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PREFERENCE FORMATION, PREFERENCE CHANGE, AND COLLECTIVE BEHAVIOR: AN EXPERIMENTAL STUDY

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vorgelegt von ELENA RAMIREZ BARRIOS

Pelargusstr. 2
70180 Stuttgart

Erstgutachter: Prof. Dr. Stefan Traub, Lehrstuhl für Finanzwissenschaft, Universität Bremen

Zweitgutachter: Prof. Dr. Christian Cordes, Institut für Institutionelle Ökonomik und Innovationsökonomik, Universität Bremen

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Nomenclature

Definitions	Meaning
$avWTP$	Average of individual willingness to pay calculated between maximal and minimal WTP.
BDM	Becker-DeGroot-Marschak mechanism.
$Cummatt_i$	Cummulated attitude of individual i in the five experimental rounds.
$Cummatt_j$	Cummulated attitude of individual j in the five experimental rounds.
DM	Decision Maker.
$H\&L$	Holt and Laury test.
$maxWTP$	Maximal amount of money that individuals want to expend in the chocolate bar.
$minWTP$	Minimal amount of money that individuals want to expend in the chocolate bar.
$Stdv$	Standard deviation of the WTP-Range.
WTP	Willingness to Pay.
WTP-Range	Interval expressing the difference between maximal WTP and minimal WTP.

Symbol	Meaning
β	Individual's ability to adapt consumption in time.
κ	Factor of external noise.
λ	Factor of strength of preferences.
σ_{si}	Internal learning states s of individual i.
σ_{ij}	Sensory experience of the individual i stored in the position j of individual's memory.
ζ	Adjust speed of habits to consumption of new goods.
a_i	Attitude of individual i
a_j	Attitude of individual j.

$\tilde{A}_i$	Tendency to attitude change of individual i.
A_i	Attitude Change of Individual i.
A_j	Social interdependence factor accounted by attitude of neighbors.
B_i	Budget of Individual i
c_s	Consume Stock.
$F_{\tau,s}$	is the impulse that triggers the corresponding internal state s at a given time interval.
h_s	Habit Stock.
h_t	Habit Stock at time t.
$I_{A,i}$	Shannon information entropy of the internal attitude A of individual i.
k_i	Number of times that individual i change her decisions regarding to WTP.
L_i	Learning function of individual i.
Lo	Lottery
r	Uniform random number defined in the interval $[0, 1]$.
$R1$	First Experimental Round.
$R2$	Second Experimental Round.
$R3$	Third Experimental Round.
$R4$	Fourth Experimental Round.
$R5$	Fifth Experimental Round.
$StdvTn$	Dummy variable of the n-th treatment in the regressions of the standard deviation of WTP-Range.
$T1$	Control Treatment.
$T2$	Second Experimental Treatment
$T3$	Third Experimental Treatment
$T4$	Fourth Experimental Treatment
U_i	Utility of Individual i
z	Market Price

1. Introduction

Human cognition is related to several processes in the brain that deal with functions like attention, memory, and other complex tasks, and is continuously adapting to face challenging physical and social environments. The way in which information is processed influences the formation and evolution of individual preferences. The decisions that we make are the result of combining and analyzing acquired information within a determined period of time.

But human beings do not only accumulate factual information in their memories. As Kandel et al. (2000, p.1007) express it: 'Pleasure is unquestionably a key factor in controlling the motivated behaviors of humans'. For economists, the interesting question is then about the properties of the evolutionary optimal reward system, and how these properties adapt to the environment in which individuals make choices. Indeed, human beings make decisions not only under the rationality of facts, but also againts the backdrop of pleasant (or unpleasant) experiences accumulated along our lives.

1.1. The Problem

A purchase decision confronts subjects with a variety of potential challenges that concerns mental processes before and within the decision process self. An individual is busy becoming aware of the need of a new product and the availability of it, collecting information about attributes and alternatives, trying to remember past experiences and considering all the possible outcomes depending on the decision (

Peter and Olson, 1993; Slovic et al., 1988). After structuring the decision problem, the consumer processes the acquired information, chooses a preferred course of action and implements the decisions at the appropriate opportunity.[1] Finally, consumers can use feedback resulting from this purchase to re-evaluate their decisions, perhaps reversing it by returning the purchased product to the store. All this accumulated information remains available for future purchase decisions. The central problem is therefore: how are cognitive processes and environment affecting the ability of individuals to make purchase decisions?

The central goal of this work is to show that the ability of an individual to make the best decision vastly depends on the information available about the object of choice, the sensory experience within the human memories, and on the diversity of opinions that the individual draws upon. If individuals are able to easily access the aforementioned factors, the preference uncertainty at the moment of choosing is likely to decrease. This, in turn, improves the level of ex-post satisfaction with the individual choice. By means of laboratory experiments, we want to study how incoming information from sensory experiences is applied effectively to solve preference uncertainties with regard to a specific consumer good and to make an optimal choice in terms of their endogenously formed preferences.

Economics and psychology have a differing point of view when it comes to the individual valuation of goods and things. Neoclassical tradition defines a rational individual as an individual which is able to choose according with her well-established preferences obeying logical rules which have been formalized in consumer theory and in models of decision making under risk and uncertainty (see Section 2.1). In order to attain the higher utility level by choices, individuals require to accurately valuate the object of choice.This is approached as soon as the complete information about this object is available.

But Psychology is not congenial with the idea of rational decision making; more specifically with the idea that a logic of rational choice can serve double duty as a

[1] For reasons of clarity, the feminine form has been used throughout, the masculine is always also implied.

model of actual decision behavior. Many research works have been devoted to illustrate how individuals violate the logic of the economic model, i.e., that individuals fulfilled all the requirements stipulated by neoclassical economics. The implication is that people do not have preferences in the sense used by economic theory (Fishhoff, 1991; Slovic, 1995; Payne et al., 1992). Therefore, if preferences cannot be exactly defined as required in the economic model, an alternative should be introduced.

Indeed, the capacity of the human mind to solve decision-making problems in general, and to deal with large amounts of information is strikingly limited (Simon, 1955; 1986). In a wide range of judgment problems, such as medical diagnosis, people are typically not better than, or outperformed by simple linear regressions or even simple methods called *'rules of thumb'* or *'heuristics'* (Gigerenzer et al., 1999). Moreover, people exhibit large and systematic biases in dealing with complex decisions. For instance, according to Stewart et al. (2003), even trading-off two or more factors in a decision about risk and return seems to overload the cognitive system.

In this work, we address the problem of introducing additional information within a decision-making process about a consumption good. Additionally, we analyze how attitudes toward the object of choice could change in time by giving additional information within the decision-making process generating preference uncertainties. Furthermore, we added a second informational source by allowing that individuals discuss their preferences via a chat interface. The major components of this thesis focus on the acquisition of information from the environment, i.e., by sensory experiences.

The common approaches to practical preference elicitation (e.g., conjoint analysis, analytic hierarchy process (Saaty, 1980), pricing out (Clemen, 1996), and other elicitation techniques (Fishburn, 1967) assume that preferences are separable, or additive, meaning that the value of one attribute does not affect preferences over the other. This is particularly the case in practical systems that require preference elicitation. In contrast, real preferences, as those obtained from experimental settings,

are rarely unconditional. Often, the value of one attribute or objective depends on the availability or the value of another objective.[2] That is the reason to introduce a mechanism to incentivize individual preferences in a more reliable fashion (see Section 5.4).

The model and experiment presented in this thesis relate to and extend previous research on information aggregation. More precisely, this work is concerned with the ability of individuals to extract information from sensory experience, to process it, and to choose accordingly, while most of the existing literature is concerned with the institutions that serve to accumulate individual knowledge. For example, many theoretical and experimental papers have considered the capability of auctions and other market institutions to aggregate private information through the price mechanism (Hellwig, 1980; Plott and Sunder, 1988; Forsythe and Lundholm, 1990; Pesendorfer and Swinkels, 1997, 2000).

Other papers have looked at the process by which individuals use information to make decisions. However, most of the literature has been concerned with issues relating to sequential decision making or herding, and has used simple stimuli such as the urn-ball design[3] (Anderson and Holt, 1997; Goeree et al., 2007; Kraemer et al., 2006). A further set of papers has examined how individual voters search and aggregate relevant information to make decisions (Lohmann, 1994; Austen-Smith and Banks, 1996; Feddersen and Pesendorfer, 1997; Piketty, 1999).

[2]This claim is supported by evidence from behavioral economics in reference to decision under uncertainty (Von Winterfeldt and Edwards, 1986).

[3]In the original experiment by Anderson and Holt (1997) this setup was implemented by putting balls labeled 'a' or 'b' in two separated urns labeled A and B, with three labeled balls in each. Urn A contained two balls 'a' and one ball 'b', whereas urn B contained two balls 'b' and one ball 'a'. The urns were equally likely to be chosen by the throw of a fair six-sided die. A throw of 1, 2, or 3 determined that urn A would be used for the draws, and a throw of 4, 5, or 6 determined that urn B would be used. Hence, each of the 6 balls was ex ante equally likely to be drawn. Since 2 of the 3 balls labeled 'a' were in urn A, the posterior probability of event A given signal 'a' is 2/3. Similarly, the posterior probability of event A given signal 'b' is 1/3. The balls were actually identified by a 'light' or 'dark' color, instead of being labeled by letters.

1.2. Research Questions

This project gradually introduces new sensory experiences with regard to a specific consumption good: *a 100 gr chocolate bar* with 70% cocoa.[4]

Figure 1.1.: Chocolate (70% cocoa) used in the experiments that has been provided by Lindt

This carefully designed laboratory experiment helps to observe how the process of decision making under uncertainty is influenced by systematically added new information. Basically, two aspects of the process of decision making are investigated: individual heterogeneity in processing newly acquired information, and the information role in overcoming uncertainty at the moment of making choices. The design of the experiment makes it possible to test a series of hypotheses relating to how effectively subjects use information in solving decision problems (see Section 6.2). In order to explain the influence of *habit formation* and *social learning* within

[4]The chocolate used in this experiment was donated by the company Lindt, located in Aachen, Germany.

the preference formation process, this project mainly seeks to solve the following questions:

1. How is the sequential process of information collection linked to the process of preference formation?

2. Once preferences have been formed, how do individual preferences change when new information is aggregated?

3. How do attitudes operates in order to modulate decision-making processes?

Since human beings do not live and make decisions in isolation, they also depend on the influence exerting by *social interaction* on the decision-making process. Social learning is done in situations where contact with neighbors is unavoidable. The interdependence of preferences introduces a kind of bias in the decision-makers' behavior, forcing them to instinctively act in a different manner than they otherwise would if there was not any social interaction. In the second part of this research the following questions will be solved:

1. Does social influence (in terms of direct sharing of information and attitudes toward objects among individuals) decrease the heterogeneity of individual preferences?

2. Does that mean that individuals are achieving higher satisfaction levels by making choices based solely on their own preferences or by combining intrinsic and collective preferences? (According to Herbert Simon (1955, 1986), '*satisfying behavior*' is the core of a decision-making model).

We expected that interpersonal exchange and social learning processes could alleviate individual heterogeneity, allowing the formation of consumption trends.

There are also a couple of more general but complementary questions that need to be solved with this project: Does learning (in the form of acquisition of new

information) limit our choice capacities? Or does learning have a positive effect on reaching the desired (targeted) satisfaction level?

Since the main component of individual communication is the attitude of individuals toward the incoming information, we develop a model of individual decision making by introducing attitudes in the individual utility function (see Section 6.1.1). Our intention is to introduce psychological aspects of individual behavior into economic theory by assuming that the decision that individuals made are strongly motivated by their individual attitude. Additionally, we explore how an individual's own attitudes redounds upon neighboring individuals and therefore could introduce changes in their utility functions. We made this by observing the influence of neighbors' attitudes in the stated individual WTP.

With these purposes, we designed an economic experiment divided into four experimental treatments, where differences in the amount and sources of additional information were introduced. In T1, our benchmark treatment, individuals, after each experimental round have been asked to state their WTP by themselves. For the other three treatments (T2, T3, and T4) our subjects were able to exchange their attitudes after each round via a chat interface. In T2 our subjects exchanged attitudes toward the chocolate with a fixed partner. In T3 individuals were assigned to a new partner for each experimental round and in T4 each individual was assigned to four partners which remained fixed for the five rounds.

The individuals were randomly assigned to groups and the exchange was conducted anonymously. After we had disentangled the messages exchanged by chat, individual attitudes were measured by a Likert's like scale (for a better explanation of this methodology see Chapter 3) indicating signs and intensities. Our scale ran from -2 to 2, where -2 meaning very negative and 2 very positive attitudes toward the chocolate after sensory experience. In order to achieve our goal to incentivize individuals to elucidate their real preferences, we made use of a re-designed Becker-DeGroot-Marschak (1964). Risk attitude was tested following the methodology proposed by Holt and Laury (2002).

In research studies involving food products, the willingness to pay is evaluated using basic purchase intent questions through simple consumer surveys (for instance Bower et al., 2003; Magnusson et al., 2003) as well as experimental Vickrey auctions with consumers bidding real money to elicit their actual WTP (Lange et al., 2002; Stefani et al., 2006, among others). As will be explained below, the current study combines a reformulated BDM mechanism (see Section 5.4) with individual risk attitudes to elicit individual preferences tuned by direct external influences as sensory experiences and information exchange with a partner (or with the members of a group).

The limited utilization of combined economic and sensory approaches in studies regarding the individual willingness to pay (hereafter WTP) for food to this date is perhaps surprising, given the obvious importance of sensory experience in repeated consumer choices. Moreover, consumer studies frequently use demographic variables to proxy for underlying differences in preferences [5].

Experiments of this kind with food such as yogurt and coffee have been carried out before (Kahneman and Snell, 1992; Menges, 1996). The present research attempts to expand on the findings of these studies by introducing *information exchange*. In other words, it gives individuals an opportunity to exchange their impressions and attitudes with regards to the object of choice, before making a final decision. Although the decisions are still made individually, the subjects also have access to personal opinions from other participants before having to make a decision. This additional information may either increase or decrease the individual uncertainty when making a decision, and may also raise or reduce individual satisfaction level after the decision is made. Until the present time, the extent of the influence of this information exchange was not explicitly investigated experimentally.

Our experiment was designed in four parts: In the first part we asked the partici-

[5] In the case of the evaluation of sensory attributes, there are well established methodological tool boxes for assessing preferences at an individual level as well as quantifying sensory characteristics. But the use of sensory experiences to elicit individual preferences will help to reduce the hypothetical bias that often accompanies such studies. The use of these methods to measure the individual WTP and its changes over time would therefore have both theoretical and practical appeals

pants for their habits, general knowledge and attitudes towards chocolate. This was done to observe the influence of new information upon the preexisting situation. In the second part, individuals received information in five steps, each step involving one of the five human senses, allowing a real interaction with other participants to interact closely with the product. After each step, new information was processed and individuals were asked to determine an interval reflecting their WTP (maximal and minimal) for the chocolate bar (100 gr). This interval allowed us to identify the preference uncertainty of our participants. No price was given to the participants; it was determined along with the information aggregation process.

To incentivize our participants to reveal their prefererences in a truthful manner, we applied a variant of the Becker-DeGroot- Marschak mechanism (BDM) that will be explained in section 5.4. The third part tested for individual risk attitudes by means of lotteries and the outcomes were chosen following the methodology introduced by Laury and Holt (2002). In the last part of the experiment, subjects filled out a questionnaire designed to elicit their risk preferences (see Section 6.3.3 for a more detailed description of the experiment). By reformulating the BDM mechanism we ensured enough incentives to reveal preferences and by testing the risk attitudes we are able to approach the individual behavior in our uncertain scenario, since information permanently change the environment where individual decisions are made.

