IULM

International University of Languages and Media
Libera Università di Lingue e Comunicazione

PhD program in: Comunicazione e Mercati: Economia, marketing e Creatività

Cycle: XXX

Curriculum in: Marketing, consumo e dimensione simbolica del valore economico

Behavioral Economics and Behavioral Change Policies:

Theoretical Foundations and Practical Applications
to Promote Well-being in the Italian Context

Surname: Cesareo **Name:** Massimo

Registration number: 1015513

Tutor: Prof. Paolo Moderato

Coordinator: Prof. Pierluigi Sacco

ACADEMIC YEAR: 2016-2017

"Men build society and society builds men"

B.F. Skinner, Walden Two

CONTENTS

Abstract

The PhD thesis is divided in four parts: *Part 1*. The first part provides a historical and theoretical background of the most influential models of decision-making developed in the last few decades in the fields of economy and psychology. It begins with an overview of the basic principles of Neoclassical Economics and follows with a description of the studies that led to the birth and spread of Behavioral Economics. *Part 2*. The second part focuses on the main Behavioral Change policy programs developed in the last few years all over the world, particularly concentrating on the main features of the so called Nudge and on its alternative approach called Boost. *Part 3*. The center of attention of the third part are the researches carried out in the last few years in the Italian context by the author of this PhD thesis. The studies are divided in two main categories: the first includes experiments on the individual's preferences within a laboratory setting while the second includes field experiments that study the actual choices of the individuals. *Part 4*. The last part offers a detailed description from a Behavioral Analytic point of view of some of the main concepts of Behavioral Economics and Nudge by highlight their common and divergent traits on a theoretical and practical level. This part is a an attempt to dig deeper into the topic of decisional processes and choices, by taking into account the extensive knowledge that derives from more than one century of studies on human behavior.

Key words: Behavioral Economics; Behavioral Change; Nudge; Behavioral Analysis; Behavioral Science

Acknowledgments

List of Abbreviations

A - Antecedent

AO - Abolishing Operation

ARF - Absolute Risk Frame

B - Behavior/Response

BA - Behavioral Analysis

BC - Behavioral Change

BE - Behavioral Economics

BS - Behavioral Science(s)

C - Consequence

EO - Establishing Operation

FFT - Fast and Frugal Tree

H&B - Heuristics and Bias program

HRC - High Risk Cluster

LRC - Low Risk Cluster

MO - Motivating Operation

NE - Neoclassical Economics/Standard Economics

R - Response

RCT - Rational Choice Theory

RFT - Relational Frame Theory

RRF - Relative Risk Frame

s^D - Discriminative Stimulus

SH - Simple Heuristics/Fast and Frugal Heuristics program

s^R - Reinforcing Stimulus

Preface

A student enters the canteen of his University and chooses a piece of cake instead of a fruit. An employee is offered to place part of his salary in a retirement plan and chooses not to take advantage of it. A customer in a restaurant has left some food in his plate that he cannot finish but he leaves without asking for the leftovers. Two teenagers sit on the table in a pub spending most of the night watching their smartphones instead of talking to each other. A woman is going to the gym to lose weight. She can choose to take the stairs or the elevator and she opts for the latter.

All of the above examples have something in common. Although these situations look different they have something in common, they all involve people's choice between alternative options or behaviors. Which factors influence the individual's choices? How is it possible to help people take "wiser" decisions?

In recent years Behavioral Sciences (BS) have increasingly focused on situations involving people's choices and dysfunctional behaviors, aiming to find those variables that explain certain behavioral responses. Here the term "dysfunctional" is used just to describe behaviors that move people away from their personal goals or from the ones set by their social environment. Researchers from the fields of economy and psychology have shown that in certain circumstances people behave inconsistently with their long term goals or values (e.g. Kahneman and Tversky 1979, 1982; Tversky & Kahneman 1973, 1981). They found that the individuals' behavioral responses are in fact greatly influenced by contextual factors.

The principles that lie behind human behaviors (including their choices) and their relation to contextual factors has been studied in depth for many decades by the behavioral analysts (e.g. Skinner, 1938, 1953, 1957, 1971, 1974). However, it is just in the last few decades that the interest in this topic has grown exponentially in both fields of BS and of public policies. Starting with the formulation of the Prospect Theory by Daniel Kahneman and Amos Tversky (1979), a milestone in

the study of decisional processes, the debate on the individual's choice has received a huge interest from both fields of economy and psychology. That has led to the rise of new Behavioral Change (BC) policy programs that have spread all over the world in the last decades.

Part 1

Behavioral Economics

Introduction

Choice concerns the way individuals allocate their time of responding among available response options (Fisher and Mazur 1997, p. 387). Humans live in a world characterised by limited resources where there is a constant need to deal with situations in which making choices is necessary. It could be a choice between different goods or different behaviors. Not choosing can also be considered a choice and often with relevant implications (for an extensive description see the book of Cass Sunstein *"Choosing not to choose: Understanding the value of choice.",* 2015). Therefore, it is not surprising that the study of human choices is a fundamental issue in the fields of both economy and psychology.

An important question rises when talking about choices: how do people take decisions and which are the factors that influence their choices? Different theories have been proposed over time with huge implications in the public domain. The rise of Behavioral Economics (BE), in particular, led in recent years to the development and spread of public policy programs consistent with its core principles all over the world. The most wide spread is defined as Nudge[1].

It is necessary to define few main concepts to have a more clear understanding of some of the most recent developments in the field of the study of decisions[2]. The most relevant is the definition of rationality. Individuals can be seen as more or less rational agents. Although the term rationality is commonly used with a positive connotation, it should be seen as purely descriptive. Rationality may be considered as widely arbitrary and it assumes a specific meaning only as part of a certain theoretical model.

According to the Rational Choice Theory (RCT) behaviors can be divided in two categories: rational and irrational. The former are those that follow the axioms

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[1] The terms "Nudge" and "Nudging" will be used interchangeably in the PhD thesis

[2] Although the terms decision and choice may have a different meaning, for the purpose of the PhD thesis they will be used interchangeably

postulated by the theory while the latter are those in contradiction to it. Comparing Neoclassical Economics (NE) and BE and referring to the above mentioned RCT, the first describes people as fundamentally rational, while the second claims that people often act in a way that is far from being considered rational (Angner 2017, p.4).

Another important distinction is about the nature of the theories of choice that can be descriptive or normative. A descriptive theory explains how people act in reality in certain circumstances, on the other hand, a normative theory describes how people should be acting in a hypothetical best case. A theory can also be defined as both descriptive and normative. In this case the theory assumes that people act in the way that they should act (Angner 2017, p. 3). Typically, the term rational choice refers to those theories that are (or are meant to be) normatively correct, whether or not they are adequate from a descriptive point of view. NE claimed to be both normatively and descriptively adequate while BE aimed to be just descriptive (Kahneman, 2003).

Part 1: an overview. This part of the thesis provides a historical and theoretical overview of the main models of decision making developed in the last decades. First, the main principles and theories of NE are described briefly. Next, BE is presented in depth with its main findings and its internal stream of studies. The attention is put on the work of Daniel Kahneman and Amos Tversky (1937-1996) on one side and Gerd Gigerenzer on the other. This part is essential to introduce the second part of the PhD, in which are described the main policy programs unfolded from the principles of BE.

1. Neoclassical Economics: Historical Backdrop and Theoretical Framework

The term "Neoclassical Economics" dates back to 1900, when the American economist Thorstein Veblen used it in his paper "The Preconceptions of Economic Science" (Veblen, 1900, cf. Colander, 2000). Two main periods can be traced within NE: an early stage and a postwar stage.

Early Neoclassical Economics. In Classical Economics and the early stage of NE, it was widely accepted to talk about cognitive and affective states. The link between economic and psychological principles can be traced back to the work of the philosopher and economist Adam Smith (1723-1790). Although he did not have a theory of decision making in the modern sense, his vision of human nature appeared multifaceted and, like his contemporary David Hume, Smith was deeply interested in the psychological underpinnings of human behavior.

Several contemporary authors (e.g. Palacios-Huerta 2003, p. 243; Ashraf, Camerer & Loewenstein 2005, p. 140) have gone so far as suggesting that Hume and Smith in fact identified and discussed some of the phenomena that now occupy BE. Smith and his contemporaries, analysed dynamically inconsistent behaviors and provided important insights about phenomena widely accepted and empirically tested in contemporary BE like loss aversion, overconfidence, social preferences and others.

The early stage neoclassical economists were inspired by the utilitarian philosopher Jeremy Bentham and their economic models were based on hedonic psychology (Heukelom 2007, p. 2). The thought of the economist William Stanley Jevons well represents the spirit of the time who said that the subject of economy should have been maximising pleasure and reducing pain (Jevons, 1965, p. 37).

Early neoclassical economists did not see any reason to adopt alternative methods to test the adequacy of the foundations of their economic theories because they were relying on the method of introspection to study people's choices and they believed that introspection supports the principles of hedonic psychology. This approach to the study of human behavior was one of the most common methods used in psychology as well until Behaviorism emerged in the scientific realm.

Postwar Neoclassical Economics. In 1913 John B. Watson wrote his pioneering article *"Psychology as the Behaviorist Views it"* (Watson, 1913) heavily criticizing reliance on introspection and the references to mental states. That article marked the emergence of Behaviorism (Gardner 1987, p. 11).

In the postwar period, from the mid-1930's to the mid-1950's, NE also underwent analogous transformation (Mandler 2001, p. 8). Especially after the Second World War when the dissatisfaction of several economists towards the results achieved by NE brought change to the approach of the study of decision making. Postwar neoclassical economists wanted to root their discipline in a solid methodological ground and at the same time to improve the predictive power of their theories. They claimed that economy should make reference to conscious states so they rejected the idea that introspection was a scientifically acceptable means to explore such states.

The basic concepts of pleasure and suffering as foundation of choice, were substituted by a theory of preferences. People's sensations of pleasure and suffering are not observable, while their choices can be observed directly. After assuming that people's choices reflect their preferences it was possible to test empirically what people prefer. By substituting the concept of "utility" (see Part 1, section 1.2.2.) with the one of "preference", postwar neoclassical economists explicitly intended to separate economy from psychology (Robbins 1984, p. 85). However, It is important to underline that they did not deny that people might be motivated by pleasure, pain and/or other mental states. They simply chose to remain agnostic about questions like motivation and preference formation arguing that such issues were outside the scope of economy (Robbins 1984, p. 86).

To sum up, the most important characteristic of postwar NE is the sharp break up with the classical and the early neoclassical traditions. Postwar theorists directed their efforts toward cutting the bonds with all kinds of psychology (hedonic and etc.) in order to adapt economy better to contemporary methodological structures and to improve the predictive power of its theory. As a result, they developed a general theory that did not take into account some important specific features of

human behavior which will be described later on in the PhD thesis (Angner & Loewenstein, 2007).

1.2. Rational Choice Theory

NE was characterised by its association with the RCT, i.e. the most popular and influential economic model until 1970s (for an extensive description see the book *"The Economic Approach to Human Behavior"*, Becker 1976). One of the main assumptions of the RCT, is that individuals should act to maximise their gains and minimize their losses. The economic model claimed to be simultaneously descriptively adequate and normatively correct assuming that people would act mostly as they should. That does not mean that all individuals act rationally in every situation, but that deviations from perfect rationality are so small or not systematic that they can be neglected. Following that standpoint, people should not be affected by contextual factors, they would weight short and long term costs and benefits of each element of a choice set, sorting the available options according to their preferences. In order to be considered rational, people should act according to two fundamental axioms.

1.2.1. Axioms in the Rational Choice Theory

Transitivity. When three options are given, if the option A is preferred over the option B and the option B is preferred over the option C, then A should be also preferred over C (Angner 2017, p. 19). For example, choosing from the restaurant's menu, in which there are available three different dishes, i.e. pizza, cheeseburger and salad, if the person prefers the pizza over the cheeseburger and the cheeseburger over the salad, therefore, according to the axiom, he would also prefer the pizza over the salad. Formally, this relation can be described in the following way: If $A \geq B \geq C$, then $A \geq C$ (for each A, B and C).

Completeness. When a choice set is given people would always be able to say if they prefer the option A over the option B, or the opposite, or if neither is preferred (Angner 2017, p.20). Taking again as an example the menu of a restaurant, a person may say that he likes the pizza more than the cheeseburger, the cheeseburger more than the pizza, or that the two options are equally

preferred. Formally, the relation can be described in the following way: A ≥ B ∨ B ≥ A (for each x, y). If B ≥ A e A ≥ B, it can be said that indifference prevails. According to the axiom, a rational man would choose his favorite option or in the case of indifference, one of his favorite.

It is important to point out that the RCT does not explain why people prefer one option over another, i.e. why they prefer the pizza over the cheeseburger. It only describes the relation between the variables according to the two axioms.

1.2.2. Utility

One concept widely used in the RCT is utility. The concept of utility simply highlights the fact that when a choice set is provided, people should be able to put in order their preferences so that it would be possible to assign to each of the available options a number. The highest would represent the most favourite option, the lowest - the least favourite one. In the middle would be the other options, still arranged according to their preferences. For example, if a person likes pizza (A) more than cheeseburger (B) and cheeseburger more than a salad (C), than it would be possible to assign the number 3 to the pizza, 2 to the cheeseburger and 1 to the salad so that A>B>C. So an utility function u (·) represents a relation between the order of preference of the different options in a given choice set (Angner 2017, p. 32).

The RCT describes how people should act in conditions of certainty in which risk is not involved. Those are situations in which a choice set with a limited number of options is given. The theory of rationality does not include choices in which risk is involved or probability has to be taken into account (Angner 2017, p.89).

1.3. Theory of Probability

The theory of probability takes into account these kind of situations in which people should make probabilistic reasoning and judgements. Supposing to have a set of outcomes called the sample space S. This sample space can be thought of as the universal set for all possible situations that we are studying. The sample space is comprised of subsets called events E1, E2, . . ., En. We also assume that there is a way of assigning a probability to any event E. The probability of the event E is

denoted as P(E) (Angner 2017, p.90). The theory of probability, as the RCT is based on some axioms.

1.3.1. Axioms in the Theory of Probability

The first two axioms described below are used in conditional probability, i.e. the measure of the probability of an event based on the occurrence of a previous event.

Axiom one. The probability of any event is a non-negative real number. Formally, the axiom can be described in the following way: $0 \leq \Pr(E) \leq 1$. (Angner 2017, p. 91)

Axiom two. If results are equally probable, so that $\{E_{13}, E_2..., E_n\}$, the probability of each event Ei is 1/n. Formally that can be described in the following way: $\Pr(E_i) = 1/n$. (Angner 2017, p.91)

The last four are used when dealing with unconditional probability, i.e. the measure of the probability that an event will end with a specific outcome, independent of the occurrence of any other event (Angner 2017, p.90).

Axiom three. If two events E_1 and E_2 are mutually exclusive, then the probability of E_1 or E_2 is equal to the probability of E_1 plus the probability of E_2 , so that $P(E_1 \vee E_2) = P(E_1) + P(E_2)$. (Angner 2017, p.94)

Axiom four. The probability of the entire sample space is one, so that $P(S) = 1$. (Angner 2017, p.95)

Axiom five. The probability that an event E would not occur is equal to 1 minus the probability that the event occurs, so that: $\Pr(\neg E) = 1 - \Pr(E)$. (Angner 2017, p. 96)

Axiom six. If two events E_1 and E_2 are independent, the probability of the intersection of E_1 and E_2 is equal to the probability of E_1 multiplied by the the probability of E_2, so that: $\Pr(E_1 \& E_2) = \Pr(E_1) \times \Pr(E_2)$ (Angner 2017, p.96).

1.4. Expected Utility Theory

The expected utility theory is another important feature in NE. It dates back to Daniel Bernoulli in the 18th century and was formally developed by John von Neumann and Oskar Morgenstern in their book Theory of Games and Economic

Behavior (von Neumann and Morgenstern, 1944). In their book, the authors defined the expected utility function in connection to lotteries and gambles. A lottery is a list of probabilities, where pi is the probability that outcome "i" occurs.

The theory of expected utility combines the concept of "utility" from the RCT (see Part 1, section 1.2.2.) with the concept of "probability" (see Part 1, section 1.3.) in order to build a model useful to define a rational decision maker in conditions of uncertainty and risk. The starting point for the von Neumann and Morgenstern was the utility function of Bernoulli (see Figure 1) from which they derived four axioms, i.e. completeness, transitivity, independence and continuity. Completeness and transitivity were already described as axioms in the RCT (see Part 1, section 1.2.1.), with the only difference that A, B and C has to be taken as lotteries (L, L', L'').

1.4.1. Axioms of the Expected Utility Theory

Independence. The independence axiom is the most controversial one. It assumes that if two lotteries L and L' are mixed with a third one L'' which is not relevant, the order of preference will be the same as if the two options were presented independently of the third one (Heukelom, 2007). Formally, this relation can be described in the following way: for any probability $p \in [0,1]$ and any Lotteries L, L' and L'', $L \geq L'$ if and only if $pL + (1-p) L'' \geq pL' + (1-p) L''$.

Continuity. The continuity axiom assumes that when there are three lotteries (L, L' and L'') and the individual prefers L to L' and L' to L'', then if there is a possible combination of L and L'' the individual will be indifferent between this mix and the lottery L' (Heukelom, 2007). Formally, this relation can be described in the following way: If $L \geq L' \geq L''$, then there exists a probability $p \in [0,1]$ such that $L' \sim pL + (1-p) L''$.

1.4.2. Expected Utility Function

A rational agent, would choose according to the four axioms. His preference would be represented by an utility function, i.e. one can assign a real number (utility) ui to each outcome i = 1, 2, ..., n such that:

L ≥ L' if and only if U(L) ≥ U(L'), where U([p1,p2,...,pn]) = p1u1 +p2u2 +... +pnun.

This result is called the von Neumann-Morgenstern expected utility theorem. (von Neumann and Morgenstern, 1944).

In the expected utility theory, risk preferences can be represented with an utility function (U) that is concave for risk-averse individuals, convex for risk takers individuals and linear for risk neutral individuals (see Figure 1). As it will be seen later on in the PhD thesis (Part 1, section 2.2.2.) some people often act in ways that are not consistent with the axioms of the theory, and that brought to the formulation of the Prospect Theory by Kahneman and Tversky.
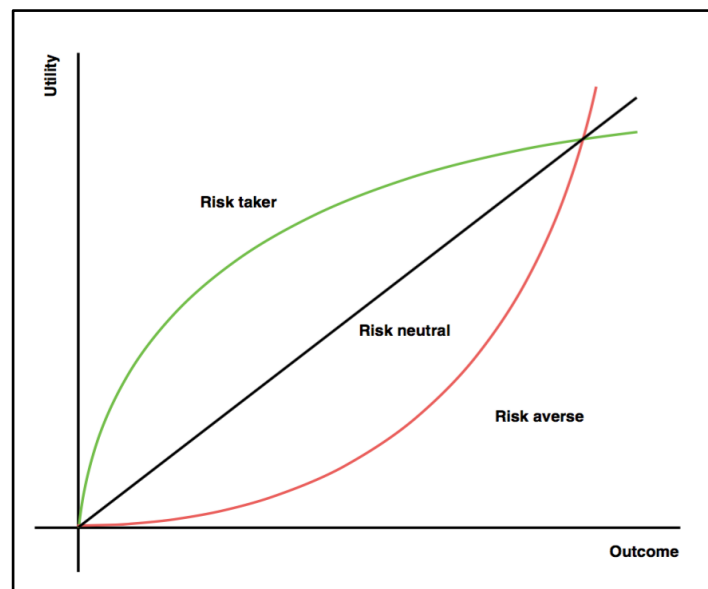
Figure 1. The graph represents the three possible shapes of the utility function.

2. Behavioral Economics: Historical Backdrop and Theoretical Framework

Although NE has achieved a leading position during the second half of the twentieth century, some economists started to think that their discipline would have benefit from a closer ties with psychology. According to Angner and Loewenstein (2007), the term "Behavioral Economics" can be found as early as 1958 (cf. Boulding 1958, p. 21) and criticisms about the neoclassical perspective date back at least since the early 1950's. Researchers like George Katona and Herbert Simon wrote books and made researches stressing on the need to use psychological measures in economy and about the need to adopt the notion of bounded rationality to better understand individuals' decision making. However, the work of these authors did not change the direction of economy. (Camerer, Loewenstein & Rabin 2008, p. 6)

Another important step in the emergence and spread of BE was the formulation of the expected utility and discounted utility models of decision making by the neoclassical economists. These models provided in fact "hard targets" that were easy to test empirically (Camerer, Loewenstein & Rabin 2008, p.6) and gave more solid base for the later development of BE.

What was really influential for the birth of BE were two historical paradigm shifts. On one side the cognitive revolution that started from the 1960's onwards influenced psychology and the human sciences (Mandler, 2002). Cognitive scientists were skeptical about the idea of using a method based on introspection. However, they thought that scientific psychology should take into account what's "in the head of the people" (Angner and Loewenstein, 2007), including their attitudes, beliefs, desires and empirical rules. This paradigm shift had a great impact on both experimental and clinical psychology in the following decades with a long debate between the American and European schools of psychology, with a hegemony of the behavioral perspective since the beginning of the century.

Like cognitive scientists, on the other side, behavioral economists, despite being skeptical about the theories and methods of the early neoclassical period, renewed their interest in the psychological underpinnings of human behaviors and decisions. That led to paradigm shift in the field economy of the same magnitude as the one in psychology that positively influenced the BS.

At this time, after the neoclassical period, economy and psychology reestablished their ties, both renewing their interest in the study of human behavior and in the way economic decisions are taken. All together those processes led to the birth of BE and to the development of policy programs deeply rooted and connected with the studies on human behavior (Prevedini & Carnevali, 2016).

2.1. Defining Behavioral Economics

Several authors attempted to define BE. Camerer and Loewenstein described it as an approach for understanding decision making and behavior that integrates BS with economic principles:

"behavioral economics increases the explanatory power of economics by providing it with more realistic psychological foundations […] At the core of behavioral economics is the conviction that increasing the realism of the psychological underpinnings of economic analysis will improve the field of economics on its own terms - generating theoretical insights, making better predictions of field phenomena, and suggesting better policy"
(Camerer, Loewenstein and Rabin 2004, p. 3).

Richard Thaler, an American economist and Professor of Behavioral Science and Economics at the University of Chicago Booth School of Business gave a similar definition in the *"Yearly Guide for Behavioral Economics"*:

"I view behavioral economics to be economics that is based on realistic assumptions and descriptions of human behavior. It is just economics with more explanatory power because the models are a better fit with the data."
(Thaler, 2016, p. 23)

Although different definitions have been provided, most of the experts in the field agree on a fundamental concept: the aim of BE is to provide a model of human behavior that is descriptively adequate. A theory that describes realistically how people choose, can be extremely powerful to help address dysfunctional behaviors and to help substitute them with functional ones. Therefore, it could be said that (more or less explicitly) the goal of BE is to study how people take decisions with the aim to help them to act consistently with their long term goals or with the goals of the society they belong to.

As described above, according to NE humans would act as rational agents. That means that people are assumed to be completely aware of the costs and benefits associated with all possible actions and they would behave in ways that fully maximize their long-term gain. All behaviors are, in this sense, carefully calculated. Both behavioral and neoclassical economists consider economy as the study of people's decisions and the outcomes of these decisions for society. However, the former assume that humans, in certain conditions, act in ways that are inconsistent with the principles of rationality, i.e. they don't act as they should.

Daniel Kahneman, Psychologist and Nobel Prize winner in economy in 2002, brilliantly sums up these concepts in his book *"Thinking, fast and slow"* (2011).

"Much of the discussion in this book is about biases of intuition. However, the focus on error does not denigrate human intelligence, any more than the attention to diseases in medical texts denies good health. Most of us are healthy most of the time, and most of our judgments and actions are appropriate most of the time. As we navigate our lives, we normally allow ourselves to be guided by impressions and feelings, and the confidence we have in our intuitive beliefs and preferences is usually justified. But not always. We are often confident even when we are wrong, and an objective observer is more likely to detect our errors than we are. "

(Kahneman 2011, p.4)

It is important to underline that behavioral economists don't deny the existence of rationality per se and, therefore, BE shouldn't be seen as an opposition to the NE. They just claim that, although in many situations people behave rationally, deviations from perfect rationality happen often and are systematic and that many irrational behaviors are easily predictable. Therefore, it is possible to develop theories to understand in what circumstances such behaviors take place and how to prevent them, which is the subject of study of BE.

A central role in BE is represented by the concept of "bounded rationality" that is considered one of the psychological foundations and inseparable part of the definition of BE (Samson, 2014). The term was proposed by Herbert Simon to explain why people behave irrationally. According to the author, rationality is bounded because our cognitive system can rely on limited resources (Simon, 1956, 1978). The notion of bounded rationality is the basis of two main research programs developed in the last decades. One was initiated by Kahneman and Tversky (e.g. Kahneman & Tversky, 1973; Tversky and Kahneman,1974; Kahneman, Slovic & Tversky, 1982) and was called Heuristic and Bias (H&B) and another one by Gerd Gigerenzer (e.g., Gigerenzer, G., Todd, P., & ABC Research Group ; Todd and Gigerenzer, 2012) called the Simple Heuristics (SH) (also known as "Fast and Frugal").

2.2. Kahneman and Tversky's Framework of Research

At the end of the 70's Kahneman and Tversky, two Israeli psychologists, developed series of successful studies aimed at understanding how people make decisions. In particular, they focused on the study of decision-making under the condition of uncertainty, bringing to light some of the processes carried out by individuals that were in contrast with some of the above mentioned principles and theories of NE.

The collaboration of Kahneman and Tversky comprised mainly three programs of research (Kahneman, 2003) , i.e. the H&B program (Kahneman and Tversky, 1973; Tversky and Kahneman,1974; Kahneman, Slovic & Tversky, 1982); the

Prospect Theory (Kahneman and Tversky, 1979; Tversky and Kahneman,1992) and the related notion of loss aversion (Kahneman, Knetsch, & Thaler, 1990, 1991; Tversky and Kahneman, 1991); and Framing effects (Tversky and Kahneman, 1981, 1986).
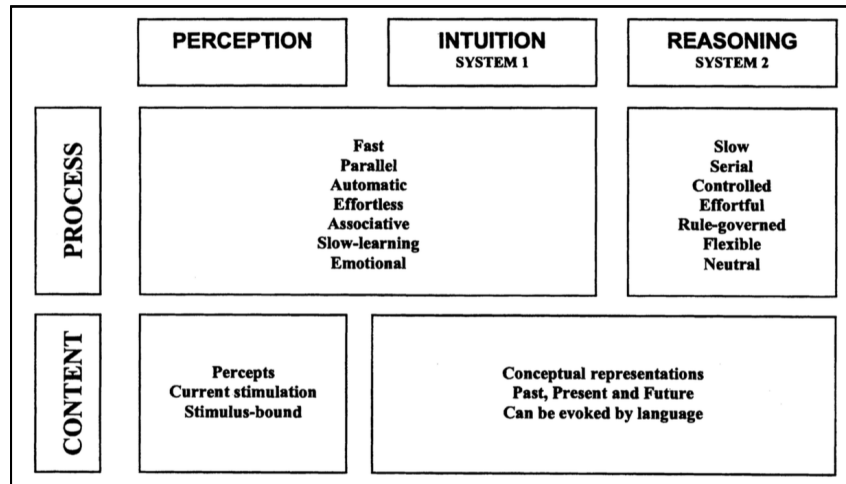
2.2.1. The Heuristics and Bias Program

According to Kahneman (2003) the aim of the H&B research program was to set a map of "human bounded rationality" (Simon, 1956, 1978), describing the most prominent heuristics and systematic biases. The human cognitive system can rely on a limited amount of resources to solve problems. When the amount of information is too high or complex people are "forced" to rely on mental shortcuts and simplified strategies in order to make decisions, i.e. they are "forced" to use heuristics (Tversky & Kahneman, 1974, Kahneman, 2011). Although these strategies work properly in most cases in certain circumstances they can lead to systematic mistakes in evaluation, called biases (Tversky & Kahneman, 1974

In his book "Thinking Fast and Slow" (Kahneman, 2011) Kahneman adopted a dual system model to explain how people make decisions and to distinguish between intuition and reasoning. The author described two systems that metaphorically co-exist in people's brain, borrowing from Keith Stanovich and Richard West (2000), two terms: System 1 and System 2. System 1 has been described as fast, automatic, effortless, associative and difficult to control. It had an important evolutionary function for the human species and it is still active nowadays when it is necessary to make complex choices. System 2, on the contrary, is slower, serial, effortful and deliberately controlled (see Figure 2).

In most of the situations the two systems act in coordination. However, in certain cases the fast and automatic System 1 would get in conflict with the slower and based on reason System 2, leading to the above mentioned bias and, therefore, leading people to make predictable mistakes.

What follows is a description of the three most prominent heuristics and their related bias i.e. representativeness, availability, and anchoring as formulated by Kahneman and Tversky in their H&B stream of studies.

PERCEPTION	INTUITION SYSTEM 1	REASONING SYSTEM 2
PROCESS	Fast Parallel Automatic Effortless Associative Slow-learning Emotional	Slow Serial Controlled Effortful Rule-governed Flexible Neutral
CONTENT	Percepts Current stimulation Stimulus-bound	Conceptual representations Past, Present and Future Can be evoked by language

Figure 2. The scheme shows the dual system model of decision-making (Kahneman, 2003).

