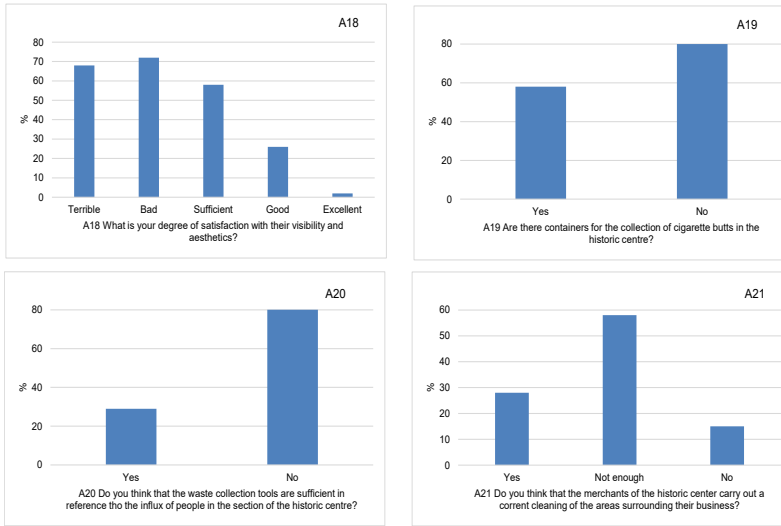
With respect to the first point (the perception of respondents regarding the general state of the environment), it is evident that the large majority of the citizens of Barletta negatively evaluate the aspects concerning the cleanliness and the order in their streets (Fig. 1).

Furthermore, an important paradox emerges: comparing the answers given through the item A07 (whose responsibility is it?) with those of A19 (are there enough waste bins?) and A20 (there are enough bins for collecting cigarette butts?), the respondents tend to blame on the behavior of citizens, rather than on the policies implemented by the PA but, at the same time, they judge the collection sites insufficient. This happens for complex problems, when the cause-effect mechanisms are interrelated and autocatalytic. In concrete, this aspect is an important signal of how useful a "gentle" approach, such as that of nudging, could be.

Analyzing the attitude and the behavior of respondents towards the problem (Fig. 2), while we record a preponderant predisposition of citizens to respect the environment, items 23 and 24 report less proactivity (item 23: the number of those who, despite seeing a refusal to road, they do not collect it) and a manifest problem for the release of cigarette butts in the appropriate wastebaskets, preferring to hide them in planters or throw them on the street (item 24). Maybe, there is a methodological limit concerning the difficulty of collecting information having an ethical profile on human behaviors, through direct interviews based on structured questionnaires (Hancock *et al.*, 2001; Qu and Dumay, 2011; Alshenqeeti, 2014). In these cases, an ethnomethodological approach based on the direct observation could help, even though the state of things (the degradation generated by behaviors contrary to the environment, with garbage left on the street) represents robust evidence of the generalized behaviors of a community.

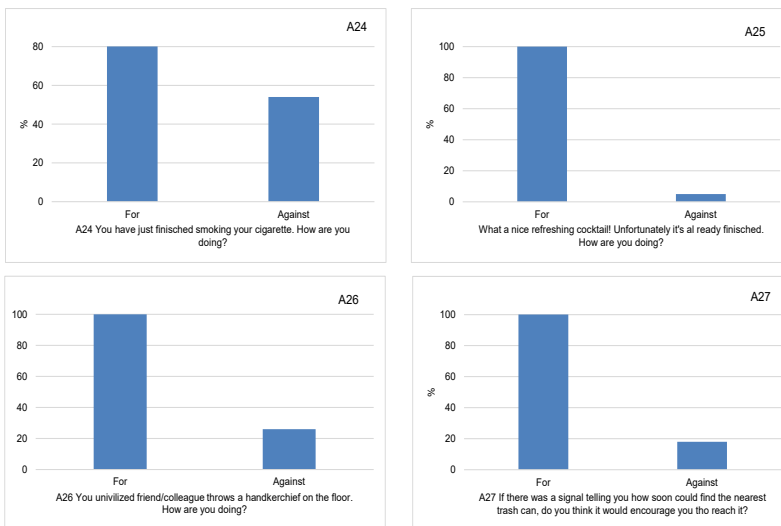
Fig. 1: The perception of respondents regarding the general state of the environment