In this project, WTP is implemented to reveal individual preferences, i.e., to better approach the preferences' dynamic in a scenario where new information is aggregated. In order to account for individual uncertainty, the experimental design allowed the participants to choose a WTP-interval with the boundaries being expressed as minimal and maximal WTP. This fact is explained in detail in Section 5.4. The results showed a high level of heterogeneity in the way our subjects were processing information. Regarding uncertainty, we found that subjects increased their uncertainty level, showing a drift in the probability distribution of their answers. This last result reveals a biased individual calculation capacity raising uncertainty

levels from one round to the next.

1.3. Outline

The thesis is organized as follows: Chapters 2, 3 and 4 present a literature overview of the psychological and economical approaches to this problem and introduce the theoretical frame to handle our research problem. Chapter 2 explores individual decision-making and problems of information processing. The chapter begins by introducing the neoclassical approach to solve individual decision-making problems. In this approach is required to simplify human subjects to be mathematically modeled as optimal consumers. This oversimplification is exacerbated by the poor capacity of individuals to assimilate new environmental inputs (Simon, 1955), challenging the neoclassical concept. By this reason the neoclasical school cannot solve the dilemma faced by buyers at the moment of choosing (the most popular examples of violations to neoclassical theory are Bernoulli (1798) and Allais (1953)).

Chapter 3 presents a review of the role played by attitudes for preference formation, mainly from a psychological point of view, placing emphasis on the economic consequences of attitude formation and attitude change along the process of preference formation. This chapter clarifies the relevance of the study of attitudes as an element that modulates individual behavior within the decision process. Chapter 4 is devoted to introducing human information processing, cognition and perception being core elements of this process. Naturally, these two strongly linked abilities map the environment in which the individual behaves within an objective context. Memories from prior experiences are perceived and recognized in order to select the pertinent information at the moment of choice and help individuals to improve their personal satisfaction.

The following four chapters describe the applied methodology to solve the research questions, the obtained data and its analysis, and the experimental findings aimed to prove the validity of our hypotheses. This part begins with Chapter 5 with a

detailed description of the methodological issues to be applied in the experimental design. In Chapter 6, the experimental design is presented. The chapter begins with a description of the hypotheses that support the mathematical models and the models themselves are presented. Then, it describes the experimental design used to solve the research questions. Chapter 7 presents the experimental results testing the proposed hypotheses and Chapter 8 concludes the study by discussing the experimental findings.

2. Consumer Behavior: Normative Decision Theory and Decisions

Individual decision making is in the center of microeconomic theory. The understanding of the process, which leads to a decision or a best alternative from a finite set of possible alternatives, forms the basis of decision theory. In order to better understand individual behavior, economists have proposed several refined models able to describe this process. This chapter is aimed to summarize the main approaches to decision making applied in economic theory.

This chapter is divided into three sections. First, we make a short introduction to neoclassical decision theory and its basic axioms. The concern here is not only to summarize decision theory as a set of axioms prior to the process of decision making, but particularly the phenomenon of decision making itself. In the second section, we make a brief summary of Stochastic Choice and Random Utility theory, developed as alternative theoretical approaches aimed to overcome the problems faced by introduce uncertainty in the neoclasical economic models. As introduced in Chapter 1, individual choice is made in uncertain environments that cannot be completely described by means of Expected Utility theory, and Models of Stochastic Choice and Random Utility have been formulated as an attempt to better approximate individual behavior in risky environments. The ideas consigned in such models will be used as a basis to formulate a mathematical model to describe individual behavior in our experimental setting. The third section discusses the pertinence and applicability of theory and models summarized in Section 2.1 and 2.2.

2.1. Neoclassical Decision Theory

Individual consumption behavior analyzes what consumers buy and for what reasons they do buy certain goods or services. Its study is of particular importance because the demand and price of a product depend on the individual's preferences (needs, beliefs and expectations). Theories on individual consumption behavior concentrate on how individuals determine to maximize the enjoyment (utility) from their purchased good/service. For example, if the price of good x_1 increases, consumers will buy less of x_1 because it is more expensive for them, with the result that the same consumption level of x_1 yields less utility. On the other hand, if the price of good x_1 decreases, then consumers will buy more, raising their utility level. Individual consumption behavior is the interaction between price change and consumer demand and what influenced the consumers to purchase the product, taking other factors, such as budget constraints, into consideration.

The first mathematical approach to understand individual consumption behavior, the so-called *Neoclassical Economics*, has been formally introduced in the 19th Century by Marshall and his scholars. The ambition of the first neoclassicists was to mathematically formalize the subject's behavior to facilitate calculations of earnings and losses after decision processes. Due to individual behavior attempts to maximize outcomes, the calculus was introduced in the marginalist revolution as a tool to predict individual choices and outcomes. The two main components of consumer theory are individual *preferences* and *utility*, and the *budget constraint*. These factors are needed to derive a demand curve, more specifically the *marshallian demand curve*, aimed to depict individual preferences at a given time.

The field of economics studies human behavior as a relationship between ends and scarce means that have alternative uses. Neoclassical economics pursues this study by means of supply and demand models that determine prices based on the subjective preferences of producers and consumers. Neoclassical economics relies on subjective preferences for determining prices in order to escape from the objective value theory of classical economics, according to which the value of goods could be

established by reference to some basic commodities or the labor input required to produce a good. Neoclassicists hoped that by introducing formal mathematical tools to obtain objective values, Economics could be placed on a more scientific basis as an essentially descriptive and predictive theory of human behavior. In neoclassical economics, decision theory is developed with a purely axiomatic method (see Section 2.1.2). The theory proceeds by first defining a set of possible choices that the decision maker faces. Then, the decision maker selects one of these options. The observed data are pairs of choices offered and decisions that are made regarding the set of these possible choices.

2.1.1. Expected Utility Theory

The Expected Utility Theory (EUT) states that the decision maker (DM) chooses between risky or uncertain prospects by comparing their expected utility values, i.e., the weighted sums obtained by adding the utility values of outcomes multiplied by their respective probabilities. The expected utility model (EU) is the oldest decision model, and its central ideas date back to the 17th century. The history of EUT is constructed in terms of the principle of maximizing expected monetary values. It was first conceived by mathematicians (Pascal, 1670; Bernoulli, 1798) to help wealthy people to choose among different gambling options. It is interesting to note just how many thinkers have contributed to it, and at the same time to realize that the earliest statements of the theory were the most powerful ones and were followed by weaker conceptions. It just took the field of economics a surprisingly long time to grasp its full potential.

EUT consists of two components. The first is that people use or should use the *expected value of the utility* of different possible outcomes of their choices as a guide to make decisions. This component goes back to Pascal (1670). The second component is the idea or insight that more of the same creates additional utility only with a decreasing rate. This assumption of *decreasing marginal utility* plays a central role in economics in general.

This simple decision rule is the most important question in decision theory. But first, what is the meaning of the utility numbers referred to in the formula, do they belong to the same value scale as do the numbers that represent the DM's choices under uncertainty? Second, is the weighting sum procedure of combining probabilities and values the only one to be considered at the moment of choice? Should it be taken for granted that the DM relies on probability values without taking other things of theoretical constructions into account (the probabilities are exogenously given and are not explicitly part of the DM problem)?

From these questions, we can distinguish two theoretical versions aimed to solve the problem: the Subjective Expected Utility Theory (SEUT) regarding uncertainty and the von Neumann-Morgenstern Theory (VNMT) in the case of risk. The basis and axiomatic structure of EUT can be used both as a positive and normative (or prescriptive) theory.

However, there are a couple of problems when trying to generalize the EUT to non-additive or non-probabilistic decision theories. The most notable examples are Bernoulli's (1798) resolution of the St. Petersburg paradox, and Allais's (1953) invention of a rather provoking problem referred to as Allais's paradox. Both express strong violations of rational thinking by decision making.

In the St. Petersburg proposition, people were asked how much they would pay for a prospect as follows: by tossing a fair coin, if tails comes out of the first toss, the game will stop and in this case, you receive nothing. In the complementary case, you receive two guilders and stay in the game. Also, if tails comes out of the second toss of the coin, then you receive nothing and stop the game, and in its complementary case you receive four guilders and stay in the game; and so on *ad infinitum*. The expected utility value of this prospect is $\sum_n 2^n \cdot \frac{1}{2^n} = \infty$. Since people always stop after only few steps, they are setting a set of definite, possibly quite smaller upper values, on the St. Petersburg prospect, and as a consequence they are not pricing it in terms of its expected monetary value. Bernoulli's hypothesis counts as the first experiment in EUT theory.

Two centuries later, Maurice Allais (1953) questioned the naturalness of EU-based choices by proposing the following questionnaire:

Question 1. Which prospect would you choose of :

- x1= to receive 100 million FF with probability 1, and
- y1= to receive 500 million FF with probability 0.10, 100 million FF with probability 0.89, and nothing with probability 0.01.

Question 2. Which prospect would you choose of :

- x2 = to receive 100 million FF with probability 0.11, and nothing with probability 0.89, and
- y2 = to receive 500 million FF with probabilty 0.10, and nothing with probability 0.90.

Allais found that the answers that were given the most were x1 to question 1 and y2 to question 2. He argues that, although these prospects could be chosen by good reasons, they violate EUT since there is no function U that would satisfy both:

$$U(100) > \frac{10}{100} \cdot U(500) + \frac{89}{100} \cdot U(100) + \frac{1}{100} \cdot U(0), \tag{2.1}$$

and

$$\frac{11}{100} \cdot U(100) + \frac{89}{100} \cdot U(0) > \frac{10}{100} \cdot U(500) + \frac{90}{100} \cdot U(0). \tag{2.2}$$

The *Allais Paradox,* as Allais called it (though it is not really a paradox) was one of the first conflicts between decision theory and human reasoning to be experimentally exposed.

The theoretical influence of the EU theory seems to have had a long-lasting influence until 1944, when von Neumann-Morgenstern chose to determine the utility value of a randomized strategy in this mathematically convenient way. Not only is current game theory still heavily dependent on EU calculations, but its influence is also confirmed by the microeconomics of imperfect information. A fundamental result in decision theory, according to von Neumann and Morgenstern (1947,) is

that subjects having preferences, that satisfy the axioms in Section 2.1.2, behave as if they had a simple numerical representation of their preferences. More specifically, it is a well defined function that associates a single number with a lottery (called the utility) that can be written as $U(x)$. This function *represents the preferences* whenever x_1 is preferred to x_2, the utility of x_1 is larger than the utility of x_2, that is $U(x_1) > U(x_2)$.

The von Neumann-Morgenstern theorem also states that preference orders satisfy the axioms presented in Section 2.1.2 only if the numerical representation has a very simple form, equal to the expectations of the utility of each outcome, according to some function $u(x)$ of outcomes.

Marschak (1950) and Herstein and Milnor (1953), probe that the EU formula was derived as the numerical counterpart of a qualitatively defined preference structure subjected to various axiomatic constrains (see Section 2.1.2). All available axiomatizations assume that there is a binary relation $\leq$ on the Set X of all risky prospects (also called lotteries), subject to the pre-ordering properties (axioms).

2.1.2. Axioms of Preferences

To fully describe the behavior of a subject, one should in principle list the infinite set of decisions between an infinite set of possible lotteries. To make this situation manageable, a set of axioms has been put forward.

Axiom **1** requires that preferences are *complete*: for every choice between two bundles of goods, x_1 and x_2, either x_1 is preferred to x_2, or x_2 is preferred to x_1. The occurrence of both possibilities is not excluded: in this case, the subject is indifferent between the two bundles. When the subject prefers x_1 to x_2, but does not prefer x_2 to x_1, we say that she strictly prefers x_1 to x_2.

The preference order $\succeq$ is then written as $x_1 \succeq x_2$. Formally:

1. Axiom Completeness. For all bundles x_1 and x_2 we have: Either $x_1 \succeq x_2$, $x_2 \succeq x_1$, or $x_1 \sim x_2$. Without this property, preferences are undefined.

Axiom **2** requires that preferences be *transitive*: if the decision maker prefers x_1

to x_2 and x_2 to x_3, then she prefers x_1 to x_3.

2. Axiom *Transitivity.* For all bundles x_1, x_2, and x_3 we have: If $x_1 \succeq x_2$ and $x_2 \succeq x_3$ then $x_1 \succeq x_3$.

3. Axiom *Continuity.* If $x_1 \succeq x_2$ and x_3 lies in a radius r of x_2 then, $x_1 \succeq x_3$.[1]

These axioms are central to all the theories because the validity of the theories using indifference curves will be affected if these axioms change.

2.1.3. Representation of Preferences

A consumer's preference ordering can be represented by a (real valued) utility function $u(.)$ if, for any two bundles x and y, $x \succ y$ if and only if $u(x) > u(y)$.

A consumer's preference ordering can be represented by a (continuous) utility function if and only if the preference ordering is complete, reflexive, transitive and continuous (Debreu, 1954). Furthermore, the preferences can be represented graphically by continuous indifference curves as represented in Figure 2.1. An indifference curve shows the consumption of two different goods, and simultaneously gives information about how much utility it provides and which combinations are possible between the two goods in order to keep the income constant. Its representation could be made in a cardinal or in an ordinal fashion.

We are given a preference order which we want to scale to the real numbers. The map from objects to numbers, which preserves order properties, is called a utility function.

It is common to additionally assume that:

- More is better (monotonicity). So indifference curves that are downward sloping, 'thin' and all elements of the domain are 'good' (marginal utility is positive).

- Indifference curves are *strictly convex* and the solution to the maximisation

[1] The fourth and last axiom, the Independence Axiom (the so-called VNM independence), is also simple, but more of a technical nature and can be written as: If $x_1 = x_2$ then for any number $r \in [0, 1]$ we have$r(x_1, x_3) = r(x_2, x_3)$. This axiom is a new restriction that exploits the special structure of uncertainty.

problem is unique (utility function is strictly quasi-concave).

- If u(x) is a function representing a consumer's preferences, any monotonic transformation of that function will also represent the consumer's preferences, for instance, $\alpha u(x) + \beta$, $log(u(x))$, or $\alpha u(x)$, when $\alpha > 0$. That is, utility functions are ordinal, not cardinal.

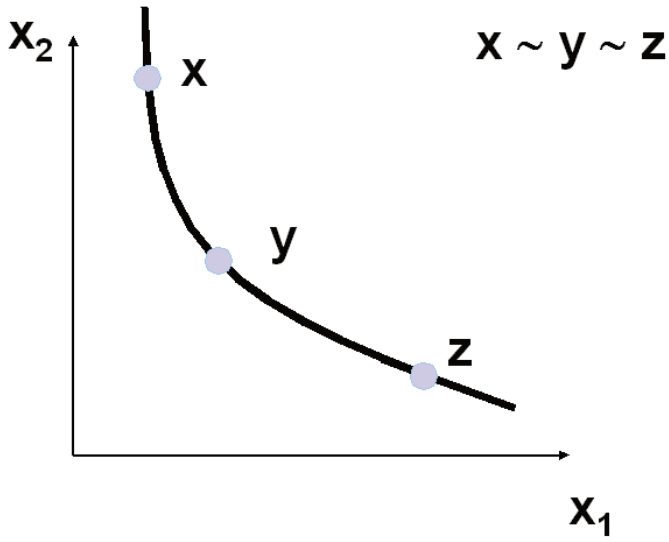

Figure 2.1.: Indifference Curve of Individual i. The individual is indifferent between the bundles x, y, and z.