2.2.1.1. Anchoring

A very common bias is the so called "anchoring effect" (Tversky & Kahneman, 1974). In order to make estimations on a quantitative dimension people often tend to anchor themselves to a reference point and to adjust it on the basis of further information recalled from their memory or received by external sources. This strategy is extremely useful and effective in many situations. For example, in order to estimate the time needed to get from our city to an unknown one, it can be useful to use as a reference point our distance to a city that we know. In this way it is possible to try to estimate the distance to our unknown destination. However, this strategy can lead to distortions and the adjustment process may be insufficient. People's final judgments, indeed tend to be often biased towards the initial anchor. This bias was illustrated by Kahneman in his book "Thinking, fast and slow" (Kahneman 2011, p. 119) Students were asked to take a number from a tricked roulette so that a group of students took a low number (low anchor) and another one a high number (high anchor). Following the students were asked to

estimate the number of African countries participating in the United Nations. The experiment showed how the students' answers were influenced by the numbers they got from the roulette, so that the students who took the lower number provided a lower estimation compared to the ones who took the higher number. The example did not just show the existence of this bias, but also that completely irrelevant numerical anchors can have a significant impact on people's decisions.

2.2.1.2. Representativeness

Another source of bias described by Kahneman and Tversky is the so called "representativeness heuristics" (Kahneman & Tversky, 1982). Very often, assessing the likelihood that an element A belongs to a category B, people make their choices based on the similarity between A and their idealistic image of B, in other words, on how much A is representative of B. This strategy sometimes is successful and yet very often leads to mistakes and decisions based on stereotypes instead of probabilistic assumptions.

Representativeness has been brilliantly showed in the "Linda" experiment (Kahneman & Tversky, 1982; Tversky and Kahneman, 1983) in which the researchers provided the experimental subjects with the description of a fictitious character called Linda. The description was the following:

"Linda is thirty-one years old, single, outspoken, and very bright. She majored in philosophy. As a student, she was deeply concerned with issues of discrimination and social justice, and also participated in antinuclear demonstrations."

Following, the experimental subjects were asked to estimate the likelihood that Linda would belong to the two categories listed below:

1) *Lisa is a bank teller*
2) *Lisa is a bank teller and is active in the feminist movement.*

About 85% to 90% of the experimental subjects opted for the second option violating the conjunction rule, which says that the conjunction of two events

cannot be more probable than any of the two events alone (bank teller): $P(A \& B)$ $\leq P(B)$ (Kahneman, 2011).

The mistake, was reasonable due to the fact that the description of Linda was more representative of the conjunction of the the 2 options (option 2) than of just one of them (option 1). This phenomenon is commonly known as the conjunction fallacy (Tversky & Kahneman, 1983).

2.2.1.3. Availability

Another shortcut that is often misleading is the "heuristics of availability" (Tversky & Kahneman, 1973). Individuals tend to assess the probability of an event frequency based on the ease with which they recall examples relevant to it. Thus, often overestimating the possibility of that event to happen and underestimating another actually more frequent one.

For example, in one of their studies Kahneman and Tversky found that the frequency of words that started with "k in the English dictionary was erroneously judged to be higher than the frequency of words with a 'k' as the third letter. (Tversky & Kahneman, 1973). The authors claimed that this happened because retrieving words by their first letter is easier than by their third one.

This process is closely related to concepts of accessibility and salience (Thaler & Sunstein, 2009, p. 25). For example, people often tend to overestimate the incidence of events causing vivid and emotional deaths, such as hurricanes or earthquakes, while underestimating the likelihood of occurrence of less vivid but statistically significant events such as deaths caused by asthma attacks. Similarly, most recent events tend to have a greater impact on people's behavior and choices than older events (e.g. Burns, Peters & Slovic, 2011; Slovic, 1987; ; see also Thaler & Sunstein, 2009).

2.2.2. Prospect Theory

The Prospect theory, is a behavioral model that shows how people take decisions in circumstances that involve risk and uncertainty, i.e. in which there is a certain probability to gain or lose something. Prospect theory was claimed to be

explicitly a descriptive theory of choice. That represented a novelty at the time, in contrast to a long history of models of rational choice that served double duty as normative logics and as idealised descriptive models. Kahneman and Tversky's formulation (Kahneman & Tversky, 1979) assumed that people would think in terms of expected utility in relation to a reference point rather than in terms of absolute outcomes.

Setting up several choice risk experiments involving problems presented in different frames, the authors developed the "value function" and the "concept of loss aversion". Usually people dislike losses more than an equivalent gain and for this reason they are more willing to take risks to avoid a loss than to gain something. Moreover, people's willingness to take risks is influenced by the way in which choices are framed. (Kahneman & Tversky, 1979; Kahneman, 2003; Kahneman, 2011).

According to NE, the utility of decision outcomes is assumed to be determined entirely by the final state of endowment and therefore, it is reference-independent. In 1738 Daniel Bernoulli described this concept in his essay, proposing the so called "theory of expected utility" (Stearns, 2000). Bernoulli's assumption was that states of wealth have a specified utility and while taking choices under risk, people maximise the expected utility of wealth.

The assumption that decision makers evaluate outcomes by the utility of final asset positions has been retained in economic analyses for almost 300 years. Kahneman and Tversky developed different experiments to empirically test the assumption, showing repeatedly the inadequacy of the utility function in explaining choice. The authors, calling it Bernoulli's error, described it as a clear example of theory-induced blindness. That means that once a theory has been accepted and repeatedly used as a reliable model noticing its flaws gets extremely difficult (Kahneman, 2003). Let's take a look at the following problems:

Problem 1: In addition to whatever you own, you have been given $1,000.
You are now asked to choose one of these options:

    A)   *50% chance to win $1,000 or*

    B)   *get $500 for sure*

Problem 2: In addition to whatever you own, you have been given $2,000.
You are now asked to choose one of these options:

    C) 50% chance to lose $1,000 or

    D) lose $500 for sure

Although the problems are equivalent in terms of final states of wealth, they are framed in a different way. As a result, while in the first one a greater proportion of people would chose the riskless option B), in the second one people would be more likely to choose the riskier one C). In other words, people's responses to the problem are different if it is framed as a gain (1) or as a loss (2) (Kahneman 2011, p. 280).

In Bernoulli's theory a reference point was not taken into account. In their formulation Kahneman and Tversky proposed an alternative theory of risk, in which the carriers of utility are gaining and losing changes of wealth rather than states of wealth (Kahneman, 2003).

Prospect Theory predictions have been represented by Kahneman and Tversky in the value function (see Figure 3) that is defined by gains and losses and is characterised by three features:

1) it is concave in the domain of gains, favoring risk aversion;

2) it is convex in the domain of losses, favoring risk seeking;

3) it is sharply kinked at the reference point, and loss-averse-steeper for losses than for gains by a factor of about 2-2.5 (Kahneman, Knetsch, & Thaler, 1991; Tversky and Kahneman, 1992; Kahneman, 2003; Kahneman, 2011).

The Prospect Theory and its publication on the prestigious economic journal Econometrica of the seminal paper "Prospect theory: An analysis of decisions under risk" (1979) has been a milestone in the development of BE. It is thanks to and starting with this paper (that is currently the most cited in the history of the journal) that the discipline began to spread widely all over the world with a huge impact on the field of study of decision making and with a positive influence on policy makers.
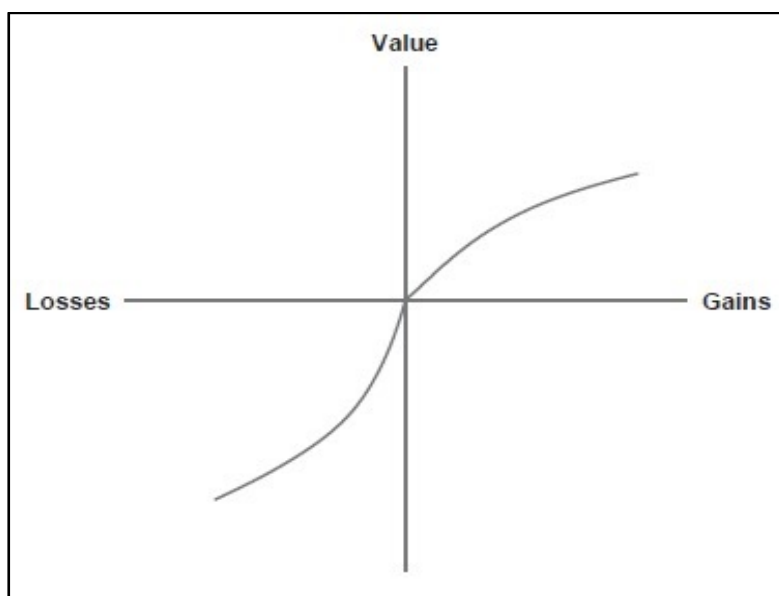
Figure 3. The graph (Kahneman, 2002) shows the value function described by Kahneman and Tversky in the Prospect Theory.

2.2.3. Framing Effect

The last stream of studies of Kahneman and Tversky focused on the so called "framing effect" (Tversky and Kahneman, 1981, 1986). According to the principle of invariance, an essential aspect of rationality, preferences should not be affected by variations of irrelevant options or outcomes (Tversky & Kahneman, 1986). Kahneman and Tversky showed how the principle is systematically violated in certain circumstances and how people's decisions are affected by the frame in which a problem is formulated. It was tested empirically, using "ad-hoc problems", like the one of the Asian disease (Tversky &

Kahneman, 1981). People were randomly assigned two versions of the same problem that was the following:

"Imagine that the United States is preparing for the outbreak of an unusual Asian disease, which is expected to kill 600 people. Two alternative programs to combat the disease have been proposed. Assume that the exact scientific estimates of the consequences of the programs are as follows"

In the first version of the problem, the possible options were the following:

1) *If Program A is adopted, 200 people will be saved*

2) *If Program B is adopted, there is a ⅓ probability that 600 people will be saved and a ⅔ probability that no people will be saved*

Which of the two programs would you favor?

In this version of the problem, most of the respondents preferred the program A. The same story was proposed to other people, framing the possible options in a different way:

1) *If Program A' is adopted, 400 people will die*

2) *If Program B' is adopted, there is a one-third probability that nobody will die and a two-thirds probability that 600 people will die*

Which of the two programs would you favor?

In this version of the story, conversely to the first one, the majority of people's preference was for the program B', the risk-seeking option. In other words, people preferred the option A over the option B and the option B' over the option A'. From the perspective of a rational model of decision-making, this clearly does not make sense, considering that there is no substantial difference between the two versions. (Kahneman & Tversky, 1981, Kahneman, 2003). The authors interpret this outcome claiming that for the respondents of the first version of the problem, the certainty of saving people was disproportionately more attractive.

Conversely, the certainty of deaths in the second version was disproportionately more aversive.

In another famous experiment, McNeill, Pauker, Sox and Tversky (1982), showed that people's choice between surgery and radiation therapy was changing by describing outcome statistics in terms of survival rates or mortality rates. When the rate was proposed in a frame of survival, i.e. 90% short-term survival, the chance that patients choose the surgery option was substantially higher than when a mortality frame was used, i.e 10% immediate mortality.

2.3. Gigerenzer's Framework of Research

The conceptual framework of Kahneman and Tversky has been certainly the most prominent in the field of BE. As extensively described, the H&B program interprets bounded rationality in terms of a wide range of systematic biases treated by Kahneman and Tversky as deviations from normative behaviors. Implicitly the H&B program, accepted thus the neoclassical model of rationality as the normative standard of rational behavior. However, some authors criticised some of the assumptions of Kahneman and Tversky providing alternative explanations in the domain of decision-making. Among these, the Simple Heuristics research program (SH) (e.g., Gigerenzer, Todd & ABC Research Group, 1999; Gigerenzer, Hertwig & Pachur, 2011) proposed by the German psychologist Gerd Gigerenzer that will be here briefly described in its core concepts.

The author developed his stream of studies inspired by Herbert Simon's emphasis on environmental structures and the interplay between cognition and environment. (e.g. Goldstein and Gigerenzer, 2002; see also Gigerenzer, 2015). Simon, indeed provided an ecological view of human behavior in order to explain people decisions: "the human rational behavior is shaped by a scissors whose two blades are the structure of task environments and the computational capabilities of the actor."(Simon, 1990, p. 7). According to Simon's standpoint,

internal factors are not sufficient to explain behaviors because they don't take into account the influence of the context in which they take place.

Comparing the H&B and the SH programs it can be said that they share a common objective, that is to build on Simon's notion of bounded rationality (Grüne-Yanoff & Hertwig, 2015). However, the two programs diverge in several points. According to Gigerenzer there are three main differences between the SH and the H&B programs (Gigerenzer, Hertwig & Pachur 2011, p.8):

First, in the H&B program heuristics have been used as common-sense labels typically not been developed into computational models (Gilovich, Griffin & Kahneman, 2002), The SH program on the contrary, proposed a computational model of heuristics.

Second, the H&B provided a definition of rationality that was not based on Simon's scissors metaphor. The structure of the environment in shaping people's behavior has not been taken into account in the H&B. The SH, on the contrary, provided an ecological perspective of rationality, by taking into account the structure of the specific environment in shaping people's decisions (Todd, Gigerenzer & the ABC Research Group, 2012). Humans are seen as ecologically rational. That means that their way to make decisions evolved according to the constraints of the environment and the whole of the organism.

Third, the H&B program rests on the assumption of a general accuracy–effort trade-off. That means that people cannot put less effort in a task and increase its accuracy. The SH, instead provides evidence of some violations of the information-accuracy tradeoff (e.g. Gigerenzer, Todd & ABC Research Group, 1999) as will be described in the next sections.

2.3.1. Simple Heuristics Program

According to Gigerenzer, the aim of SH is to explore the cognitive mechanisms that a boundedly rational decision maker, with limited computational capacity, employs in order to take decisions that are "good enough" (e.g. Goldstein & Gigerenzer, 2002). More precisely, Gigerenzer described three main goals of the

SH developed in different streams of studies, i.e. to explore and describe the "adaptive toolbox" that provides knowledge about people's decisions; to provide an extensive description of the notion of "ecological rationality"; and design intuitive strategies that help people make better decisions (Gigerenzer, Hertwig & Pachur 2011, pp.6-7).

A description of the first two goals follows and the last one is discussed in Part 2 of the PhD thesis when talking about what has been proposed by some authors as "boosting" (see Part 2, section 4).

2.3.1.1. The Adaptive Toolbox

This program is descriptive in its nature and aims to describe how actual humans make decisions, considering their bounded rationality, and to map the heuristics on which individuals rely in order to develop a box of cognitive tools. Following the view of Evolution, the ultimate goal of all species is reproduction. The adaptive toolbox helps them to face different situations and to pursue their goals by making decisions that are as quick and accurate as possible. Its function is not to guarantee consistency in decisions but to provide tools that are useful to achieve proximal goals, such as finding a mate or escaping dangers.

The heuristics described in the toolbox are domain specific and are made up of building blocks that are more general and can be part of different heuristics. These building blocks are defined as Search Rules, Stopping Rules and Decision Rules (Gigerenzer & Selten 2002, p. 43).

Search Rules. Search rules building blocks include random search, ordered search and search by imitation and refer to two fundamental exploration dimensions: search for alternatives within a choice set and search for cues by evaluating the available alternatives (Gigerenzer & Selten 2002, p. 43-44).

Stopping Rules. At some point it is necessary to stop and search for alternatives or cues in order to decide what to do next. However, stopping rules don't work weighing all the costs and benefits of certain decisions but rather they follow simple criteria that are easy to confirm (Gigerenzer & Selten 2002, p. 44-45).

Decision Rules. Once the search has been stopped a decision or inference must be made. Traditionally theories of decision-making stress on the notion of a general accuracy-effort trade-off. When people deal with situations in which they need to take a decision, more accuracy can be gained just by putting more effort. However, not always there is a trade-off between simplicity and accuracy and in some circumstances, less information and less computations could lead to more accurate predictions (Gigerenzer & Selten 2002, p. 45).

2.3.1.2. Ecological Rationality

The stream of studies on ecological rationality is normative in its nature and it is focused on the analysis of the structure of the environment and the conditions under which heuristics are likely to succeed or fail (Goldstein and Gigerenzer, 2002). According to Goldstein and Gigerenzer (2002) when the heuristics match with specific contexts can be an effective tool for the individuals and the degree of this matching determines the accuracy of the heuristics. An advantage in the use of simple heuristics, compared with more complex model of reasoning is their robustness and generalisability to other contexts and to new problems. Moreover, simple heuristics work particularly well in environments characterised by uncertainty and unpredictability (Gigerenzer, Todd & ABC Research Group, 1999, pp.18-20). In other words, the parameter to define a strategy as ecologically rational is the degree on which it is adapted to the information in a physical or social environment. Two of the most known (and adaptive) heuristics described in the SH are recognition heuristic and gaze heuristic.

2.3.1.2.1. Recognition Heuristic

Among the heuristics proposed in the the SH program, Goldstein and Gigerenzer (2002) described what they called recognition heuristic:

"The recognition heuristic exploits the basic psychological capacity for recognition in order to make inferences about unknown quantities in the world"
(Goldstein & Gigerenzer, 2002).

Goldstein and Gigerenzer showed how this kind of mental shortcut can lead to positive outcomes. The authors, tested this assumption by asking to US and German students to estimate the population of both American and German cities. The students were provided with the names of a pair of cities and asked to choose which one has more citizens. Interestingly, it was found that US students were scoring better than German ones asked to estimate German cities. In a similar way, German students scored better than US ones when they had to make estimates of the American cities. This kind of results are present also in other kind of heuristics and have been defined as "less is more effect". It shows how in certain circumstances people violate the "accuracy-effort trade-off" performing better when they have less information (Goldstein and Gigerenzer, 2002; see also Samson, 2016).

2.3.1.2.2. Gaze Heuristic

Another heuristic described by Gigerenzer, is the so called "Gaze Heuristic". The heuristic describes how in some circumstances just by eye gaze, it is possible to predict the outcome and take fast and effective decisions. This concept has been clarified by the author in his book "Risk Savvy" (2015) by describing as an example a real event that in 2016 inspired the movie "Sully":

On January 2009, three minutes after the take off from La Guardia airport in New York City, a flock of geese flew into both engines of a US Airways Flight 1549 with 150 passengers on board, shutting the engine down. After running all the emergency procedures related to the engine issue, the captain Chesley Sullenberger and the copilot Jeffrey Skiles had to take an immediate and crucial decision to try going back to La Guardia airport or to try landing in the Hudson River. Processing all the relevant information in that moment such as speed, wind and altitude would have probably meant to crash. Instead, Sullenberger and Skiles simply used a rule of thumb: Fix your gaze on the tower. If the tower rises in your windshield, you won't make it.

In 2009, During the popular talk show of Charlie Rose, Skiles stated:

"It's not so much a mathematical calculation as a visual one, in that when you are flying in an airplane, things that…….a point that you cannot reach will actually rise in your windshield. A point that you are going to overfly will descend in your windshield."

This rule of thumb brought Sullenberger to take the decision to land on the river. All the passengers plus the captain and the copilot survived the accident. In this case what made the "Hudson Miracle" possible was the combination of teamwork, the use of checklist, and the above mentioned rule of thumb (Gigerenzer 2015, pp. 24-25).

2.4. Simple Heuristics and Heuristics and Bias programs: Practical Implications

Gigerenzer's heavy criticisms of the H&B work led to a sharp debate with Kahneman and Tversky (e.g. Gigerenzer 1991, 1996; Kahneman & Tversky, 1996). While the first repeatedly claimed the inconsistency of some assumptions of Kahneman and Tversky's work (Gigerenzer, 1991, 1996), the second rejected Gigerenzer's criticisms by arguing their mismatch with the assumptions of their work (Kahneman & Tversky, 1996).

As stated by Kahneman:

"Gigerenzer's critique employs a highly unusual strategy. First, it attributes to us assumptions that we never made (e.g., that judgmental heuristics are independent of content and context or that judgments of probability and of frequency yield identical results). Then it attempts to refute our alleged position by data that either replicate our prior work (extensional cues reducing conjunction errors) or confirm our theoretical expectations (discrepancy between individual and global measures of overconfidence). These findings are presented as devastating arguments against a position that, of course, we did not hold. Evidence that contradicts Gigerenzer's conclusion (base-rate neglect with explicit random sampling; conjunction errors in frequency judgments) is not acknowledged and discussed, as is customary; it is simply ignored. Although some polemic license is expected, there is a striking mismatch between the rhetoric and the record in this case."

(Kahneman, 1996).

An in depth analysis of the debate between the authors is beyond the purpose of this PhD thesis. However, the work of Kahneman and Tversky (mainstream BE) on one side, and that of Gigerenzer on the other, not necessarily have to be seen as in opposition. Actually their explanations could be complementary, both adding to the better comprehension of the reasons why different decision making processes occur in different situations.

In the second part of the PhD thesis are illustrated the practical implications of both the H&B and SH programs by describing two of the most flourishing policy programs that emerged in the last decades, i.e. Nudge and Boosting.

Part 2

Behavioral Change Policy Programs

Introduction

As described in the first part of the PhD thesis, in some occasions people act in contradiction with the principles of rationality. For example sometimes people choose an option A over an option B even though the second option would be more beneficial for them. The task of policymakers is to help people take decisions and make choices that are in line with their goals and wellbeing.

In the last 20 years BS deeply influenced the design and implementation of public policies (see Jones, Pykett & Whitehead, 2013; Lunn 2014; Shafir 2013). Disciplines such as psychology, BE, sociology and various branches of the neurosciences, provided policymakers with useful tools to understand better human behaviour beyond the concept of rationality. Within this context, in the last decades, the notion of "Behavioral Change" (BC) (a term used to describe strategies to influence people's behaviors) has been increasingly used in the realm of public policies. The study of human decision-making and the impact of social contexts, emotions and other relevant factors on it, became crucial in developing public policies. Several governments created centrally directed units with the goal to set contexts that promote virtuous and prosocial behaviors (Whitehead et al., 2014).

Spreading of Behavioral Change Policies. In their report, Whitehead and colleagues (2014) published data about the overall spread of BC policies in the world. Figure 4 shows 135 countries where BC policies have been developed at least in some parts of their territories. Among these, 51 developed nudge-type centrally directed policies (see Figure 5). Moreover, in many countries were centrally directed policies are absent, nudge-type policies are still adopted though used in a "more ad hoc" way (see Figure 6).

Figure 4. On the world map are shown in red the 135 countries in which BC policies have been implemented
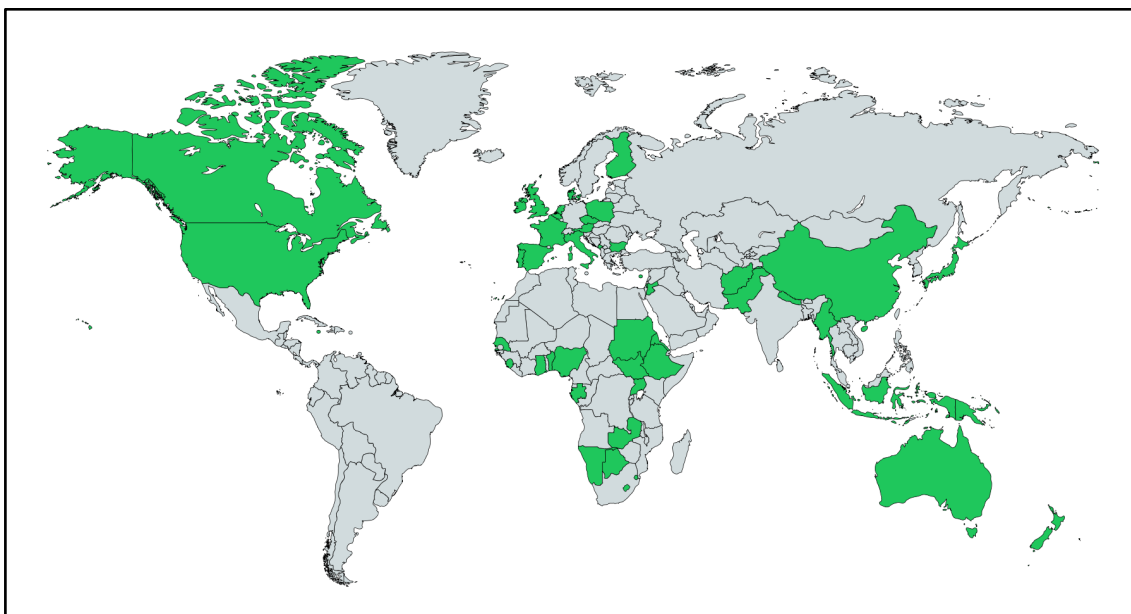
Figure 5. On the world map are shown in green the 51 countries in which have been developed nudge-type centrally directed policies.
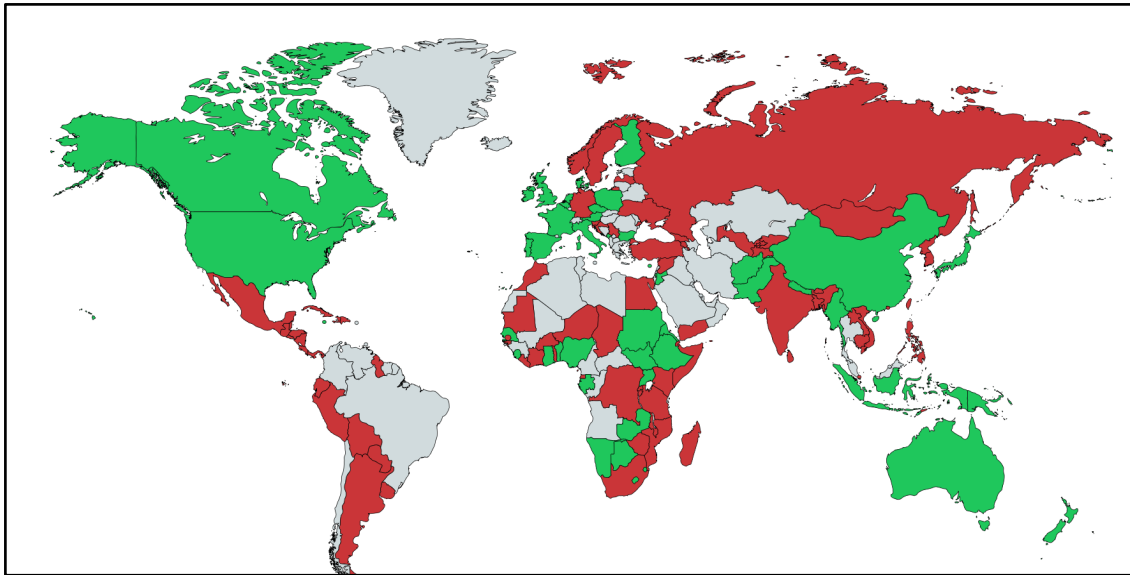
Figure 6. On the world map are shown in green the countries in which have been developed nudge-type centrally directed policies. In red are shown the countries in which nudge-type policies are adopted, even though not centrally directed.

Behavioral Change Tools*. According to Ly, Mazar, Zhao and Soman (2013) there are various tools available for policy makers in order to promote desirable BCs:

Regulation and Restrictions. It is possible to ban certain options, especially when certain behaviors are harmful and expose people to high risks. However, a backfire of this banning strategy is often the lack of compliance and it may lead to resistance among the population and to side behaviors that are not easy to control.

Incentives. Another tool to promote BC is the use of incentives that can be negative or positive (that can be monetary and non monetary). The first include those tools that are assumed to discourage certain behaviors, such as fines or taxes. The second include for example grants and subsidies, but also symbolic rewards and aim to increase the probability of certain behaviors.

Information and Education. Rising awareness among people and educating them is assumed to be useful to help people act in rational ways or to help them make informed decisions. However, educating people and providing them with information about risks and benefits of certain behaviors in many occasion may

not be sufficient. During the years, traditionally, governments have developed huge campaigns to promote desirable behaviors, like doing physical activity, or to reduce behaviours that are harmful, like smoking. However, often those produced little or no results. That does not mean that education or information should not be provided or used as a tool. However often people act automatically and are influenced by contextual factors that cannot be overcome by using just information. These strategies should be seen as complementary to other tools.

Nudges and "Nudge-type" Strategies. Instead of restricting people's behaviors, providing them with a lot of information or changing their economic incentives, nudges aim to influence people's behavior by working on physical or verbal stimuli in the environment in which they move and live. This is a relatively recent strategy in BC that have spread greatly in the last few years.

Part 2: an overview. In this part of the PhD thesis is traced first the main historical and theoretical frame of Nudge. Next is provided, an overview of the main and emerging alternative approach to Nudge defined by some authors as Boosting (e.g. Grüne-Yanoff & Hertwig, 2015; Hertwig & Ryall, 2016). It was based on the theoretical framework of the SH program (see Part 1, section 2.4.1.), (Gigerenzer, Todd & ABC Research Group 1999; Gigerenzer & Selten, 2002; Goldstein & Gigerenzer, 2002; Gigerenzer, 2015). This part, together with the principles described in Part 1 is necessary to introduce the third part of the thesis, in which are described the research projects carried out by the author of the thesis.