Source: Our elaboration

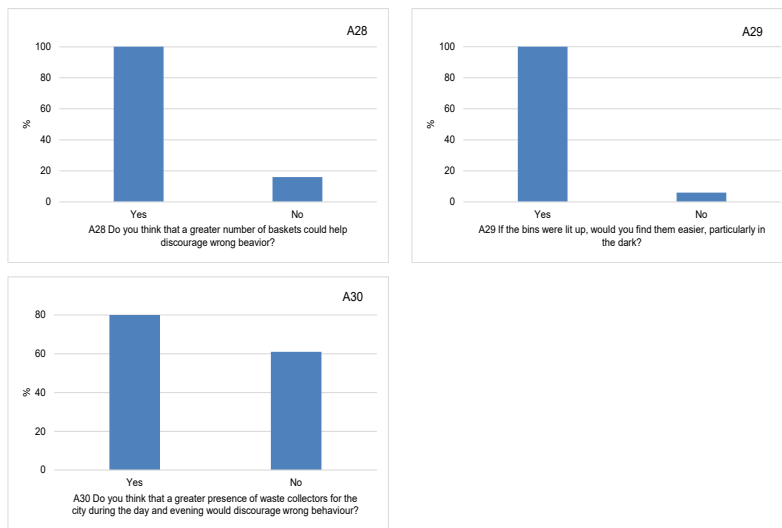
Fig. 2: The attitude and the behavior of respondents towards the problem



Source: Our elaboration

With regard to the question of which triggers would encourage respondents to adopt the desired behavior (see Fig. 3), first of all it emerges that a greater presence of waste collectors during daytime hours (item 30) does not return the same percentage of effectiveness compared to other actions, such as increasing the number of baskets (item 28) and making existing ones more visible (item 29). In particular, this last aspect represents one of the key aspects of nudging, where human behavior is triggered by psychological factors.

Fig. 3: The triggers that would encourage respondents to adopt the desired behavior



Source: Our elaboration

Finally, regarding the involvement of the respondents to the nudging project, out of the 231 interviewed, 208 of them (90%) showed interest, compared to 23 who showed indifference. As can be seen by reading the following paragraphs, the participation recorded in the experiment had been significant.

3.2 Baseline

After studying the behavior of individuals that are the main subjects of this project, the second step it's to analyze the context in which they act.

On Thursday, September 2nd, 2021, from 8:00 p.m. to 9:00 p.m., we carried out a Cleanup in the streets of the historic city center, collecting in special bags provided by the company Bar.S.A. Spa, the waste reported: a. glass, paper, and plastic, in the undifferentiated bag; b. cigarette butts, in a specific bag. The choice of day was indifferent for the window that runs from Monday to Thursday, due to the fact that every morning, ecological workers from the in-house waste collection company, Bar.S.A. Spa, carry out manual and mechanized cleaning of the city's historic center, thus restoring the situation of street cleanliness on a daily basis.

Conversely, the choice of a day on the weekend (including Friday) could have generated a bias on the longitudinal survey, as the flow of visitors tends to decrease from late August and early September.

The Cleanup event was attended by volunteers from the Retake Barletta association, and, to raise awareness about the problem, was opened to anyone interested (Fig. 4b), through word of mouth, the posting of posters (Fig. 4a), and announcements on the social channels of the project participants.

At the end of the clean-up, the bags collected were counted, reaching the following units:

- a. undifferentiated (beer bottles, plastic cocktail glasses and food wrappers): 4 bags from 110 liters;
- b. cigarette butts: 1 bag of 50 liters of 1, 82 Kg.

We use different unit of measures for the evaluation of undifferentiated and cigarettes collected.

For undifferentiated, we measured the waste collected in nr° of garbage bags filled, having the same capacity, because the variety of waste collected and placed in the undifferentiated, have different specific weight.

Due to this, we could not provide a comparable data using grams as the unit of measurement, that will be so vitiated by error due to the different weight that the filled bags may have in proportion to the type of waste that is placed inside (e.g., full or empty can). While, for cigarettes the unit weight is almost the same between the different brands and therefore comparable through the method of the before/after.

Fig. 4a: Clean up event posters (left) - Fig. 4b: Clean up event attendees (right)



Source: Our elaboration

At the end of the clean-up we were able to assess how, despite the fact that our work took place following Bar.S.A's daily collection service and in the early evening hours, when the historic center was still not crowded of people, the amount of abandoned and collected waste was significant.