2.1.4. Revealed Preferences

In a seminal paper written by Samuelson (1938) he makes an attempt to replace the accepted ordinal theory of utility by introducing the first description of the concept he later called 'revealed preferences'. He argues that one ought to analyze the consumer's behavior without having recourse to the utility at all because the concept of utility is not a directly observable phenomenon. Samuelson stated what has since become known as the 'Weak Axiom of Revealed Preference' by writing '...if an individual selects batch one over batch two, he does not at the same time select two over one' (Samuelson, 1938, p.65).

In 1948 Samuelson accepted that his theory was only a means of revealing consistent preferences and enhancing the acceptability of the *ordinal utility theory* by showing how one could construct an individual's indifference map by purely observing his market behavior. Samuelson concluded his article by saying that '[t]he whole theory of consumer's behavior can thus be based upon operationally meaningful foundations in terms of revealed preference' (Samuelson, 1948, p.251). This is only true if we assume the consumer to be rational and to have unchanging preferences that are complete, asymmetrical, non-satiated, strictly convex, and transitive (or continuous). The theory, originally intended as a substitute for the utility theory, has, as Houthakker clearly notes, 'tended to become complementary to the latter' (Houthakker, 1950, p.159).

The correction introduced by Houthakker assured integrability, and by that the theory had according to Samuelson been 'brought to a close' (Samuelson, 1950, p.355). Starting 'from a few logical axioms of demand consistency... one could derive the whole of the valid utility analysis as corollaries' (Samuelson, 1950, p.370). Since Samuelson had shown the 'complete logical equivalence' of revealed preference theory with the regular 'ordinal preference approach', it follows that 'in principle there is nothing to choose between the formulations' (1953, p.1). According to Houthakker (1961, p.709), the aim of the revealed preference approach is 'to formulate equivalent systems of axioms on preferences and on demand functions.'

Despite all these efforts, ordinal utility theory and revealed preference theory are, following Wong, 'not two different theories; at best, they are two different ways of expressing the same set of ideas' (Wong, 2006, p.118). And with regard to the theoretically solvable problem, we may still concur with Hicks that 'there is in practice no direct test of the preference hypothesis' (Hicks, 1956, p.58). Sippel's experiments showed 'a considerable number of violations of the revealed preference axioms' (1997, p.1442) and that from a descriptive point of view - as a theory of consumer behavior - the revealed preference theory was of a very limited value. Mas-Collel et al. (1995, p.14) conclude their presentation of the theory by remarking

that ‘for the special case in which choice is defined for all subsets of X, the set of alternatives, a theory based on choice satisfying the weak axiom is completely equivalent to a theory of decision making based on rational preferences.’

When talking of determining people’s preferences through observation, Varian, for example, has ‘to assume that the preferences will remain unchanged’ and adopts ‘the convention that... the underlying preferences... are known to be strictly convex.’ He further postulates that the ’consumer is an optimizing consumer.’ If we are ‘willing to add more assumptions about consumer preferences, we get more precise estimates about the shape of indifference curves’ (Varian, 2006, pp.119-123). Given these assumptions and that the observed choices satisfy the consistency postulate as amended by Houthakker, one can always construct preferences that could have generated the observed choices. This does not, however, prove that the constructed preferences really generated the observed choices, ‘we can only show that observed behavior is not inconsistent with the statement. We cannot prove that the economic model is correct. Kreps shares Varian’s view, pointing to the fact that revealed preference theory is ‘consistent with the standard preference-based theory of consumer behavior’ (Kreps, 1990, p.30).

As Syll (2013) pointed out, the utility theorists tried to deduce it from axioms and postulates on individuals’ economic behavior. Revealed preference theory tried to build a new theory and to put it in operational terms, but ended up with just giving a theory logically equivalent to the old one. Further, pondering Amartya Sen’s verdict of the revealed preference theory as essentially underestimating ’the fact that man is a social animal and his choices are not rigidly bound to his own preferences only’ (1982, p.66) and Georgescu-Roegen’s (1966, pp.192-3) description of an assessment of what the theory accomplished should come as no surprise: ‘... some economists consider the approach offered by the theory of choice as a great progress... This is simply an illusion, because even though the postulates of the theory of choice do not use the terms ‘utility’ or ‘satisfaction’, their discussion and acceptance require that they should be translated into the other vocabulary.’

We can only observe the decisions that individuals make, while it is not possible to directly observe their preferences, or even estimate utilities. However, we interpret their decisions as a revelation of their preferences. Through economic analysis, it is possible to find out that if an individual makes a choice, the chosen option will be qualified as the preferred option over other alternatives. Since the language of revealed preferences appears to be intuitive, this idea has been formalized in the axioms in Section 2.1.2.

2.2. Alternative Approaches to the Neoclassical Theory: Stochastic Choice and Random Utility Theories

Non-stochastic choice models have been demonstrated to be mathematically consistent, but cannot properly describe the choice that individuals made under uncertain situations. As an alternative, stochastic choice models were introduced. In the 1940s D. Cartwright (Cartwright, 1941a; Cartwright, 1941b; Cartwright and Festinger, 1943) discovered that subjects are not always certain about the choices they make and that these choices have a stochastic nature. He asked subjects to choose between two alternatives. For example, the task of estimating the volume of two containers would be very difficult, in particular to estimate which container has a larger volume. In such a case, the individuals have a tendency to associate the shape or relative (subjective) height of the container with its capacity, and therefore individuals usually give an erroneous estimation of volume.

Also, by asking the subject to make the choice repeatedly, after some time elapsed, the experimenter could test the frequency of one alternative in different decision-making problems. The experimenter could now construct what is known as *empirical random choice*. Cartwright also measured the response time and then plotted the average for each decision problem against the minimum frequency of any two choices

in the same problem. He found that the longest response time was observed when the minimum frequency was approaching 50%.

In different trials, the problems, in which the subject was more likely to select the predetermined preferred choice, also were the problems that were the most time-consuming for the subjects. These findings suggest a model of decision making in which two opposing forces push in the direction of each of the available options. When the difference between these forces is large, the majority of the time the decision goes in favor of the preferred option and the decision is made rather quickly. When the forces are the same, the frequency of choice moves closer together and the time to choose becomes longer.

These kinds of models are very attractive to better approach the individual behavior in choice situations, but they do not completely describe certain individual reactions that are not considered in theoretical models and are difficult to extract in experimental settings.

Experimental studies on repeated decision making under risk have found that individuals often do not choose the same alternative when they are faced with identical binary choice problems that are repeated within a short period of time. For instance, Camerer (1989) reports that 31.6% of subjects reverse their initial decision on the second repetition of a choice task. Starmer and Sugden (1989) observe a switching rate of 26.5%. Hey and Orme (1994) find that 25% of repeated decisions made are inconsistent, even when individuals are allowed to declare indifference. Ballinger and Wilcox (1997) report a median switching rate of 20.8%.

2.2.1. Stochastic Choice Models

An overwhelming majority of decision theories are deterministic, *i.e.* they predict that an individual will make identical choices if a decision problem is repeated, unless she is indifferent. Such a decision theory is typically embedded into a model of stochastic choice, when there is a need to relate a deterministic theory to stochastic data. Stochastic data may be either consist of individual choice patterns from re-

peated decision making (e.g. Hey and Orme, 1994) or of aggregate choice patterns from unrepeated decision making (e.g. Harless and Camerer, 1994). Thus, a model of stochastic choice serves as an intermediary, which translates a deterministic prediction of decision theories in a stochastic choice pattern that can be estimated by econometric methods on empirical data. Most empirical studies of choice under risk attribute observed deviations from behavior implied by a decision theory to random errors made by individuals. Stochastic choice models take various functional forms, linking the choice probability, $s(z)$ to the value differential z, between an option and its alternative. The value differential is directly deduced from the decision theory.

Three major shapes of the probabilistic choice function are commonly used. First, Fechner's (1860) model of random errors used in Hey and Orme (1994) makes use of a Gaussian cumulative density function (probit). Second, Luce (1959)'s choice model used by Holt and Laury (2002) implies a logistic curve. Third, the 'tremble' model of Harless and Camerer (1994) sets the probability of a misstep to a constant. The models can be briefly described as follows:

Fechner Model of Homoscedastic Random Errors

Hey and Orme (1994) estimate a Fechner model of random errors, where a random error distorts the net advantage of one lottery over another (in terms of utility). Net advantage is calculated according to the underlying deterministic decision theory. The error term is a normally distributed random variable with zero mean and constant standard deviation. According to Hey and Orme (1994), the log-likelihood of observing N decisions, when individuals choose a risky lottery $Lo_i, i \in \{1, ..., N\}$ over a certain monetary amount O_i, can be written as

$$LoLo_R = \sum_{i=1}^{N} log(\psi_{0,\sigma}) \cdot [(u(Lo_i, \theta) - u(O_i, \theta)], \tag{2.3}$$

and the log-likelihood of observing M decisions, when individuals choose a certain monetary amount $O_i, i \in \{1, ..., M\}$ over a risky lottery Lo_i, can be written as

$$LoLo_A = \sum_{i=1}^{N} log(1 - \psi_{0,\sigma}) \cdot [(u(Lo_i, \theta) - (u(O_i, \theta)]), \tag{2.4}$$

where $\psi_{0,\theta}[.]$ is the cumulative distribution function (cdf) of a normal distribution with zero mean and standard deviation σ. Parameters θ and σ are estimated to maximize the combined log-likelihood $LoLo_R + LoLo_A$.

Luce Choice Model (Strict Utility Model)

Luce (1959) proposes a stochastic choice model where the probability, that a risky lottery Lo is chosen over a monetary amount O for certain, can be written as

$$u(Lo,\theta)^{1/\mu}/[u(Lo,\theta)^{1/\mu} + u(O,\theta)^{1/\mu}], \tag{2.5}$$

where $\mu > 0$ is a noise parameter. This model has been recently popularized by Holt and Laury (2002). It is well-known (e.g. Theorem 30 in Luce and Suppes, 1965) that the Luce choice model can be rewritten as a Fechner model of homoscedastic random errors so that the probability, that a risky lottery Lo is chosen over amount O for certain, is given by $\lambda_{mu}[u\ (Lo,\theta) - u\ (O,\theta)]$, where $\lambda_{mu}[X] = 1/1 + exp(-x/\mu)$ represents the cdf of the logistic distribution and $u\ (.) = log(u(.))$.

Notice that in this model utility scale is determined up to a multiplication by a positive constant (Luce and Suppes, 1965, p 335).

Tremble model

Harless and Camerer (1994) argue that individuals generally choose among lotteries according to a deterministic decision theory, but there is a constant probability that this deterministic choice pattern reverses (as a result of pure tremble). Let θ be a vector of parameters that characterize the parametric form of a decision theory and let $u(Lo,\theta)$ denote the utility of a lottery Lo according to this theory. Here we consider only binary choices between a risky lottery and a degenerate lottery that delivers one monetary outcome with probability one. According to Harless and Camerer (1994), the log-likelihood of observing N decisions, when individuals choose a risky lottery Lo_i, $i \in [1, ..., N]$ over a monetary amount O_i for certain, can

be written as

$$\begin{aligned} LoLo_R &= \sum_{i=1}^{N} log(1-p) \cdot I(u(Lo_i,\theta) > (u(O_i,\theta)) \\ &+ \sum_{i=1}^{N} log(p) \cdot I(u(Lo_i,\theta) < (u(O_i,\theta)) \\ &+ \sum_{i=1}^{N} log(1/2) \cdot I(u(Lo_i,\theta) = (u(O_i,\theta)), \end{aligned} \tag{2.6}$$

and the log-likelihood of observing M decisions, when individuals choose a monetary amount $O_i, i \in \{1, ..., M\}$ for certain over a risky lottery Lo_i, can be written as

$$\begin{aligned} LoLo_A &= \sum_{i=1}^{M} log(p) \cdot I(u(Lo_i,\theta) > (u(O_i,\theta)) \\ &+ \sum_{i=1}^{M} log(1-p) \cdot I(u(Lo_i,\theta) < (u(O_i,\theta)) \\ &+ \sum_{i=1}^{M} log(1/2) \cdot I(u(Lo_i,\theta) = u(O_i,\theta)), \end{aligned} \tag{2.7}$$

where $I(x)$ is an indicator function, precisely, $I(x) = 1$ if x is true and $I(x) = 0$ if x is false, and $p \in (0, 1)$ is probability of a tremble. Notice that a tremble occurs when the utility of a risky lottery is less than the utility of a sure amount, but an individual chooses the risky lottery nonetheless; or when the risky lottery yields higher utility, but an individual chooses the sure amount. Parameters θ and p are estimated to maximize log-likelihood $LoLo_A + LoLo_R$.

2.2.2. Random Utility Models

In *random utility models*[2] the subject has a set of different potential utility functions, and only one of them is drawn every time the individual has to make a decision. This momentarily dominant utility determines the choice for that period. Since utilities are different, the choices from the same set of options may be different over different times, although in every period the decision-maker picks the best option.

[2]See McFadden and Richter (1991) for an early axiomatic analysis and Gul and Pesendorfer (2003) for a complementary development.

In stochastic choice models, the utility function is the same in each period. The decision maker does not always choose the option with the highest utility, but is more likely to choose an option with higher utility when compared to that of other options. These kinds of models present two important advantages: *first*, the decision process comprises of two steps: *evaluation* and *choice*. *Second*: the frequency of the choices gives a measure of the *strength* of individual preferences. With these elements put together, it is possible to identify a cardinal utility function. An early axiomatic analysis of this problem can be found in Davidson and Marschak (1959) and Debreu (1958), and a recent characterization through axioms is presented in Maccheroni et al. (2007).

Loomes and Sugden (1995) argue that individual preferences over lotteries are stochastic and can be represented by a random utility model. Individual preferences over lotteries are captured by a decision theory with a parametric form that is characterized by a vector of parameters θ. We will assume that one of the parameters $\theta_R \in \theta$ is normally distributed with mean μ and standard deviation σ and the remaining parameters θ_{-R} are non-stochastic. Let $\overline{\theta_R}(\theta_{-R}) \in \theta$ denote the value of parameter θ_{-R} such that given other parameters $\theta_R \in \theta$, an individual is exactly indifferent between a monetary amount O for certain and a risky lottery Lo, i.e.

$$U(Lo, [\overline{\theta_R}(\theta_{-R}), \theta_{-R}]) = U(O, [\overline{\theta_R}(\theta_{-R}), \theta_{-R}]). \tag{2.8}$$

Without loss of generality, we can assume that for all parameter values above this threshold, i.e., $\theta_R > \overline{\theta_R}(\theta_{-R})$, an individual prefers the sure amount over the risky lottery (otherwise we can always define a new parameter $\theta_R^* = -\theta_R$). The log-likelihood of observing N decisions, when individuals choose a risky lottery $Lo_i, i \in \{1, ..., N\}$ over a monetary amount O for certain, can be then written as

$$LoLo_R = \sum_{i=1}^{N} log(\psi_{\mu,\sigma} \cdot [\overline{\theta_R}(\theta_{-R})]), \tag{2.9}$$

and the log-likelihood of observing M decisions, when individuals choose a monetary amount $O_i, i \in \{1, ..., M\}$ for certain over a risky lottery Lo_i, can be written as

$$LoLo_A = \sum_{i=1}^{M} log(1 - \psi_{\mu,\sigma} \cdot [\overline{\theta_R}(\theta_{-R})]). \tag{2.10}$$

Notice that the probability that an individual chooses a risky lottery over a monetary amount is simply the probability of observing preferences characterized by parameter $\theta_R < \overline{\theta_R}(\theta_{-R})$. Similarly, the likelihood that an individual chooses the sure amount is just the likelihood of observing parameter $\theta_R > \overline{\theta_R}(\theta_{-R})$. Parameters θ_{-R}, μ and σ are estimated to maximize total log-likelihood $LoLo_R + LoLo_A$.