3. Nudge: Historical Backdrop and Theoretical Framework

BE started as an academic attempt to assess and describe irrational choices. Authors like Kahneman and Tversky aimed to challenge some of the notions postulated by the NE. From the notion of bounded rationality different research programs were developed (see Part 1, section 2.2.) . The most well known was defined as H&B program (Kahneman, 2003) and its aim was to set a map of human decision making taking into account the main systematically committed mistakes in the process of making choices.

In recent years BE moved from the academic realm to the one of public policy. The stream of work promoted by an American economist Richard Thaler and an American legal scholar, Cass Sunstein was particularly flourishing. Since the publication of their book *"Nudge: Improving Decisions about Health, Wealth, and Happiness"* (Thaler & Sunstein, 2008), Nudge gained critical and widespread visibility.

Searching on the Pubmed database the number of publications that include in their titles or abstracts the terms "nudge" or "nudging" are 388 since the formulation of the Prospect theory by Kahneman and Tversky (see Figure 7). Among them 330 (85%) have been published since 2008, i.e. the year of the publication of Thaler and Sunstein's book (Thaler & Sunstein, 2008). Moreover, by taking into account just the number of papers published since Thaler and Sunstein's seminal work, it is possible to observe an exponential increase. Between 2008 and 2012, 81 papers were published, while 249 has been published between 2013 and 2017[3].

The spread of Thaler and Sunstein's work gathered so much interest in the public domain that the President Barack Obama decided to appoint Sunstein as administrator of the Office of Information and Regulatory Affairs (Grunwald, 2009). In this way the theoretical framework of BE became crucial to the

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[3] Data are updated on 3 September 2017

understanding of how to set environments that promote sustainable and positive BCs.
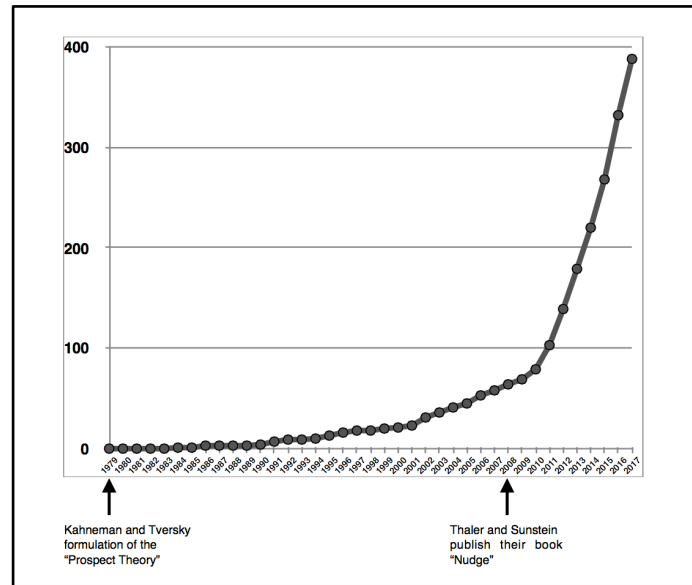
Figure 7. The figure represents the cumulative number of publications found on the database of Pubmed using as keywords "nudge" or "nudging".

To date, interest in Nudge has been supported by a large number of interventions all over the world that shows their effectiveness in a broad range of domains from social policies to environmental protection (e.g. Thaler & Benartzi, 2004; Reinhart, Marshall, Feeley, & Tutzauer, 2007; Ayer, Raseman & Shih, 2009; Duflo, Esther, Kremer & Robinson, 2011; Behavioral Insights Team, 2010, 2011; Gallagher & Updegraff, 2012) showing the multifaceted nature of Nudge.

Econs and Humans. Nudge can be conceptualised as an approach that is applicable to the domain of public policies and is deeply rooted in the theoretical frame of BE and more precisely in Kahneman and Tversky's theorisation. To introduce the concept of Nudge, it is useful to start with the distinction made by Thaler and Sunstein (2008) between Econs (or homo oeconomicus), hypothetical beings able to behave always rationally, and Humans (or homo sapiens), i.e. the

people that really populate our planet and are more influenced by contextual factors:[4]

"If you look at economics textbooks, you will learn that homo economicus can think like Albert Einstein, store as much memory as IBM's Big Blue, and exercise the willpower of Mahatma Gandhi. Really. But the folks that we know are not like that. Real people have trouble with long division if they don't have a calculator, sometimes forget their spouse's birthday, and have a hangover on New Year's Day. They are not homo economicus; they are homo sapiens."

(Thaler & Sunstein, pp. 6-7)

Let's take as an example one of the most important issues of public health in modern society i.e. unhealthy eating habits and obesity. According to the World Health Organization the incidence of obesity globally has doubled since 1980. In 2008, 35% of the world's adult population was overweight (BMI $\geq$ 25 kg / m2) 11% of which were obese (BMI $\geq$ 30 kg / m2), (World Health Organization, 2014). Although it is perfectly clear and scientifically proven that obesity increases the risk of serious illness and premature death (World Health Organization Regional Office for Europe, 2014) many people engage in eating habits that are harmful to their health. For example many people eat regularly fast food thinking about the immediate pleasure, allured by the little effort in terms of time and cost. That gives the impression that people are mindless or underestimate the consequences of their own behavior (Thaler & Sunstein, 2008). Several other examples can be listed: smoking, taking drugs, doing little or no physical activity, wasting food, etc.

In all the listed situations, Econs would act in a completely different way. Knowing the effects of overeating, smoking or taking drugs they would compare the benefits of behaviors that provide immediate pleasure, with the probability to develop severe diseases or to die prematurely. Consequently, they would choose

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[4] This distinction is not new, it is present since the emerging of Behavioral Economics. Many other terms and concepts adopted by Thaler and Sunstein (e.g. System 1 and System 2) are borrowed from the work of Kahneman and Tversky.

to follow a healthy diet and to spend their life without smoking or taking drugs. In other words, they would act according to the principles of rationality (see Part 1, section 1.2.).

According to the theorisation of Kahneman and Tversky (e.g. Kahneman and Tversky, 1979; Kahneman, 2003; Kahneman, 2011) Humans use simplified strategies for reasoning called heuristics, that lead them to make systematic mistakes called bias (see Part 1, section 2.2.1.). The term "systematic" here plays a crucial role, as Dan Ariely described in one of his books people are predictably irrational (Ariely, 2009). That means that it is possible to observe in what conditions certain biased choices are recurrent and then to develop strategies that promote positive BCs.

3.1. Defining Nudge

As stated by Thaler and Sunstein a nudge 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 & Sunstein, 2008 p. 6). Looking at the author's' definition a few core concepts could be determined and clarified:

First, a nudge is an intervention that acts upon the context in which people live (any aspect of the choice architecture); second, the main goal of a nudge is to influence people's behaviors (altering people's behavior); third, biased choices are systematic, and provide the opportunity to set interventions that have predictable outcomes (in a predictable way); and finally, a Nudge intervention does not use coercion, punishments or significant economic incentives[5] (without forbidding any options or significantly changing their economic incentives). Each of these points is detailed in the following sections.

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[5] Talking about economic incentive may be unclear and misleadingly focusing the attention just on monetary incentives. However, Thaler and Sunstein clarify this notion by warning the readers to consider as incentives also cognitive (rather than material) costs necessary to make a choice. In this perspective, both material and cognitive costs should be kept low (Thaler and Sunstein 2008, p. 8)
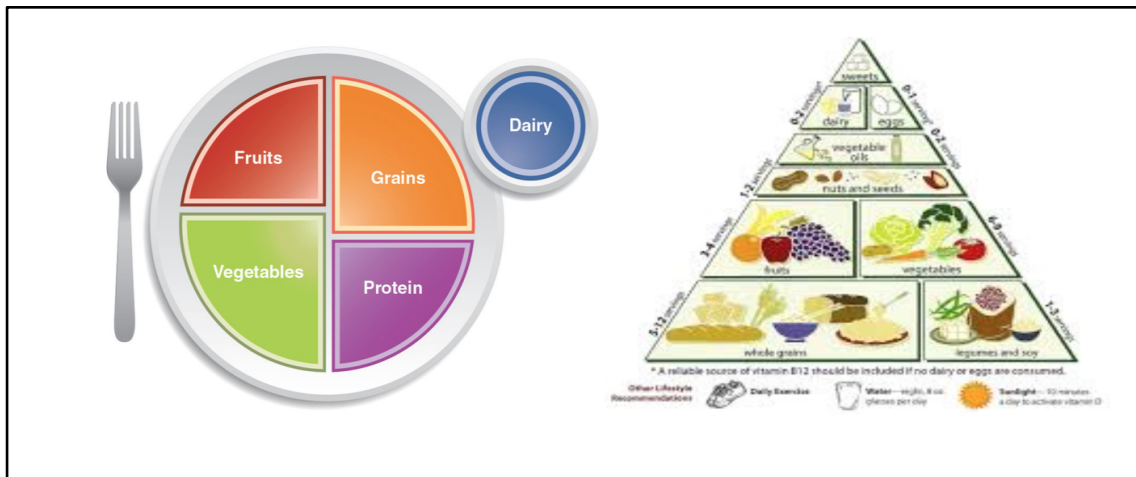
3.1.1. Choice Architecture

In their book, Thaler and Sunstein coined the term "choice architecture" to underline the deep influence that environment can have on people's choices. The authors underline this concept with a brilliant metaphor. As well as an architect in planning a building can facilitate certain behaviors, policy makers can work on the environment in which people move in order to promote behaviors that are in line with the goal of the citizens and their collectivity (Thaler and Sunstein, 2008, p. 3). This goal can be achieved acting upon physical or verbal stimuli, changing for example the way in which options are presented to people or verbally prompting to them certain choices.

To further clarify the concept, let's take the example of an initiative called "choose my plate". In order to educate people to follow a balanced diet, US government used for long time the traditional figure of a food pyramid in which the different amounts of the needed nutrients were illustrated within a pyramid in descending order. This image is certainly scientifically correct, but very little intuitive.

Under Obama's administration the pyramid was replaced by a new image, a plate on which there were represented the daily proportions of the different nutrients: fruits, vegetables, cereals and proteins are clearly indicated (see Figure 8).

The information became clearer, simpler to use and easier to retrieve by the memory when choosing or consuming food without using coercion (Moderato, 2014).

Figure 8. In the figure above are shown "MyPlate" and the "Food Pyramid" respectively from left to right.

Choice architecture would be most effective as a team work between researchers and policy makers. The former should test the effectiveness of the different tools and behavioral procedures to change people's irrational behaviors. The latter should work to spread the knowledge, applying evidence based interventions on a large scale.

3.1.2. Choice Architecture: a Tool Kit

During the years, researchers tested several effective strategies (nudges) useful to promote positive BCs, by observing people's interactions with their environment and the circumstances in which an intervention may be useful. These strategies may be more or less generalisable among contexts and require specific competences in order to be adequate to change the targeted behaviors. Thaler, Sunstein and the stream of researchers who supported their approach tried to describe some of the most effective strategies to influence people's behaviors. Two fundamental ways to address biases are defined as de-biasing and counter-biasing (e.g. Brest, 2013; Milkman, Rogers & Bazerman, 2009). The former aims to develop strategies to activate System 2 (rationality and analytical processing). The latter works directly on System 1, using bias against other biases.

A breaf description of some of the most known and commonly used nudges follows. Most of these strategies have been more or less explicitly proposed by

Sunstein or described in the literature (e.g. Sunstein, 2014a; Sunstein, 2014b) and can be included in one of the two above mentioned kind of strategies. However, it is important to underline that this categorisation has to be taken as purely exemplifying and not as a fully comprehensive toolbox.

Default Rules. As stated in the introduction to Part 1 of the PhD thesis even not choosing can be considered a choice with relevant implications for public policy. Setting a default rule means to set an option that will be considered as the people's choice, unless they decide to opt-out. This strategy has been found to be very effective. People, indeed, tend to don't choose when that is possible. Within the field of Marketing the use of default rules to sell products is widely applied. For example, the subscription to a magazine may initially be offered for free or for very little money. After a limited period of time, if the person does not actively decide to unsubscribe, the offer gets automatically renewed at full price. The same principle has been used to promote prosocial behavior, more or less intentionally (e.g. Thaler & Benartzi, 2004; Johnson & Goldstein, 2004; Pichert & Katsikopoulos, 2008). According to the principle of Nudge, the default rule should be the one that is in line with individuals' goals and values and opting out should be very easy, ideally by just a mouse click (Sunstein, 2014b).

A famous study in the literature of Nudge is the one conducted by Johnson and Goldstein (2004) who showed for example how the default rule that regulates organ donations in different EU nations greatly shaped people's choice of being or not donors (see also Part 3, section 8.1.).

However, it is not always easy to define which option is the favorite one of people. In such cases Sunstein suggested the adoption of an active choice (Sunstein, 2014b). Instead of being considered automatically in or out, people would be requested to choose the option they prefer in order to be able to complete a certain action.

Simplification. While facing complex information, reducing (physically or conceptually) the number of options available may increase the likelihood of a

choice being made (Sunstein, 2014c). Simplification is characterised by reducing the costs needed to choose in terms of cognitive resources, time or energy.

In his book Barry Schwartz described what he defined as "the paradox of choice" (Schwartz, 2016). The author claimed that in many domains maximising the amount of available options has been pursued as a goal in order to increase people's freedom to satisfy their desires. According to this vision, in the last decades the number of different products, and of different alternative options of the same product increased exponentially. Just few decades ago it was possible to choose among a restricted amount of different models of jeans, food, or whatever else product. Nowadays the number of choices are countless. Schwartz describes the paradoxical effects of this choice.

On one hand, the increase in the number of available options leads to a reduction in customers' satisfaction. The author attributes this effect to the fact that, when just few options are available, the responsibility for the choice and for the mistakes can be attributed to external causes (e.g. "there were not enough options", "I could not find what I was looking for"). With many available options, all the responsibility is on the customers, that can blame no one else but themselves for their choice and possible mistakes. On the other hand, having to deal with a countless range of options can led customers to a paralysis in their choices. People can rely on limited cognitive resources and they are not able to process too much information. For this reason it gets hard for them to choose according to their preferences. Each choice would have pros and cons, and comparing it with each of the other available options of the choice set would require a great effort. This fact/issue also contributes to customer's dissatisfaction (Schwartz, 2016).

The paradox of choice is an example of how complexity can lead to unwanted outcomes. Having to handle too much information, as described by Schwartz, or with information that is too complex for the average person, can bring individuals not to choose, not to participate and thus lose opportunity. That may

have relevant consequences at an individual and social level and leading to violations of the law or not voting for example.

The term simplification is very broad and would need to be further defined. However, reducing complexity has been shown to be effective in promoting desirable behaviors in different domains such as tax payment, financial savings or reducing college dropout (for an extensive description about the topic see the book *"Simpler: the future of government",* Sunstein, 2014c).

Social Norms. The literature provides several examples on how people tend to behave in ways that are consistent with the ones of the social group they belong to. Group expectations (Festinger, 1954), social pressures toward group conformity (Asch, 1951; Asch, 1987) and the acquisition of reference group norms (Newcomb, 1957; Šarīf, 1966) have been proven to greatly shape individual's behavior. By emphasising what most people do, the probability that those who belong to the same group will act in a similar way would most likely increase.

Sunstein (2014a) underlines that in order to have greater impact the information provided to the people whom are addressed by the interventions should be as specific and local as possible for example underlining words in a text (when that's possible). This would lead a big percentage of the community to act in the desired way (e.g. the percentage of people that pay taxes online, or vote, or engage in healthy behaviors). When most or many people are engaged in undesirable behavior this strategy can still be used by highlighting what people think their social group should do instead of what most people actually do (e.g. "90 percent of Italians think that citizens should vote").

Gerber and Rogers (2009) showed the effectiveness of this strategy developing an intervention aiming to increase the turnout of the elections in New Jersey in 2005 and those in California in 2006. A sample of potential voters, were divided into two groups, respectively "Low Turnout" and "High Turnout" and contacted by telephone. The first one was informed that the turnout would have been

probably low. The second, on the contrary, has been informed that the turnout would have been probably high. Although the study detected voter intentions rather than actual electoral behavior, the results showed that the message received by the voters influenced their intentions. The "High Turnout" was significantly higher compared to the "Low turnout".

Salience. Using visual or verbal stimuli can be a good strategy in order to direct people's attention toward a particular option and to increase the likelihood that a certain option or behavior is chosen or considered. Let's take an example described by Thaler and Sunstein in their book. In Amsterdam, at the airport of Schiphol, in order to reduce spillage has been stuck on each urinal the image of a black fly. This apparently irrelevant intervention reduced the spillage by 80 percent according to the Aad Kieboom and his team who conducted the fly-in-urinal trials (Thaler & Sunstein 2008, p. 4). As for the term simplification also the term salient should be probably better operationalised. However, it can be said that taking care of small details and to those elements of the environment that can be made more salient can help to promote positive behaviors. As Thaler and Sunstein suggest in the book, an easy rule of thumb to follow by "choice architects" both in the private and public sectors could be that "everything matters" (Thaler & Sunstein 2008, p. 4).

Pre-commitment and Implementations of Intentions. Often people tend to procrastinate their actions even though they know they would benefit by engaging in certain behaviors. Time discounting research which studies the differences in the evaluation of rewards received at different points in time showed that present rewards have a greater impact on people's decisions than future ones (Frederick, Loewenstein, & O'Donoghue, 2002). Moreover, the probability of this behavioral pattern has been shown to increase especially when people are tired, hungry, stressed, or focused on something else (Baumeister & Tierney, 2012).

Making people pre-commit to engage in certain action may lead them to act in a way that is consistent with what they have already committed to and thus (assumed to be) in line with their goals. Various examples in the literature show the effectiveness of this strategy to help people save more money (Thaler & Benartzi, 2004) or to choose healthier food (Milkman, Rogers, & Bazerman, 2009; Read & van Leeuwen, 1998).

Another similar strategy described by Sunstein (2014a) is to elicit people's intentions. Simple questions such as "did you think to act in X way? "are often strategically used to make people verbalize their intention to act in a certain way or to remind them that it is possible to take into account an option that they may have ignored.

A field experiment conducted by Milkman and colleagues (Milkman, Beshears, Choi, Laibson & Madrian, 2011) prompted people to form implementation intentions about influenza vaccination. Those who received the prompt to write down just a date had a vaccination rate 1.5 percentage points higher than the control group, which was statistically insignificant. Those who received the more specific prompt to write down both a date and a time had a 4.2 percentage point higher vaccination rate, a difference that is both statistically significant and of meaningful magnitude.

Reminders. People tend to have a great deal on their minds, and when they do not engage in certain behaviors, that may be due to a combination of inertia, procrastination, competing obligations or they may be just forgetting. A reminder can have a positive impact on the accomplishment of certain tasks.

Castleman and Page (2013) showed for example the effectiveness of this strategy in tackling relevant social issues. In US, a child born in a poor family has 9% probability to finish college, compared with 54% of children born in wealthy families. In their study the authors aimed to increase the percentage of subscriptions to college among non wealthy young people. A reminder was sent in order to remind them about the deadline for college subscriptions. The

intervention costed $7 per student, with an increase of 7% in college subscriptions among the subjects addressed in the intervention.

Providing Feedback. In many situations people lack information to take informed decisions or are unaware of the long-term consequences of their behavior. This strategy consists of providing people with information about the consequences of their own past choices or about the future consequences of their actual behaviors. This strategy does not aim to persuade, but simply to inform: the individual is free to choose whatever he wants. However, before receiving the feedback the person was "free" to choose any option, after that he is "forced" to think about the consequences of his behaviors.

Hershfield and colleagues (2011) were arguing that it is difficult for people to save for retirement because they cannot imagine themselves well enough at an older age. They made an experiment in which the participants were divided in two groups. To each participant of the first group (n = 50) was shown a "realistic age -progressed rendering" of themselves in order to stimulate their desire to save more. They were choosing how much they want to save on a slide bar. If the amount was low the picture was with a frowning face, if on the other hand, the amount was high the rendering was smiling. No pictures were shown to the second group of participants. The results showed that the first group of participants decided to save on average more than twice as much as the second group ($172 vs. $80).

Framing Effect. The way in which the same problem is formulated could stimulate different choices. In this case we are talking about the framing effect that was first studied in the 80's by Tversky and Kahneman (1981). A substantial number of studies showed the effectiveness of this strategy to change people's behavior (e.g. Tversky and Kahneman, 1981, McNeil, Pauker, Sox & Tversky, 1982; O'Connor, 1989; Stone, Yates & Parker, 1994; Hanks, Just, Smith & Wansink, 2012)

Framing effect can be implemented both on verbal and physical stimuli. That means that it is possible to influence people's choice both by proposing them the same options in a different frame (e.g. risk informations about a certain therapy) or by placing objects of the environment in different ways (e.g. moving products in order to make them more visible or easy to take).

An example of "verbal frame effect" is provided by O'Connor (1989). In his study, the author showed, how by framing in different ways the possible outcome of different cancer treatment alternatives can lead patients to choose different therapies. On the other hand, an example of "physical frame effect" is provided by the studies of Hanks and colleagues (Hanks, Just, Smith & Wansink, 2012). By changing the position of foods in a school lunchroom, by making the healthier ones more visible. The authors found an increase by 18% in the choice of healthier food and a decrease by 28% in the choice of less healthy ones.

3.1.3. Libertarian Paternalism and Freedom of Choice

A fundamental assumption in the theory of Nudge is that the interventions should be designed in a way that does not preclude the freedom of choice of the individual. He, by definition, must be able to circumvent nudges without burdens or particular difficulties (Thaler & Sunstein, 2008, p. 6). Thaler and Sunstein refer to Nudge as a form of soft paternalism.

One of the main critics against Thaler and Sunstein's approach, is the manipulative nature of Nudge, that influence deliberately people's behavior in specific directions. However, the authors themselves highlighted one important thing, i.e. that human behavior is unavoidably influenced by contextual factors. Therefore, it is just possible to let the environment influence people's choices without changing it, or understand how to work on it in order to direct certain behaviors in ways that are in line with people's goals and values.

The authors embraced the second path, proposing the term "Libertarian Paternalism" to underline the dual nature of Nudge interventions. The term "paternalism" refers to the need of deliberately influencing individual's choices,

i.e. the ones considered as the most beneficial for the individual and collective well-being. With the term "libertarian" the authors stress on the idea to leave individuals free to choose alternative options, without making them excessively costly in terms of time or money.

The topic of freedom is not something new in the field of BS and as discussed in Part 4, has been widely addressed by Burrhus F. Skinner in his book "Beyond Freedom and Dignity" (1971), whose thoughts on the subject are perfectly in line with the ideas of Thaler and Sunstein.

4. Boost: Historical Backdrop and Theoretical Framework

Nudge emerged from Kahneman and Tversky's framework and their H&B program (Grüne-Yanoff & Hertwig, 2015). As described in Part 1(see section 2.2.1), the H&B program was not the only one in BE, the stream of studies of Gigerenzer and his SH program led to the raise of what has been defined as Boosting (Grüne-Yanoff & Hertwig, 2015; Hertwig & Ryall, 2016).

According to Gigerenzer many experts think that ordinary people don't have the capacity to understand information that involves logical thinking, such as probability or risks. Even when scientists try to educate people to outgrow their tendency to make errors the final effect is usually a failure. Following that line of thought about the "general public" the Deutsche Bank Research published "a list of errors that we Homer Simpsons" commit against rationality (Schneider, 2010). Furthermore, popular books repeat and magnify the idea that Homo sapiens is "predictably irrational" (e.g. Ariely, 2009) and they would need nudges in order to act wisely. (e.g. Thaler & Sunstein, 2008)

Gigerenzer's standpoint differs consistently and his criticism against the work of Kahneman and Tversky has been also addressed at Nudge which originated from their theories. The author claims that people should not be considered as poorly equipped to deal with logical decisions and that their intelligence is underestimated:

"My story is different. People aren't stupid. The problem is that our educational system has an amazing blind spot concerning risk literacy. We teach our children the mathematics of certainty - geometry and trigonometry - but not the mathematics of uncertainty, statistical thinking. And we teach our children biology but not the psychology that shapes their fears and desires."
(Gigerenzer 2015, pp.16-17).

To clarify the author's standpoint it could be useful to describe a paradoxical situation that occurred after the attack of the Twin Towers on September 11, 2001. In the following months, indeed, many Americans stopped flying and

started using cars in order to get to their destinations. This trend lasted for the next twelve months with severe consequences. The number of fatal car crashes increased, rising above the average of the last five years. About 1600 Americans lost their lives, a number that is six times higher than the total number of passengers (256) who died in 2001 on the fatal flights. (Gigerenzer 2015, pp. 13-15; see also Figure 9).
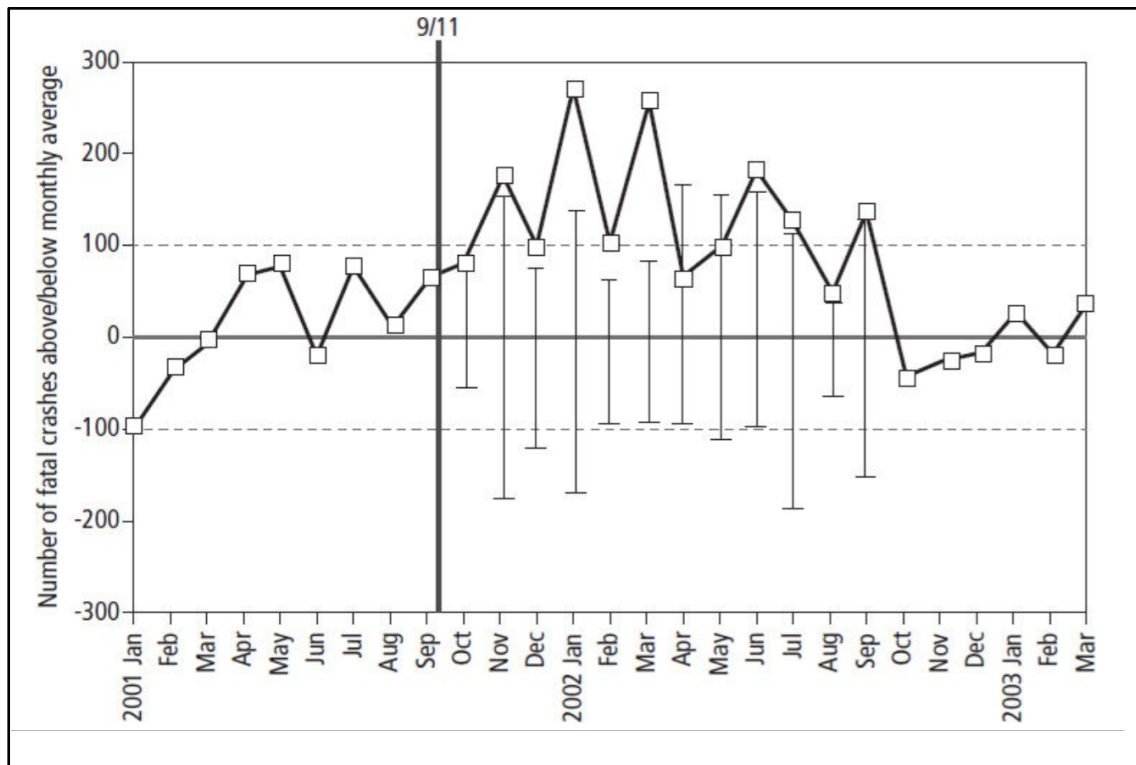
Figure 9. The graph shows the numbers of fatal car crashes from 2001 to the beginning of 2003 showing a relevant increase in the twelve months that followed the terrorist attack of the Twin Towers.

According to Gigerenzer, this paradoxical behavior is not the result of poor cognitive capacities but it is a matter of statistical illiteracy that leads people to overestimate (or underestimate) certain risks in specific circumstances. Therefore, his response to Nudging is the formulation of Boost strategies.

4.1. Defining Boost

The aim of Boost policies is to empower people to improve their competences by providing them with skills to take better decisions without pushing them in any

particular direction (Gigerenzer & Hoffrage 1995; Sedlmeier & Gigerenzer 2001). Using again the example of the attack of the Twin towers, a boosting approach would just provide people with basic skills to understand on their own which are the risks of taking their car or the airplane. No strategies that deliberately push them to use the airplane, by taking advantage of their cognitive boundaries, would be implemented.

According to Grüne-Yanoff and Hertwig (2015) it is possible to define three main classes of boost policies, i.e those that work on the context in which people take decisions; those that provide people with skills necessary to take decisions or that improve their knowledge; and those that design "smart strategies" that combine the first two policies.

4.1.1. Working on the Context

The literature provides evidence that most people have issues with processing statistical information and that can lead them to make wrong inferences about the information provided. (e.g. Berwick, Fineberg & Weinstein 1981; Koehler 1996). Several authors stressed on the point that, the way information is presented can greatly influence people's responses and decisions (e.g. Gigerenzer and Hoffrage 1995; Hoffrage, Lindsey, Hertwig & Gigerenzer 2000). One way to help them make informed decisions is to provide information that can be easily processed and that can help them estimate the real probability in the occurrence of an event correctly. This goal can be achieved by representing the information with natural frequencies rather than probabilities, by providing information about risks in absolute rather than relative terms (Gigerenzer, Gaissmaier, Kurz-Milcke Schwartz & Woloshin, 2007), or by providing graphical representations of the information rather than numerical ones (Kurz-Milcke, Gerd Gigerenzer & Laura Martignon, 2008; Garćıa-Retamero, Galesic & Gigerenzer, 2010).