Collecting trash along this route, allowed us to identify the “dirtiest” areas and place the Nudge tools in the optimal way possible.

3.3 Application of Nudging

After processing this data, we came up with the nudge strategy that best helps to achieve the set goal and we analyzed the impact of this strategy as a littering management policies solution and argue if nudging was an highly effective way of influencing behaviors without resorting to coercion or potentially regressive taxation (Hagmanet *al.*, 2015).

The basis for these ideas is the Fun Theory whose philosophy believes that the easiest way to change people's behavior for the better is to make things fun to do (Takahashiet *al.*, 2020). Basing on this theory, on September 03-04, Nudging tools made with the help of SGmetal and Retake Barletta,

were installed in previously identified and monitored areas. Specifically, we have:

- restored visibility to the bins already present in the historic center, by identifying them with likeable posters representing historical and important characters for our city acting for social sustainability, and painting green footprints on the ground to highlight path to reach them (Fig. 5a);
- installed nr°2 glass baskets made from recycled car tires and highlighted them by using green color and footprints to reach them (Fig. 5b);
- installed nr°2 baskets for differentiate plastic and paper. The game requires you to score your waste and trash it correctly by hitting the basket. A fun way to entice people to sort their waste (Fig. 6a);
- installed nr°5 cigarettes holders, made from the old lights of football stadium. The invitation to put out the cigarette comes from the curiosity to make a choice and express a preference. Next to the pubs have been placed the cigarette holders containing the poll of preference between Beer-Wine or Gin Tonic-Spritz while, near to the restaurants have been placed the poll concerning food preference, for example: Spaghetti with mussels-Orecchiette pasta with vegetables (Fig. 6b).

Fig. 5a: New restyling to existing baskets (left) - Fig. 5b: Glass baskets with pneumatic (right)



Fig. 6a: Paper/Plastic Basket (left) - Fig. 6b: Cigarette holder (right)



Source: Our elaboration

3.4 Checking and comparing

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Through the monitoring activity we understood how effectively the Nudging tools were received by citizens and how much they have been used actively and correctly:

- Paper/plastic baskets were the most successful tools, during monitoring days, were always full and properly used (Image 7.a-b-c-d-e-f).
- The glass baskets, provided positive results, but not to the same extent as the basketball baskets, for which, the invitation to play caused greater results. The disadvantage of the glass basket was probably its excessive height, and its non-transparency, which, by not allowing to see inside, could make the usefulness of the basket misleading and not obvious. In addition, Bar.sa encountered problems, during the daily cleaning of the operators, due to the excessive depth and weight of the glass (Image 8.a-b).
- The cigarettes holders have been used and highly appreciated especially by young people. They have a very easy emptying method and do not require daily cleaning, due to their capacity (Image 9.a-b-c).

Fig. 7 a-b-c-d-e-f. Monitoring Paper/Plastic Basket



7.a)



7.b)



7.c)



7.d)



7.e)



7.f)

Source: Our elaboration

Fig. 8.a-b. Monitoring glass baskets



8.a)



8.b)

Fig. 9.a-b-c. Monitoring cigarette holder



9.a)



9.b)



9.c)

Source: Our elaboration

4. Results

The results regarding the success and usefulness of the tools, were made available in the Final Clean up step.

On September 13th, with the same operational intervention group, as on September 2nd, we carried out, on the same route, and at the same time, the final clean up, to assess the benefits or not of the experiment, in terms of bags and cigarettes collected.

At the end of that operation, the bags collected were counted, reaching the following Tab units:

Tab. 3: Evaluation of results with before-and-after technique

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	Differences in collected waste		Differences
	No Treatment (mean) September 2nd	Treatment (mean) September 13th	
Undifferentiated waste	4 Bags from 110 Liters	2 Bags from 110 Liters	A reduction of ~50% of waste collected before
Cigarettes in Kg	1 Bag from 50 L of 1, 82 Kg	1 Bag from 50 L of 1, 17 Kg	A reduction of ~36.45% of cigarettes collected before
Cigarettes in number	(1820g-36, 9g)/0, 2g = 8915, 5 units	(1170g-36, 9g)/0, 2g = 5665, 5 units	

Source: Our elaboration

In order to compare the two stages, we transformed the weight of the envelope from Kilograms into grams and stripped it of the specific weight of the envelope equal to 36.9g. We divided the net weight with 0.2g corresponding to the specific weight of a cigarette butt, obtaining approximately the number of cigarettes collected.