2.3. Do we Need to Propose a New Model?

Stochastic choice models made a first step by considering non-deterministic choices in lotteries and introducing them satisfactorily to economic theory. However, these models have been traditionally restricted to modelate choices between lotteries for mainly three scenarios: The *Fechner* model approximates the shape of decisions to a probit function, the *Luce* model implies a logistic function and the *Tremble* model reduces the probability of choice by setting it as a constant. All these models require the researcher to know or be able to accurately approach the probabilities of choices. These models describe the phenomena, but are not designed to explain why people are changing their choices in the way they do, and which intrinsic factors are involved in the decision-making process.

A better approach can be made from random utility models, but the hypothesis, that random choice is produced by random utilities, imposes restrictions on observed behavior. In this class of models, the choice is made from a set of lotteries referred to as a menu. Since each of these utility functions is linear, the choice is always in a special subset of the menu (or its boundary in technical terms). By keeping a fixed threshold as frame where decision can oscillate, the researchers explain choices between lotteries and sure monetary outcomes. These facts do not allow free choices without knowing the menu where the choices can be made.

In our model, described in detail in Section 6.1.1, we make use of two components

borrowed from stochastic and random choice models to approach the phenomenon of preference instabilities:

1. A *probability* θ, that our subjects change their decisions after neigbourhood influences and additional information after sensory experience.

2. A *threshold*, here modelated with a random number which will be activated according to individual attitudes toward the chocolate.

Here again, after information aggregation, our individuals make decisions in two steps: *evaluation* and *choice*. We seek to better approximate real individual behavior in changing scenarios, where more than one informational source is present. To give adequate answers to the research questions introduced in Section 1.2, it is required to explicitly consider attitudes, interactions and knowledge simultaneously in a multiagent model.

3. Attitudes and Preference Formation

Neoclassical economics has assumed that individual preferences are given, that is, they are not influenced by markets or other economic institutions, legal rules or external influences in general. Additionally, preferences are stable and coherent, and the individual seeks rationally to maximize those preferences. These assumptions, so called the *axiom of exogenous preferences*, are being criticized increasingly (Bowles, 1998, 2004).[1] To better approach human behavior, economics takes psychological elements which differ from the way they are traditionally described by economists. Psychology systematically explores human judgment, perception of well-being and behavior in different situations.

Preferences are often determined by change in outcomes relative to the *reference level*, and not merely by absolute outcomes (see Rabin, 1998). Even if we were able to modify our standard assumptions about $U(x)$, it is sometimes misleading to conceptualize people as attempting to maximize in a coherent, stable and good perceived $U(x)$ function. Processes as the accurate evaluation of probabilities, such that $U(x)$ actually occurs, or the right evaluation of information, require time and effort, and both are difficult to achieve, because beliefs, attitudes, and human capacities are not predictable and depend on individual situations.

[1] Bowles presents an alternative view in the frame of institutional economics (Bowles 1998) by endogenizing individual preferences. To our understanding, these attempts reflect the growing explanatory reservations of economists concerning the standard assumptions on preferences (transitivity, non-satiability, convexity, etc.), the optimization-maximization calculus, and the economic decision making (assumption on perfect information and perfect rationality).

3.1. Preference Formation

As introduced in Chapter 2, the term *preferences* in economics refers to the principle that guides choices made by individuals. Preferences are most commonly represented quantitatively through a utility function. In the general decision framework, based on the seminal work by von Neumann and Morgenstern (1944), probability distributions are used to weigh the utility values for each of the possible outcomes. Given a set of options, a rational agent chooses the one that maximizes its expected utility, that is the one that in expectation leads to the result it prefers and gives the highest satisfaction level. Preferences therefore, play a significant role in decision making, similar to that of attitudes.

There is no global agreement that exists on a single definition of preferences, but a definition common to various disciplines must be settled. In Chapter 2, preference was defined as a comparative evaluation of a set of possible choices. In an attempt to generalize this term to make it applicable to other sciences apart from economics, Druckman and Lupia (2000) define preferences as follows:

> 'A preference serves as a cognitive marker that reminds people how to interact with various aspects of their environment. Preferences are stored in memory and drawn when people make decisions. When for example people say that they prefer Lincoln to Douglass, they identify an aspect of their environment that, in their mind, provides them with greater benefits than other environmental aspects.' (Druckman and Lupia (2000), p.2).

The objects of preferences can include observable, physical continuous phenomena (such as, for instance, musical instruments) and unobservable, physically discontinuous phenomena (such as discussing research findings). The objects within a preference are those that a person can imagine as substitutable. For more than two hundred years, the economic mainstream has been that these objects of preference are always given externally. In recent years, the evidence against this view

of cognition has been accumulating. For instance, the perception of color. People treat color as a basic attribution of other objects, and many people express to have a favorite color. But colors, as we know them, are as much human creations as they are exogenous characteristics of our surrounding. The objects of preference are not simply out in the world waiting to be ranked. They are instead objects that our perceptive capacity allows us to differentiate and recall, and that our cognition capacity allows us to remember and evaluate.

By using Contingent Valuation surveys Kahneman et al. (1999) found that the answers given by their participants are better understood as expressions of attitudes than as an indication of economic preferences. He added the concept of *attitude* (borrowed from social psychology) and the core process, labeled *affective valuation*, as a signal of the emotional response to objects.

3.2. Attitudes

Many different definitions of the word have been proposed (see Campbell, 1963), but none has been universally approved. In contrast to social instincts and basic neeeds, as rather unchanging substance of preferences, attitudes conform the most variable part of preferences.

Attitudes are persistent dispositions to regard certain entities as either favorable or unfavorable (Fishbein and Ajzen, 1975, p.6). This concept has a broader range of application than the concept of preference, because entities include physical objects, living beings, and abstract concepts, involving anything that can elicit an affective response. Presumably, if attitudes cause some behavior in any direct way, the implication of this definition is that the disposition to regard an object will lead in a behavioral approach toward the object. Attitudes are *mental representations*, not object states of affairs. Utility models considering attitudes could approximate human behavior in choice situations more accurately, but in economic theory they have seldom been considered explicitly.

One of the first and most famous contributions to the study of attitudes was given by Thurstone (1928) who claimed that attitudes can be measured. Thurstone's (1931) method involved devising statements pertaining to an attitude object and then having them rated by a panel of judges on a scale of 1 to 11, on which 1 being the most unfavorable and 11 the most favorable. In a second phase, the twenty-five objects with the highest 'agreement score' among all the judges were selected. The experimenters gave then these items randomly to the people who were asked to indicate which statement they endorsed. If a person was very favorably disposed toward the object, the average scale number would be very high. For the opposite case, the scale number would be low.

Further studies about attitudes were strongly influenced by Thurstone's contribution. Likert (1932) for example, created a very refined scale used extensively in consumer research.[2] In his procedure, subjects are given a large number of statements regarding an attitude object and are asked to express their agreement with each statement on a five point scale: (-2) for strongly disagree, (-1) disagree, (0) undecided, (1)agree, (2) strongly agree.

Another direct technique was presented by Osgood, Suci and Tannenbaum (1957). They used bipolar dimensions as warm-cold, good-bad, etc and subjects were asked to rate attitude objects presented to them on a 1-9 scale, according to the favourability. The problem with these methods is that subjects are, by the experimental situation, encouraged to answer in a socially desirable way which normally was inconsistent with their true attitudes.

Other methods in attitude assessment have been proposed by Wrightman (1969) about opinion formation, and Milgram, Mann and Harter (1965) about sympathetic attitudes toward social groups. Indirect techniques use physiological measurements to assess the attitude toward an object, i.e. the pupils of the eye tend to dilate when an observer is looking at something of interest, also the electrical resistance measured

[2]In this work, we made use of the Likert' scale to account for attitude formation and attitude change of the participants toward the chocolate bar before and after new information has been aggregated. This method is implemented here in order to disentangle and evaluate the information that was exchanged via chat, where the attitude is explicitly given. See Sections 6.1.1, 6.5 and Chapter 7.

on the skin - the galvanic skin response - varies systematically in accordance with different attitudes after the provision of different stimuli (Cooper and Pollock, 1959).

3.2.1. Attitude Formation

Following Fishbein and Ajzen and their scholars, attitude formation is a function of individual beliefs. Fishbein and Ajzen (1975, 1980) made a successful proposal regarding how behavior depends on attitudes, and their results are synthesized in the *Theory of Reasoned Action*. The corresponding mathematical expression can be written as:

$$B \approx I = A_B * w + [\text{other variable}], \tag{3.1}$$

where B is the Behavior in question, I is the person's intention to perform behavior B, A_B is the attitude (or evaluation) toward performing behavior B, and w is a regression weight.

Attitude formation has been conceptualized as a lineal model:

$$A_B = \sum_{i=1}^{n} b_i e_i, \tag{3.2}$$

where b_i is the strength of the salient belief (the subjective probability) held by a person that performing behavior B leads to outcome i (this *outcome* includes consequences, efforts, costs, characteristics, and other attributes), e_i is the evaluation attitude i, n is the number of salient beliefs the person actually holds regarding performing behavior B, that means the subjective probability judgments about an object's or event's assess to other objects or events (Fishbein and Ajzen, 1975, p.131). The process can be understood as follows:

> '... [F]rom direct observation, other sources of information and inference, a person forms beliefs, about the attributes of an object. Beliefs are the statements about whether or not, or in what ways, the object possesses certain attributes. Attributes are evaluated independently in

> terms of their favorableness or unfavorableness. Both beliefs and evaluations are taken to be exogenously and independently determined. The person's attitude toward an object depends on his beliefs about the attributes of an object together with his evaluations of those attributes. Attitudes in turn, generate intentions, and intentions determine behavior.' (Katzner 1989, p.136).

Attitudes are not innate. Attitudes may be formed, and once they are formed they may change. In the course of a person's life, all experiences lead to the formation of different beliefs about objects, events and actions. These beliefs result from direct observation and from inference processes as forms of social learning. Beliefs internally drive the processes of attitude formation and attitude change. These processes are apparently similar and closely related, but attracting different bodies of theory: Attitude formation is usually discussed in terms of learning models while attitude change is often considered to be a consequence of persuasion.

Classical theories suggest that all attitudes are learned according to conventional 'learning paradigms'. Three of these paradigms are usually cited: *classical conditioning*, *instrumental conditioning* and *modeling*.

Classical conditioning refers to the acquisition of meaning by a stimulus. Thus, attitudes are formed toward stimuli as a function of pleasantness or unpleasantness of the environment in which the object is experienced. Classical conditioning was discovered and studied by Ivan Pavlov in his famous experiments with dogs (see Hilgard and Bower, 1966), and mainly refers to involuntary behavior which induces a predetermined unconditioned response or reflex. In the case of classical conditioning, some characteristics limit its scope: Unconditioned responses are part of our innate behavior and are not subject to change. Furthermore, no new forms of behavior are learned since innate responses are merely associated with different stimuli. Indeed, classical conditioning thus does not explain how humans acquire complex forms of behavior.

Instrumental conditioning studies the way in which attitudes develop when their

impression is followed by a 'rewarding state of affairs' (see Hovland et al., 1953). For example, we may learn our attitudes toward work, what and how to eat, how to spend money, and so forth, because expression of these attitudes was reinforced by the approval and affection of our parents, teachers, and social environment. The difference between classical and instrumental conditioning (Skinner called the latter 'respondent behavior' (Skinner, 1953)) is that the former is a form of passive reaction while the latter is behavior for which no conditioned or unconditioned stimulus is observable a priori. Instrumental conditioning allows individuals to learn behavior leading to certain behavioral consequences. Reinforcement process is a very basic learning mechanism which allows people to form attitudes toward objects.

Events that follow operant behavior and increase the probability of its future repetition are called reinforcers (see Skinner, 1953, pp.72-5). There is a difference between positive reinforcers (as a very delicious food) which increase the future operant behavior (wish to repeat some experiences in future periods, like 'visit again this restaurant'), and negative reinforcers (as obliged long exposition to cold weather, or electric shocks). Therefore, reinforcers are strongly related with human wants, because it can be argued that only these things, that are reinforcing, tend to satisfy human wants (e.g., Witt, 2001). However, not all individuals search to satisfy the same wants (e.g. for some people social status is more reinforcing than a good job, but for others not).

Attitude formation is also studied as a *social learning process* (see Bandura, 1972). That means, our attitudes are formed as a result of directly *modeling* our own behavior, or imitating the behavior that is modeled by others. We may adopt particular attitudes because we have observed others expressing or behaving in accordance with those attitudes, especially if the others obtained rewards as a result. Social learning means that a person acquires some behaviors by observing (and later imitating) someone else performing that behavior and being reinforced by its consequences. In classical conditioning, the individual is seen as a black box. Imitational learning opens this black box, because all the possible assumptions about the underlying

decision process have to be considered.

In social learning models, two broad phases have been distinguished, the *acquisition phase*, where behavior is observed and learned and the *performance phase*, where such behavior is proved after learning. Indeed, the learning phase is restricted to the acquisition phase, reinforcement by performance (behavior) also contributes to this learning. Imitational learning has been shown to be a very important form of human learning and has been fruitfully employed in 'mental training' in business life and in marketing (Franke and Kühlmann, 1990).

3.2.2. Attitude Change

Attitude change is very important to psychology and also to economics, because both human attitudes and the environment are permanently changing and interacting with each other, permanently challenging the decisions that individuals make. Attitudes evolve over time in part as a result of economic conditions and when they change, they create further adjustments to the economic environment. Attitude change is in this study considered as the vehicle to change preferences over time. Hence, if an individual does not change her attitude, her preferences remain stable (see Chapter 6).

The literature about attitudes in social psychology can be divided in two broad categories: The first deals with how *persuasion by others* results in attitude changes and the other category refers to how attitudes are changed through *self-persuasion*. There is a vast amount of literature on persuasion, and many variables, that affect the degree to which a person can change someone else's attitude have been identified. Early research (e.g. Hovland et al., 1953) also pointed to the conclusion that credible sources of information are more effective than incredible sources. Thus, information coming from a credible source appears to be more important in changing attitudes unless, the subject is uncertain about the credibility, in which case the arguments play a large role (Jaspers, 1978). Additionally, the credibility factor is thought to not be externally induced or simply based on the individulas' own interest. Nevertheless,

W. J. McGuire (1969) showed that under some circumstances a source does not need to be disinterested or unbiased to be persuasive.

A very good example of this is *advertisement*. Everyone has at some point seen an advertisement where a beautiful girl announces a new photo camera. The girl has neither credibility nor technical knowledge of this product, but she is very attractive. Then, the potential buyers do not know how to decide in a way that really satisfies their beliefs, because of the perturbing (noisy) factor introduced by the girl. These irrational impulses to attitude change created by attractiveness were already studied by Horai, Naccari, and Fatoullah (1974). But attractiveness and credibility have different effects on persuasion (see Norman, 1976). Other factors that influence persuasion in a simple and direct manner are the structure of content of the message (Fishbein and Ajzen, 1972; Levental, 1970), and the personality of the subject (Hovland and Janis, 1959; Hovland et al., 1957; Rogers and Shoemaker, 1971).

The second area, *self-persuasion* has been intensively studied and has its origins in the seminal work of Heider (1958) and Festinger (1957). They found that people strive for cognitive consistency. When beliefs or attitudes are inconsistent, people are motivated to dispel the inconsistency in several ways. For example, people could change or leave the environment in order to avoid that the two sources of information are longer in conflict, they may reevaluate the alternatives or change an existing attitude to make it more compatible with the reality of the available information. This last process is the most important here and hundreds of studies have been conducted regarding different aspects of this theory (see Wicklung and Brehm, 1976 for a review).