### 4.1.2. Providing People with Skills/Knowledge

The second group of boost policies aims to provide people with simple information that may be effective in dealing with specific problems or events.

For example the procedures to follow in case of emergencies or medical interventions that need to be performed within a few hours of its occurrence in order to be more effective in the case of a stroke. However, in different European countries, people recognise only few symptoms (see Mata, Frank & Gigerenzer 2014). A boost policy could then teach the population to recognise cardinal symptoms of stroke in order to make them call earlier the ambulance and thus increase the chance that a medical intervention would have a positive outcome.

This kind of boost policies can be seen as somehow close to the traditional provision of information or educational campaigns. However, this kind of boost policies don't aim to persuade people to change their preferences but just to enhance their skills with "smart strategies" that can be applied when it is necessary with a small effort and high effectiveness.

4.1.3. Design of "Smart Strategies"

In some circumstances, risks have not been or could not be measured. In these cases, changing the way information is presented may not be sufficient, nor possible. In these cases, the boosting approach designed specific tools useful to help people make better decisions. The Fast and Frugal trees (FFTs) are an example. FFTs are simplified decisional tree with at least one end node after each decision node (Grüne-Yanoff & Hertwig, 2015) and compared with traditional decision trees, the FFTs have the advantage to make faster and easier the decisions and to have a high degree of robustness (Luan, Schooler & Gigerenzer 2011). An example of the use of the FFT is the one provided by Jenny and colleagues (Jenny et al. 2013; see Figure 10).
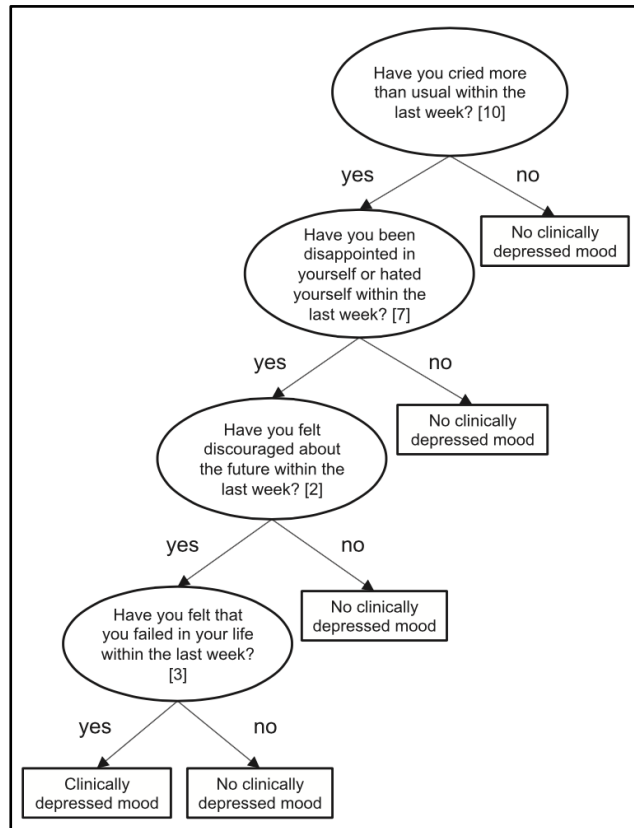
Figure 10. The figure (Jenny et al., 2013) shows the FFT used by the authors in their intervention to screen cases of clinical depression.

The tree has been designed to improve the performance of physicians when screening patients for clinical cases of depression. The author simplified the questionnaire traditionally used that was composed by 21 questions, replacing it with a FFT in which just four binary questions (yes vs no) were included. The FFT has been found to be as effective as the two standard tools of measurement that required five times more cues in detecting depressed moods from epidemiological data.

5. Nudge or Boost?

Like the H&B program, Gigerenzer heavily criticised Nudge as an approach because it does not embrace as its goal the idea to create cultural literacy but just to make people act in the way that the policy makers chose to be the best according to some normative standard. However, Nudge theoreticians often highlight the need to build interventions that are fully transparent and that allow people to choose what they prefer. What can be surely stated is that both approaches have as their main goal increasing people's wellbeing. It is possible that in certain contexts, applying boosting policies could be harder or too expensive and some nudges could have more effective results. In other cases boost policies may be equally or more fruitful than nudges and could help to increase people's compliance when dealing with particularly "hot" topics. In other cases, nudging and Boost policies could be used jointly. A dialogue between the proponents of the different programs may be more beneficial for the scientific community and more useful in order to build knowledge and to improve the effectiveness of policy interventions, balancing cost and effectiveness of the different strategies adopted.

Part 3

Behavioral Change Interventions in the Italian Context

Introduction

As described in Part 2, BC policy programs and in particular Nudge, widespread in the last decade. The main levers of Nudge interventions that have been taken into account in order to develop the present researches are three: sustainability, generalisability and versatility.

Sustainability. Although in many situations it is undoubtedly useful and necessary to build large experiments that involve a significant amount of human and economical resources, an important feature of Nudge is its sustainability. Several interventions have been developed with little or no costs and that is one of the reasons that brought the discipline into the mainstream of public policy, gathering the attention of several governments around the world. The collection of studies proposed here aimed to keep into account this feature of low cost, and therefore all the interventions were developed and executed extremely economically.

Generalisability. Although the literature about Nudge proved its effectiveness under various conditions, great consideration was taken in terms of generalisability of the results. For this reason it has been decided to replicate the experiments in other cultural contexts (study 1) or to implement the interventions in different cultural settings (study 3). The other studies are still in the phase of replication and the results will be available in the near future.

Versatility. There is a reason why the researches described are focused on different issues. Nudge is a discipline that showed its multifaceted nature and its flexibility in tackling issues from a broad range of domains. That's probably one of the main reasons of its spreading all over the world. In Italy, however, little has been done yet, and testing the effectiveness of Nudge in different fields may be useful to gather the attention around the discipline.

Part 3: an overview. The third part of this PhD thesis describes the stream of studies carried out by the author and his research group.

The researches have been divided into two categories: studies about preferences (N=2) and studies about choices (N=3). The distinction between "preference" and "choice" is purely arbitrary and the wording was chosen just in order to distinguish between the experiments that did not involve an actual choice (i.e. subjects did not have to "physically" choose a real product nor behavior) to the ones in which actual choices were required (people had to emit an actual choice or behavior). Each research will be presented as a short paper.

The two studies about preferences aim to explore some processes described in Part 1 of the PhD thesis in relation to the BE framework. These studies have been carried out with populations of students in a controlled setting. The first one takes into account the so called "decoy effect", with the replication of a study carried out in another cultural context. The second one is focused on the framing effect, and more precisely on how different risk frames may lead to different perceptions of risk.

The three studies about choices aim to apply the principles of Nudge described in Part 2 of the thesis in the Italian context. The interventions are part of a project called "Nudge and well-being". These are field experiments in which actual choices were observed. The term well-being here is taken in its broadest meaning and has been used on purpose to underline the versatility of the discipline. The first intervention was implemented to tackle the problem of food waste in the Italian restaurants. The study has been presented in the EABA conference in 2016. The study has been replicated in different cultural contexts and the results is discussed as well. The second is a pilot study developed to reduce the usage of smartphones in two pubs in Milan, Italy. Lastly an intervention for the reduction of the consumption of sugar in a coffee shop in Catania (Italy) is presented.

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7. Studies about Preferences

7.1. Decoy Effect and customer preferences for newspaper subscriptions: A Randomized Controlled Trial

Abstract

The study is a replication of an experiment carried out by Kivetz, Netzer and Srinivasan (2004) to show the so called "decoy effect". A randomized controlled trial was carried out in a population of students (N=114). The sample, has been divided into two groups which have been provided with one of two versions of a test. The first one included two possible options for a subscription to a newspaper. The second one included additionally a third option. Following the independence axiom, people's preferences should not change when a third option is introduced in the choice set. However, we hypothesised that the third option would affect students' choices acting as a decoy. Results confirmed the hypothesis showing an asymmetrically dominated choice among the students.

Keywords: asymmetrically dominated choice; decoy effect; preferences; subscriptions

According to the literature, individual preferences are based on what is offered rather than based on absolute preferences (e.g. Ariely & Wallsten, 1995; Herne, 1999). Among the systematic bias studied during the years, several behavioral economists addressed what has been defined as "decoy effect", technically known as an asymmetrically dominated choice. That occurs when people's preference for one option over another changes as a result of adding a third one (Bateman, Munro, & Poe, 2008). The asymmetrically dominated option is a "decoy" that increases the preference for the dominating option.

In 2004 a group of researchers developed an experiment with the students of a Master program in Business Administration (Kivetz, Netzer, & Srinivasan, 2004). The experiment was based on a real situation that happened in 1997. The weekly newspaper "The Economist" offered to their customers the opportunity to choose between three possible subscriptions, i.e. online, printed or combined (both printed and online). The price for the first option was $59, while for both the second and the third ones was $125 (see Figure 11).

Figure 11. The figure represents the offer promoted on the website of "The Economist" in 1997. The second and the third options have the same price, although the latter includes both the first and the second option.

Clearly the second option was not providing any advantages for the customers. However, the researchers hypothesised that it would affect their preferences.

Two groups of students were provided with different versions of the offer. One group received the same one proposed by "The Economist" while the other group was provided with just two options i.e. the digital and the combined ones. The researchers found that, in the first case, 72% of the students opted for the combined option while in the second case just 43% of the students choose it.

To sum up, taking out from the choice set the option that no one would have chosen (i.e. $125 for the print subscription) resulted in changing people's preferences. This findings are in contrast with the axiom of independence that claim that if an option A is preferred over an option B in a choice set that includes A and B, introducing a third option C and thus expanding the choice set

to A,B and C, must not lead to a preference reversal making B preferred over A. Thus, if the digital option was preferred over the combined one, adding a third option, i.e. the printed one, should not have changed the preferences of the students.

The present study is a replication of "The Economist experiment" adapted to the Italian context. The aim was to test the generalisability of the results obtained by Kivetz, Netzer and Srinivasan (2004) in another cultural context. According to the original findings, it has been hypothesised that similarly in the Italian context, the preferences of the subjects of the the study would have been influenced by the decoy and their preferences would change according to the version of the options provided.

7.1.1. Materials and Method

Setting and Sample

The data was gathered in a classroom of IULM (International University of Languages and Media) in Milan on a sample of 114 students aged between 20 and 35. Between them 19 (16.7%) were males and 95 (83.3%) were females. The mean age was 21.31 (SD=2.06)

Ethical approval: All procedures performed in the study were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Materials

Papers with the two versions of the task were printed and randomly assigned to the students in order to assess their preferences. Each student received two stapled papers. The first one was a cover paper on which they had to write their age and gender. On the second there was the version of the task. The "version A" counted three options while the "version B" counted just two options.

The two versions were as follows (see Appendix A for the original versions of the task):

Version A:

Suppose that you want to subscribe to a magazine of your interest.

You have 3 possible options.

Trace and put an x on the side of your favorite one:

A: € 59: digital subscription

B: € 125: printed subscription

C: € 125: printed + digital subscription

Version B:

Suppose that you want to subscribe to a magazine of your interest.

You have 2 possible options.

Trace and put an x on the side of your favorite one:

A € 59: digital subscription

B € 125: printed + digital subscription

Experimental design

A between groups plan was implemented, with an independent variable (version A vs. version B) and two independent groups. The dependent variable was the students preferences.

Outcome Measure

The dependent variable (outcome) was the students' preference (digital subscription choice vs. printed + digital subscription).

Procedure

The two versions of the task were assigned randomly among the students so that 56 (49.1%) students received the version A while 58 (50.9%) the version B. The students had 40 seconds to complete the task.

7.1.2. Results

The student's preferences in the two versions are reported in Figure 12. Comparing the answers provided in the two versions of the task the data shows a reversal pattern among students' preferences.
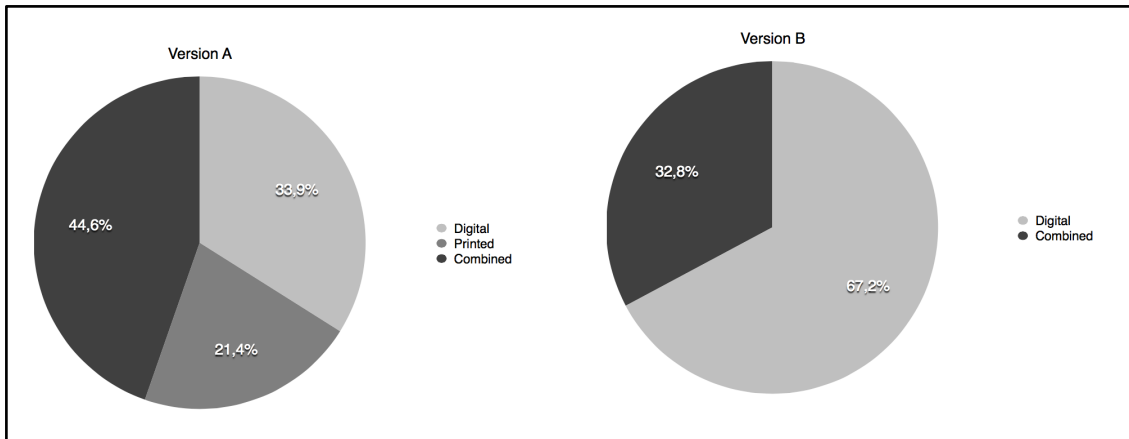
Figure 12. The percentage of students' preferences for each of the available options in Version A and Version B of the task are shown in the pie-charts.

Participants chose differently in the two experimental conditions (Chi-square (1) = 5.90; p=0.015). Among the students who received the version A of the task (three options) 19 (43.2%) chose the digital option while 25 (56.8%) chose the combined one. Among the students who received the version B (two options), 39 (67.2%) chose the digital option while 19 (32.8%) choose the combined one (Figure 13). The effect size showed that the likelihood of choosing the digital option was about 2.5 times higher in the two options version compared with the three options one (OR = 2.70; 95% CI: 1.20-6.07). On the contrary, the likelihood of choosing the digital option was about 60% less when the third option was provided. (OR=0.37; 95% CI: 0.16-0.82).
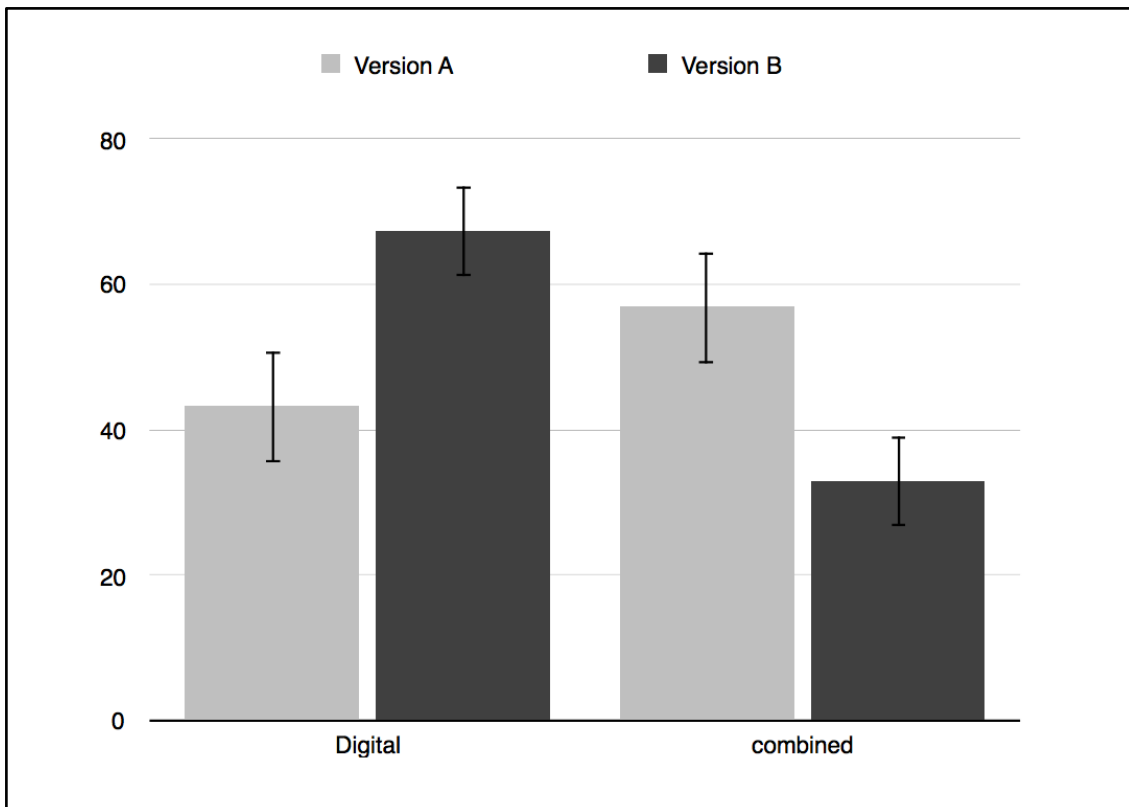
Figure 13. The percentage of students' preferences for the digital or the combined (digital +printed) options in version A and version B of the task are shown in the histograms. In version A were taken into account just the data of the students who chose the digital or the combined option, while those who choose the paper option were excluded by the analysis.

7.1.3. Discussion

The replication confirmed the hypothesis showing an asymmetrical dominated choice among the students with a preference reversal among the two versions of the task. A significantly higher percentage of students chose the digital option compared to the combined one in the version that included just two options. The opposite trend was observed among students who received the three options version. The preference for the digital option raised by 24% when just two options were presented. The data confirms that the same trend of results that was found in the original experiment. Results seems to be culture independent and generalisable in other contexts, or at least in the Italian one.

The main limitations of the study are two. First, while the experiment assessed students' preferences, it did not measure their actual choice. The difference in the price between the digital option and the combined one is relevant. The subjects

who received the version A may have stated that they would have preferred the combined option, but in a real life choice context they may have opted for the digital option. Second, the results have been tested on a population of students as in the original experiment. Most of the students in the present experiment were females. It would be interesting to test the same problem with a sample of normal population in order to have more generalisable results.

Conflict of Interests: The authors declare that they have no conflict of interests.

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7.2. Relative and Absolute framing: a Randomized Controlled Trial to evaluate the risk perception about incidence of colorectal cancer by consuming processed meat

Abstract

A randomised controlled trial was carried out in a population of students (N=130) in order to assess their perception of the risk to contract colorectal cancer among daily consumers of processed meat. In the study were provided two versions of the problem: a "Relative Risk Frame" (RRF) and an "Absolute Risk Frame" (ARF) ones. Both versions provided four possible answers including only one correct.

We hypothesised that a higher percentage of students would have answered correctly to the problem when it was provided in an ARF vs. RRF version. Moreover, we hypothesised that those provided with the ARF version would have an overall lower perception of the risks compared with those provided with the RRF version. The results confirmed both hypotheses.

Keywords: framing; risk perception; processed meat; colorectal cancer

In one of his papers Gigerenzer and colleagues (2007) described a phenomena that defines "collective statistical illiteracy". That simply means that most of the people are not able to understand the meaning of numbers and statistical inferences. According to the author, statistical literacy is of great importance for individuals in order to face a technological democracy, listing a series of examples useful to understand how the framing of informations may change people's choices.

Relevant for the purpose of the present study can be an event that happened In October 1995. The U.K. Committee on Safety of Medicines claimed that third-generation oral contraceptive pills increased the risk of potentially life-threatening blood clots in the legs or lungs by 100%. The information spread fast and exponentially among practitioners and was presented in an emergency announcement by mass media.

The huge impact of the news was followed by a decrease in the consumption of the pills by women, scarred by the potential threat. This led to an increase in unwanted pregnancies and to 13,000 additional abortions in England and Wales

in the following year (see Figure 14). Moreover the cost of providing abortion for National Health Service increased by $70 million at that time (Furedi, 1999).

As highlighted by Gigerenzer, this situation was caused by a misleading frame of information. Indeed, the claimed risk due to the consumption of the third generation contraceptive pill was compared with cases of thrombosis due to the use of second generation contraceptive pills. In other words, 1 woman out of 7000 had thrombosis as a result of the pill. The number increased to 2 among those women who took the third generation pill. Although the information provided by the U.K. Committee on Safety of Medicines and by the media was true, the information was framed in relative terms producing panic with the described above consequences. The increase of 100% in absolute terms was actually extremely small (from about 0,014% to 0,028%).
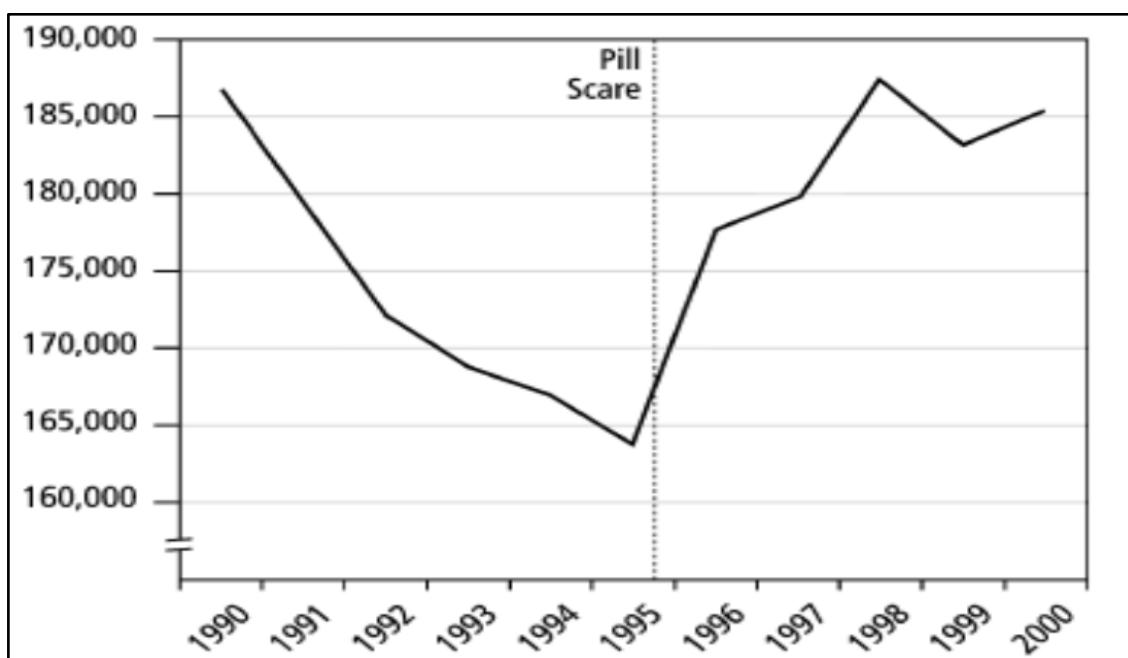
Figure 14. The number of abortion in the decades 1990-2000 in England and Wale are represented in the graph (Gigerenzer, 2015) showing an increase in its incidence after the information about the increased risk of taking the third generation pills was released and spread among the citizens.

This example shows extremely well how people's incompetence of understanding statistical notions can greatly influence their choices with

important implications for their health and for the economy. Another important point is that cases like that could be an unintentional result of the lack of understanding about the statistical illiteracy of common people by those spreading the information, but also an intentional strategy to push people's choices and preferences in certain directions.

The present study will address the topic of risk framing, in relation to the risk of contracting cancer. In October 2015, the World Health Organization, warned people about the 18% increase in the risk of contracting colorectal cancer by consuming 50g of processed meat on a daily basis (see also Bouvard et al., 2015; McGuire, 2016). Similarly to what happened with the case of the third generation pills, the mass media shared the news. However, the risk was compared to the overall risk of contracting colorectal cancer in the normal population, that was about 5%. That means that in absolute terms, the risk increased from about 5% to 6%.

In the present study it has been hypothesised that the number of people that are able to estimate correctly the percentage of the risk would change according to the proposed frame. A higher number of correct answers is expected with ARF compared to RRF.

7.2.1. Materials and Method

Setting and sample

The data was gathered in a classroom at IULM (International University of Languages and Media) in Milan from a sample of 130 students aged between 20 and 35. Between them 23 (17.7%) were males and 107 (82.3%) were females. The mean age was 21.41 (SD=2.02).

Ethical approval: All procedures performed in the study were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Materials

Papers with the two versions of the task were printed in order to assess student's preferences. Each student received two stapled papers. The first one was a cover paper on which they had to write their age and gender. On the second there was one of the two versions of the task. In the "version A" risk was framed in relative terms, while the "version B" was framed in absolute terms. Both versions had four possible answers, including the only one correct answer (answer C: about 6). The two versions of the problem were as follows (see Appendix B for the original versions of the tasks):

<u>Version A:</u>

*For people who never eat processed meat, the risk to contract colorectal cancer during their life is **5%**.*

*For people who eat **50g** of processed meat everyday, the **relative** risk to contract colorectal cancer during their life increases by **18%**.*

*Out of **100** people, how many, probably would contract colorectal cancer during their life by eating **50g** of processed meat everyday?*

A about 5   B about 18   C about 6 D about 23

<u>Version B:</u>

*For people who never eat processed meat, the risk to contract colorectal cancer during their life is **5%**.*

*For people who eat **50g** of processed meat everyday, the risk to contract colorectal cancer during their life increases by **1%**.*

*Out of **100** people, how many, probably would contract a colorectal cancer during their life by eating 50g of processed meat everyday?*

A about 5   B about 18   C about 6 D about 23

Experimental design

A between groups plan was implemented, with an independent variable (version A vs. version B) and two independent groups. The dependent variable was the student's answer to the problem.

Outcome Measures

The primary outcome was the percentage of students' correct answer to the task (answer C: about 6).

The secondary outcome was the percentage of students who had a low risk perception, according to two possible clusters of answers (Low Risk Cluster (LRC): students who responded A or C, i.e. 5 or 6; High Risk Cluster (HRC): students who responded B or D, i.e. 18 or 23)

Procedure

The two versions of the task were assigned randomly among the students so that 66 (50.8%) students received the version A, while 64 (49.2%) the version B. The students were asked to answer correctly to the assignment, i.e. to write an X close to the number of people who probably would have contracted colorectal cancer, according to the data provided in the task. The students completed the assignment under time pressure. They had 40 seconds to complete the task.

7.2.2. Results

The student's answers of the two versions are reported in Figure 15. Taking into account the primary outcome measure, i.e. the percentage of students who choose the correct answer, results show a significant difference in the rate of correct answers to the two versions of the task (Chi-square(1) = 8.31; p=0.004).
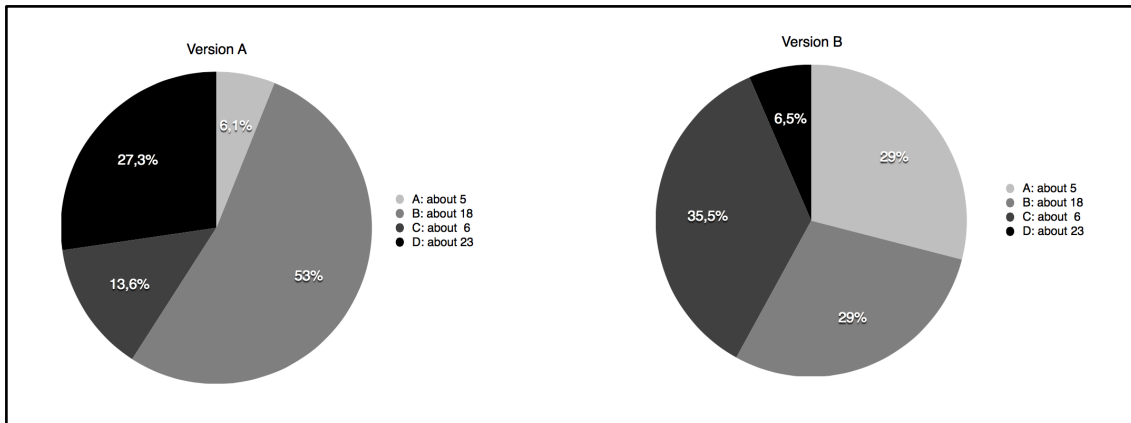
Figure 15. The percentages of students who choose each of the possible answers in the version A and in the version B of the task are represented in the pie charts.

Among the students who received the version A (RRF) 9 (13.6%) chose the correct option (answer C: about 6; see Figure 16). Among the students who received the version B (ARF) 22 (35.5%).