The results compared before and after the application of the Nudges, showed the reduce of 36, 45% of cigarettes collected and mean the 50% of undifferentiated. This data made us realize how much the inputs were used, in their capacity and usefulness. Even the merchants of the businesses on the route, during the routine clean up before closing time, pointed out a marked decrease in litter abandoned near their establishments and a change in attitudes of young people who lives in the area. The difference in the effect of nudging found for the two behavioral categories (littering and discarding cigarette butts) may depend on different factors, both in terms of frequency (high in cigarette consumption) and psychologically, in terms of the assessment of the environmentally harmful effect of the gesture (low in discarding butts).

A great achievement was also getting citizens to approach Nudging for the first time, who welcomed the novelty with curiosity.

With these achievements we have in a small way created our own space in the minds and consciousness of citizens. For it to work and reap lasting results, however, this space needs to become larger by applying nudging strategies on an ongoing basis as a stable social policy.

5. Conclusion

With the use of Nudge as social policy, we create a more conscious relationship between citizens and the environment, stimulating a super-effective alliance with PAs to implement the reduction of waste abandonment in urban settings.

The observation of a high level of commitment from both the volunteers who participated in the experiment and the local traders who manned the stations, as well as the interest of the Municipality of Barletta in planning

the different phases of the experiment with the research group, allow us to formulate a positive answer to Research Question 1 (Can nudging be used by Municipalities to promote the reduction of littering behavior?). Indeed, when for the activities of waste removal and prevention is used taxpayer money, the problem of litter can constitute a challenge for PAs, also of a financial nature and also presents economic, environmental and health implications:

- the money spent on litter removal activities could in fact go to other sectors such as infrastructure, education and job creation;
- the materials that become abandoned waste take on a recycled value which, in so doing, is lost, leading companies to use more expensive virgin materials;
- abandoned waste is not liked. They could drive tourism away from our cities and this has an evident negative effect on employers' sources of income and workers in the tourism sector (Lemma, 2014);
- as it comes from research (Heck, 2020) polluted environments make people feel insecure and are associated with higher rates of antisocial behavior and crime. Experiments reveal that people feel less guilty of abandoning waste in an environment that is already polluted with respect to a clean environment⁶.

In the light of the research collected on Nudge and the experiment carried out, a great goal would be to direct the government to support the use of Nudge strategies for improving the survival probability of the territory system from a sustainability perspective (Barile *et al.*, 2018).

This approach is based on the assumption that citizens as consumers of social services need to be educated in a post-modern world (Bonfanti and Brunetti, 2015).

As a result, this nudge experiment as other implementation of recycling and waste management programs is likely to increase organizational efforts and therefore temporary costs, but can involve costs long-term savings (Abrate *et al.*, 2015).

Based on the results of the experiment (see Tab. 3), the answer to RQ2 (How effective is nudging in reducing littering?) can only be positive. A reduction of litter by 50% and of cigarette butts thrown on the street by about 36% is an important result to reflect on. Moreover, as natural experiment, the strength of this research lays on the fact that residents were unaware of the research experiment, so increasing its ecological validity (Merkelbach *et al.*, 2021).

We are also aware of the limitations of this work.

First, there is the objective limitation that the results relate to an example of nudging to reduce cigarette use and littering in the streets and that caution should be exercised in generalizing the results to other contexts. Indeed, one of the main limitations of nudge in the field of sustainability and environment protection is that it operates by influencing intuitive and non-decisional processes of individuals. And the individuals' mindsets are

⁶ Rapid Evidence Review of Littering Behaviour and Anti-Litter Policies. <https://www.zerowastescotland.org.uk/sites/default/files/Rapid%20Evidence%20Review%20of%20Littering%20Behaviour%20and%20Anti-Litter%20Policies.pdf>

shaped by context, coming to create an autocatalytic process: the more I pollute, the dirtier the context becomes; the more the context is dirty and more polluted (referring to the Broken Window Theory of Kelling and Wilson, 1982). But, although this makes nudge a possible strategy to change the behavior of people who have little engagement with the sustainability discourse, there is a growing consensus that “the best interventions will surely be those that seek to change minds alongside changing contexts” (Dolan *et al.*, 2012).