Heider (1958) argued that people must consider their social environment to be predictable. From his thesis the *attribution theory* has been settled. People make sense of their world by attributing causes to one thing or another. More importantly for Heider was that people perceive behavior as caused. A person may do something because she had to (environmental cause) or because she wanted to (internal cause). Other fundamental ideas from social psychology, such as *role-playing* (Janis and

King, 1954; Janis and Mann, 1965) can also be used to help us understand how attitudes may change through self-persuasion.

Generally, 'attitudes that are changed as a result of considerable mental effort tend to be stronger than those with little thought and thus are more persistent, resistant to counter-persuasion, and predictive of behavior than attitudes that are as a result of a process invoking little mental effort in assessing the central merits of the object'. (Petty and Wegener 1998, p.370). The process of attitudinal change may include an effect of *mere exposure* to new stimuli (Zajonc, 2001), for instance, discussions about a welfare state reform may support the formation of a positive attitude towards the new system together with the obvious effect that positive expectations from a new welfare rule carried out. Public agents in the mass media play a decisive role in this process of attitude change.

3.2.3. Attitude-Consistent Behavior

Social psychology understands *attitude* as a mediating variable corresponding to mental processes or states that account for the consistency of an individual's favorable-unfavorable and cross-situational responses toward an object. Petty et al. (1994, p.70) state: 'attitude is a general and relatively enduring evaluation of some person (including one-self), group, object, or issue. A degree of endurance implies that the *long-term memory* acts as a repository for the evaluation that the individuals have attached to the attitude object, and generally indicates that it is a global appraisal.'

Their basic definition is given by Eagly and Chaiken (1993, p.1), who refer to an *attitude* as a 'psychological tendency that is expressed by evaluating a particular entity with some degree of favor or disfavor' (cf. Olson and Zanna, 1993; Tesser and Shaffer, 1990).[3] Attitudes develop out of an evaluative responding of one of these three kinds, are mentally represented in memory, and are activated in the presence of the object to which they refer (Eagly and Chaiken, 1993).

[3]Eagly and Chaiken's (1993) definition summarizes and extends the definition given by Fishbein and Ajzen (1975) already introduced in Section 3.2.

Indeed, the behavior involved in the formation of attitudes does not receive the largest share of attention from attitude researchers and theorists. Most of the studies seek to understand how attitudes affect behavior. Since the pioneering conceptualization and measurement in the third and fourth decades of the last century (Bogardus, 1925; Likert, 1932), attitude has been portrayed as an *organocentric* predisposition to behave consistently towards the object to which it refers wherever it is encountered. The verbal statements by which attitudes are recorded in response to questionnaires have been assumed to accurately express the underlying 'real' or 'true' attitude held in mind and thus predict and explain its non-verbal manifestations.

3.2.4. Habits: Repeated Prior Behavior

Triandis (1977, 1980) defined habits as 'situation-specific sequences that are or have become automatic, so that they occur without self-instruction' (Triandis, 1980, p.204). In a similar way, Eagly and Chaiken (1993, p.180) state that 'the concept of habit implies that a behavior has become so routinized through repetition that a person has ceased to make any conscious decision to act, yet still behaves in the accustomed way.' Another way to express this is that habitual behavior is maintained by direct contact with the contingencies of reinforcement rather than instructed through verbal behavior. Eagly and Chaiken also refer to habits as 'non attitudinal determinants of behavior' and as one of several 'psychological tendencies that regulate behavior' (Eagly and Chaiken, 1993, p.216, 671). In other words, individual habits are not susceptible to be manipulated in a short time and they change only slowly. In the experimental design, we took this fact into account by measuring habits at the beginning of each experimental setting (see Section 6.3.3).

Ronis et al. (1989, p.216-18) point out that the explanation of habits requires that attention is given to two component processes: *initiation*, namely when the behavior comes about, requiring decision making; and *persistence*, which implies automatisms and lack of conscious direction. A decision, almost by definition, involves conscious

thought and reflection on one or more alternatives. They associate attitudes with initiation (novel behavior), but not persistence. They also argue that attitudes could predict initiation, but not persistence. Prior behavior is a strong predictor of novelty, and habits predict future behaviors more effectively than intentions do (Ronis et al. 1989, p.221). In other words, attitudes correlate with habitual behavior only under certain circumstances. Habits are, therefore, an important component to consider in the process of preference formation and preference change.

3.2.5. Instability of Preferences

Changing beliefs or attitudes will have an effect on a person's intention to perform a given behavior. To find out the influence of these changes, the individuals must first identify attitudes and beliefs relevant to the intention and their relative weights, and second, consider the impact on their intentions. This impact can be seen as an attitudinal (descriptive) message and as a normative message. Changing behavior can be seen as a consequence of changes in intentions. As Bowles (1998) explains:

> '...we acquire preferences through genetic inheritance and learning.' (Bowles, 1998, p.79).

Economic institutions in the form of social groups during the first 10,000 years of biological human societies could affect the gene structure in a particular population, explaining the preference formation in determined groups as genetically induced (Feldman and Laland, 1996; Durhan, 1991; Bowles, 1998). But undoubtedly, the greatest influence of preference formation and changing is influenced by cultural transmissions, such as learning. After cultural learning, such preferences will be internalized, and thereafter become generalized reasons for behavior. For example, learned preferences for the tastes of the regional food is learned by a process passed on from generation to generation and reinforced by attitudes toward determined recipes from parents and relatives.

Once formed, preferences may become internalized through a process identified by Leon Festinger (1957) called *dissonance reduction*:

> '...[T]he human organism tries to establish internal harmony, consistency or congruity among his options, attitudes, knowledge, and values....there is a drive toward consonance among cognitions.'

The dissonance consists of two elements, namely *one's values* and a *behavior*, as when one is doing something which is inconsistent with one's values. Festinger (1957) used this idea to explain *specific ideological changes* (or shifts of opinions) which modify a person's way of life. Following his example of a worker who is promoted at work and the first days giving commands to his former colleagues could be dissonant, but with time, the change will be internalized and this dissonance will disappear.

Dissonance reduction provides another explanation for how economic circumstances that induce new preferences might become general reasons to explain behavior. Apart form that, religious advertising and political activities have a strong influence in establishing our new preferences. After some early experiments, *dissonance reduction* was demonstrated to influence economic behavior. A good example is the experiment conducted by Brehm (1956). From his results, one can conclude that in order to justify their decision, subjects in altered their attitude toward products. Although the products were equally attractive initially, they deemed the chosen one better in order to reduce the dissonant actions 'I like the rejected item one as well as the chosen one and yet I didn't choose it'.[4]

Indeed, understanding the decision-making process implies to understand how attitudes and habits modulate individual choices in everyday situations.

[4]see Lea et al., 1987, chap 7.

4. Information Acquisition and Information Processing

4.1. Data, Information, and Knowledge

Shannon and Weaver's (1949) Basic Communication Model is the starting point for analyzing the communication process in terms of the intent of the sender, the needs of the receiver, and the elements of the communication environment (Shannon, 1949). The communication model in figure 4.1 shows the basic components present in a simple two-way exchange of information. Every communication, whether it is real-time, such as a face-to-face meeting or a telephone conversation, or asynchronous, such as an e-mail and fax, involves the following:

- The *environment* in which the communication takes place.
- A *sender* or encoder who starts with a purpose.
- A *message* created to accomplish the purpose through the *content* (the words and/or images) and the *media* (the format in which the content is presented: audio, text, video, or multimedia).
- *Technology*, which is made up of codes and channels (data networks).
- *Noise*, which is anything that reduces the likelihood of the message being interpreted the way the sender intended.
- A *receiver* or decoder who interprets the message.

- A *feedback* message that reverses the process.

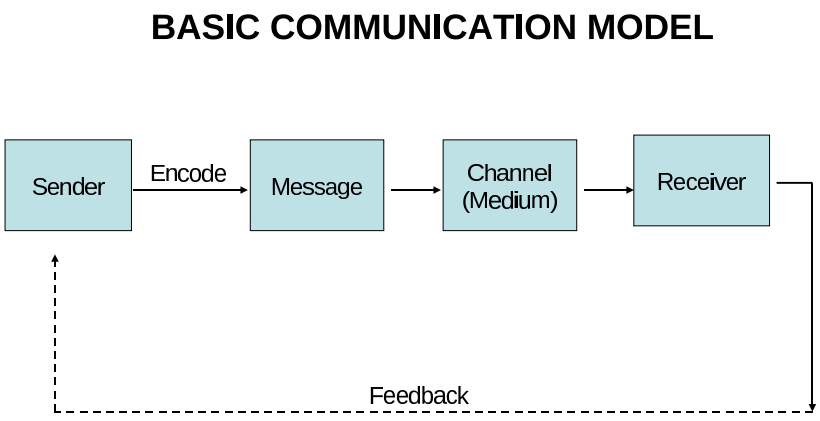

Figure 4.1.: Basic Communication Model.

Here, the *sender* sends a *message*. This message, composed of data, is transmitted through a *channel* to the *receiver*. Then, the receiver, based on the incoming information, sends feedback as a response from the received message and a new loop can begin. A more advanced communication model would consider multiple parties, the different types of each component, and the perceptual filtering of a message done by both the sender and receiver, that is, the characteristics, thoughts, and emotions of all parties that contribute to the message's formation and interpretation.

Decisions arise as the result of processing this information during a period of time. For some decisions the amount of time required to process information is longer than the time needed for other decisions. To be able to make a decision, individuals accumulate information in form of knowledge which will be recalled when it is needed. The basis of the work in this regard is the conversion of data into information, and the subsequent transformation of information into knowledge,

to enable decisions to be made. Thus, if we have better data this will enable us to have better information leading to better knowledge and hence better decisions.

Indeed, in this work we assume that the amount of information has an impact on the individual's behavior in markets. Particularly, we want to explore how the perceptual system is organized to receive inputs through our senses, and how this perceptual system influences the decision-making process, *i.e.* how the perceptional system sends relevant information accumulated in form of experiences contributing to reduce individual uncertainties at the moment to make a choice.

In looking at the use of information in decision making, there is an overriding causal model underpinning the present analysis. Our basic notion is to assume a conversion of data into information and information into knowledge to enable decisions to be made. The terms data, information and knowledge are frequently used as overlapping concepts. These three concepts are ill- or ambiguously defined in the literature. In order to make clear its application within the present work, it is important that we begin by defining what is meant by the terms.

Data. The word data is the plural of Latin word datum, past participle of dare, "to give"; hence, the meaning is "something given". In general, data consists of propositions that reflect reality. A large class of practically important propositions are measurements or observations of a variable. Such propositions may comprise numbers, words, or images. 'Measurement is an experimental and formal process aimed at obtaining and expressing descriptive information about the property of an object (phenomenon, body, substance, ...)' (Mari, 2007).

Information. The Oxford English Dictionary defines information as 'Knowledge communicated concerning some particular fact, subject or event; of which one is apprised or told; intelligence, news' (Oxford English Dictionary, 1989, p. 944). Hence the way in which the word information is used can refer to both *facts* as such and the *transmission of the facts*. Information is the result of processing, manipulating and organizing data in a way that adds to the knowledge of the receiver. This definition has been mathematically formalized by Claude Shannon (Shannon, 1949).

Information about the environment is conveyed to the brain from the eyes, hands and other sense organs. Traditionally, people have referred to the five senses of vision, hearing, touch, taste and smell. But our senses are more wide-ranging, complex, and sensitive than we normally realize, and in everyday life we use only a fraction of their power. It is the range and coordination of the human senses, together with their sensitivity, that provide us with a unique quantity and quality of information about the environment. Information is valuable because it can affect individual behavior, decision making, or outcomes. A piece of information is considered valueless if, after receiving it, things remain unchanged. From the received data from the environment we extract information. This information is accumulated in our brain as knowledge, which will be used to make decisions.

With data, we tend to deal with facts. With information we tend to deal with the interpretation of facts. When we speak of knowledge, we are dealing with a more general concept.

Knowledge is usually equated with the best way to interpret facts and use information. Like the related concepts truth, belief, and wisdom, there is no single definition of knowledge on which scholars agree. Knowledge acquisition involves complex cognitive processes: perception, learning, communication, association, and reasoning. The term knowledge is also used to describe the confident understanding of a subject, potentially with the ability to use it for a specific purpose. Knowledge does not exist until people are involved (Ichikawa and Steup, 2012).

Knowledge does not only consists of data. It also contains our beliefs and expectations. As written above, data are the facts of the world. We can perceive these data with our senses, and then the brain can process it. Human beings have used data as long as we have existed to form knowledge of the environment surrounding us. Until humans started using information, all we could use was data directly. If somebody wanted to know how tall her neighbor was, she would have to come and look at her. Knowledge was limited by direct experiences. Information allows us to expand our knowledge beyond the range of our senses. We can capture data in

information, then move it about so that other people can access it at different times.

As an example, we can take a recipe from our grandmother: The flavors in our mind are knowledge after we experienced the recipe. The recipe written on a piece of paper is only data, but interpreting it give us information about how to proceed to prepare the cake, and after we taste it, we accumulate experience-based information in our brain. If we want to share the recipe, we are sharing only data. Indeed, information captures and interprets data at a single point (in our example, when your grandmother wrote the recipe) whereas the data could changes over time (by improving the recipe).

A **decision** is a choice made from available alternatives. A decision is a final product of the specific cognitive process of an individual or a group of persons which is called decision making, and therefore it is a subjective concept. Because it is a mental object, it can be an opinion, a rule or a task for application. On the other hand, *decision making* is the cognitive process leading to the selection of a course of action among alternatives. Every decision-making process produces a final choice (Weirich, 2012). It can be an action or an opinion. It begins when we need to do something but we do not know what. Therefore, decision making is a reasoning process which can be rational or irrational, and can be based on explicit or tacit assumptions.

The definition of these terms clearly indicates that knowledge and decisions are not solely rational processes. Indeed, it is plausible to think about a decision process as a result of mixing rational and hedonistic experiences with knowledge about the objects of choice. For this reason, it is neccesary to introduce concepts from the cognitive theory in order to understand how this aquisition of information is related to decision making.

4.2. Cognition, Perception, and Their Role to Make Decisions

The term *cognition* refers to the mental process of knowing, perceiving, and judging which enables people to interpret the world about them. Humans' reactions will be influenced by the ways in which certain kinds of objects are perceived. Thus, an individual's conception of the world will tend to be unique, in the sense that no two persons have the same set of beliefs and attitudes (Snyder and Fromkin, 1980) (Although a certain degree of uniformity will exist because human beings share several basic characteristics). These fundamental characteristics may relate to biological needs such as food and rest, or psychological satisfaction that is to be found for example in music. The higher the cohesion among people, the more likely they are to share similar sets of cognition. The subjective view of the world is reflected in a cognitive map (a concept first introduced by Edward Tolman (1948)). These views (beliefs) form the core of an individuals' personal orientation towards life in general.

Consumption habits (as introduced in Section 3.2.4) are also likely to be influenced by the cognition that people hold. The environment in which people live is complex and confusing because of much activity and many stimuli competing for attention. People exposed to this high amount of noise attempt to build some cognitive structure that helps to interpret the world in a meaningful way (Rosch, 1975). The individual cognitive map is mainly influenced by two sources: *stimulus* (exogenous factors) and *personal* (endogenous factors). These factors interact to produce an individual's personal set of concepts, which affect all her activities, including economical ones.

As mentioned in Section 4.1, we conveyed information from the environment to the brain through our five senses. To understand how senses can be satisfactorily applied in decision making it is important to first to understand how they operate. That is why it is important to clearly introduce the concepts of *sensation* and *perception*.