The effect size showed that the likelihood to choose the correct option was about 3.5 times higher in the version B compared with the version A (OR =3.48; 95% CI:1.45-8.33).
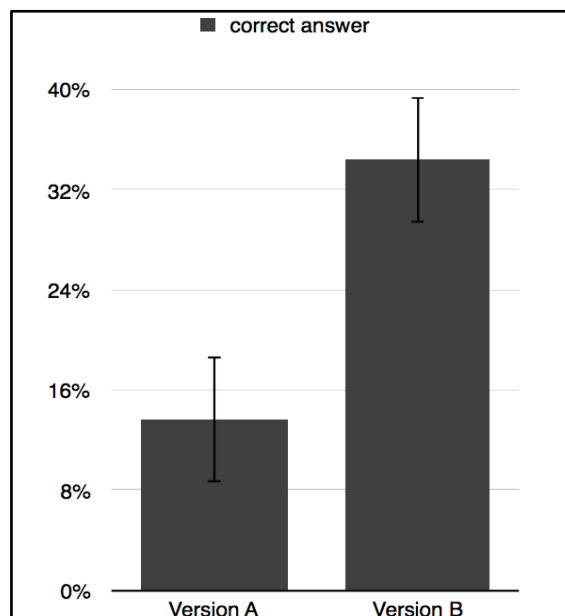
Figure 16. The percentage of correct answers in the Version A and the Version B of the tasks is shown in the histograms.

Taking into account the secondary outcome measure, differences were found in the two experimental conditions (Chi-square(1) = 26.47; p<0.001). Among the students who received the version A of the task, 13 (19.7%) chose one of the options included the LRC, while 53 (80.3%) choose one of the options included in the HRC. Among the students who received the version B, 40 (64.5%) chose one of the options included the LRC, while 22 (35.5%) chose one of the options included in the HRC. The effect size showed that the likelihood to choose the LRC was about 7.5 times higher in the version B compared with the version A (OR = 7.4; 95% CI: 3.3-16.6)

Moreover, analysing the error distribution differences were found (chi-square(1)= 20.93 p<0.001). Post hoc shows that the likelihood to choose option B instead of option D is similar in the two groups (p=0.172); the likelihood to choose option B instead of option A is higher in the version A rather than in version B (p<0.001); finally, the likelihood to to choose option D instead of option A is higher in the version A rather than in version B (p<0.001).

7.2.3. Discussion

The study confirmed the hypothesis, showing that a significantly higher percentage of students choose the correct answer when they received the ARF version (version B), compared with the RRF one (version A).

Results were even more clear when the options of the problem were grouped into clusters. More than 60% of the students who received the version B showed a "low risk" perception while, among the ones who received the version A, about 80% showed a "high risk" perception value.

The study presents some main limitations and some points could be further addressed in future researches.

The experiment assessed the students' understanding of the problem, however, it did not measure any actual choice. It would be useful to test whether the answers provided by the students are consistent with their choices. For example, it would be interesting to see if the students who showed an high risk perception have an

higher tendency to avoid to buy or to eat processed meat compared with those who showed a low risk perception.

The results have been tested on a population of students, most of whom were females. Testing the same problem with a more homogenous sample would be helpful to understand if the data could be generalised to the population.

Further experiments may test if students' answers are significantly influenced by the time constraint or are time independent.

Finally, further experiments may assess if the subject matter of the problem influenced people's way to answer. For example it could be tested if the same pattern of answers will result when replacing the information that highlights the risks of certain products/behaviors, with information that highlights the benefits. That could provide useful guidelines on how to communicate risks and benefits. It could help to set interventions that promote desirable choices, for example providing relative frames when talking about protective factors, and absolute frames when talking about risks.

Conflict of Interests: The authors declare that they have no conflict of interests.

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8. Studies about Choices

8.1. No waste by default: Nudging to prevent food waste in restaurants

Abstract

Nudge techniques concern 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. In order to tackle the problem of food waste in restaurants, three studies were carried in three different cultural settings: Italy, Switzerland and Greece.

Study one was conducted in a pizzeria close to Milan. In the intervention customers were provided with informations about food waste. Additionally the default rule was manipulated so that, when customers had uneaten food in their plates, they were automatically provided with a "doggy bag", unless they actively chose to opt out. Study two was a replication of the Italian trial in a restaurant close to Lugano, Switzerland. The data showed that in both studies the number of doggy bags provided to the customers increased significantly during the experimental condition. Study three was conducted in a restaurant close to Thessaloniki, Greece, providing the customers just with information about food waste and about the possibility to ask for the the doggy bag. No significant effect was found in this study.

Keywords: food waste; nudge; default rule; leftovers; doggy bag

As stated by Sunstein and Thaler it could be considered as nudge: "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" (Sunstein and Thaler, 2008, p. 6). From a behavioral standpoint this definition stresses on some main points. Nudge is any deliberate attempt to 1) work on the context 2) in order to alter the probability of emission of a behavior, 3) influencing it in a predictable way, 4) without punishing alternative behavioral responses and suppressing alternative choices or providing significant economic rewards.

Although not explicitly stated by Sunstein, the majority of the techniques used in Nudge interventions are mainly focused on antecedents modification, in order to set the occasion for emitting the desired behavior (Sunstein, 2014). The literature shows the effectiveness of Nudge in facing problems in many different domains

from social policies to sustainability (e.g. Bailenson 2011; Hershfield et al. 2011; Costa & Kahn 2013; Kallbekken, Sælen & Hermansen 2013) using a broad range of techniques in order to promote prosocial behaviors. Among these the manipulation of the default rule turned out to be effective in different case studies in promoting desirable behaviors (e.g. Johnson & Goldstein, 2003; Pichert & Katsikopoulos, 2008; Keller et al. 2011) according to the idea of libertarian paternalism.

An example of how default rule works is a study carried out by Johnson and Goldstein (2004) in which the authors found that the percentage of organ donors in the EU countries was distributed following two patterns. The countries where people had to actively choose to become organ donors (opt-in) showed a very low percentage of donors. Conversely in the countries in which people were considered by default organ donors, unless they actively choose to opt-out the percentage was much higher, in many countries close to 100% (see Figure 17).
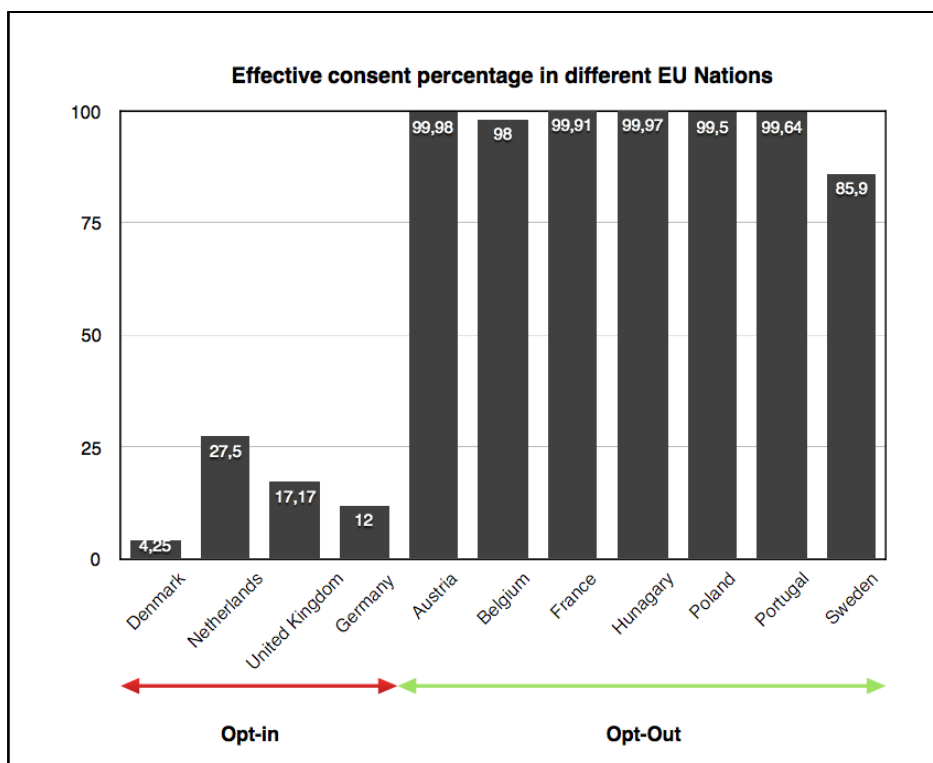
Figure 17. The histograms show the percentage of organ donors in different EU countries.

Although, in the last decade many studies have been conducted trying to change socially relevant behaviors through "nudge techniques", there are fields that still remain unexplored, and one of them is the food waste issue. In recent years the that has been a hot issue within the international community (FAO, 2011; FAO, 2013) suggesting that about one third of the produced food gets wasted every year worldwide (FAO, 2013; Monier et al., 2011; Gustavsson et al., 2011). Today around 34% of food consumption takes place out of the home and one third of it in public places like restaurants (Coldiretti et al., 2010; Fontanelli et al., 2011; Segrè et al., 2011). Unfortunately, in the restaurants not all the food ordered by the customers is being consumed, so leftovers are often thrown away. Reducing the amount of leftovers thrown away could have a significant economical and environmental impact on a large scale (CE, 2014; Thönissen, 2009; FAO,2013).

In Italy a law (n. 166/16) to tackle food waste has been recently approved. Specifically, Article 9 refers to the reduction of waste in restaurants and to the increase of the availability of "doggy bags". In Italy, according to a survey made by Coldiretti (2010) around 21% of food waste comes from restaurants and one of the sources of waste is leftovers (Parfitt et al., 2010). Usually, clients have to actively ask the waiters to pack their leftovers into the so called "doggy bags", and surveys show that only 36% of customers ask for their leftovers. (Paladino, 2015; Gaiani, 2013; Coldiretti, 2016).

A first study was implemented in Italy and aimed to test the effectiveness of the default rule to reduce food waste in a pizzeria. It was hypothesised that by automatically providing people with a "doggy bag" (or "foodie bag")[6] when they have leftovers in their plates would increase their use. Following, a second study was in a Swiss restaurant to test the generalisability of the results found in the first study. Finally, the third study tested the effectiveness of an informative approach, providing the customers just with information about food waste and

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[6] In the study the "doggy bags" were renamed as "foodie bag", so the two terms will be used interchangeably in the PhD thesis.

about the possibility to ask for a doggy bag. It was hypothesised that there would be a milder effect compared to the one obtained by manipulating the default rule. The three studies will be presented separately in the next sections.

8.1.1. Study 1: reducing food waste in an Italian pizzeria

8.1.1.1. Materials and Method

Setting

The data was collected at dinner time, from 7.00 P.M. to 12.00 A.M. in a small restaurant close to Milan, Italy, hosting around 55 to 60 people per meal. The restaurant was mostly serving pizza which was chosen as the target food for the experiment. Considering that the measurements were self-reported, a context with a small number of customers was chosen in order to increase the reliability of the data collected during the intervention. Indeed, in a bigger restaurant a higher number of employees would have been involved in gathering data, therefore, increasing the risk of mistakes.

Ethical approval: All procedures performed in the study were in accordance to the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Materials

In order to manipulate the default rule one double-sided poker chip was used, placed in front of each client in the restaurant. The chip was green on one side and red on the other. To make the rationale of the intervention easily understandable for the customers were developed table centerpieces (see Appendix C1) with instructions about what to do with the poker-chip in order to obtain the foodie bag. Moreover, were developed flyers placed in the menus with information about food waste and the same set of instructions available on the centerpieces (see Appendix C3).

Measures

The restaurant staff was provided with an observational grid placed in the kitchen on which they were trained to note an "X" for any plate with leftovers (see Appendix C5). To collect the data about the demand of "doggy bags", were provided stickers to be put on each doggy bag given to the customers. In this way it was possible to easily count the number of doggy bags demanded during each phase of the research. During the experiment any plates with inside at least one slice of pizza was considered as leftovers.

Procedures

The data was collected for one month: two weeks for the control phase and two weeks for the experimental one. During the control phase it was simply measured the demand of doggy bags as described above.

During the experimental phase, the double-sided poker chips were placed on the tables in front of each client, with the green side up,. To request a doggy bag, the clients just had to leave the chip on the green side (default rule), otherwise, they had to turn the red side up. The centerpiece was placed on each table, and the flyer with the instructions was placed inside each menu.

Experimental design.

Between groups plan was implemented, with an independent variable (intervention vs. nonintervention) and two independent groups, with repeated measures on the dependent variable. The dependent variable was the number of doggy bags requested by the customers.

8.1.1.2. Results

Overall, 46 and 40 plates with leftovers were left in the control phase and in the experimental phase respectively. In the control phase nineteen costumers (41%) asked for the doggy bag, and in the experimental phase thirty four costumers (85%) asked for the doggy bag. A chi-square test was used in order to compare the data in the two conditions. The demand of doggy bags was 44% higher

during the experimental phase compared with the control one (Figure 18). The difference showed to be statistically significant (Chi-square(1) = 17.27 p < .001), and the effect size showed that in the experimental phase the likelihood of demanding a "doggy bag" was about 8 times higher than in the control phase (OR = 8.05; 95% CI: 2.82-22.96).
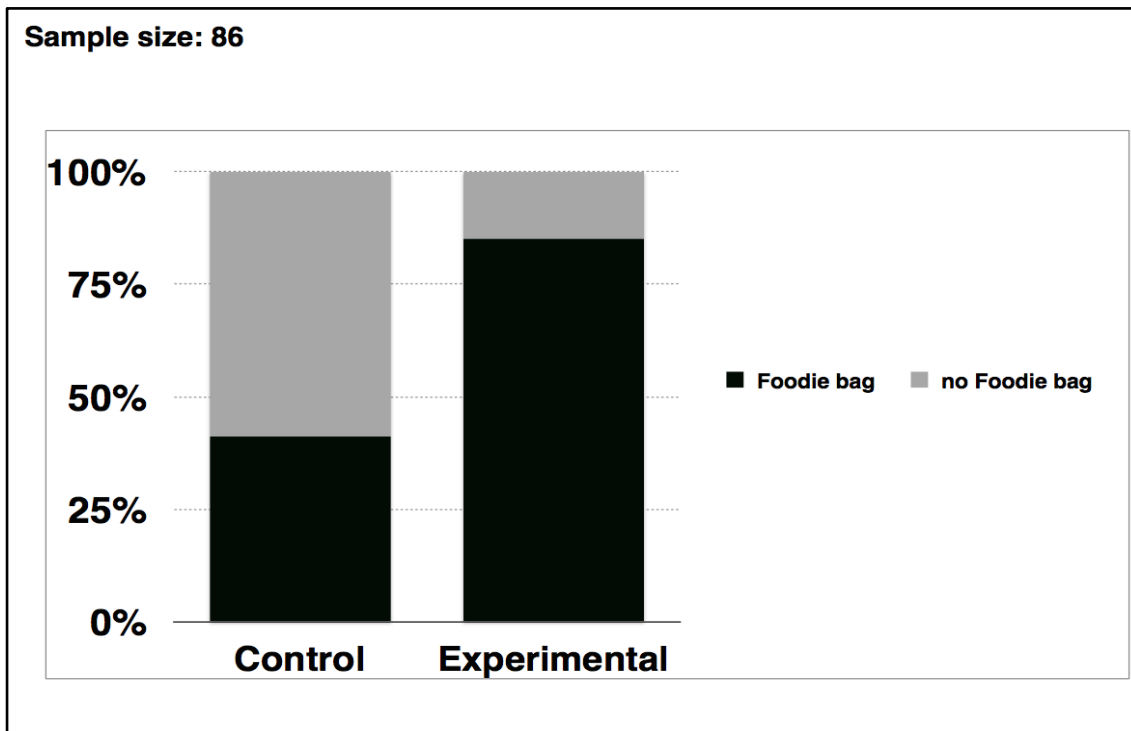
Figure 18. The histograms show the percentage of subjects who chose the doggy bag out of the overall number of people who had leftovers in their plates at the end of the dinner.

8.1.2. Study 2: reducing food waste in an Swiss restaurant

Study 2 was a replication of the Italian trial in a Swiss restaurant. The aim was to test the generalisability of the results in another cultural setting.

8.1.2.1. Materials and Method

Setting

The data was collected both at lunch and dinner time, from 12.00 P.M. to 3.00 P.M and from 7.00 PM to 12.00 A.M. in a Swiss restaurant close to Lugano hosting around 100 people per meal. The main difference in the Swiss trial was that the restaurant was not serving just pizza, but different kinds of dishes.

Ethical approval: All procedures performed in the study were in accordance to the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Materials

The same materials of the Italian trial were provided to the owner of the restaurant.The information about the overall food waste on the centrepiece and the menu flyers was replaced with the relevant one for Switzerland. During the experiment any plate with at least one slice of pizza left was considered as leftovers. For the other dishes, waiters were trained to count as leftovers those plates in which there was about ⅓ of food left. For that reason were provided guidelines with verbal instructions and images that showed the waiters what to consider as leftovers (see Appendix C4).

Measures

The number of leftovers and the number of people who requested them was measured as in the Italian trial by using stickers.

Procedures

The procedure was the same as in the Italian trial. However, the data was gathered just for two weeks (one week for the control phase, one week for the experimental one). The length of the overall period of the intervention was chosen according to the availability of the owners of the restaurant.

Experimental design

A between groups plan was implemented, with an independent variable (intervention vs. nonintervention) and two independent groups, with repeated measures on the dependent variable. The dependent variable was the number of doggy bags requested by the customers.

8.1.2.2. Results

Overall 38 and and 35 plates with leftovers were left during the control phase and during the intervention phase respectively. During the control phase fifteen costumers (39%) asked for the doggy bag, and during the intervention phase twenty-five customers (71%) asked for the doggy bag (Figure 19). A chi-square test was used in order to compare the data in the two conditions. The demand of doggy bags was 32% higher during the experimental phase compared to the control one (Figure 5). The difference showed to be statistically significant (Chi-square(1) = 7.51 p = .006), and the effect size showed that in the experimental phase the likelihood of demanding a "doggy bag" was almost 4 times higher than in the control phase (OR = 3.83; 95% CI: 1.44-10.22).
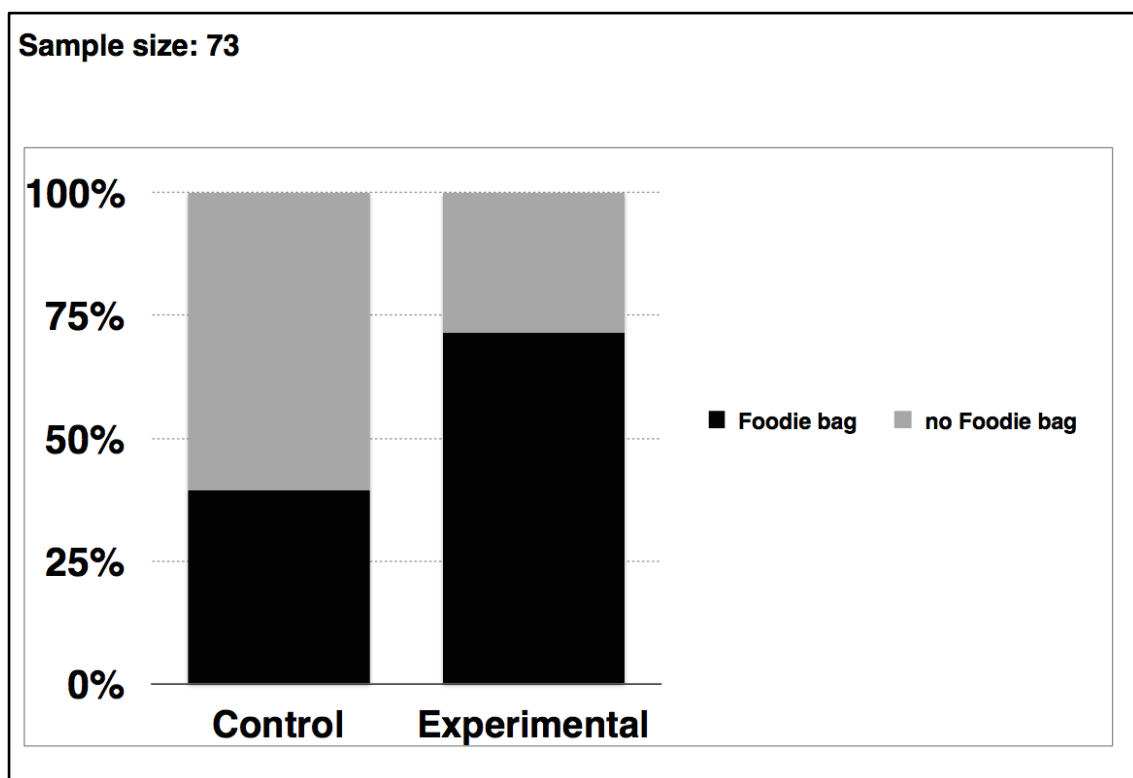
Figure 19. The histograms show the percentage of subjects who chose to ask for the doggy bag out of the overall number of people who had leftovers in their plates at the end of the meal.

8.1.3. Study 3: reducing food waste in a Greek restaurant

Study 3 was carried out in Thessaloniki, Greece and aimed to test the effectiveness of information and default rule separately. The initial hypothesis

was that the food waste information condition would have a slightly bigger effect compared to the control condition and that the default would have a greater effect compared to the information only phase. However, just the food waste information phase was carried out due to the unavailability of the restaurant to implement the default phase. So just the first hypothesis was tested.

8.1.3.1. Materials and Method

Setting

The data was collected during the whole opening time, from 12 P.M. to 8 P.M. in a Greek restaurant close to Thessaloniki hosting around 60 people per meal. Similar to the Swiss trial and different from the Italian trial, the restaurant was not serving just pizza, but different kinds of dishes.

Ethical approval: All procedures performed in the study were in accordance to the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Materials

Differently to the Italian and Swiss trials, on the materials were reported just the informations about food waste and a verbal instruction, i.e. "ask for your Foodie Bag!" (see Appendix C2). Only the centrepieces with information about the overall food waste in Greece were used (written both in Greek and English). During the experiment any plates with inside at least one slice of pizza were considered as leftovers. For the other dishes, waiters were trained to consider as leftovers when in the plate there was about ⅓ of food left as in the Swiss trial. Guidelines with verbal instructions and images that showed the waiters what to consider as leftovers were provided.

Measures

The number of leftovers and the number of people who requested them was measured as in the Italian trial by using stickers.

Procedures

The procedure was the same as in the Italian trial and the data was gathered for a total amount of four weeks (two for the control phase and two for the experimental one).

Experimental design

A between groups plan was implemented, with an independent variable (intervention vs. nonintervention) and two independent groups, with repeated measures on the dependent variable. The dependent variable was the number of doggy bags requested by the customers.

8.1.3.2. Results

Overall, 57 and and 108 plates with leftovers were left in the control phase and in the intervention phase respectively. In the control phase 40 customers (70.2%) asked for a doggy bag, and in the intervention phase 87 customers (80.5%) asked for the doggy bag (Figure 20). A chi-square test was used in order to compare the data in the two conditions. The demand of doggy bags was 10% higher during the experimental phase compared to the control one. However, the difference showed not to be statistically significantly (Chi-square(1) = 1.72 p = 0.189).
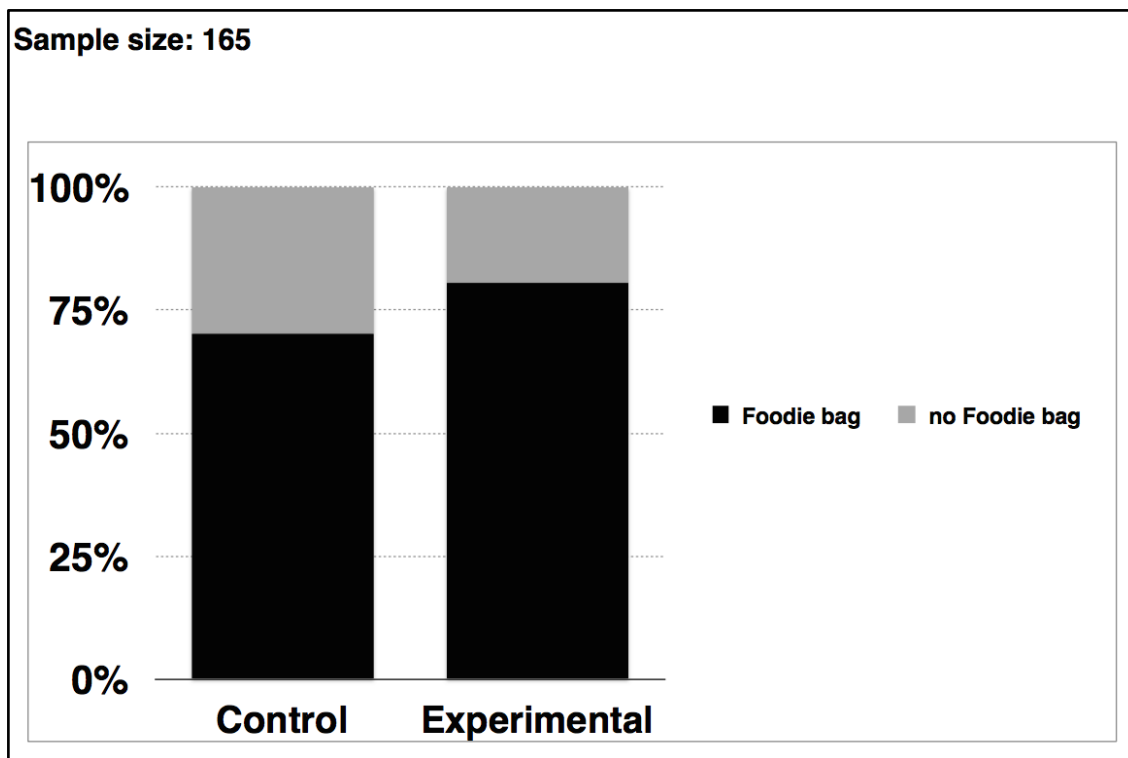
Figure 20. The histograms shows the percentage of subjects who chose the doggy bag out of the overall number of people who had leftovers in their plates at the end of their meals.

8.1.4. Discussion

The importance of the context to influence people's behavior is crucial when talking about Nudge. Study 1 and study 2 supported the experimental hypothesis with a statistically significant difference between the control and the experimental phase in the request of doggy bags (overall OR=5.55; 95% CI=2.7-10.99). By manipulating the default rule the probability that a customer with leftovers in his plate would ask for a doggy bag increased in the experimental condition compared to the control one. As Johnson and Goldstein (2004) showed in their work, default rules seem to affect people's behaviors independent of their cultural background. Taken together, results of study 1 and 2 seem to support this assumption. Furthermore the percentage of people who asked for a doggy bag in the control phase (p=0.52) and in the experimental phase (p=0.17) was similar in the Italian and Swiss contexts

However in the first two studies, the intervention did not allow us to discriminate which part of the intervention works: the informative part (i.e. the informations

about food waste) or the "pure nudging intervention"(i.e. the default rule manipulation obtained by using the poker-chips).

For this reason has been implemented the third study, that partially addressed the above mentioned issue. Results showed that providing the customers just with informations about food waste, is ineffective in increasing the demand of doggy bags. However the results could be explained by the higher percentage of customers who asked for the doggy bag in the control phase of the Greek study (72%). compared to the ones found in the Italian study (41%) and in the Swiss one (39%). The difference may be due to an overall cultural difference in Greece compared with Italy and Switzerland so that Greek customers could be in general more prone to ask for leftovers and an intervention in that cultural background could be unnecessary. In order to have meaningful evidences about the effectiveness of a mere informational approach it would be necessary to test it in settings that have a comparable initial percentage of customers who require the doggy bags to the ones of the Italian and Swiss trials. Another issue in the Greek trial is the huge difference found between the conditions in the overall number of leftovers. It is highly possible that some unpredicted variable interfered during the data gathering.

Taking into account the overall results of the three studies, it is possible to say that manipulating the default rule appeared to be effective and sustainable to deal with the problem of food waste in restaurants, while the effectiveness of a mere informative approach should be further tested. The results of the present paper should be interpreted keeping in mind that the study population was fairly small. To conclude, further studies should assess the actual behavior of people after they received their doggy bag. It would be of interest to understand if customers who received the doggy bag effectively eat the leftovers in a future moment or throw them away.

Conflict of Interests: The authors declare that they have no conflict of interests.

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8.2. Digital Detox: preliminary findings of a Nudge intervention to reduce the usage of digital devices in social contexts

Abstract

In recent years, the development of new information and communication technologies (ICT) produced radical changes in interpersonal interactions and exerted a growing influence on human behavior. The widespread of digital devices led to their omnipresence in different contexts including those appointed for socialisation like pubs and restaurants. An intervention was developed in order to reduce the frequency of smartphones use by the customers of one pub in Milan. In the center of each table were placed baskets for the customers to put their smartphones inside. In order to prompt the clients to use the baskets, on them were stick inviting labels with the image of a smartphone and a slogan. The data of the frequency of use of the digital devices was measured before and after the baskets were placed on the tables. The results of the experimental phase showed higher percentage of time in which none of the subjects included in a specific Statistical Unit (SU) interacted with their smartphone and a lower percentage of time in which every subject included in a specific SU interacted with their smartphone.

Keywords: digital detox; nudge; salience; smartphone

In the last decades information and communication technologies (ICT) widespread all over the world. Smartphones, in particular, changed their function from being mere communication gadgets to indispensable, almost vitally important tools in people's lives and their use penetrated almost all of our daily life activities (Lee et al., 2014).