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Furthermore, in this paper we do not use methods to estimate the effectiveness of nudging compared to other techniques in waste disposal. Experts seem to agree that nudges are a complement to traditional policy instruments rather than a substitute for coercive (laws and regulations) and economic instruments (e.g., fiscal incentives, subsidies, taxes or fees). Nudge is not seen as a panacea, but seems to contribute mainly to better design of other initiatives and to improve the effectiveness and efficiency of policy instruments and the speed of their implementation (Avineri and Goodwin, 2010).

Thirdly, we do not calculate the net benefits to Municipalities by using nudging, considering the full cost for its implementation. Future research should therefore also address public policy makers, where regulation and budgeting will continue to be important factors influencing policies and interventions that could promote cost-effective behavioral changes with potentially high environmental benefits. In this perspective, econometric models and Structured Equation Modeling techniques could be adopted.

References

- ABRATE G., BRUNO C., ERBETTA F., FRAQUELLI G. (2015), “Business innovation and waste management sustainability: the case of door-to-door collection”, *Sinergie Italian Journal of Management*, vol. 33, n. Sep-Dec, pp. 377-393.
- AJZEN I. (1991), “The theory of planned behavior”, *Organizational Behavior and Human Decision Processes*, vol. 50, n. 2, pp. 179-211.
- ALLCOTT H. (2011), “Social norms and energy conservation”, *Journal of Public Economics*, vol. 95, n. 9-10, pp. 1082-1095.
- ALSHENQEETI H. (2014), “Interviewing as a data collection method: A critical review”, *English Linguistics Research*, vol. 3, n. 1, pp. 39-45.
- AMBLEE N., BUI T. (2011), “Harnessing the influence of social proof in online shopping: The effect of electronic word of mouth on sales of digital microproducts”, *International Journal of Electronic Commerce*, vol. 16, n. 2, pp. 91-114.
- AVINERI E., GOODWIN P. (2010), *Individual behaviour change: Evidence in transport and public health*, The Department for Transport, London, UK.
- BARILE S., SAVIANO M., POLESE F., DI NAUTA P. (2012), “Il rapporto impresa-territorio tra efficienza locale, efficacia di contesto e sostenibilità ambientale”, *Referred Electronic Conference Proceeding Convegno Sinergie “Il territorio come giacimento di vitalità per l’impresa”*, pp. 387-402.

- BAUER J.M., ARESTRUP S.C., HANSEN P.G., REISCH L.A. (2022), "Nudging more sustainable grocery purchases: Behavioural innovations in a supermarket setting", *Technological Forecasting and Social Change*, vol. 179, pp. 1-10.
- BECCHETTI L., SALUSTRI F., SCARAMOZZINO P. (2018), "Nudging and environmental corporate responsibility: a natural experiment", *CEIS Research Paper Series Paper No. 426*, vol. 16, pp. 1-19.
- BESHEARS J., GINO F. (2015), "Leaders as decision architects: Structure your organization's work to encourage wise choices", *Harvard Business Review*, vol. 93, pp. 52-62.
- BEST H., KNEIP T. (2011), "The impact of attitudes and behavioral costs on environmental behavior: A natural experiment on household waste recycling", *Social Science Research*, vol. 40, n. 3, pp. 917-930.
- BONFANTI A., BRUNETTI F. (2015), "Effects of customer education in terms of customer perceived value: the role of customer evaluation skills", *Sinergie Italian Journal of Management*, vol. 33, n. May-Aug, pp. 219-238.
- BROWN G., RAYMOND C. (2007), "The relationship between place attachment and landscape values: Toward mapping place attachment", *Applied Geography*, vol. 27, n. 2, pp. 89-111.
- BUSS D.M. (edited by.), (2015), *The Handbook of Evolutionary Psychology*, Volume 1: foundation, John Wiley & Sons, New York.
- CASTALDI G., CECERE G., ZOLI M. (2021), "Smoke on the beach": on the use of economic vs behavioral policies to reduce environmental pollution by cigarette littering", *Economia Politica*, vol. 38, n. 3, pp. 1025-1048.
- CESCHI A., SARTORI R., DICKER S., SCALCO A., TUR E.M., TOMMASI F., DELFINI K. (2021), "Testing a norm-based policy for waste management: An agent-based modeling simulation on nudging recycling behavior", *Journal of Environmental Management*, vol. 294, pp. 1-10.
- CIALDINI R.B., RENO R.R., KALLGREN C.A. (1990), "A focus theory of normative conduct: Recycling the concept of norms to reduce littering in public places", *Journal of Personality and Social Psychology*, vol. 58, n. 6, pp. 1015-1026.
- CORRAL VERDUGO V., FRÍAS ARMENTA M., GONZÁLEZ LOMELÍ D. (2003), "Percepción de riesgos, conducta proambiental y variables demográficas en una comunidad de Sonora, México", *Región y Sociedad*, vol. 15, n. 26, pp. 49-72.
- COWLING R. (2014), "Let's Get Serious About Human Behavior and Conservation", *Conservation Letters*, vol. 7, n. 3, pp. 147-14.
- DIEKMANN A., PREISENDÖRFER P. (2003), "Green and greenback: The behavioral effects of environmental attitudes in low-cost and high-cost situations", *Rationality and Society*, vol. 15, n. 4, pp. 441-472.
- DOLAN P., HALLSWORTH M., HALPERN D., KING D., METCALFE R., VLAEV I. (2012), "Influencing behaviour: The mindspace way", *Journal of Economic Psychology*, vol. 33, n. 1, pp. 264-277.
- DRAHOS P. (2017), *Regulatory theory: Foundations and applications*, Australian National University Press, Australia.
- FREEDMAN M.R., BROCHADO C. (2010), "Reducing portion size reduces food intake and plate waste", *Obesity*, vol. 18, n. 9, pp. 1864-1866.
- FERRARO P.J., PRICE M.K. (2013), "Using nonpecuniary strategies to influence behavior: evidence from a large-scale field experiment", *The Review of Economics and Statistics*, vol. 95, n. 1, pp. 64-73.