Both sensation and perception are stages of processing of the senses. *Sensation* is when the stimulus impacts upon the receptor cells of a sensory organ. It is mainly of biochemical and neurological nature.

Perception is the awareness of understanding of sensory information (Grohol, 2005). In latin *percepto* means apprehension with the mind or senses. Perception is the first element involved in the human information processing that facilitates knowledge construction, and then, use of memory to give this perception a *recognition*. Perception occurs through stimuli generated by various sensory inputs incoming in one or more of our five senses, i.e., by tasting or smelling. Many cognitive psychologists hold that, as we move about in the world, we create a model of how the world works following our perception (García Mira and Real, 2005). That is, we sense the objective world, but our sensations link it to percepts, and these percepts are interpreted within the context of the environment we find ourselves in. As we acquire this new information and consider it relative to the knowledge we have in memory from prior experiences, our perceptions shift as we select further pertinent information to aid our judgments and purchase decisions.

At the same time, perception is both a conscious and a unconscious process. The perceptual system *recognizes* the information, assembles it, and draws comparisons with previously stored material (knowledge). Then, knowledge is used, reused and hence gets constructed. Perception is a selective process and certain amounts of information from the outside are selected because not all the information coming in can be assimilated. Perception is affected by factors such as attitudes, values, motives, stress and a person's background.

The additivity of perceptions, and its effect triggering the human behavior in future decisions, opened a new research area called sensory marketing research (Krishna, 2009). As perceptions have been stored as memories, they significantly contribute to decision making. This perceptual learning is often characterized by a high *specificity* to stimulus parameters such as location or orientation.[1] Additionally, a

[1]Selectivity and locality imply that the underlying neural changes are most probably occurring within early cortical representations that contain well-ordered topographic maps to allow for this selectivity.

transfer of the newly acquired abilities is often considered an important marker of that processing level at which changes are most likely to occur: limited generalization is taken as evidence for a high locality of effects in early representations. In contrast, transfer of learned abilities is taken as evidence for the involvement of higher processing levels as is often observed in task and strategy learning (Recanzone et al., 1992; Karni and Sagi, 1991).

Feedback provides valuable information about the correctness of a performer's responses during the learning (Fahle et al. 1995). One plausible explanation is that perceptual learning can occur in the absence of external reinforcement, with the result that internal reinforcement can serve as a learning signal. For instance, stimuli that are highly discernible can serve as a template that subjects can use to assess stimuli in more difficult conditions: it has been suggested that fast-learning studies often do not require feedback but that slow-learning protocols do (Fahle et al., 1995; Hubert et al., 2009).

One way in which perception becomes adapted to tasks and environments is by increasing the attention paid to perceptual dimensions and features that are important (Goldstone, 1998). This view is shared with models of visual attention that assume that an efficient stimulus processing relies on an interaction between sensory (controlled) and executive (controlling) processes (LaBerge, 2002; Shipp, 2004). Within this framework, individual attitude might reflect an important factor for establishing robust perceptual representation, even when conditions are sub-optimal or not efficiently controllable by executive functions (Sarter et al., 2006; Hubert et al., 2009).

4.3. Sensory Experiences as Perceptual Learning

Information processing and cognition are two fundamental cornerstones strongly related to decision-making processes as already shown in the previous sections. But first, we need to understand how the different senses are concretely involved in the

process of attitude formation. This understanding is relevant to design an experiment to explore the role of the sensory experiences to overcome instabilities of preferences.

4.3.1. Information Processing and Sensory Experiences

A *sensory experience* is the result of the reactions of the senses to different elements from the environment. The reactions that a sensory experience exert in the individuals is normally used as a valuable instrument in marketing research. These elements or triggers are called *'stimuli'* in the traditional psychology context.

> '[O]ur senses are finely attuned to change. Stationary or unchanging objects become part of the scenery and are mostly unseen. Customary sounds become background noise, mostly unheard... if something in the environment changes. We need to take notice because it might mean danger or opportunity.' (Hultén, et al, 2008, p.18.)

The sense organs mediate different kinds of signals, by means of which we can shape our behavior. A conscious sense impression is assumed to take place when nerve impulses reach the cerebrum. When information comes to the human brain, a person becomes conscious of, for example, a light or an odor. The cerebrum is responsible for directing memory and the mechanism of the thought.

In *gestalt psychology*, it is commonly held that color and form have a direct impact on an individual's perception ability, even without any concurrent conscious thinking (Schiffman, 2000).[2] In connection with experience-based purchase and use, the holistic perspective is emphasized in terms of different functional and aesthetics elements in a sensory marketing (Hultén et al., 2009). These elements contribute to establish differences that allow customers, for instance, to develop a preference for a particular brand or specific taste.

[2]The holistic nature of perception is one of the central tenets of gestalt psychology, and it is assumed that the whole, or the gestalt, is greater than the sum of the parts.

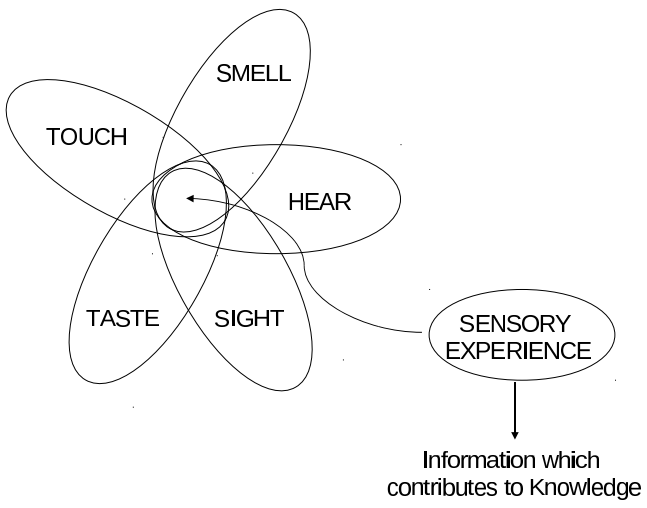

Figure 4.2.: Sensory Interplay Within Sensory Experiences. Source: Hultén et al., 2009, p.17

The five human senses contribute to individual analysis since individual results appear in a differing manner as generic or stereotyped campaigns. The senses tend to be used in combination and, to convey experiences for hearing, seeing, smelling, touching, and tasting. Together, these senses contribute to perception and the subsequent formation of attitudes towards the attitudes of an object. This sensory interplay, that is, when a sense stimulates another one (as in figure 4.2) contributes to synergies that give customers a deeper holistic experience.

The brain itself can only process information which is encoded in a language that consists of electrical discharges. The task of a sensory cell is to convert the relevant stimuli into this brain language in a process called transduction. Transduction differs greatly between light sensitive cells and cells that detect mechanical stimuli. After the uptake of a stimulus, the next functional step is the transduction of the sensory signal. All cells operate with a certain repertoire of intracellular signals that can be chemical or electrical which trigger the cell's internal responses to stimulation.

4.3.2. Our Five Senses and Consumption

According to Peck and Childers (2006), out of the 81 sensory studies done within the framework of consumer behavior focusing on the taste, smell, touch and hearing, over one-third of them (28) have been published within the last five years. Clearly, sensory perception is a growing field inside the consumer behavior research. Because of the amount of advertisement that consumers see every day for the thousands of products that are available in the marketplace, it seems that unconscious triggers, like those appealing to the basic human senses, may be a more efficient way to appeal to consumers (Sengupta and Gorn, 2002).

In the last three decades, some consumer behavior researchers have been incorporating mixed elements of vision, touch, audition, smell and taste in their research. Some of this research has been explicitly focused on the antecedents and consequences of sensory perception for example, the effect of verbal and visual advertisement on ad processing (Houston et al., 1987) or the effects of spoken versus written advertisement on ad recall (Unnava et al., 1996). Other researchers also used sensory perception for mood manipulation in e.g. food tastes (Kahn and Isen, 1993), or a certain kind of music (Gardner, 1985). However, despite the focus on consumer behavior, their works are not cohesive in a unique research stream. First in 2008 a group of researchers created the so-called '*sensory marketing*' research stream (see Krishna, 2009) aimed to investigate the joined influence of our senses for decision-making processes.

Vision

The eye is the only human sensory organ where a considerable amount of information processing already takes place before it enters the brain circuits that eventually generate perception (Frings, S., 2012). Once the visual information has entered the brain it will be classified. Whenever possible the brain operates by parallel information processing. The retina splits the visual information into two main channels: One contains the information on color and form of an object, the other has the

information about localization and its movement. These two classes of information go separate ways through the brain and, only after the analysis has been completed, they rejoin to allow the perception of the object as a whole.

Of the five human senses, our sight sense has so far dominated marketing practices (Lindström, 2005; Krishna, 2009). It is clear to note that most of the information from objects is coming first through our eyes and the intentions to experience them with other senses is elaborated first after we have seen them. Most studies have centered their attention on understanding the effects of seeing in human decision making and what has been used extensively in marketing campaigns. In fact, 83 percent of all marketing studies are limited to the sense of sight alone (Lindström, 2005). We rely so much on our sense of vision to navigate our way through our daily life that, in fact, we tend to take our eyes for granted until they fail us. Our eyes are important instruments used for cognitive purposes, to generate knowledge and recognition of scenarios stored in our memories.

> 'Visualizing is a way of knowing: it is a mode of generating knowledge. How we see determines what we see: and how we see is embodied in our mental images. By virtue of their condensing impulse, images have a kind of power that abstract ideas can never have.' (Nicholson, 2003).

However, the relationship between the shopper and the environment stems from selective attention. Our short-term memory span is limited to around seven chunks, each roughly equal to a word or familiar unit of information (Miller, 1956). Further, research by Simon (1974) found that each chunk could be a familiar phrase and subsequent studies found a link to attention allocation. Therefore, it is futile to bombard shoppers at the point of sale, as too many stimuli result in the information being discounted (Moray, 1993). Furthermore, research by Simons et al. (2002) warned about deviating customers' gaze with other distractions (Soars, 2009).

For instance, a common practice is using colors to manipulate individual mood, and as a consequence the purchase intentions. RGB (Red/Green/Blue) low-energy

lighting provides an environment of low-cost possibilities to vary mood as it can create any shade on the color spectrum. Yellow is generally the first color the human eye notices and light blue has been known to lower blood pressure. However, whilst most shades of blue have a calming influence, some encourage reflection and hence have a tendency to make people spend less. By varying lighting levels and color, it is possible to influence how much time shoppers need to make a decision.(Lindström, 2005)

Olfaction

Smelling something usually triggers an emotion. We are constantly exposed to the smell of other people, animals, earth, food, factories, which is indeed an endless variety of olfactory objects. We may find an olfactory stimulus agreeable or unpleasant. We may even experience craving or repulsion; but we seldom are indifferent towards an olfactory stimulus. Smelling seems to inevitably come with hedonic judgment. Unlike the skin, the ear, and the eye, the nose forces us to make a decision about an object that we examine by its odor (Frings, 2012). Some of these hedonic responses are even genetically fixed.

Odor discrimination is a combinatorial process; the sensory information is contained in the combined activity of many sensory cells. Humans have 400 odorant receptors; each one has a slight different structure and hence a preference for a slight different group of odorants (Frings, 2012). As a consequence, the set of receptor neurons activated by one odorant gradually differs from the set activated by another one. Instead of looking at the response of a single receptor neuron, the brain analyzes the pattern of activity that results from groups of neurons responding to the stimulus (Mombaerts, 2006). How is this map read out by higher levels of the brain, and how is it translated into perception, hedonic assessment, and memory? These are research topics from neurophysiology that are still in an early state of understanding.

Our senses of smell and taste, which are normally considered to be quite different,

are actually very closely tied to each other. In fact, if we did not have a sense of smell, the food we eat would have very little taste. The receptors for the sense of smell are high in the nasal cavity in the direct airflow through the nose and down into the lungs. Unless the odor is very strong, we have to sniff in order to force the air up our noses to the receptors, which are then activated and pass their messages along to the brain. For instance, wine tasters put their noses into glasses of wine and inhale deeply.

Perhaps because we rely so heavily on vision and hearing for sensory information, we tend to overlook the importance of smell, but it is of course the basis of a vast global industry, both in the production of perfumes, which are used in cosmetics as well as in scents used in household products such as washing liquid and lavatory cleaner. Most of the studies in marketing developed by using the olfactory sense have dealt with the scents of specific products or ambient scent (Lindström, 2005; Downey, 2009).

The Sense of Touch

Touching things or be touched is arguably the most basic sensory experience. The first formally known research in Haptics was done by Aristotle as early as the 4th century B.C. Aristotle proposed his theory of aisthesis or sensation which suggested that our senses are ordered hierarchically with touch on the top, and the other senses are only increasing the acuity of the touch sensation. In his mind, 'touch provided a true picture of the intrinsic nature of the object. Touch is the very first sense to develop and the last sense one loses with age. Already as embryo, humans have a very developed touch sense. It can be observed in a fetus' reaction to touch impulses from outside the mother womb allowing it to learn its place in the womb and find itself. (see Floyd, 2006; Guerrero and Floyd, 2006). Touch is a fundamental part of the human relationships and has the power to attract or repel, help or hurt.

Touch is a remarkable sense. Increased research interest has been directed toward the study of haptics and the most recent trends involve a renewed interest in the

relationship between touch and vision. Touch can operate very effectively when needed to grasp objects and discover their important features. The sense of touch often appears to operate more slowly than vision. But this is largerly dependent upon the skill of the perceiver and whether or not the individual can use two hands to feel objects. Scale is also important, since delay and other temporal variables may be less important for smaller objects. Blindfolded sighted individuals may not be able to identify pictures as rapidly as blind persons, and familiarity and practice clearly play a role in object identification. If objects are familiar, one would expect a high level of accuracy and rapid object recognition using touch (Heller et al., 1996).

It is a very important field in marketing research, because people become closer with the product by touching it (Lindström, 2005). Motivated by the large amount of Internet sales (only in the USA, Forrester Research estimates sales of over $ 200 billion in 2008) Peek and Childers asked 199 subjects to evaluate a sweater and a cellphone. Half of the participants were given the chance to touch the product whereas the other half could only see it through Plexiglas. They try to alleviate the individual 'need for touching' by written descriptions of the products. Only in the case of cellphones, these written descriptions helped individuals to alleviate their need for touching (by reading the description of weight, the most important haptic characteristic of it) but could not answer individual inquiries about the sweater softness.

In research of altruistic behavior it has also been demonstrated that haptics is a very important factor to increase donations. Peck and Wiggins (2006) gave brochures for an Arboretum that either had a 'touch element' with it or did not. They observed that the people's willingness to donate increased with the touch element. Material properties such as texture and hardness are more salient for touch than other object properties such as form and size (Klatzky et al, 1987). David Katz (1884-1953) was an early important source in the study of texture (microstructure, the fine structure of the surface). He combined phenomenological observations with interesting experimentation.

Hollins and his collaborators have conducted work showing that perception of texture is multidimensional (Hollins et al. 1993; Hollins and Risner, 2000). Picard and her colleagues (Picard et al., 2004) allowed a free exploration of 40 different ecological surfaces instead of the passive stimulation conditions used by Hollins et al. The results showed that the soft-hard dimension in the texture space is of hedonic character. Thin-thick was a likely second perceptual dimension orthogonal with the soft-hard dimension. These two dimensions were stable salient dimensions in all the stimulus sets. This dimension depended on the stimuli that were included into a given set.