According to the Yearly report of "We Are Social" (2017), an agency specialised in social media and digital marketing, about half of the world's population uses a smartphone and about two-thirds of the world's population has a mobile phone. Comparing the data of the Internet use of 2015 and 2016 there is a notable 10% increase (354 million users). The number of active social media users and mobile social media users raised by 21%, (482 million) and 30% (581 million) respectively. People are using much less their personal computers and more and more their smartphones on webpages and applications. Facebook is currently the most used social network (more than 1.5 billion active users in the world), even

though the use of messaging and snapshots applications such as WhatsApp, Messenger, Snapchat etc. is increasing exponentially (We Are Social, 2017).

Italy is following the same trend. From 2015 to 2016 the number of people with access to the web increased by 4% (with and overall 66% rate of penetration, i.e. 39.21 million users) and of those using the social media by 17%. Personal computer use decreased by 14% while the use of smartphones increased by 44% (We Are Social Italia, 2017).

Despite the usefulness of digital devices in a wide range of situations and domains, their widespread produced several side effects in terms of physical and mental health. Several researches found that a prolonged and regular use of a smartphone to check missed calls or messages may result in compulsive usage and even lead to mobile phone addiction for smartphone users (Bianchi & Phillips, 2005; Oulasvirta et al., 2012; Takao, Takahashi, & Kitamura, 2009). In their study, Oulasvirta and colleagues (2012) showed, for example, that their subjects checked their phones 34 times a day, and in many occasion not for a real need but just because it became a rooted habit.

The compulsive usage may lead to health issues such as sleep disturbances and depression (Thomée et al., 2007; Thomée, Härenstam & Hagberg, 2011). The overuse of technology is also linked to heightened psychological distress (Chesley, 2005). Technostress is the phenomenon of the end users experiencing stress due to information and communication overload (Ragu-Nathan, Tarafdar, Ragu-Nathan, & Tu, 2008). Medical literature also suggests that the electromagnetic radiation of smartphones may affect biological systems by altering the antioxidant systems of human tissues, leading to oxidative stress (Ozguner et al., 2005). Therefore, compulsive smartphone usage increases the user's stress level for both psychological and physiological reasons.

Social interactions have been also deeply affected by the spread of digital devices. Moreover, the overuse of smartphones in social and recreational contexts, has been found to be associated with a reduction in the quality and

quantity of social interactions (Geser, 2006). Detoxification from digital devices may be thus critical to help individuals improve these aspects of their life.

The focus of this study is on the last point described above, i.e. the use of smartphones in social contexts. It is important to understand that the pervasive and dysfunctional use of such devices can be significantly influenced by contextual factors. According to Thaler and Sunstein (2008) setting an appropriate "choice architecture" may be useful to change dysfunctional behaviors without the need to impose economic incentives or bans and punishments. The research presents two studies built upon the principles of Nudge and focused on reducing the utilisation of smartphones in social contexts, and more precisely in two different settings.

8.2.1. Materials and Method

Setting

The intervention took place in one pub located in the centre of Milan, Italy. The pub has been chosen based on the availability of the owners to participate in the initiative. The pub was serving drinks and offered a buffet throughout the evening.

Participants (Statistical Units)

The statistical unit (SU) chosen for the data analysis refers to the number of people seated on the tables. The SU adapted every time the number of people on the observed table changed.

Ethical approval: All procedures performed in the study were in accordance to the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Materials

A wooden basket with stuck on labels with the image of a smartphone and a slogan that invited customers to place their devices in ("sei davvero social?

#posalo i.e. are you really social? #leaveit") was placed in the centre of each table (see Appendix D1). The boxes had 6 compartments for the smartphones.

Measures

Two observers independently assessed the rate of the smartphones use by the customers. To gather data each observer was provided with 5 observational grids for each phase of the intervention. Both the control and the experimental grids provided two blank cells to note the number of people seated on the table and the number of people who were interacting with their smartphones. (See Appendix D2) A list of the specific behaviors considered as "interactions with the smartphone" (see. Table 1) was established in advance.

Target behaviors	Non-target behaviors
The customer holds the smartphone and is looking at it	The phone is on the table but nobody is interacting with it
The customer holds the smartphone to make a call or to send an sms	The phone is held on the legs but the customer is not looking at it
The customer touches the smartphone to check notifications, time etc.	
The customer uses the smartphone as a sharing tool, with the other participants on the table (in this case the behavior is reported twofold: an X for both - the customer that is holding the smartphone and for the one/s that is/are looking at it.	
The customer takes photos or selfies (if the subject is making a photo to other customer or a selfie with them, the behavior will be reported twofold: an X both for the customer that is making the photo and for the one/s that is /are having the photo.	
The customer holds the phone in his hand without looking at it.	

Table 1. The table above describes the target behaviors, i.e. the ones that are considered as interactions with the smartphone, and the non target behaviors, i.e. those that are not considered as interactions.

A momentary time sampling (MTS) recording method was used during the observations. With the MTS, the observer records whether a behavior occurs or does not occur at the end of a presetted time interval. The method was chosen for several reasons.

First, the main target of the experiment were prolonged behaviors (calls, texting, check internet, playing games, etc...) although the short ones were also included during the observations. In addition, there are many different possible interactions with smartphones, we expected to deal with a wide range of behaviors. The MTS reliably measures behaviors that are long and/or heterogeneous.

Second, MTS is effective to observe group of individuals. The study aimed to observe the widest possible sample of people. We expected to find in a pub a heterogeneous clientele and this method seemed to be the most useful to pursue the goal.

Third, MTS is less intrusive compared with other time sampling methods. During the experiment, the observers were seated in the pub as customers, so the MTS was the best choice to reduce the chance to be noticed and to influence the customer's behavior.

Finally, MTS is less tiring for the observers compared with other time sampling methods in which they have to look at their subjects for a prolonged amount of time.

The MTS is not the best method to observe short behaviors. Although these were not the primary target, to reduce this problem to some extent, short intervals of time for monitoring were settled in order to increase the number of observations and thus the chance to record at least part of the short behaviors.

Observational grids were used to record the control and the experimental data.

Procedures

The pub was observed two times, in the same day of two consecutive weeks, from 7.00 PM to 11.00 P.M.

Six tables were observed in sequence by two observers in order to evaluate the inter-observer agreement. Each table was observed on the count of 5 seconds. The observers were provided with headphones to listen to a recorded audio file measuring the time and helping them synchronise when to shift their look to the next table. Each observation string (i.e. the consecutive observation of the six tables) was lasting 30 seconds with a pause of 5 seconds between each observational string. Thus, each table was observed with a time latency of 35 seconds. Each observation grid counted 30 observational strings and the time necessary to fill each grid was 17 minutes and 30 seconds.

The pubs were observed until all 5 observational grids were filled. Tables to observe were chosen based on two criteria:

1.   the observed tables had to be clearly visible from the table in which the observers were seated;

2.   at least three tables had to be full, i.e. having at least two or more people seated on each table

For each observed table, for each observation (i.e. every 5 sec.) each observer had to sign in on the observational grid the number of subjects seated at that moment and the number of people that emitted one of the target behaviors showed in Table 1. Whenever the observer missed an observation or the visibility of one or more tables was not clear to directly look at the subjects, an empty space was left in the grid.

Experimental design

A between groups plan was implemented, with an independent variable (intervention vs. nonintervention) and two independent groups, with repeated measure on the dependent variable. The dependent variable was the frequency of use of the smartphones.

Outcome measures

Three outcome measures were considered:

Outcome 1 was the percentage of time in which none of the subjects included in a specific SU interacted with their smartphone.

Outcome 2 was the percentage of time in which every subject included in a specific SU interacted with their smartphone.

Outcome 3 was the maximum consecutive period of time within a SU in which none of the people interacted with their smartphone.

Data analysis

From the data analysis were excluded the SU that counted less than four consecutive observations. Moreover, were excluded from the data analysis those observations in which just one person was seated on the table.

Categorical data are presented as n (%) and continuous data as means (SD), and median and interquartile range in case of Non-normal distribution. A 95% confidence interval (CI) indicates uncertainty around the estimates. Chi-square (Fisher exact test was used when appropriate) was used to evaluate differences between categorical variables, whereas Mann-Whitney test was used to investigate differences between continuous variables. All analysis were carried out with SPSS (version 22.0, SPSS, Inc, Chicago, IL, 2011) $P < .05$ was considered statistically significant for all analyses.

8.2.2. Results

Inter-observer agreement (IOA), i.e. the degree to which two or more independent observers report the same observation after measuring the same event (Cooper, Heron & Heward 2007, p. 213), was calculated during the control and the experimental phases for both the number of people seated on the tables and for the frequency of use of the smartphone.

During the control phase the IOA for the number ranged between 96% and 100% while the IOA for the frequency ranged between 86% and 97%.

During the experimental phase the IOA for the number ranged between 96% and 100% while the IOA for the frequency ranged between 93% and 100%.

Overall seventy-four statistical units were observed: forty-seven (63.5%) in the control phase and twenty-seven (36.5%) in the experimental phase.

The SUs ranged between 2 and 4 persons per table. In the control group 29 SUs (61.7%) were composed by two people; 9 (19.1%) were composed by 3 people and 9 (19.1%) by 4 people; in the experimental group 15 SUs (55.6%) were composed by two people; 3 (11.1%) were composed by 3 people and 9 (33.3%) by 4 people. There are no differences between the two groups in this distribution (Chi-square(2)=2.21; p=0.331).

The median time spent at the table by people included in each SU was similar in the two conditions (U=626.50; p=0.928), and it was respectively 5 minutes and 15 seconds (interquartile range = 7 minutes and 35 seconds) in the control phase and 6 minutes and 25 seconds (interquartile range = 8 minutes and 45 seconds) in the experimental phase.

Effectiveness of the intervention

Outcome 1: The percentage of time spent by all the subjects without using smartphone in each SU was significantly higher (U=454.5; p=.038) in the experimental phase (median = 98.5%; interquartile range = 25%) than in the control group (median = 75%; interquartile range = 50%). Furthermore, 22 SU (46.8%) in the control phase and 19 SU (70.4%) in the experimental one did not use their smartphone for 80% of the observations (Figure 21). The likelihood of not using smartphone is significantly higher in the experimental group than in the control group (Chi-square(1)=3.85; p=.05).
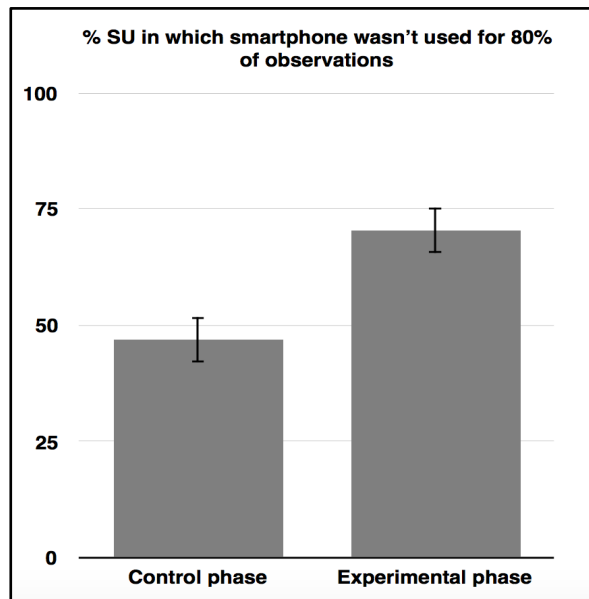
Figure 21. The histograms show the percentage of SU in which smartphones were not used for 80% of the observations during the two phases.

Outcome 2: The percentage of time in which all the subjects in the SU interacted with their smartphone was significantly higher (Chi-square(1)=6.64; p=.011) in the control group (21.3% (N=10)) than in the experimental group (0%) (Figure 22).
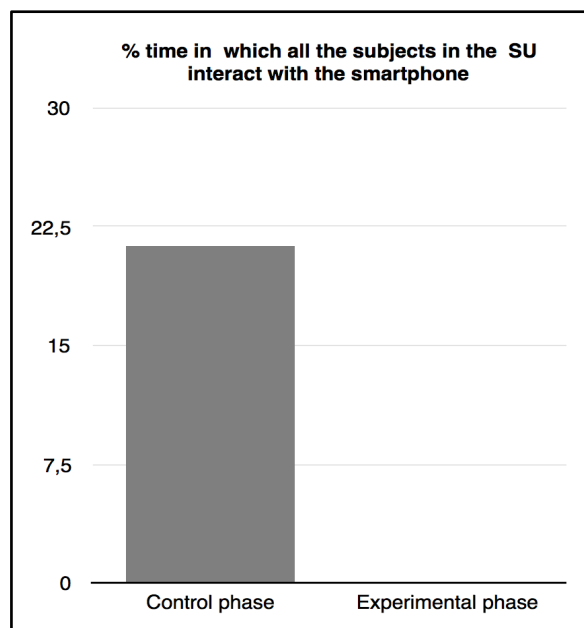
Figure 22. The histograms show the percentage of time in which all the subject of a SU interacted with their smartphones during two phases.

Outcome 3: Figure 23 shows the overall longest consecutive median time spent by the subjects of the SU without any interaction with their smartphone in the control and the experimental group.

The median time in which all the people of one SU did not use their smartphone was similar in the two conditions (U=502.00; p=0.393), and it was respectively 3 minutes and 30 seconds (interquartile range = 6 minutes and 31 seconds) in the control phase and 4 minutes and 39 seconds (interquartile range = 8 minutes and 59 seconds) in the experimental phase.
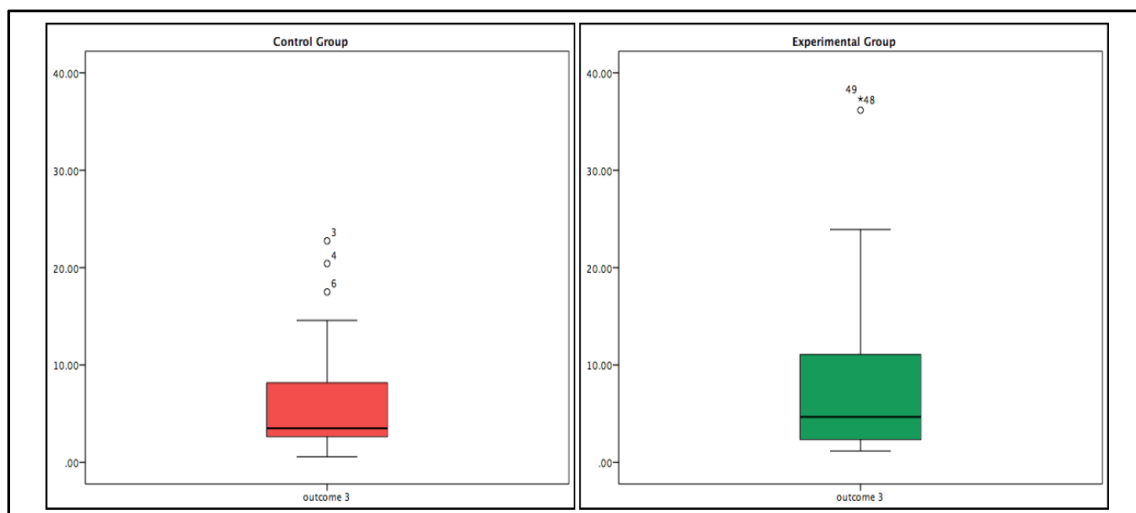
Figure 23. The overall longest consecutive median time spent by the subjects of the SUs without any interaction with their smartphones is represented in the box-plots.

8.2.3. Discussion

Three outcome measures were considered in order to evaluate the effectiveness of the intervention i.e. the the percentage of time in which none of the subjects included in a specific SU interacted with their smartphone (Outcome 1); the percentage of time in which every subject included in a specific SU interacted with their smartphone (Outcome 2); and the maximum consecutive period of time within a SU in which none of the people interacted with their smartphone (Outcome 3).

Results showed that the percentage of time spent by subjects without using smartphone in each SU was significantly higher in the experimental phase,

compared with the control one (Outcome 1). Moreover, the percentage of time in which all the subjects interacted with their smartphone in each SU was significantly higher in the control phase compared with the experimental one (Outcome 2). Finally, statistically significant differences were not found comparing the overall longest consecutive median time spent without interaction with their smartphones by the subjects of the SUs in the two conditions (Outcome 3).

The study presents some main limitations. First, the pilot study can rely on a fairly small sample of observed SU. More observations must be conducted in order to have clearer results. Second, the study took into account the frequency in the usage of smartphones. However, no measures were observed about people's interpersonal interactions. It would be useful to assess if the reduction in the usage of the smartphones is effectively related to an increase in interpersonal communication. Finally, due to privacy issues it has not been possible to make video observation which would have been a more precise method to observe all possible interactions of the subjects with their smartphones.

Considering the low cost of the intervention, however, the results seem promising and it would be worthy to extend the observations to different cultural contexts in order to test their generalisability. Ongoing researches are already addressing this point. Moreover, it could be interesting to test the effectiveness of the intervention by using just the slogan without the basket.

Conflict of Interests: The authors declare that they have no conflict of interests.

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8.3. Less sugar by default: resize the packets of sugar to reduce its consumption in a coffee bar

Abstract

The present study aimed to reduce the sugar intake among the customers who purchased coffee in a coffee shop inside a gym in Catania, Italy. We hypothesised that people would frame their choice about the amount of sugar to put in their coffee in units (number of packets) and not in amount (grams). Thus, we expected a significant decrease in sugar intake among the customers in the experimental phase. The customers of the coffee shop were observed for for two weeks (N=213) and just the data about those who put sugar in their coffee were analysed (N=96). During both the first (control phase) and the second week (experimental phase), sugar consumption was measured. During the experimental phase, however, the packets originally used in the coffee shop (7.5g) were replaced with packets that contain less sugar (4g). Results supported the hypothesis, showing a significant reduction in the sugar consumption during the second week.

Keyword: sugar; nudge; default; coffee shop

In 2015, the World Health Organization (WHO) recommended that the intake of free sugars should not exceed 10% of the total daily intake of calories[7]. (World Health Organization, 2015). The literature provides evidence that a prolonged overconsumption of sugar can increase the chance to develop several health issues and diseases such as diabetes, coronary heart disease and obesity (e.g. Vecchia, Franceschi, Bidoli, Barbone & Dolara, 1993; Janket, Manson, Sesso, Buring & Liu, 2003; Johnson et al., 2009; Lustig, Schmidt & Brindis, 2012; Yang et al., 2014). Among the factors that in general influence food consumption, packaging and portion sizes have been found to play a significant role (e.g. Rolls, Morris & Roe, 2002; Aerts & Smits, 2017; Poelman et al., 2016).

Despite these evidences worldwide the last 30-40 years have been characterised by a general increase in package size of products (e.g. Smiciklas-Wright, Mitchell, Mickle, Goldman & Cook, 2003).

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[7] The WHO did not refer to the sugars contained in fresh vegetables and fruits or those naturally present in milk, because there is no reported evidence of adverse effects of consuming these sugars

Nudge is a policy program developed by Richard Thaler and Cass Sunstein starting from the principles of BE in order to help people to act in a way that is more functional with their goals (Thaler & Sunstein, 2008) without using punishments or bans. That is achieved by working on the environment in which people act and take decisions.The literature about Nudge shows that one of the most effective strategy to promote desirable behaviors is the use of the default option (e.g. Johnson & Goldstein, 2004; Thaler & Benartzi, 2004). Setting a default option means setting an option that will be automatically chosen unless people actively choose to behave in an different way. Many examples can be listed. Smartphones and digital device are sold with predefined setting that people can eventually change. Many subscriptions get automatically renewed unless the customer actively decides to unsubscribe. According to Sunstein, however, the default rule should be the one that is in line with people's preferences in order to be considered as a Nudge.

The present study aimed to reduce the intake of sugar in a coffee shop working on offering reduced amount sugar in the package. We assumed that people frame their choice about the amount of sugar to put in their coffee in units, (number of packets) rather than considering the effective amount (grams) contained in the packets. It has been hypothesised that by replacing the original packets of sugar with ones that contains a smaller amount of it, would have reduced the average of sugar intake per person.

8.3.1. Materials and Method

Setting

The intervention took place in a gym in Catania, Italy.

Participants were the self-selected customers of the gym's coffee shop. The data was collected for twelve days (from Monday to Saturday), between 3pm and 4pm.

Ethical approval: All procedures performed in the study were in accordance to the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Materials

Packets with 7,5g of sugar were used during the control phase, replaced with 4g packets during the experimental one.

Measures

An observational grid was used in order to note how many packets of sugar each client was pouring in their drinks (see Figure 1)

Procedure

The experimenter observed just the customers who purchased coffee. After the client's finished to drink it, the experimenter take note of the number of packets used. Four possible source of data were recorded:

1. When people did not use any sugar, a 0 was noted on the grid;
2. When one or more packets were empty the number of used packets were noted on the grid;
3. When the packet was not empty, it was arbitrary choose to consider it as half full packet;
4. When were used a certain number of packets plus a part of another, it was noted the number of packet plus half.

For the data analysis, were considered just the clients who used brown or white sugar, while were excluded those who used other kinds of sweeteners were excluded.

Outcome measure

The average of grams consumed per person among the customers who put sugar in their coffee was the outcome measure of the experiment. In order to do it, packets have been converted in grams.

8.3.2. Results

During the control phase 102 customers were observed; among them 52 (51%) put sugar in their coffee while 50 (49%) did not. During the experimental phase 111 customers were observed; among them, 44 (40%) put sugar in their coffee while 67 (60%) did not;

To evaluate the amount of sugar consumed in the two phases an independent t-test was performed excluding participants who did not put any sugar in the coffee. The average intake of sugar per person was 5.91g (SD=1.87) during the control observation, reducing to 3.05g (SD=1.01) during the experimental one (see Figure 24). The difference between the average of sugar consumed during the control phase and the experimental one was statistically significant (t(94)=9.10; p<0.001; Cohen's D=1.37).
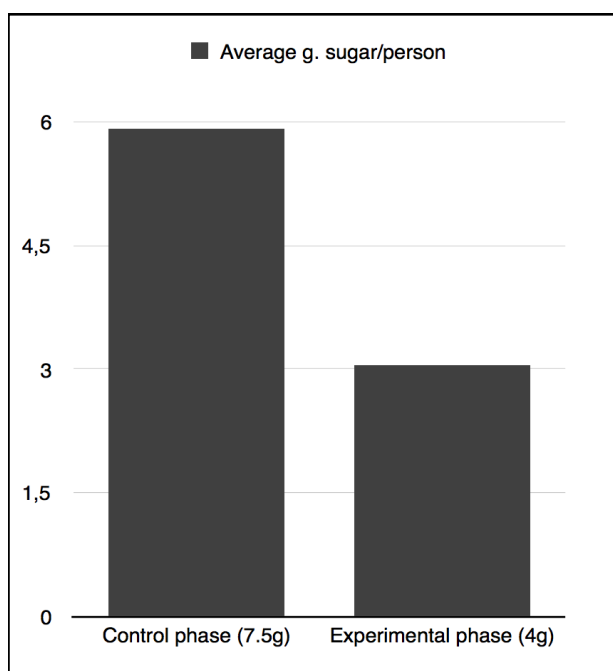
Figure 24. The histograms show the average grams of sugar consumed by the customers of the coffee shop who put sugar in their coffee.

8.3.3. Discussion

The results confirmed the initial hypothesis, showing a significant reduction in the average of sugar intake during the experimental phase. The study seems to support the effectiveness of manipulating the default rule when facing with unhealthy behaviors that are assumed to be "mindless". Results seems to be in line with the idea that customers, when choosing the amount of sugar base their choice on units instead of on real amount. Further experiments could assess the generalisability of this finding in other cultural contexts and with different kind of goods.

The intervention has some main limitations. First, due to the experimental design, it is not possible to exclude that some of the clients were regular customers and so, present in both the control and the experimental condition. Second, the choice to consider as half the non-empty packets of sugar was arbitrary. However, the same measurement was kept in both conditions. In further studies it could be useful to measure the non-empty packets in order to have more precise data.

Conflict of Interests: The authors declare that they have no conflict of interests.

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Part 4

Behavioral Analysis
and Behavioral Change

Introduction

In the literature different authors claim that BE should be seen as an application of cognitive science in the realm of economic decision-making (e.g. Angner & Loewenstein, 2007, Heukelom, 2007) and some of them go further claiming that BE should have been called more properly cognitive economics (Angner & Loewenstein, 2007).

In the first part of the PhD thesis it has been traced the historical and theoretical frame of BE providing information about the intellectual background that led to its emergence and development. In Part 2 it has been made an account of the main policy programs rooted in BE principles. Part 3 described the research projects carried out by the author of this thesis during the last three years. The next part is proposed as an attempt to understand some notions of BE and its best known applied approach (Nudge) based on the principles of BA.

Part 4: An overview. This part of the PhD thesis provides a historical and theoretical frame of Behaviorism, with a particular focus on the functional contextualist approach called "Behavioral Analysis" (BA), whose main exponent was Frederick B. Skinner (1904-1990). BA is rarely mentioned when talking about BE and Nudge. The focus here is on common and divergent points between BE, Nudge and BA.

The place of part 4 at the end of the PhD thesis, after the research presented in Part 3 has been chosen for an important reason. BE and Nudge led to a wide range of interventions that showed their effectiveness and helped greatly to build up knowledge about decision making and choice. Therefore, after having in mind the traditional perspective building on the concepts of BA can broaden and expand the understanding of human behavior and choices. Moreover, as in every relatively new discipline much can still be done but it is important to give a credit to the work of researchers and experts like Kahneman, Tversky, Thaler, Sunstein and Gigerenzer who built its foundations. Their framework has been often sharply criticised without offering effective alternatives neither of their

theoretical nor of their applicational standpoint. However, no absolute truths are provided, this part only sets the basis of a multidisciplinary dialogue that could further improve the knowledge about decision making and choices that are constant part of daily life. It is a small contribution to the scientific approach to the study of human decisions without breaking up with the valuable findings in the research until now.

9. Pepper's World Hypotheses

The differences in the different approaches of psychology depends on the level of analysis chosen, the unit of analysis taken into account and the experimental procedures adopted. Based on these elements, each approach elaborates observations and inferences that are organised in an interpretative model. In other words, the world around us is "seen", analysed, described and interpreted differently according to what one chooses as the basic element for observation (Moderato & Copelli 2012, p. 10). The epistemological premise from which the this part of the PhD thesis will start is the one adopted by Skinner and by the modern behavioral approaches, that is called "functional contextualism".

In order to have a better understanding of Skinner's theoretical framework and its developments, it is useful to start from the work of the physiologist Stephen C. Pepper (1891-1972). In 1942 Pepper published his book "World Hypothesis: A Study in Evidence". The author postulated the existence of a few philosophical models, defined as "world visions" or "world hypothesis"[8]. Those were "hypotheses" about how the world works and the scientists, therefore, must observe carefully and must try to understand. From such a starting point it is possible to build knowledge (Pepper, 1942). Looking at reality without preconception or "lenses" it is impossible to reach valid conclusions and would not allow any progress in knowledge. In the best case it would only give rise to a set of perceptual experiences that the observer would not be able to interpret. The aftermath, unfortunately, is that each of the "world's views" is unavoidably partial. Thus, the "world hypothesis" differs in scope (the amount of events that they can explain) and precision (the shortage of alternative explanations formulated for embedded events). Because scope and precision are inversely related, no "world view" can fully meet both criteria: unavoidably it is possible to gain in precision at the expense of scope, and vice versa (Hayes, Hayes & Reese, 1988).

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[8] The two terms will be used interchangeably

Another peculiarity of the world's visions is that they are independent and alternative to each other. They can be compared but not put in competition with each other. According to Pepper's theorisation, this assumption has some relevant implications: First, it is unjust and useless to criticise a "world view" using the principles of another "world view". Second, the validity of a "world view" should not be claimed by highlighting the fallacies of another one. Finally, eclecticism is not admitted as an option, because combining different visions of the world would be a source of confusion. Pepper's "world visions" can be represented by four "root metaphors", i.e. mechanism, formism, organicism, and contextualism, useful to conceptualise and organise reality into a coherent system of categories (Pepper, 1942; Moderato & Ziino, 1995; Anchisi, Moderato & Pergolizzi, 2016).

Mechanism. The "root metaphor" of mechanism is the machine made up by discrete parts that are systematically connected. The relations between the different parts does not change their nature, since they exist independently of their relation. Moreover, as in any machine, some kind of energy must be inputted into the system in order to obtain predictable results. According to this vision of the world, the whole universe is like a big machine.

The mechanist aims to find out what parts compose reality and what are their relations. Assuming that the parts fit each other in a precise order, Pepper tries to discover the true nature of an event by identifying what kind of part it is and its exact location in the general system, i.e. the machine. This goal is pursued based on a theoretical model built upon the observed facts. However, the correspondence between the theoretical model and the facts from which the model was built can not be used as proof of the suitability of the model itself. The same fact can not be used either to build a model or to confirm it. Thus, the validity of the model is verified by comparing it with a variety of facts implied by the model itself, using a hypothetic-deductive method. The more derivative and indirect are the predictions, the greater the power to confirm them (Hayes, Hayes & Reese, 1988; Anchisi, Moderato & Pergolizzi 2010, p. 108) .