- FISCHER J., DYBALL R., FAZEY I., GROSS C., DOVERS S., EHRLICH P.R., BRULLE R.J., CHRISTENSEN C., BORDEN R.J. (2012), "Human behavior and sustainability", *Frontiers in Ecology and the Environment*, vol. 10, n. 3, pp. 153-160.
- GOLDTHORPE J.H. (1998), "Rational action theory for sociology", *British Journal of Sociology*, vol. 49, n. 2, pp. 167-192.
- GROOM B., HEPBURN C., KOUNDOURI P., PEARCE D. (2005), "Declining discount rates: the long and the short of it", *Environmental and Resource Economics*, vol. 32, pp. 445-493.
- GUNNINGHAM N., SINCLAIR D. (2017), "Smart regulation", In *Regulatory theory: Foundations and Applications*, vol. 8, pp. 133-148.
- HAGMAN W., ANDERSSON D., VASTFJALL D., TINGHOG G. (2015), "Public views on policies involving nudges", *Review of Philosophy and Psychology*, vol. 6, n. 3, pp. 439-453.
- HANCOCK B., OCKLEFORD E., WINDRIDGE K. (2001), *An introduction to qualitative research*, Trent focus group, London.
- HASELTON M.G., NETTLE D., MURRAY D.R. (2015), "The evolution of cognitive bias", *The Handbook of Evolutionary Psychology*, Joh Wiley & Sons, pp. 1-20.
- HECK D.W., THIELMANN I., KLEIN S.A., HILBIG B.E. (2020), "On the limited generality of air pollution and anxiety as causal determinants of unethical behavior: Commentary on Lu, Lee, Gino, and Galinsky (2018)", *Psychological Science*, vol. 31, n. 6, pp. 741-747.
- HEUVEL C. VAN DEN (2019), *Influencing subconscious behavior to reduce litter in public space in the Northern Netherlands*, Master thesis, University of Groningen, Netherlands.
- HINTERMANN B., RUTHERFORD T. F. (2017), "Social planning and coercion under bounded rationality with an application to environmental policy", *International Tax and Public Finance*, vol. 24, pp. 854-878.
- HOLYOAK K.J., MORRISON R.G. (2012), (edited by.), *The Oxford Handbook of Thinking and Reasoning*, Oxford Library of Psychology.
- HOORNWEG D., BHADA-TATA P. (2012), "What a Waste - A Global Review of Solid Waste Management", *World Bank Washington D.C.*, vol. 1, pp. 1-15.
- JEGATHEESAN V., LIOW J.L., SHU L., KIM S.H., VISVANATHAN C. (2009), "The need for global coordination in sustainable development", *Journal of Cleaner Production*, vol. 17, n. 7, pp. 637-643.
- JESSOR R., COLBY A., SHWEDER R.A. (1996), *Ethnography and human development: Context and meaning in social inquiry*, University of Chicago Press.
- JOHNSON-LAIRD P.N. (1983), (edited by.), *Mental models: Towards a cognitive science of language, inference, and consciousness* (No. 6), Harvard University Press.
- JOHNSON-LAIRD P.N. (2012), "Inference with mental models", *The Oxford Handbook of Thinking and Reasoning*, Oxford University Press, Oxford (GB), pp. 134-145.
- KAHNEMAN D., SMITH V. (2002), "Foundations of behavioral and experimental economics", *Nobel Prize in Economics Documents*, vol. 1, n. 7, pp. 1-25.
- KEIZER K., LINDENBERG S., STEG L. (2011), "The reversal effect of prohibition signs", *Group processes and Intergroup Relations*, vol. 14, n. 5, pp. 681-688.