Hearing

Next to seeing, hearing provides us with information about our environment that we rely on the most. Our experience and our ability to make sense of the world are largely shaped by these two senses. In both seeing and hearing, our sense organs react to waves of energy from the environment. Sound waves are focused by the outer ear on the eardrum, where they stimulate nerve endings that send messages to the auditory nerve and from there to the brain.

In terms of hearing and consumer behavior, for the past forty years scientists have been mainly interested in the effects that background music may have in advertising and in retail stores. They found that loud music causes people to spend less time shopping. In contrast, soft music causes people to spend more time shopping but also to spend more money. The more uncertainty about a purchase, the more positive an impact music can have (Duncan Herrington, 1996). Because of its potential impact on atmosphere, background music may influence choices between stores of the same type (Baker et al., 1992). A correlation was found between music, emotion and purchases-customers were more favorably disposed to a product when in a good mood (Gardner, 1985). Supermarket sales increased by 38 per cent with slow music compared to fast music (Milliman, 1982).

For many animals, the perception of vibration is more important than touch

sensation or even seeing. Being touched by a predator marks the moment when it is often too late to escape. Vibrations, on the other hand, travel over some distance and can alert the animal under bad light conditions or in darkness before the predator can strike. It is therefore not surprising that animals have developed sensory organs for the detection of vibratory signals. The perception of vibrations is the base of hearing. Only by vibration perception can our brain hear signal from the outside (Hudspeth, 2008). The human cochlea has the form of a snail-shell with three turns. Along its entire length, hair cells are positioned in four rows numbering approximately 3,000 each row (Manley and Ladher, 2007). The cells sit in a tissue, the basilar membrane, which has a very particular property: it is stiff at the bottom of the cochlea and floppy at the top of the snail-shell. Mainly as a consequence of this gradient in stiffness the basilar membrane responds to sound: when we play a triad on the piano, three distinct sections of the Corti are set into vibration, one vibrating with the lowest tone, one with the middle tone, and one with the highest tone. All other areas of the basilar membrane remain motionless (Manley and Köppl, 1998).

The importance of sound to behavior can be summed up under two headlines: i. Communication within the same and with other species and ii. Alerting the presence and location of enemies, food sources and other organisms. It might be expected that the extend of use of this kind of information by different organisms will depend on their sensory and neural equipment (Pickles, 2008). Communication using sound can be cheap and effective. Cheap in the sense that, since ears are so sensitive, the amount of energy necessary to produce detectable sound is very small. Sound communication can also be carried out in darkness. Communication using sounds has a number of important advantages in guaranteeing the surveillance of species, but also in all-day choices (Pickles, 2008).

The way we perceive the acoustic world is the result of both the selectivity of the hearing organ and the neural processing of auditory nuclei in the brain. These sensory pathways extract information in different ways and the nuclei are to some extent organized in groups, each group being dedicated to one main aspect (or

feature) of auditory perception. Thus it can be seen that often within large nuclei, groups of neurons exist that deal with one particular aspect of the stimulus. Two of the most obvious questions regarding stimuli are: 'what is it?' and 'where is it?' (Manley, 2012).

The information transmitted by the sound ('what is it?') can be passed on to the brain using one ear alone. Information on the location of the sound source ('where is it?) is dealt by analyzing the relation of the signal to the space , which is perceived by the two ears, and this requires a great deal of neuronal processing.

Taste, Direct Experience and Perceptions

The fact that every sense has some role in generating taste has received neurophysiological support (Rolls 2005; Small et al., 2001). Rolls (2005) shows that the pure effects of gustatory stimuli are represented in the primary taste cortex (frontal operculum/insula), whereas the convergence of multiple sensory inputs used to represent taste occurs in part of the orbito-frontal cortex, referred to as the secondary taste cortex (Rolls, 2005).

The primary sense accompanying taste is olfaction, or how the food smells (Small and Prescott, 2005). In fact, smell impacts taste both before (orthonasal) and after (retronasal) food enters our mouth (Rozin 1982). Smell plays such an integral role in taste perception that without it, it is difficult to distinguish a potato from an apple, or wine from apple juice (Herz, 2007). The intrinsic visual appearance of the food also contributes to the sense of taste in generating expectations and perceptions of flavor (DuBose et al., 1980) and can ultimately dominate gustatory cues altogether (Hoegg and Alba, 2007). The sound the food makes when bitten plays a key role in taste perceptions for certain food items (e.g., potato chips, celery, crackers), impacting perceived freshness as well as quality (Zampini and Spence, 2004). The texture (de Araujo and Rolls, 2004) and temperature of food can affect taste. Recent research has shown that temperature sensations on the tongue are directly related to taste. Specifically, warming the tongue elicits sweet and bitter tastes, whereas

cooling the tongue leads to sour and salty taste perceptions (Cruz and Green, 2000).

The receptors for the taste sensations are found mainly in the taste buds on the tongue. The tip of the tongue is most sensitive to sweet and salt, the sides to sour, and the back is most sensitive to bitter. Food producers are well aware of the fact that what we refer to as taste depends heavily on our sense of smell, but with prepared foods there is not too much they can do about it. This may help to account for their efforts to stimulate the basic sweet and salty sensations by using vast amounts of sugar and salt to manufacture these products.

Taste can be conceptualized as a form of direct product experience. Smith and Swinyard (1983) emphasize the information value finding a much higher attitude-behavior correlation after a taste experience than without tasting the product at all. Scott and Yalch (1980) maintain that their research demonstrates a tendency for people to accept information consistent with their perceptions about the causes of their behavior and to reject information when it contradicts these attributions. Some research considers that product trial through tasting can be diagnostic and influences perceptions and choice. Levin and Gaeth (1988) vary the temporal order of tasting a product (before and after reading a ground beef label) and the valence of the label information (positive, 75% lean; negative, 25% fat). The framing effect of the labeling was reduced when consumers sampled the product compared to when they did not.

Braun (1999) looked at a different aspect of taste and memory, by asking the question of whether advertising received after a direct product experience (in her study tasting orange juice) altered how consumers remember their experience. She found that consumer recall of a past direct experience was subject to distortions. Post-experience advertising made the consumers think they had drunk a better tasting juice by altering their memories through advertising. Kahn and Isen (1993) did not include actual tasting but rather tasting perception in their study. They found that a positive affect manipulation increased variety-seeking behavior relative to the control of unpleasant or negative features of the items were not made salient.

Research on the gustatory sense is quite varied and includes administration of taste tests, change in taste relating to new product formulations, store sampling, branding, packaging, and taste as a direct product experience (Lindström, 2005). We will come back only to the latter because of its pertinence with our research study.

4.4. Information Processing and Decisions

After sensory information is collected trough the different organs, humans experience three consecutive steps of information processing that occur within micro-seconds:

1. Within the *'information phase'* the decision-maker gathers certain signals about her environment, and then categorizes and organizes them into pieces of (cognitively meaningful) information to be applied further.

2. The *'deliberation phase'* assumes that the decision-maker mentally processes the organized and selected information in the form of an intention (or plan of action).

3. The *'implementation phase'* is the step where the decision-maker breaks down and schedules the plans of action, and then acts accordingly, through effectors and instruments (see figure 4.3).

The three phases are assumed to take place sequentially.[3] By these steps the decision maker relates herself reciprocally to her environment.

However, humans have limitations in their capacity to create and process information (Simon, 1955). Despite many common capabilities, humans exhibit individual differences in information processing. Individual differences may be long term due to limits in physical or intellectual capabilities, or short term differences in memory, attention span, or learning abilities due to fatigue or stress. A large proportion

[3] In Walliser, B. 2008.

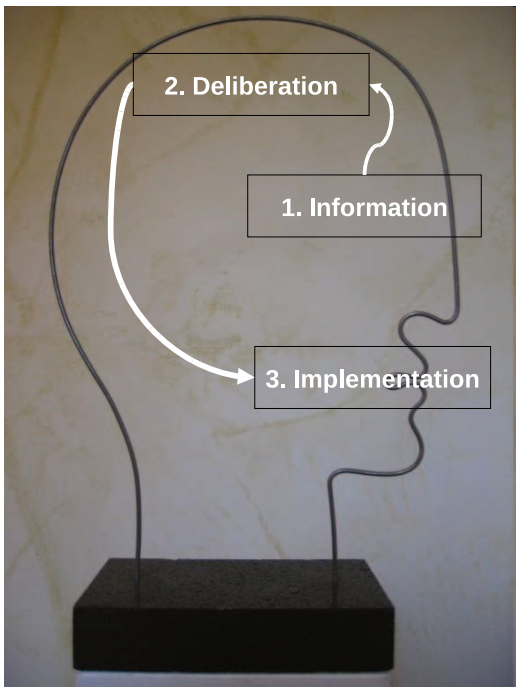

Figure 4.3.: Phases of Decision by Humans. Source: Own design based on Walliser (2008) and the precedent discussion.

of the literature in decision making is dedicated to finding out and explaining the factors which generate distortions. Some of them are introduced as follows.

4.4.1. Memory Limitations

Beginning with Simon's (1956) classic notion of *Bounded Rationality*, scholars have recognized that the quality of decision making can be affected by the inherent limitations of human memory. These limitations can be classified as follows:

First of all, behavior tends to be guided by goals that are currently in working memory (Anderson, 1995). Because they are not reactivated by external (or environmental) stimuli, goals in the long-term memory do not tend to control behavior. Also, because so many goals and tasks can be present at once, some or all may be forgotten. The human memory must constantly rehearse and evoke such goals in order to retain them in working memory in order for them to help to guide behavior.

The tendency for new goals to replace old goals is one of the reasons why setting proximal goals (e.g. save $1 by this Friday) can be more effective than setting distant goals (save $200 by the end of the year; see Schunk, 1991).

The second factor affecting our decision ability is that our working memory is limited to processing all the information about options (Simon, 1986). Choices that involve two- or three-dimensional options do not necessarily exceed the limits of working memory, but choices involving four or more dimensions per option may exceed these limits (Byrnes 1998, Chap. 5 and 6).

If it has been a long time since a decision maker implemented an effective strategy or if there are some interference effects caused by the existence of competing strategies in her memory (Anderson, 1995), the individual making a decision may not be able to retrieve the right strategy for the right context. Hence, the individual will have to rediscover this approach through one of the construction strategies (e.g. by means of causal reasoning or device seeking; see Byrnes 1998, Chap. 4).

In summary, memory limitations contribute to the tendency of distractions to promote deviations from the optimal goal path, but these limitations are not distractions within themselves.

> 'Memory problems are not really defects in the way one behaves in decision making. Instead, memory limitations reflect constraints on the normal operation of the system'. (Byrnes 1998, p.82).

Even when the decision makers share similar values and goals, knowledgeable decision makers are more likely to succeed in comparison to less knowledgeable decision makers. The reason is that there is a causal connection between certain strategies and success. Those who maintain these strategies in their repertoire attain the goals they desire. Hence, the lack of knowledge reflects a problem in the level of contentment with the decisions made.

4.4.2. Lack of Calibration

In order to make appropriate choices, the decision maker has to be *appropriately* uncertain about her choices (Lichtenstein, Fishhoff and Phillips, 1982). A large number of studies have shown that adults are generally overly confident in their ability to perform well on difficult tasks and show a lack of confidence in their ability to perform easy tasks (see Lichtenstein et al., 1982; or Sniezek and Buckley, 1995 for reviews). The lack of calibration is a problem for a decision maker because it increases the likelihood of failure and because it is false, it prompts individuals to avoid getting involved in easy tasks (when they should) and to engage in hard tasks (when they should not). This pattern of behavior keeps the individual from attaining their personal goals as often as they otherwise should. For inadequate knowledge, the lack of calibration is a moderating factor that affects the content of decisions and appears to contribute to decision-making strategies.

4.5. Persuasion by Others: Information Exchange in Groups

Group discussions enable participants to share information so that the group as a whole can access a larger pool of information than any one acting alone (Shaw et al., 1981). The fundamental purpose for using groups to make decisions is to enable a more complex exchange of information and individual preferences about decision alternatives. However, some information known by some members of the group is never exchanged. That results in poor decisions.

In order to reach decisions under influence of group members, participants simultaneously engage in three activities (Dennis, 1996): *information recall*, either from memory or notes; *information exchange*, either giving or receiving information; and *information processing*, that is, using the information: assessing a cognitive implication of the information and sorting in memory. Human beings have a limited amount

of cognitive resources to spread across these activities (Ball and Zuckerman, 1992). As a consequence, most people can engage in only one activity at a time.

The information exchange in groups is not perfect and not all recalled information is actually exchanged. Participants must first decide to contribute to the discussion with information and then have the opportunity to contribute it. Social motivation may reduce the amount of information that subjects choose to exchange and could produce a cognitive inertia in which group discussions tend to a single topic or train of thought (this inertia may occur because rehashing information under discussion can appear more relevant than introducing a new topic that is not closely linked with the current discussion). Information recall in a group is biased toward common information because of the laws of probability: common information known by all participants is more likely to be remembered by at least one individual. Individuals are also more likely to remember information the more are exposed to it (Stasser et al., 1989) thus reinforcing the common information bias.

Once information is exchanged, subjects must process it before they can make a decision. Following Petty and Cacciopo (1986), there are two routes by which information is processed. In the *central route*, participants actively assess the information and its quality and integrate it into an overall understanding of the situation and their preferences. This process of opinion formation is also called persuasive arguments or information influence. *Information influence theory*, the first route, argues that unique information should be more persuasive than common information should be absorbed and considered (Myers and Lamm, 1976). However, empirical psychological evidence suggested that unique information is more likely to be ignored after it is first mentioned (Stasser et al., 1989) Decisions are more likely to be based on common information received during discussion (Gigone and Hastie, 1993).

During group discussions, participants may lack the opportunity to process the information they receive because they must pay attention to other participants (cognitive blocking). If they do not pay attention, they will miss the others' contributions

(Lamm and Trommsdorf, 1973). Therefore, the received information during discussions is only superficially processed and is not considered as fully as information acquired before discussion (Dennis, 1996).

Information that supports pre-discussion information and choices is more thoroughly processed and integrated into an individual's cognitive schema (Petty and Cacciopo, 1986). In contrast, individuals tend to develop counter arguments to information that challenges their initial decision. Furthermore, when subjects face a group majority, whose preferences are different from her own, the subject assumes the majority to be correct and focuses on comparing her preference to that of the majority. In this way, the world of alternatives is reduced to only two possibilities (Nemeth 1986, p.25). In contrast, when a minority has a different preference, it will be assumed that minority participants are incorrect and they will dismissed. Only if after discussions the minority meaning shows consistency by presenting information, the minority could change the others' minds.

The second route is the *peripheral route* in which subjects' preferences are shaped more by peripheral cues such as the attractiveness or number of people arguing for a position, rather than the quality of the information itself. This process is also known as social comparison or normative influence. When subjects learn new information from others, they consider this information in the light of their existing information, which may trigger the recall of related information stored in the subjects' minds. As a consequence, under information influence, the information itself, not the preferences of others, causes the reconsideration and change in preferences. Several psychological experiments have found changes in preferences in cases where subjects' ability to communicate was restricted to objective information (no information about others' preferences), providing evidence that information influence is present in group interaction (see Burnstein and Vinokur, 1973).

The second route, the *normative influence theory* argues that subjects are motivated to conform to the opinions of others to preserve a favorable self-perception and self-presentation (Myers and Lamm, 1976). From this perspective, to know

preferences is more important than knowledge about the information on which they are based. Here we can consider two theoretical connections:

First, after obtaining information on others' preferences, participants may change their preference to match that of the others more closely, either through choice or coercion. Participants may not change their preference but just state a more socially acceptable preference than their true preference. By doing this, they avoid stress (without examining any information and without any change in their true preference; Maas and Clark, 1984).