Formism. The "root metaphor" of formism is similarity or in other words the recurrence of recognisable forms. Formists do not assume that facts are organised

in a systematic way, and therefore they do not need to hypothesise about any kind of "force" in order explain them. If facts would need to be integrated by a set of formistic principles, then they would necessarily form a system, and formism would begin to mix with some characteristics of mechanism. Causality in this vision is nothing but a link between sets of details. In other words it is the form that explains the facts. As in mechanism, in formism the truth criterion is correspondence, but in this case the simplest explanation has to be the most appropriate (Hayes, Hayes & Reese, 1988).

Organicism. The "root metaphor" of organicism is the process of organic development, as in the case of living systems. In such systems change is assumed while stability has to be explained. A good example are models of development in stages according to which individuals are expected to move from one stage to the next one in a certain sequence and in a predictable way. To explain a stage of development of a person it is necessary to explain which rules govern the change. For the organicists the whole is not a sum of the parts. Conversely, the whole is the basic unit and the parts are meaningless unless they are taken in its context. The truth criterion in organicism is coherence. When a network of related facts leads to a conclusion, it is the coherence of that network of facts that makes the conclusion "true". Any contradictions in the understanding come from an incomplete knowledge of the whole organic process (Hayes, Hayes & Reese, 1988).

Contextualism. The "root metaphor" of contextualism is the ongoing act in context. That means that an event takes its meaning only in the light of its current and historical context: the subject of study is the act in its context. Within this perspective, the concept of similarity between events based on their formal properties loses its meaning. What makes similar some events can only be their relation to the context, i.e. their function. That means that the events are considered as belonging to the same class if they have the same consequences. Thus the concept of similarity in the form is replaced by similarity in the function. In other words, two events belong to the same class if they share the same function, while events similar in their form may belong to a different function.

For example a man sitting in silence in a waiting room and another one shouting, although their behavior is of different kind it may belong to the same class of events, for example "to gather attention". Conversely, two men may be both sitting in silence, but one could be trying to gather attention and the other one to isolate himself. In this example, the form of their behaviors is identical although the function is completely different. Moreover, within this perspective, the distinction between the act and its context is of great importance. In fact, the same event can be considered an act or a context depending on the researcher's interest and this can lead to an infinitive regression.

However, in its analysis contextualism adopts a pragmatic truth criterion so that the analysis is deemed "true" if it includes enough features of the context to achieve successfully the goal of the analysis. It is important to note that contextualism does not specify anything about the value of the goals themselves, which are formulated by the researcher and taken as starting assumptions (Hayes, Hayes & Reese, 1988).

The Two Souls of Behaviorism. Although Pepper's book was not written for psychologists or scientists, different psychological approaches often seem to have the characteristics of one or another of the four "world views". As it is seen in the next sections the term "behaviorism" refers to different approaches that are different both at an epistemological and theoretical level. It may be said metaphorically that behaviorism showed, in its history, "two souls" that fit with different "world views". The first one is mechanistic and it characterised the first behaviorism of Watson. The other one, is contextualist and it is the one adopted in what is called "Behavioral Analysis" (Anchisi, Moderato & Pergolizzi 2016, p. 111).

10. Behaviorism: Historical Backdrop and Theoretical Framework

Wilhelm M. Wundt (1832-1920) was a German physician, physiologist, philosopher and professor. He is universally considered one of the founding figures of modern psychology and the foundation of his Laboratory in Lipsia (1879) is considered the beginning of experimental psychology. In 1913, the year of publication of Watson's Behaviorist Manifesto (Watson, 1913), however, experimental psychology was more in the minds of the psychologists than a reality.

Wundt certainly gave a fundamental impulse to the development of psychology. However, his attempt had little to do with experimentation and a scientific approach in the study of human psychology still was needed to be built. Wundt's main contribution was that he began to deal with the mind-body debate in a scientific way and no longer just philosophically. He focused his studies on the contents of consciousness using the method of introspection, by which, an adequately trained individual, exposed to particular stimuli, described his experiences. The structuralism of Wundt and his American student Titchener was a system characterised by staticity and insensitivity to the phenomena of adaptation. However, this idea was poorly suited to the pragmatic spirit of American society (Anchisi, Moderato & Pergolizzi 2016, p. 103).

Functionalism was a more dynamic concept and in line with the spirit of the time that found greater consensus in America. It emerged as a valid alternative to structuralism. The starting point for this school of thought was considering psychological processes as psychological functions with an adaptive value for the body. That was in greater harmony with Charles Darwin's theory and Herbert Spencer's studies. Great importance was in fact attributed to concepts like evolution, adaptation, environment, function, which are fundamental to understand the roots of modern behaviorism. It is within this cultural background characterised by the debate between structuralism and functionalism in which the

behavioral revolution emerged and flourished. (Anchisi, Moderato & Pergolizzi 2017, p. 103)

In 1913 Watson published his article *"Psychology as the Behaviorist Views it"* (Watson, 1913). For a young science like psychology the natural and almost mandatory choice was following the path of other natural (organic and inorganic) sciences of the 19th and 20th centuries. Following this vision, the focus in psychology had to be the behavior of organisms instead of the expression of invisible processes like thoughts and emotions. The method to use in order to study behavior had to be the same used by natural sciences. The laboratory became the place where the researcher could have control of the environment and thus could simplify reality by dealing with "simple" stimuli.

The task of Watson was difficult and ungrateful. Considering the extreme complexity of human behavior and the limited tools available at the time, the best way he found in order to carry on his research was to simplify as much as possible the subject of his studies. Behaviorism, therefore, represented a revolutionary opportunity for the progress of psychology. On one hand, it allowed psychology to definitively stick out from an animistic conception. On the other it contributed substantially to the constitution of the epistemological state of scientific psychology. By using a scientific approach it got detached from the method of philosophical speculation to deal with problems and events of the real world (Anchisi, Moderato & Pergolizzi 2017, p. 102). Watson defines its subject and method of psychology in his Manifesto (1913) in the following way:

"Psychology as the behaviorist, views it, is a purely objective experimental branch of natural science. Its theoretical goal is the prediction and control of behavior."
(Watson, 1913)

The tools of behavioral psychology became direct observation, experimentation, analysis and non-prejudicial interpretation of events, observed as they occur and modified by specific circumstances. For this reason the behavioral paradigm has been for long time the basis of research in modern psychology.

10.1. Watson Mechanistic View of Behavior

Mechanism characterised the Stimulus-Response (S-R) model of Watson (Harzem, 1995). The S-R model excluded any subjective variables from the scientific investigation and replaced them with a black box that did not satisfy those who perceived it as central to the understanding of human variables that were not directly observable such as emotions and thoughts. In other words, all the humans' private events were excluded by the analysis.

In Watson's paradigm, as described above (Part 4, section 9) by talking about the mechanistic root metaphor, the "human behavior machine" is made up of a chain of connections that are directly and effectively linked. The chain is represented by a series of causes and effects. The changes that occur in these causes and their related effects are perfectly predictable. Environment represents a reduction of the stimuli, and responses represent a reduction of behaviors.

10.1.1. Limits and Criticism

The first phase of behaviorism, from the beginning of '900 until the second world war, consisted predominantly of an ideological display against the previous Wundtian psychology that was based on psychic factors. Two positions can be distinguished from this. Watson (1924, p.14) declared behavior as an object of study of psychology and defined it through its form. According to him behavior included muscle movements and glandular secretion. From this perspective, which Hayes (2005) defines metaphysical behaviorism, all the activities of the organisms could be reduced to events of this type; and even if mental activities or other activities that did not involve pure movement existed, these could not be the object of study of a scientific psychology because the public agreement on how they occurred was impossible (Hayes defines this second position methodological behaviorism). Both metaphysical and methodological behaviorism were characterised by a reductionist approach, excluding every subjective variable from the scientific investigation replacing it with a black box. This position did not satisfy those who conceived as central the

understanding of human behavior variables that are not directly observable, as emotions and thoughts.

Starting from the second half of the 20th century, scientific psychology began to get interested in the study of private experiences that J. B. Watson locked in the untouchable black box.

On one hand risen the current of the cognitivists, sharply criticising behaviorism and explicitly focusing their interest in the study of private experiences as the causes of behaviors. Covert behaviors bursted into the psychological landscape becoming an object of studies. Irrational thoughts and beliefs were identified and modified in order to change the overt behavior of the person and many aspects of human functioning were described through internal entities (personalities, mental schemes, associations, attachment styles) that more or less explicitly assumed a causal function.

On the other hand, behaviorism experienced some evolution. Collaterally to the metaphysical and methodological currents two other approaches developed: Kantor's interbehaviorism and Skinner's BA (Anchisi, Moderato & Pergolizzi 2017, p. 106). The study of private events got the main challenge in BA and that is particularly clear in Skinner book Verbal Behavior (1957). The author clearly stated to the examining thoughts, emotions and sensations, though this important fact went unnoticed by the scientific community:

A science of behavior must consider the place of private stimuli as physical things, and in doing so it provides an alternative account of mental life. The question, then, is this: What is inside the skin, and how do we know about it? The answer is, I believe, the heart of radical behaviorism. (*Skinner 1974, pp. 211–212*)

10.2. From Watson to Skinner: A Contextualist Approach in the Study of Human Behavior

According to many authors (e.g. Hayes & Brownstein, 1986; Moderato & Chase, 1995; Morris, 1988), an example of a contextual approach within psychology is that of BA, the science that has developed thanks to the researches and the theoretical writings of the most influential behavioral psychologist of the 20th

century, Burrhus F. Skinner. BA is contextual, because its study is focused on the ongoing behavior in its context and because it describes the properties of the relation between the organism and the environment.

Moreover BA is rooted in the functionalist philosophical tradition, which origins can be attributed to the Aristotelian naturalism. This implies that all the explanations that accompany what is observed must be given in terms of other observable elements of the same type. Thus it is necessary to remain within the "circle" of the experience and phenomena without taking into account transcendent entities or supernatural forces (Anchisi, Moderato & Pergolizzi 2016, p. 112).

Prediction and Control*.* The goals pursued in BA are two: prediction and control (Skinner, 1953). The former is achieved by describing the changes in the dependent variables as a result of the changes in the independent ones. The latter is achieved by manipulating the independent variables. Therefore, they are identified on the basis of two features: they must allow both predictive and manipulative action. Events that allow to achieve just one or the other aspect can not be accepted in an experimental BA.

Truth Criterion. According to Pepper, what saves the contextualists from falling into an infinite cycle of component analysis is the criterion of adequacy of the analysis (Pepper, 1942). That is, the analysis is "true" only if it is useful to pursue a certain kind of outcome or objective, defined beforehand. As Skinner stated:

"It is true that we can trace human behavior not only to the physical conditions that shape and maintain it, but also to the causes of those conditions and the causes of those causes, almost infinitely, but we need to conduct the analysis only to the point where, effective action can be taken"
(Skinner, 1974, p.210).

This point, according to Skinner is represented by the manipulable environment (Hayes, Hayes & Reese, 1988), because it is only at this level that the

achievement of the analytical behavioral prediction can be evaluated and the objectives controlled (Hayes & Brownstein 1986).

10.2.1. The Subject of Study in Behavioral Analysis

Behavior can be defined as the activity of the living organisms. Human "behavior" is represented by all that people do, how do they move and what do they say, think and feel. It can be said that for living organisms, including human beings, it is impossible not to behave.

The term "behavior" in psychology has been the subject of many misunderstandings. One of them is to reduce the meaning of behavior to just actions and physical body movements. Another one is to counterpose cognition and behavior. Cognition is a part that characterises behavior. Another one, dating back to Watson, is to accept observable behavior as the only subject of the studies in psychology, excluding everything else (Moderato & Copelli 2010, pp. 21-22).

On the contrary, BA openly states its aim to study also private events or events under the skin and which can not be directly observed, such as for example, cognitive processes and emotions (Skinner, 1974).

Mentalistic elements have been often excluded from the analysis of behavior not because are denied or out of the focus of the analysis itself, but just due to the impossibility to manipulate them directly, and therefore unnecessary to pursue the goal to control behavior described in the previous section (Skinner 1953, p. 34).

As stated by Skinner:

"Explaining behaviors using mental states, just move(s) the focus out of the research of (an explanation of) the behaviors. (To) Rely upon an "inner person" means to give an explanation (of) to something that could not be explained (itself and its just a way to explain things that we are not able to explain) in other ways".
(Skinner 1974, p. 165)

Paradoxically, it may be said that BA shows little interest for behavior itself. Knowing that a person is overeating is not useful by itself (Moderato & Copelli 2010, p. 20-21). What is important in the analysis of behavior, is to understand in which conditions such behavior take place. In other words, BA is focusing on functional relations of some classes of variables. For example, in some cases overeating may be linked to the search for attention, in other cases to the fact that the person is involved in social contexts in which many people are overeating, in other cases to physiological dysfunctions, and so on. Thus, it is not the form of the behavior that matters for a behavior analyst in order to promote or reduce certain behavior, but its function.

Functional Relations. BA subject of study is a functional relation, technically called contingency, made up of three interrelated elements that take place in a specific context: a class of stimuli/events that precede the response/behavior (antecedents), a class of responses/behaviors and a class of stimuli/events that follow the response/behavior (consequences). The explanation of behavior must be described in probabilistic/functional and not in deterministic/causal terms. Functional means that BA does not focus its studies on structures, but on psychological functions, i.e. the process that rise from the interaction between an individual and the environment, that can be seen as a unit tied in a reciprocal relation (Moderato & Copelli 2010, p.17).

Historical Dimension of Behavior. Another important aspect in BA is the historical dimension of behavior on a psychological and biological level. The history of a subject is the series of events that made the person be who he/she is in the present. It is crucial for understanding people's behavior and predicting how they may probably act in the future and setting BC interventions (Moderato & Copelli 2010, p.21).

10.2.2. A Functional Contextualist Model of Human Behavior

Stimulus. Every organism lives in an environment and is constantly a subject to forces that act upon it. A stimulus (S) or event represents a perceptible change in

the environment for the organism. Any environmental variation that results in a nervous activity in the body may be a stimulus, whether such activity consists in a reflexive response element or is concretised in a reaction it manifests in one or more behavioral responses. A stimulus therefore can be defined as a physical, organic or social event that can be studied directly or by using appropriate tools.

Not all stimuli that reach the surface of the body produce effects on the individual's behavior. In other words, not all stimuli have a stimulus function: the stimulus function is the description of a specific action that a part of the environment has on a particular individual. The function of a stimulus may depend on its natural features or on its history of interactions with an organism: in other words, the stimulus function can be predisposed genetically or as in majority of the cases for humans, it can be acquired.

The main consequence of the fact that many stimulus functions are acquired is that the same stimulus can assume and perform different functions for different individuals. On the other side, different stimuli can play the same function for multiple individuals (Moderato & Copelli 2010, p. 23).

While the definition of the stimulus function can only take place on an individual basis, many stimulus functions have been studied experimentally and grouped by functional classes, i.e. eliciting, discriminative, reinforcing and punishing. A stimulus or an event has an eliciting function when it automatically produces certain responses or behaviors (R). That's the case of Pavlovian classical conditioning (Pavlov, 1927) where, for example, the food (S) elicits automatically salivation (R) in the dog. A stimulus or event have a discriminative (s^D) function when it "sets the occasion" a for behavior. It is important to highlight that in this case, according to BA, the stimulus preceded the behavior but does not cause it. A stimulus or event have a reinforcing function (s^R) when they increase the likelihood of the behavior to occur again in the presence of the s^D. Finally a stimulus or event have a punishing function when they decrease the

likelihood of the behavior to occur again in the presence of the S^D (Moderato & Copelli 2010, p. 24).

Response. A stimulus in a contextual perspective cannot be defined alone, but it is always interdependent to the response. The term "response" refers to the action that "responds" to an earlier event, precisely to the stimulus. If you stop here the term could be misleading and easily criticised. BA refers to a class of responses that share the same function.The term stimuli, Not all the responses of an individual organism affect psychology: BA is interested only on those that represent behaviors, that is, they constitute the interaction between individuals' actions with the environment. Also responses can be classified. In this case two major classes have been described: elicited responses and the emitted behaviors:

The elicited responses are involuntary reactions that automatically happen when a stimulus is presented: in the case of Pavlov's classical conditioning, the dog's salivation (R) is elicited when a stimulus (S), the meat, is presented.

Emitted behaviors, on the contrary, are not the causal effect of a specific environmental stimulus, and their genesis has to be found in the history of subject's interactions with the physical and social environment. This determines the fact that in some situations, certain emitted behaviors are more likely and frequent than in others. These responses, which may vary widely in complexity, cover the full range of human manifestations and represent the way an organism acts on and modifies the environment in a more or less adaptive way. The more or less adaptive judgment derives from the fact that humans are typically free to emit behaviors that are harmful for the environment or their society (polluting the environment, destroying habitat) or for themselves (addictions, obesity, risk behaviors) and their consequences can be seen often just in the long run (Moderato & Copelli 2010, pp. 24-25).

As for the stimuli, the elements of a class of responses in no way depends on the formal characteristics of the behavior involved. Responses belong to the same functional class as the result of their common contextual consequences:

"Consequences define properties over which responses are said to be similar" (Skinner 1953, p. 65); This type of classification corresponds to what Pepper wrote (Pepper 1942, p. 255) about the concept of contextual similarity, derived from the *"convergence of action in a single effect"*.

10.2.2.1. Three Term Contingencies Model

The most important implication of Skinner's theorisation of behavior, is that the relation between discriminative stimulus (S^D) and response (R) depends to the consequences (S^R) produced by the act itself. In other words, the probability of emission of a certain response, depends on the consequences that were present previously in the occurrence of a certain discriminative stimulus. Behavior than is the dependent variable, and researchers can act upon contextual stimuli in order to produce changes in the behavior.

Based on these principles Skinner developed the three-term contingency model or ABC model that can be formally described as follows by Skinner (1953):

S^D (or Antecedents) → R (or Behaviors) → S^R (or Consequences)

10.2.2.2. Four Term Contingency Model

Many behavior analysts have proposed a "4th" term in addition to the ones included in the three-term contingency model, citing the importance of motivation in analysing human behavior. In fact, there is another important factors that influence the relation between organisms and stimulus. These are situational or contextual events.

Each organism's stimulation relation takes place in a context that is characterised by events that are specific or typical for a particular situation. The context influences the interactions, increasing or decreasing the strength, value, and characteristics of particular functions of the stimulus and the response produced in that interaction. Several examples can be given, ranging from biological to social. The state of deprivation of a body or the state of alteration due to alcohol,

drugs, medicines and so on can be conceptualised in contextual or situational terms (Moderato & Copelli 2010, pp. 25-26).

Skinner adopted originally the term "drive" in order to define motivation, describing it not as an internal variable, but as an environmental one. For example, deprivation of food, may increase the hunger, and so having an effect on the behavior. (Skinner 1938, p. 350)

In 1950, Keller and Schoenfeld (Keller & Schoenfeld, 1950) take back the notion of drive, developing the notion of Establishing Operation (EO) to define the relation between environmental variables and changes in certain behaviors. The term EO included all those variables that increase the effectiveness of certain consequences. However, many motivational variables decrease the effectiveness of consequences so that's how the term abolishing operation (AO) was named (Michael, 1982). Later on, has been proposed the term "Motivating Operations," (MO's), a broader term that includes both EO and AO to describe "any environmental variable that alters the current reinforcing effectiveness of a stimulus, object, or event, and alters the frequency of behavior that has been reinforced by the same stimulus, object, or event" (Michael, 1988)

MOs and s^D share some points but don't overlap. Both the s^D and MO are antecedents of behavior. However, the s^D is referred to the availability of a certain reinforcer, to the possibility to have access to it by behaving in a certain way, while the MO is referred to the value of the reinforcer and to how in a certain moment the reinforcer has a reinforcing function. For example, people may have learned that when there is a green light on a coffee vending machine, if they insert their coin and push the right button they will probably have their coffee. So the green light is the s^D for having their drink. However, the strength/value of the reinforcer will increase if a person is thirsty (EO) and decrease if the person just drank (AO).

Nowadays, many BA practitioners consider MO's to be antecedent stimuli that evokes behavior formally describing the four-term contingency as follows:

$MO/S^D \rightarrow R \rightarrow S^R$ (see also Figure 25).

That's of fundamental importance while talking about Nudge, because the discipline works mostly on the antecedents of a behavior (MO and/or S^D).
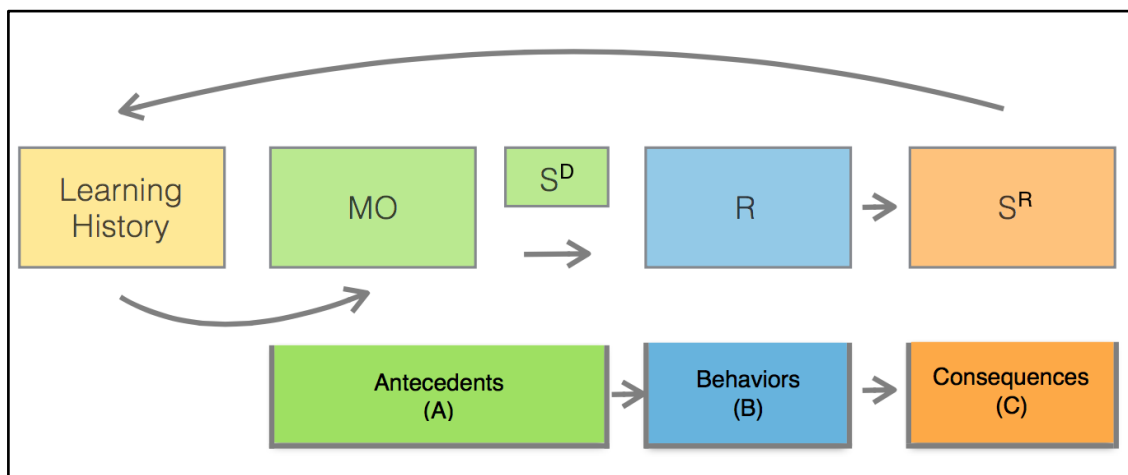
Figure 25. The four-terms contingency model

10.2.3. Verbal Behavior

Skinner's studies on human behavior were not limited to the analysis of overt behaviors, but have been extended to the study of private events and complex behavioral abilities, such language, emotions and cognitive skills. Verbal behaviors in BA are studied in the same way like any other behavior that people emit. Skinner and behavioral analysts assume that is possible to treat private events using the same tools developed to change "physical" behaviors, that is working on antecedents and consequences in order to promote BC.

So the study of verbal behavior can be seen as an extension to Skinner's paradigm of human behavior and not as a separate domain of studies. Starting from his work on verbal behavior (Skinner, 1957) the analysis of the verbal context emerged as a privileged subject of study for behavioral scientists.

Within BA there has long been a distinction between contingency-shaped behavior and rule-governed behavior. Contingency-shaped behavior is represented by those behavior that has been established by a gradual shaping of successive approximations, such as learning to catch a ball by trial and error or by a direct contact with the consequences of a certain behavior (Hayes, Strosahl

& Wilson 1999, p.28). That means that those behaviors that have reinforcing consequences will increase in their probability to be emitted in the future. Those that are punished or extinguished will decrease. Taking back the example of the vending machine, if the person that inserts the coin and pushes the button receives his drink, the chance that in the future he will repeat the same behavior, when he is thirsty, will increase (reinforcing consequence). If the machine takes the money without releasing any drinks, the chance that he will repeat the same behavior in the future will decrease (punishment). Similarly, if the machine gives back to the person the coin but does not release any product, the chance that the behavior is be repeated will decrease (extinction).

Many kinds of behavior are acquired this way, but many others are based on verbal formulations of events and the relations between them (Hayes, Strosahl & Wilson 1999, p.28). It turns out that when behavior is controlled by verbal rules tends to be relatively insensitive to changes in the environment (Törneke, Luciano & Valdivia Salas, 2008).

Rule Governed Behavior. In 1966, the concept of rule-governed behavior (RGB) was used by Skinner for the first time (Skinner, 1966). RGB has been defined as a behavior that occurs by contacting rules that describe contingencies, without a contacting the contingencies the rule describes (Skinner, 1969). For example, a personal trainer may give to his client the instruction "run half an hour per day and you will get in a good shape" and the client may follow the instruction without further contingencies.

RGB have been and are fundamental for the existence and maintenance of human species, because allow humans to have effective responses to a wide range of situations, without the need to directly contact contingencies that may be dangerous or ineffective for surviving or achieving certain goals. (Skinner 1974)

10.2.4. Limits and Criticisms

Novelty. Many important processes, such as reasoning, language acquisition, learning of arbitrary relational concepts and in general those that can be defined

as symbolic activities, have the characteristics of novelty (Anchisi, Moderato & Pergolizzi, 2017 p.332).

Probably on of the main criticisms of BA was the lack of a framework useful to explain comprehensively the complexity of language acquisition, based on operant and respondent learning. One of the problems with Verbal Behavior (1957), as Chomsky highlighted (Chomsky, 1959), was that it failed to take into account how new linguistic statements, that have not been reinforced previously, can be produced, explaining the high generative nature of human language. Even though Skinner's book did not leave the issue completely untouched, it did not provide a clear and convincing account of the almost infinitive novelty that language can generate (Shahan & Chase, 2002). Moreover, the topic was addressed by Skinner just theoretically, lacking empirical data to support his arguments. It is just decades later, in the early '70s, thanks to Sidman's experiments on equivalence class formation (Sidman & Tailby, 1982) that behavioral scientists dig deeper into the phenomenon addressing it in a more comprehensive way and providing evidences about the processes that lie in the base of language generativity.

Listener. Another relevant issue in BA has been the one related with the listener behavior. An important aspect of verbal behavior is that when it occurs, there is always a speaker and a listener. However, Skinner restricted the concept of verbal behavior to the speaker. Skinner did not a find reason to dig deeper in the analysis of the listener's verbal behavior (Skinner, 1957). Although the listener could, of course, also speak, producing a verbal behavior, the listening itself was something Skinner mostly left out of his analysis (Schlinger, 2008), so ignoring important issues such as meaning, understanding and reference.

In many situation, understanding the listener behavior is fundamental to explain how people can act in the future based on rules that are given in the present. Moreover, in many situations it seems that people do not to need to have had experienced previously certain consequences in order to follow verbal rules that

are given. How a verbal behavior now can specify behavior and consequences that will take place in the future and which the individual has not experienced earlier? On this extent Skinner's theorisation lacked a clear explanation.

Skinner answered this question by referring to "a long history of verbal conditioning" (Skinner, 1957, p. 360), but he never pinpointed how to describe such a potential learning history. A fundamental principle of how both antecedents and consequences acquire their governing functions for behavior is that they are contingent on the behavior they influence. Experimental Behavior Analysis sees the direct contiguity between stimuli as absolutely crucial, for operant as well as respondent conditioning. Skinner distinguished between this and rule-governed behavior, maintaining that a complex learning history in one way or another bridges this dividing line. But what would such a history look like? That is a question he never answered. Early on, he mentioned the possibility of human language involving something more than the principles of operant and respondent conditioning (Skinner, 1938) but he later abandoned this alternative.

The relation between covert and overt behaviors. As described previously, prediction and control are the two scientific goals of BA and in order to pursue the latter, behaviors have to be explained by taking into account contingencies that lie in the environment. In other words in BA a behavior-behavior relation is incomplete and needs to be further analysed. This assumption is valid while facing with either overt or covert behaviors. A relevant issue is that several topics within BA share with mentalistic accounts some of the same potential metatheoretical problems of encouraging incomplete accounts (Hayes & Brownstein, 1986). One of these, is the nature of the relation between covert and overt behaviors. Questions such as "What role does thinking play in the control of behavior?" are actually focusing on the nature of a behavior-behavior relation that has to be explained by appealing to particular contextual arrangements. Assuming a causative relation between thoughts and overt behaviors cannot be a complete explanation except to a mechanist, whose world view does not insist on

control as a necessary goal of science. As Skinner noted, after we have explained a response in terms of mental states or activities of feelings, we still need to explain the mental state. Of course, this raise a difficult challenge in BA - how to provide a comprehensive account of the relation that occurs between covert behaviors, such as thinking and overt behaviors such as language, without using tautological explanations? As Hayes and colleagues stated, "[t]he analysis of human language remains a mountain that behavioral psychology has yet to climb". However, over the last few decades, behavior analysts started to provide convincing evidences about the processes that lie behind language and cognition, expanding Skinner theorisation into a new theory of language and cognition defined as Relational Frame Theory (RFT). It will be briefly described in the next paragraph (for a detailed description of RFT see the book Relational Frame Theory: A Post-Skinnerian Account of Human Language and Cognition, Hayes, Barnes-Holmes, & Roche, 2001).

RFT present a post-skinnerian account of human language and cognition that provides a useful framework to better understand the core characteristics of language. RFT embraced derived relations and indeed put them at the very heart of the account. Nevertheless, it remained a natural extension of earlier conceptual and empirical research within BA.

The core concept in Hayes and colleagues' book, i.e. arbitrarily applicable relational responding, was based solidly on Skinner's concept of the operant and drew heavily on Sidman's seminal work on equivalence classes. Specifically, equivalence class formation was seen as the result of a history of operant conditioning (a learned response class), and based on this argument, the possibility of multiple forms of such response classes (relational frames) was predicted.

Thus RFT represents an additional opportunity to expand, in an experimental sense, the analysis of verbal functions expressed only theoretically by Skinner (1957) in the book Verbal Behavior and to address the above mentioned issues.