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- KELLING G.L., WILSON J.Q. (1982), "Broken windows", *Atlantic Monthly*, vol. 249, n. 3, pp. 29-38.
- KOLODKO J., READ D., TAJ U. (2016), *Using behavioral insights to reduce littering in the UK*. WBS, Great Britain.
- KRAUSMANN F., LAUK C., HAAS W., WIEDENHOFER D. (2018), "From resource extraction to outflows of wastes and emissions: The socioeconomic metabolism of the global economy, 1900-2015", *Global Environmental Change*, vol. 52, pp. 131-140.
- LEGARTH J. (1996), "Sustainable metal resource management- the need for industrial development: efficiency improvement demands on metal resource management to enable a (sustainable) supply until 2050", *Journal of Cleaner Production*, vol. 4, n. 2, pp. 97-104.
- LEMMA A.F. (2014), "Tourism Impacts Evidence of Impacts on Employment, Gender, Income", *Overseas Development Institute*, vol. 2, n. 1, pp. 87-96.
- LIU J., SIBLEY C. (2004), "Attitudes and behavior in social space: Public good interventions based on shared representations and environmental influences", *Journal of Environmental Psychology*, vol. 24, pp. 373-384.
- LUNENBURG F.C. (2010), "The decision making process", In *National Forum of Educational Administration and Supervision Journal*, vol. 27, pp. 4.
- MCCOY K., OLIVER J.J., BORDEN D.S., COHN S.I. (2018), "Nudging waste diversion at Western State Colorado University: Application of behavioral insights", *International Journal of Sustainability in Higher Education*, vol. 19, n. 3, pp. 608-621.
- MERKELBACH I., DEWIES M., DENKTAS S. (2021), "Committing to keep clean: nudging complements standard policy measures to reduce illegal urban garbage disposal in a neighborhood with high levels of social cohesion", *Frontiers in Psychology*, vol. 12, 660410.
- NGOC U.N., SCHNITZER H. (2009), "Sustainable solutions for solid waste management in Southeast Asian Countries", *Waste Management*, vol. 29, n. 6, pp. 1982-1995.
- NOVOTNY T.E., LUM K., SMITH E., WANG V., BARNES R. (2009), "Cigarettes butts and the case for an environmental policy on hazardous cigarette waste", *International Journal of Environmental Research and Public Health*, vol. 6, n. 5, pp. 1691-1705.
- NOVOTNY T.E., SLAUGHTER E. (2014), "Tobacco product waste: an environmental approach to reduce tobacco consumption", *Current Environmental Health Reports*, vol. 1, n. 3, pp. 208-216.
- OSMAN M. (2016), "Nudge: How Far Have We Come?", *Oeconomia*, vol. 6-4, pp. 557-570.
- PASQUAL J., SOUTO G. (2003), "Sustainability in natural resource management", *Ecological Economics*, vol. 46, n. 1, pp. 47-59.
- PUCHER J., BUEHLER R. (2008), "Making cycling irresistible: lessons from the Netherlands, Denmark and Germany", *Transport Reviews*, vol. 28, n. 4, pp. 495-528.
- RIKER W.H. (1995), "The political psychology of rational choice theory", *Political Psychology*, vol. 16, n. 1, pp. 23-44.
- RIVERS N., SHENSTONE-HARRISS., YOUNG N. (2017), "Using nudges to reduce waste? The case of Toronto's plastic bag levy", *Journal of Environmental Management*, vol. 188, pp. 153-162.

- RODA C., CHARREIRE H., FEUILLET T., MACKENBACH J.D., COMPERNOLLE S., GLONTI K., REBAH M.B., BÁRDOS H., RUTTER H., MCKEE M., DE BOURDEAUDHUIJ I., BRUG I., LAKERVELD J., OPPERT J.M. (2016), “Mismatch between perceived and objectively measured environmental obesogenic features in European neighborhoods”, *Obesity Reviews*, vol. 17, pp. 31-41.
- ROLLS B.J., MORRIS E.L., ROE L.S. (2002), “Portion size of food affects energy intake in normal-weight and overweight men and women”, *The American Journal Of Clinical Nutrition*, vol. 76, n. 6, pp. 1207-1213.
- QU S.Q., DUMAY J. (2011), “The qualitative research interview”, *Qualitative Research in Accounting and Management*, vol. 8, n. 3, pp. 238-264.
- SCHMIDT A. T., ENGELEN B. (2020), “The ethics of nudging: An overview”, *Philosophy Compass*, vol. 15, n. 4, e12658.
- SCHUMAN H., PRESSER S. (1996), *Questions and answers in attitude surveys: Experiments on question form, wording, and context*, Sage publishing, New York.
- SCHULTZ P., BATOR R. L., BROWN LARGE C., BRUNI, TABACONI J. (2013), “Littering in Context: Personal and Environmental Predictors of Littering Behavior”, *Environment and Behavior*, vol. 45, n. 1, pp. 35-59.
- SIMON H.A. (1955), “A behavioral model of rational choice”, *The Quarterly Journal of Economics*, vol. 69, n. 1, pp. 99-118.
- SIMON H.A. (1997), *Models of bounded rationality: Empirically grounded economic reason*, vol. 3, Massachusetts Institute of Technology Press., Massachusetts.
- SOUZA-NETO V., MARQUES O., MAYER V.F., LOHMANN G. (2022), “Lowering the harm of tourist activities: a systematic literature review on nudges”, *Journal of Sustainable Tourism*, vol. 31, n. 9, pp. 2173-2194.
- SUSTAIN C.R. (2014), *Why nudge?: The politics of libertarian paternalism*, Yale University Press, Connecticut.
- TAKAHASHI M., NAMGY U.K. (2020), “Proposal and Kansei Evaluation of a Garbage Can to Change Human Behaviour Based on Fun Theory”, In *International Conference on Applied Human Factors and Ergonomics*, pp. 717-724. Springer, Cham.
- THALER R., SUNSTEIN C. (2008), *Nudge: Improving Decisions about Health, Wealth, and Happiness*, Penguin Books USA.
- THALER R.H., SUSTAIN C.R. (2009), “Nudge: Improving decision about health, wealth and happiness”, *Constitutional Political Economy*, vol. 19, pp. 356-360.
- THALER R.H., SUSTAIN C.R. (2003), “Libertarian paternalism”, *American Economic Review*, vol. 93, n. 2, pp. 175-179.
- TVERSKY A., KAHNEMAN D. (1974), “Judgment under Uncertainty: Heuristics and Biases: Biases in judgments reveal some heuristics of thinking under uncertainty”, *Science*, vol. 185, n. 4157, pp. 1124-1131.
- XU L., CHU X., LING M. (2021), “Influence of role models on public participation in household waste separation: An examination of local contextual moderators”, *Sustainable Production and Consumption*, vol. 27, pp. 1934-1943.
- WATSON R. (2018), *Addressing predictable irrationality: insights from practice*, University of Cape Town, Faculty of Law, Department of Commercial Law, pp. 1-56.

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Enrica Iannuzzi
Rossella Piccolo
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insights from an
on-field experiment
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- WEßEL G., ALTENDORF E., SCHWALM M., CANPOLAT Y., BURGHARDT C., FLEMISCH F. (2019), "Self-determined nudging: a system concept for human-machine interaction", *Cognition, Technology and Work*, vol. 21, pp. 621-630.
- WEE S.C., CHOONG W.W., LOW S.T. (2021), "Can "Nudging" Play a Role to Promote Pro-Environmental Behaviour?", *Environmental Challenges*, vol. 5, 100364.
- ZHANG Z., WANG X. (2020), "Nudging to promote household waste source separation: Mechanisms and spillover effects", *Resources, Conservation and Recycling*, vol. 162, 105054.

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