10.2.5. Relational Frame Theory

In recent year, the work of Skinner has been widen further with the formulation of the Relational Frame Theory (RFT) (Hayes, Barnes-Holmes, & Roche, 2001). In RFT the analysis of RGB is consistent with Skinner's position, namely, that rule-following can be conceptualised as any other kind of behavior. However the RFT further elaborate the analysis of the relations between behavior and environment involved in RGB, as well as analysing how such a repertoire can be acquired, without invoking hypothetical entities (Hayes, Barnes-Holmes, & Roche, 2001).

In the early seventies, it was shown that humans with verbal competencies were able to find relations between stimuli even without learning them directly (Sidman & Tailby, 1982). For example, given three stimuli A, B and C, and their relation A > B and B > C, humans were able to derive relations between the stimuli that were not learned directly, such as C < B and B < A (mutual entailment) A > C and C < A (combinatorial entailment).

Starting from these observations it has been hypothesised that the ability to derive relations between stimuli could be fundamental to explain the acquisition of human language and to understand how this can play a crucial role in BC. The ability to respond to stimuli based on derivative relations (derived relational responding) allows to assume that the stimulus function of an event can change without directly contacting contingencies (transformation of stimulus functions).

Moreover, for humans with verbal competencies it is possible to derive relations based on Arbitrary Applicable Relational Responding (AARR). That means that humans could learn to respond relationally to objects where the relation is defined not by the physical properties of the objects, but by some other feature of the situation. A relational response of this kind is no longer dependent purely upon the physical properties of the stimuli (Hayes, Barnes-Holmes, & Roche, 2001). In this way, it is possible to structure networks of stimuli that can be linked in an arbitrary way and that are defined as "relational frames".

According to the RFT, verbal behavior occurs whenever stimuli are placed within a relational frame, generating the three phenomena of mutual entailment, combinatorial entailment and transformation of the stimulus function (Törneke, Barnes-Holmes & Hayes, 2010) mentioned above.

Relational frames can be roughly organised into families (opposition, comparison, spatial, temporal, and so on) that specify the kind of relations between stimuli specific types of relations (Törneke, Barnes-Holmes & Hayes, 2010). It is beyond the purpose of the PhD thesis to describe in detail each type of frame. Here it is sufficient to say that the human ability to put into verbal stimuli arbitrary relations make their behavior extremely flexible. This process, indeed, allow them to derive an exponential number of relations and consequently to change their behaviors independently by the direct consequences that they can produce. However the same processes can help to explain the development and maintenance of dysfunctional and harmful behaviors (Vilardaga, Hayes & Schelin, 2007).

11. Behavioral Economics and Behavioral Change Policies: A Behavioral Analytic Standpoint

According to Angner and Loewenstein (2007), the historical roots of BE can be traced into cognitive psychology, a branch of psychology emerged in direct opposition to behaviorism. Following they compare this opposition with the one between NE and BE.

Certainly, BE originates from the important and pioneering work of the cognitivist psychologists among which most important is the work of Daniel Kahneman.

However, despite the historical debate between cognitivism and behaviorism, counterposing BE and Behaviorism tout court it is undoubtedly a mistake. Most criticisms, are indeed directed at the first Behaviorism of Watson. However, Behaviorism cannot be identified with Watson theorisation that represents just a part of it and has been widely revised by the most modern approaches in the study of behavior (see Moore, 2013).

As it has be seen BA is a psychological theory rooted in the philosophy of science defined as functional contextualism. From the theoretical fundament of BA developed its basic science, the Experimental Analysis of Behavior (EAB) and from it the Applied Behavior Analysis (ABA) which is the development of procedures and technologies aiming to improve people's behavior and in broader sense society. As represented in Figure 26 BE and Nudge can be seen as an application of BA in the society.[9]

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[9] BE can be considered as at the border between basic science and its applications. In the next sections will be considered in the first meaning.
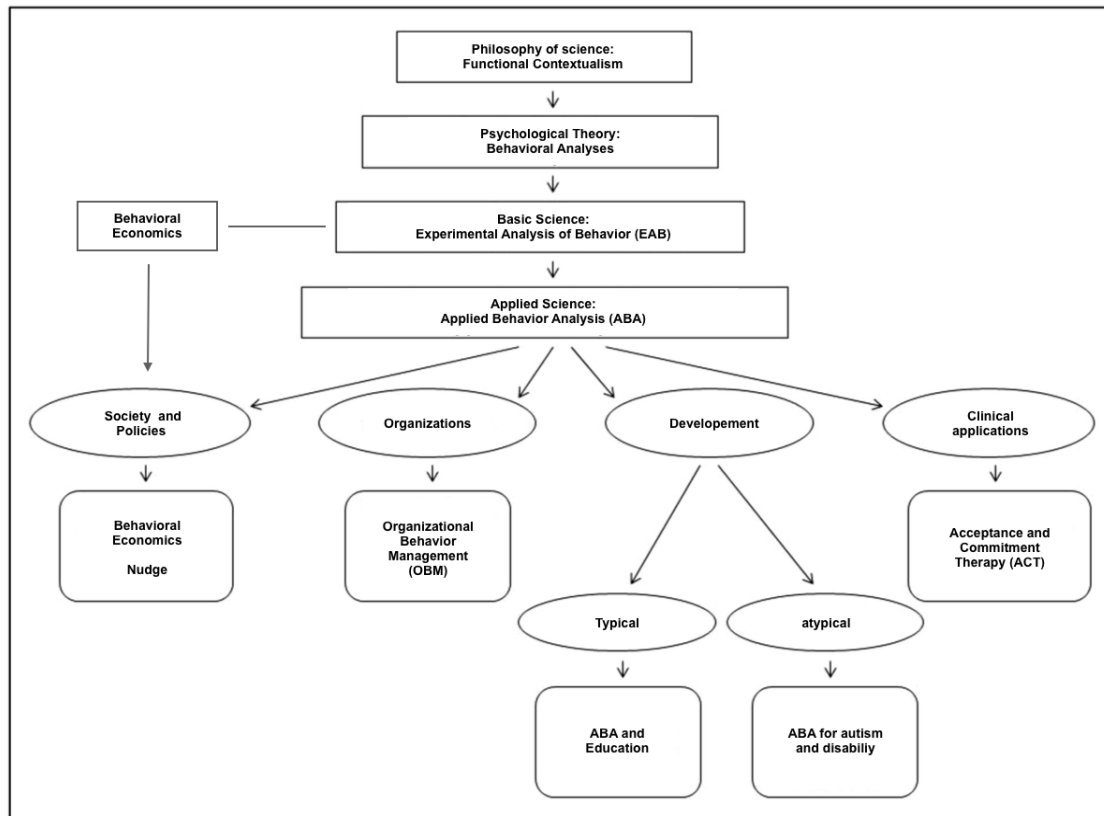
Figure 26. The figure (adapted from Anchisi, Moderato & Pergolizzi, p. 101) represents an epistemological frame of BA that includes BE and Nudge.

11.1. "Cognitive" Behavioral Economics and "Behavioral" Behavioral Economics

While addressing the theme of irrationality, a continuum could be traced in order to explain irrational behaviors (Reed, Niileksela and Kaplan, 2013). On one side lies the assumption of several researchers and cognitive psychologists that irrational behaviors may be explained in terms of mentalistic psychological causes, such as psychological predispositions or cognitive bias (e.g. Angner & Loewenstein, 2007; Camerer, 1999; Kahneman, Slovic, & Tversky, 1982). On the other side, the behavioral analytic perspective moves the focus on behavioral principles as a useful tool to define irrational behaviors (e.g. Hursh, 1980; Skinner, 1953). In line with this point of view, the relation between context and behavior becomes fundamental.

Irrational behaviors may be seen as the result of the reinforcing action of the context in establishing particular negative consequences (e.g. overeating, smoking or doing too little physical activity, etc.). That would happen because the immediate consequences of certain behaviors may have a more reinforcing value compared to those that would lead to better outcomes in the long run (e.g. being in a good physical shape, being healthy while ageing, etc.) (Reed, Niileksela & Kaplan, 2013). This kind of dysfunctional relation between behavior and consequences has been described by Bickel and colleagues as the "reinforcer pathology" (Bickel, Jarmolowicz, Mueller, & Gatchalian, 2011).

According to Reed, Niileksela and Kaplan (2013) one of the main advantages in adopting a behavioral analytic perspective in the study of human irrationality may be the more parsimonious perspective of BA. The same processes defined in BE could be probably described without using mentalistic constructs that are difficult to evaluate on an empirical level. As described in depth in the previous sections, the function of BA is finding those contextual variables (that can be verbal or physical) that can be manipulated in order to have the chance not just to predict behaviors but also to control them. Doing so, could help to focus better on the elements upon which it is possible to act in order to promote a positive BC. The recent research supports this position, providing preliminary evidence that the behavioral analytic perspective compared to the explanations of more mentalistic approaches, could provide more parsimonious explanations of some economic principles that describe irrational behaviors, (e.g., Kohlenberg, Hayes, & Hayes, 1991; Reed, Reed, Chok, & Brozyna, 2011). The behavioral analytic approach does not reject the fundamental assumptions of BE, nor it has to be seen as opposing it on the practical level. Following Kahneman's view, individuals, in certain circumstances, act in a way that is far from rational.

The methodology used to understand certain behaviors, however, is different. The subject of debate could be the description vs explanation of such behaviors. On one hand, the cognitive behavioral economists understand which are the

internal states that drive certain irrational behaviors, on the other hand, a behavioral analyst would look at the contextual contingencies that increase the likelihood of certain behavioral responses. An explanatory system that takes into account inner tendency or mental constructs could be unnecessary and of little use. By simply describing behaviors and observing their function even the use of labels like "rational" or "irrational" could be easily replaced by the terms "functional" or "dysfunctional". Indeed the first two terms are necessarily tied to models or theories that state what people should do in order to be considered rational. Conversely, the terms functional and dysfunctional, describe the relation between certain behaviors and their outcome, that can be seen as more or less useful to achieve goals predetermined by the individuals or the collective. A behavioral analytic approach would observe what actually people do and which are the contextual variables that control their behavior. People may be for example under the control of direct contingencies or their behavior may be controlled by verbal rules. By carefully assessing these variables, researchers and policy makers would have all the necessary tools to predict certain behavioral responses and control them, promoting in this way a BC. Interestingly, that's exactly what both the proponents of the H&B and the SH aim and do in practice, beyond their sharp debate.

11.2. Behavioral Change: A Behavioral Analytic Standpoint

In the next sections the main policy program developed from the theoretical framework of BE, i.e. Nudge, is analysed from a behavioral analytic perspective. On this extent, it may be useful to get back to the original definition of nudge provided by Thaler & Sunstein:

"A nudge [...] 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 & Sunstein 2008, p. 6)

Having in mind this definition it is possible to take into account its core features and to underline the existing commonalities and divergences between Nudge and BA.

11.2.1. Commonalities and Differences between Nudge and Behavioral Analysis

Work on the context. The need to work on the context in order to promote desirable behaviors is not something new in the field of BS and the study of human behaviors and their interaction with the context.Moreover, it was at the very core of BA much earlier than Thaler and Sunstein's formulation.

The techniques used in Nudge interventions should by definition be focused on the manipulation of antecedents, while the consequences of behavior should not be (directly) manipulated (see Figure 27).
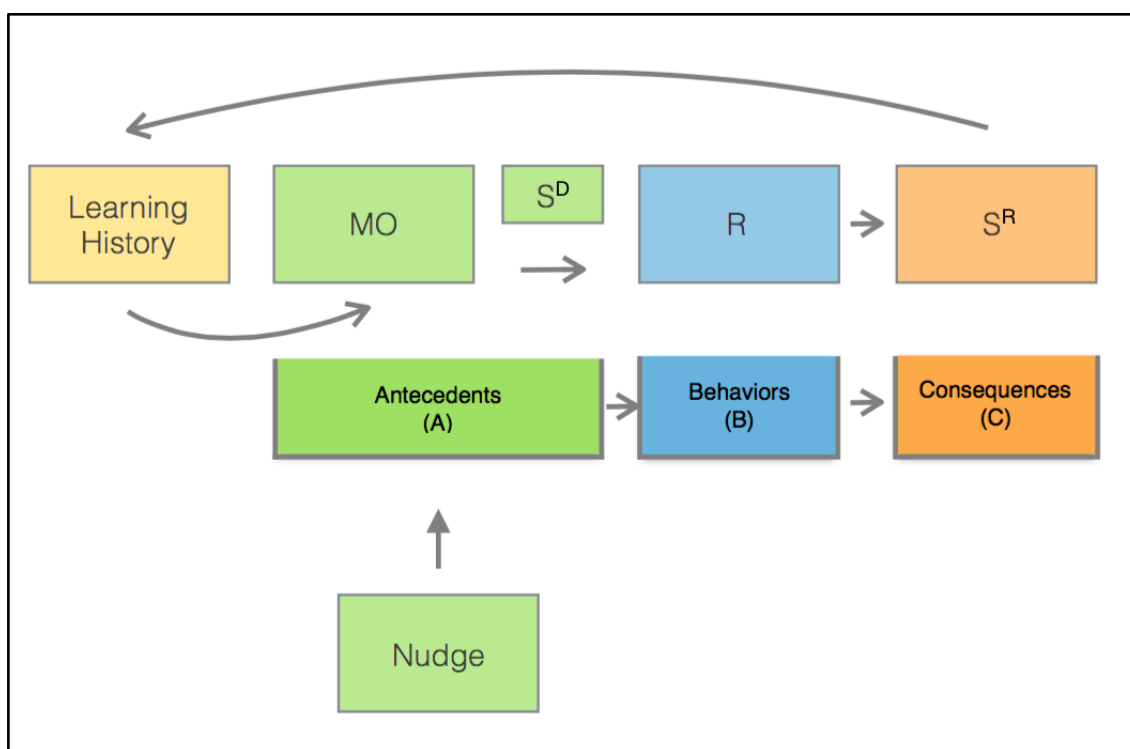
Figure 27. The figure shows how Nudge can be seen as a part of BA and where it could fit in the four-term contingency model.

Working on antecedents is another core feature of BA and may work quite well in different situations. Let's think for example of situations in which a certain

behavior have to be emitted just one time a year (e.g. subscribe to college or renew a magazine subscription) or of environments in which the crowd of people is so diverse and numerous that it would be impossible, or completely unsustainable working directly on the consequences (e.g. reducing littering in the centre of a big city). On this extent, Thaler and Sunstein have to be credited for developing a very sustainable approach.

Working both on antecedents and consequences (monetary or non-monetary) broadens the range of possible actions that a policy maker can use to pursue positive BC. It also makes more successful interventions, for example, for the promotion of long term changes to a specific target of people (e.g. keep regular healthy eating habits).

Taking into account the definition of Thaler and Sunstein, and considering Nudge as a work on certain kind of contingency, i.e. antecedents, it may be therefore defined as a way to manipulate physically or verbally the (verbal or physical) antecedents (MO and/or s^D) of a behavior to help people contact possible natural consequences of their behavior (that may be positive or negative) in order to predictably increase/decrease the chance that certain behavioral responses would occur, without directly manipulating their consequences.

To this extent, Nudge could be considered as an approach that develop its interventions by taking into account just part of the features of BA, i.e. the work on the antecedents. The three experiments of the "Nudge and wellbeing" project described in Part 3 have been developed in this way. In some cases the work was purely on physical antecedents (e.g. Experiment 5, in which the content of the sugar packets was changed) in other cases the verbal antecedents were manipulated too (e.g. Experiment 3 in which instructions and information were provided together with the manipulation of the default rule; Experiment 4 in which the label with the slogan was used together with the basket where people were supposed to place their smartphones).

Prediction and Control. As described earlier in this part of the PhD thesis (Part 4, section 10.2.) prediction and control of the behavior are the two goals of BA and any intervention must include these two features. In order to pursue these goals, behavioral analysts observe the behavior to understand which are the contextual stimuli (physical or verbal) that control it and how they can be manipulated in order to promote a positive BC. The definition provided by Thaler and Sunstein perfectly matches with the point of view of BA on this aspect. All the interventions carried out in the project "Nudge and well being" were designed to follow these two principles and to work just on variables that were directly manipulable allowing to predict certain behaviors and to control them.

Freedom of Choice. The notion of libertarian paternalism is central in Thaler and Sunstein's work and matches two main features: freedom and control. Nudge aims to leave people free to choose and in the meanwhile to push them in a kind way toward better choices. The last part is usually the source of its biggest critique and why people have doubts about Nudging. The question here may be what freedom means and most importantly how much people are in general free to choose?

Skinner in his studies challenges the notion of freedom and control and his thoughts look quite timely and fit incredibly well with the recent developments in the study of human behavior described in the PhD thesis. In the early '70s Skinner stressed in his book *"Beyond Freedom and Dignity"* (Skinner, 1971) on the need to act on contextual factors in order to change behavior. He emphasising on how some form of external control is unavoidable so that freedom is simply not achievable, nor possible. We can gain a certain amount of freedom but it is impossible to avoid the influence of certain contingencies on our behavior, due to the history of our interaction with the environment:

"A person wants something if he acts to get it when the occasion arises. A person who says "I want something to eat" will presumably eat when something becomes available.

If he says "I want to get warm," he will presumably move into a warm place when he can. These acts have been reinforced in the past by whatever was wanted. What a person feels when he feels himself wanting something depends upon the circumstances. [...] Certain contingencies have raised the probability of behavior and at the same time have created conditions which may be felt. Freedom is a matter of contingencies of reinforcement, not of the feelings the contingencies generate."
(Skinner 1971, pp.41-42)

Manipulation of contingencies is seen in this view as neither negative, nor positive. What Skinner suggests is to work to redesign the environment in order to make it as much free as possible of a specific kind of stimuli, the aversive ones. That fits perfectly well with the basic principles of Nudge.

11.2.2. Improving Nudge Interventions through Behavioral Analysis

A strong positive quality of the Nudge theory is that behavior and choice are examined with the idea that there is always a reason behind them. In addition, the dysfunctional behaviors are predictable to a great extent and thus can be expected and prevented.

One of the strengths of Nudge is that human behavior, and choices in particular, are seen like something that happen for a reason. Moreover, irrational behaviors are seen as largely predictable and prevented.

Parsimony. The work of Thaler and Sunstein is very empirical. However, they often use mentalistic terms that don't add any power in terms of control and prediction. Terms like System 1 and System 2, or Homo oeconomicus and homo sapiens can have an heuristic function and it can be extremely useful to make some concepts easy to understand and more appealing to the readers. The risk is to get stuck to these labels and to use them as explanatory of people's behaviors. Using a more analytical description in the scientific realm may be more useful to increase knowledge about people's behaviors. On this extent, BA may be a parsimonious approach in the study of human behavior, allowing to better operationalise certain concepts and processes. As described previously, manipulating antecedents and consequences allows the researchers to work on a

wide range of issues addressed in the literature of Nudge without invoking mentalistic terms. Once we know which are the dysfunctional behaviors and the ones that we want to promote, we can work on the other two contingencies (antecedents and consequences) in order to promote BC.

Better Operationalisation. In many cases, Thaler and Sunstein underline that certain contexts can facilitate certain behaviors. That's in line with BA. However, further clarification may be necessary in order to set interventions that really have in mind the behavior in its context. One of the risks in the lack of operationalisation is that, antecedent stimuli may be taken as causative of people's choices. BA as previously described, has a different vision. It assumes that the consequences of behaviors shape the behaviors themselves.

Let's make that clear with an example. A person may feel the urge to use a toilet (MO, more precisely EO), looking around and finding a door with the label "toilet" (S^D). He may open the door (B) and relieve his urge (C). The experienced C would probably reinforce B. So when in the future the person feels a similar urge and sees a door with the label "toilet" it will be more probable that he will produce the same B. However, the increased probability of B is not caused by S^D. The S^D facilitated B, but just in the sense that allowed the person to contact the reinforcing C (relieving the urge) previously experienced by emitting the same B while the EO increases its strength.

Bringing this perspective into Nudge or other BC policies programs, it should be clear that working on the antecedents of behaviors does not mean that behaviors are caused by antecedents, but just that the consequences that actually shape the behaviors are not deliberately and directly manipulated. Interventions just allow that the consequences of certain behaviors can be naturally experienced and hopefully, that they can produce long lasting changes.

Less Arbitrariness. In Thaler and Sunstein's definition of Nudge, the authors underline that interventions should not "significantly" alter economic incentives. In their book the authors further specify that they believe economic incentives (also non monetary ones) must not be high. This may create some confusion because it is not clear what "significantly" means and which is the initial

parameter from which to decide whether economic incentives changed "significantly". Thus leaving wide open space to arbitrariness especially when non monetary incentives are used. Let's take for example an intervention carried out by Banerjee and colleagues (Banerjee et al., 2010) in several rural villages in Rajasthan (India). To increase the immunisation rate in the villages, the families of the children were provided with 1kg of raw lentils after each administration of the immunisation and a set of metal plates once the full procedure of immunisation was completed. Is that a significant incentive or the intervention can be considered as a nudge? In that sense Thaler and Sunstein's definition must be further clarified.

More Consistency between Theory and Application. As stated above, many techniques used in Nudge interventions manipulate directly antecedents without working on the consequences of the behavior. However, at least some of the interventions developed so far and counted as nudges have also directly manipulated the consequences of behavior. For example, providing a smile when citizens consume little energy, directly works on the consequences of behavior (e.g. Costa & Kahn, 2013; Schultz, Nolan, Cialdini, Goldstein & Griskevicius, 2007). These kind of interventions are assumed to directly reinforce a desirable behavior, so they could be considered inconsistent with the definition of Nudge. However, it is reasonable to think that Thaler, Sunstein and the other experts in the field would consider these interventions as nudges, considering their non punishing method, their sustainability and potential effects. That's also much in line with Skinner's thought and preference for positive reinforcement instead of using punishment and aversive control. To sum up, it may be useful to provide a clearer definition of what is or is not a nudge. Moreover, a good solution could be adding direct manipulation of consequences using only those that are assumed to reinforce positively the functional behaviors.

Conclusion

The PhD thesis had several goals. First of all, the paper aimed to provide an extensive historical and theoretical framework of the most flourishing approaches in the study of decision making and its applications in society. Part 1 described what has been known until now in the realm of decision making focusing on BE and its different streams of thought. Part 2 provided a wider view of the applications of the notions evident in BE in the realm of public policies, describing the best know policy programs and their main features.

In the few last years economy and psychology play a crucial role in the development of effective tools and strategies to tackle important social issues and to promote well-being. The hope is that the attention gathered by the new emergent approaches in BC will keep growing and so their influence on public policies. The first two parts aimed also to provide a theoretical base for the understanding of the research work carried out during the PhD and described in part 3.

The second goal of the thesis was to provide evidence for the effectiveness of the approaches, described in the first two parts, in the Italian context. Several experiments were carried out, mostly in Italy, showing their efficacy and sustainability. Although some attempts to promote BA and Nudge in Italy have been done their dissemination on the territory is far from being wide spread, unlike in other countries. A more proficient dialogue between policy makers and experts in BS could greatly contribute to improve individual and social welfare through those approaches.

Finally, Part 4 aimed to broaden the dialogue around human decisions providing a behavioral analytic perspective of the principles of BE and its applications, highlighting their commonalities and divergences with BA on a theoretical and practical level. The main strengths of BE and its applications are their versatility and sustainability, that allowed to apply the ongoing knowledge in a wide range of domains and their their quick spread in the last few years. BA on the other side

is a discipline with solid methodological roots, although it has been often confined in the clinical and laboratory settings.

Skinner in his utopian novel *"Walden Two"* brilliantly synthesised what should be the aim of BS:

"The choice is clear: either we do nothing and allow a miserable and probably catastrophic future to overtake us, or we use our knowledge about human behaviour to create a social environment in which we shall live productive and creative lives and do so without jeopardising the chances that those who follow us will be able to do the same."
(Skinner 1948, XVI)

A multidisciplinary dialogue between the different disciplines that have as their main goal the promotion of well-being could certainly enrich the knowledge about the domain of human decisions and could help to build more effective and long lasting interventions, ultimately improving the quality of life of the individuals and the society.

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Appendixes

Appendix A

Materials for the experiment:

"Decoy effect and customer preferences for newspaper subscriptions: A Randomized Controlled Trial"

Original Versions of the experiment

Version A: cover paper + task

Genere M F   **ETA'**

Immagina di dover sottoscrivere un abbonamento ad una rivista di tuo interesse.
Hai 3 possibili opzioni di scelta.
Traccia una x di fianco a quella che preferisci
A € 59: abbonamento in formato digitale
B € 125: abbonamento in formato cartaceo
C € 125: abbonamento in formato digitale e cartaceo

Version B: cover paper + task

Genere M F   **ETA'**

Immagina di dover sottoscrivere un abbonamento ad una rivista di tuo interesse.
Hai 2 possibili opzioni di scelta.
Traccia una x di fianco a quella che preferisci
A € 59: abbonamento in formato digitale
B € 125: abbonamento in formato digitale e cartaceo

Appendix B

Materials for the experiment:

"Relative and Absolute framing: a Randomized Controlled Trial to evaluate the risk perception about incidence of colorectal cancer by consuming processed meat"

Original Versions of the experiment

Version A: Cover paper + task

Genere M   F   **ETA'**

Per chi non mangia mai carni lavorate, il rischio di contrarre un cancro al colon nell'arco della vita è del **5%**. Per chi mangia **50g** di carni lavorate ogni giorno della sua vita, il rischio relativo di contrarre un cancro al colon nell'arco della vita aumenta del **18%**. Su **100** persone, quante probabilmente contrarranno un cancro al colon nell'arco della loro vita mangiando **50g** di carni lavorate ogni giorno? **A** circa 5   **B** circa 18   **C** circa 6   **D** circa 23

Version B: Cover paper + task

Genere M   F   **ETA'**

Per chi non mangia mai carni lavorate, il rischio di contrarre un cancro al colon nell'arco della vita è del **5%**. Per chi mangia **50g** di carni lavorate ogni giorno della sua vita, il rischio di contrarre un cancro al colon nell'arco della vita aumenta dell'**1%**. Su **100** persone, quante probabilmente contrarranno un cancro al colon nell'arco della loro vita mangiando **50g** di carni lavorate ogni giorno? **A** circa 5   **B** circa 18   **C** circa 6   **D** circa 23

Appendix C

Materials for the experiment:

"No waste by default: Nudging to prevent food waste in restaurants"

C1. Centrepiece used in the Italian and Swiss Trial.

Printed on carton paper, A4 format, and four folded

C2. Centrepiece used in the Greek Trial.

Printed on carton paper, A4 format, and four folded

C3. Menu Flyer [10]

C4. Guidelines for waiters[11]

Piatti	Cosa considerare avanzo
Piatti unici (es. insalate, pizza, formaggi)	- 1/3 piatto (circa) - Per la pizza, almeno 1 fetta
Primi piatti	- 1/3 piatto (circa)
Secondi	- 1/3 piatto (circa) - I contorni vengono messi nella Foodie bag solo se avanza anche il secondo

- Nel caso vengano ordinate più portate, si considerano solo gli avanzi presenti nel piatto per l'ultima portata prima del dessert (ad esempio, se il cliente ordina primo e secondo, controllo solo avanzi del secondo);
- Il dessert è escluso dalla rilevazione dati.

PIATTI UNICI

Formaggi — 1/3
Insalate — 1/3
Pizza — almeno 1 fetta

PRIMI — 1/3, 1/3

SECONDI — 1/3, 1/3

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[11] The same guideline were used in the Swiss and Greek trial (in the Greek trial the language was adapted.

C5. Observational grid[12]

GRIGLIA OSSERVAZIONE:

Controllo/Sperimentale

Settimana:									
Data inizio:					Data fine:				
- Se nel piatto di un cliente sono presenti avanzi di cibo spunta una casella con una X;									
- Se un cliente richiede gli avanzi, spunta una casella con una X e stacca uno degli adesivi									
1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100
101	102	103	104	105	106	107	108	109	110
111	112	113	114	115	116	117	118	119	120
121	122	123	124	125	126	127	128	129	130
131	132	133	134	135	136	137	138	139	140
141	142	143	144	145	146	147	148	149	150

NUMERO ADESIVI INIZIO	
NUMERO ADESIVI FINE	

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[12] The same observational grid was used in the Italian, Swiss and Greek trial (in the Greek trial the language was adapted).

Appendix D

Materials for the experiment:

"Digital detox: preliminary findings of a Nudge intervention to reduce the usage of digital devices in social contexts"

D1: Basket and label

D2. Observational grid

	Tavolo 1		Tavolo 2		Tavolo 3		Tavolo 4		Tavolo 5		Tavolo 6	
Gruppo sperimentale/controllo				Data:				Osservatore:				
N° Oss	N persone N° px telefono		N persone N° px telefono		N persone N° px telefono		N persone N° px telefono		N persone N° px telefono		N persone N° px telefono	
1												
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Appendix E

Materials for the experiment:

"Less sugar by default: resize the packets of sugar to reduce its consumption in a coffee shop"

Observational grid

Gruppo: controllo/sperimentale		
Data inizio:	**Data fine:**	
N° soggetto	**N° bustine**	**Tipo zucchero** **0= bianco** **1= canna**