Second, publicly stating a preference may make the preference stronger for three reasons: *First*, public commitment may make changing preferences more difficult without losing face. *Second*, such statements may cause stronger internalization to reduce cognitive dissonance (Myers and Lamm, 1976). *Third*, hearing one's public statements can increase one's confidence in the choice, for instance, 'How do I know what I think until I hear what I say' (Weick, 1995).

Normative influence theory holds that individual preference formation is affected by a social comparison of one's own preferences to those of others. The theory claims that exposure to information is necessary and sufficient to change participants' preferences. While there is some empirical support to this theory, this is not overwhelming (Myers and Lamm, 1976; Shaw, 1981). Several studies have found that exposure to subjects' preferences without supporting information leads to little preference change (Myers and Lamm, 1976).

5. Methodological Issues

Experimental economics is an important tool which helps to examine the actions of individuals. Of course, humans behave not as particles or mouses, whose behavior is highly measurable in laboratory conditions. However, and in counterpart as affirmed by philosophers about the 'human free will' (O'Connor, 2013), experimental economists have demonstrated that human behavior is highly predictable (see Guala, 2005, p.13) especially when they make decisions in (large) groups.

In the present work, we design an economic experiment aimed to closely analyze the influence of information in the decision making-process. We centered our analysis in the individual information processing after sensory experiences. In order to understand the role of cognition, the interaction with other individuals, and the sensory experiences in the behavior of real individuals deciding about their purchase decisions experimental setups are required.

5.1. Control of Experiments

The most important advantages of laboratory methods are *replicability* and *control*. Replicability refers to the capacity of other researchers to reproduce the outcomes of the experiment with an independent verification data from naturally occurring processes (such as field data) suffering from the disadvantage that often unobserved factors have an impact on the variables of interest, and these factors are constantly changing. Hence, comparing field data at different points of time would be difficult considering the wide range of factors that must be controlled (Guala, 2005, pp.13-15;

Smith, 1982).

A relevant part of the experiment is its control, which is the capacity to manipulate laboratory conditions so that the observed behavior can be used to analyze different theories. In some cases, it is impossible to find natural field data that match the assumptions of the theory (for example, it might be difficult to find economic situations in which individuals face questions that directly test the axioms of the expected utility theory). In other cases, the data collected could be too messy to be able to distinguish between alternative theories (Guala, 2005, p.14).

An important part of laboratory experiments are the financial incentives that are paid to subjects. Subjects actually earn money in order to compensate any kind of loss incurred during the experiment. The value that people place on the outcomes is replaced in the laboratory by the possible financial payment (loss) that an individual will get (incur) in an experiment depending upon the outcome of the process. The institution regulating financial incentives for the present experiment is a redesigned Becker-DeGroot-Marschak-mechanism (Becker et al., 1964), making individuals able to truthfully reveal their preferences in uncertain scenarios. The introduced changes to the original BDM mechanism and the way in which our mechanism operates will be explained in detail in section 5.4. With the control provided by incentives, conflicts across the objectives of different individuals can be induced. Here, simple mechanisms for resolving the conflicts can be implemented in a laboratory environment, in a manner that is theoretically understandable.

As we need to known the risk attitudes of our participants in order to be able to predict behavior, a risk attitude test was designed following the Holt and Laury procedure (Holt and Laury, 2002). This mechanism will be explained in detail in section 5.5.

5.2. Advantages of Computerized Experiments

Given that verbal interactions are not completely efficient in information exchange, we make use of a computer-mediated communication. By this, subjects communicate their choices to the experimenter through the computer. As will be explained in Section 6.3.3, in treatments T2, T3 and T4, our participants were able to exchange information in groups with different size, via chat interfaces. This computer-mediated communication had three important advantages:

- All participants could enter information at the same time. Their contributions (information and opinions) are immediately shared with other participants in a group. Because all participants can type at the same time, they do not need to wait for others to contribute to the discussion. This feature mitigates cognitive blocking which inhibits the exchange of information in verbal interactions.[1]

- All the remarks typed into the computer are stored and remain displayed during the whole experimental round as a kind of *Group Memory*. This has two important effects: participants can refer to this information later during the discussion and reprocess it in conjunction with new information, and, second, it solves a key problem present in all verbal discussions: that processes of listening and information processing are mutually exclusive (Lamm and Trommsdorff, 1973).

- Participants make contributions without attaching their names or identities. This motivates them to participate differently: *Anonymity* may reduce the reluctance to contribute information that contradicts the dominant group preference (Nunamaker et al., 1991). Additionally, participants also are often motivated to defend or support their initial preference, so the information

[1] In verbal discussion, only one person can speak at one time, so all other participants are blocked from contributing. This blocking significantly reduces the exchange of information because participants wait for the contributions before discuss, which prevents them from contributing information far from the discussion point or from introducing a new topic. Also, participants forget their contribution during the waiting time, especially if it is not linked with the actual discussion topic.

they choose to contribute favors their preferences or attacks an alternative. Anonymity may also make subjects more receptive to contrary information. Thus anonymity may improve the information exchange by increasing the amount of common and unique information discussed.

5.3. The Ideal Subject Pool

Subjects in an experiment could be university students, bureaucrats, who can participate in the decision to implement a policy that they have designed, or, for instance, other participants such as farmers, water authorities or councils who would be influenced if a given policy was implemented in the field. There is also a lot of work trying to determine what will be the most suitable subject pool for each research question (Henrich et al., 2010). Since economical theories normally assume generality, any subject pool is informative and, therefore, suitable to probe theories or assumptions with behavioral contains.

Furthermore, new theoretical predictions are more easily to probe in the presence of cognitive sophistication. Because students are typically above average regarding cognitive sophistication, they are often a perfect subject pool. Moreover, students, unlike most other subject pools, are readily available (and more cost effective). Additionally, students are used to learning, they are educated, and intelligent. Experiments can therefore be easily be replicated, which is important to establish empirical regularity and hard to achieve with any other subject pool (for a recent discussion about this topic, see (Gächter, 2010).

5.4. Predictability and Incentive Mechanisms

5.4.1. The Becker-DeGrooth-Marschak-Mechanism

An important task of experimental economics is to design institutions for eliciting values that people place on goods. A large number of laboratory tests of demand-

revealing mechanisms have been carried out aimed to understand the way in which preferences for such goods are revealed in the real world. For an overview about these experiments, see Davis and Holt (1993, Chapter 6); for a real-world test, see Bohm (1984). Another important set of experiments concerns sealed-bid auctions, where alternatives to the traditional and imperfect demand-revealing first-price auction have been tested (i.e., the second-price auction proposed by Vickrey, (1961)). For an early summary about the works applying this mechanism, see for example Smith (1982).

Within the field of experimental economics itself, procedures providing incentives for subjects to truthfully reveal the values they assign to private goods are required. A leading approach has been the Becker-DeGroot-Marschak (BDM) mechanism (Becker et al., 1964). This well-known mechanism consists of telling the subjects that their stated selling price will be compared to a random price drawn from some predetermined uniform distribution. Would the random price exceed the selling price, the subject receives the random price (not her stated price) instead of the lottery, while in the opposite case she will have to play the lottery and collect its outcome, whatever it will be.

This mechanism was developed according to the 'Expected Utility Hypothesis'[2] (Becker et al., 1964), that is, it requires the *consistency requirements* of individual preferences and beliefs imposed by the Expected Utility Theory (EUT).

The BDM mechanism has been used for eliciting both minimum seller prices and maximum buyer prices. Most of the work done, as in the original paper by BDM, focusses on eliciting minimum seller prices for a good. Subjects are each given a unit of a good and asked to state their minimum price for selling it. A buying price is drawn from some random distribution made known to the sellers. If the buying price exceeds or equals the selling price, the seller receives the buying price and gives up the object; otherwise, the seller retains the object (see, for instance, Becker et al., 1964; Bohm 1984; Davis and Holt, 1993; Irwin et al., 1998; Kahneman et al.,

[2] Already introduced in Section 2.1.1.

1990; Rutström, 1998; Shogren et al., 2001).

The argument of the BDM mechanism follows the logic of optimal bids in second-price auctions: suppose the subject's stated selling price is above the random selected market price. Then the random number is to fall in-between the true and the stated selling price with some non-null probability, and the subject will have to play the lottery while forgiving the option to collect an amount that exceeds her true valuation. Conversely, by understating the true valuation an individual performs, it is possible for the random number to be larger than the stated price, but smaller than the true one. This means that the subject has to collect an amount that is below her valuation. Therefore, the only dominant strategy under the BDM mechanism is to bid the true valuation.

The BDM mechanism has been widely employed in economics and is often used to induce a subject to truthfully reveal the certainty equivalent to a lottery regardless of her risk attitude in static environments. In the experimental setting by Grether and Plott (Grether and Plott, 1979), when confronted with the BDM mechanism, subjects were explicitly told that 'your best interest is served by accurately representing your preference. The best thing you could do is be honest' (Grether and Plott, 1979, p.637). It is straightforward to show that in the BDM mechanism, subjects have a dominant strategy in revealing the value of non-risky objects truthfully (see, e.g., Holt, 1986; Davis and Holt, 1993, p. 461). Additional evidence of this feature is to find in (Irwin et al., 1998; Kahneman et al., 1990; Rutström, 1998; Shogren et al., 2001; Keller et al. 1993).

Despite critical research against this elicitation method carried out by Holt (1986) and Karni and Safra (1987), its validity persists if the experimental design attains to ensure that individual beliefs fulfilled the requirements summarized in the Kolmogorov axioms (required to apply the standard probability theory.

Despite the theoretical appealing, there are three concerns about the incentive compatibility of the BDM mechanism that have been raised in the field: (i) subject bids are sensitive to the boundaries of the distribution for the market price (see,

for instace Bohm et al., 1997; Lazo et al., 1992). (ii) subjects' preferences may not conform to the expected utility theory. This is particularly a problem if the value of the good is uncertain, as this can lead to preference reversals (Karni and Safra, 1987), but it may also be a problem even if the value of the good is certain (Horowitz, 2006). (iii) subjects may not be able to compute their optimal bid (Harrison, 1992). Irwin et al. (1998) investigate the interaction between payoff dominance (reward saliency) and cognitive efforts in a decision task. They find that it is not necessary to have a steep payoff schedule to induce optimizing behavior when a subject is able to deduce their optimal strategy from the initial information provided.

In spite of these apparent shortcomings, we chose to apply the BDM method because of its several appealing properties as a tool of empirical research. The following are three relevant points supporting our decision:

1. As introduced above, it provides an exact measure of willingness to pay and it is incentive compatible under weak assumptions under the condition that subjects behave conform to the expected-utility theory.

2. The best strategy for the subjects is to sincerely choose their WTP (see, among others, Grether and Plott, 1979; Holt, 1986; Davis and Holt, 1993).

3. This mechanism allowed us to compare the results of different experimental treatments.

We modify the original BDM-mechanism in order to overcome the problems listed above. We account for the evolution of preference uncertainty induced by environmental changes in a dynamical scenario with the sequential introduction of new information by means of sensory experiences. In our experimental design we include a systematic sensory experience in five steps, each one devoted to trigger one of the five human senses. As the subjects become closer to the object of choice by these experiences, they increase their knowledge about it, that means, there will be periodically accumulate criteria to better choose.

5.4.2. Redesigned Becker-DeGroot-Marschak-Mechanism

As will be explained below in Section 6.3.3, at the beginning of the experiment each participant will receive an initial endowment of 500 ECU.

After each step, our subjects should reveal their maxWTP and minWTP for the chocolate bar. According with the habits, attitudes, and consumption preferences of our subjects, one of the following three possibilities could appears after subject i draws a WTP-Range (the difference between maxWTP and min WTP, $WTP - Range = maxWTP - minWTP$):

1. if

$$u_i(0, 500ECU) > u_i(1, 500ECU - z_i), \tag{5.1}$$

   that is, if subject i prefers the bundle without the chocolate bar, she will choose a WTP-Range resultzing in $maxWTP < 100ECU$. By doing so, she ensures that after the BDM-mechanism is applied, the randomly generated market price, z_i is located above her maxWTP. If the randomly generated market price is higher than the Full-information maximal price ($z > maxWTP$), the subject will buy nothing and retain her initial endowment. This case is illustrated in figure (5.1).

2. if

$$u_i(0, 500ECU) < u_i(1, 500ECU - z_i), \tag{5.2}$$

   that is, if subject i prefers the bundle containing the chocolate bar, she chooses her minimal WTP in a way that $minWTP < 100ECU$. By applying the re-designed BDM-mechanism, she is certain to buy the chocolate bar at the randomly drawn market price *yielding additionally a consumer surplus* because her $minWTP > z_i$. If the randomly generated market price is lower than the Full-information minimal price, $minWTP > z$, the individual will buy the chocolate bar at the randomly generated market price and receive the difference with her endowment. See figure (5.2).

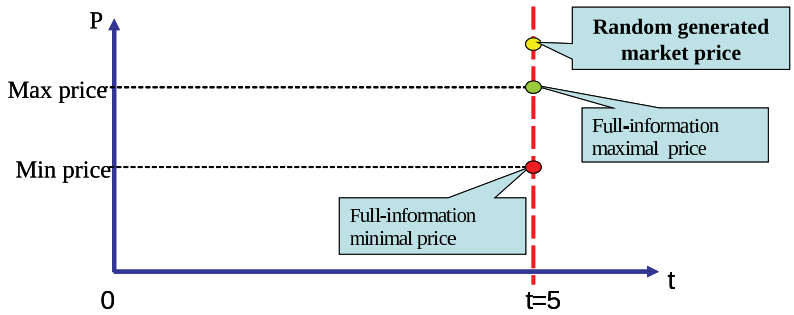

Figure 5.1.: First Case of the BDM Mechanism.

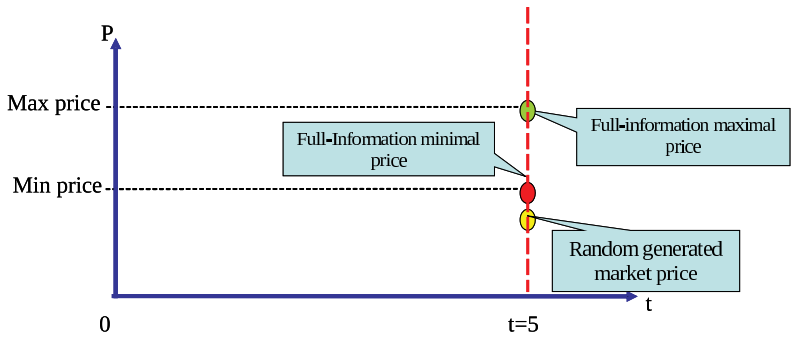

Figure 5.2.: Second Case of the BDM Mechanism.

3. if

$$u_i(0, 500ECU) = u_i(1, 500ECU - z_i), \tag{5.3}$$

that is, if subject i is indifferent between the two offered bundles, i should choose a

maxWTP and a minWTP (to form her WTP-Range) such that her $minWTP < z_i < maxWTP$, or better said, she draws an interval around the potential market price. If the randomly generated market price z is located between the Full-information maximal price and the Full-information minimal price, $maxWTP > z > minWTP$, the participant will automatically participate in a lottery, giving her the chance to buy the chocolate with a 50% probability at the randomly generated market price.

Here, the decision is made by two lotteries, the first one, in which the market price for individual i, z_i is drawn, and the second lottery, where two outcomes are drawn. Each lottery has the same chance: to buy (50%) or not to buy (50%) the chocolate bar. The mechanism is known by the subjects and the three cases are explained before beginning this part of the experiment. Additionally, well-informed participants are expected to make a good approximation to the real market price.

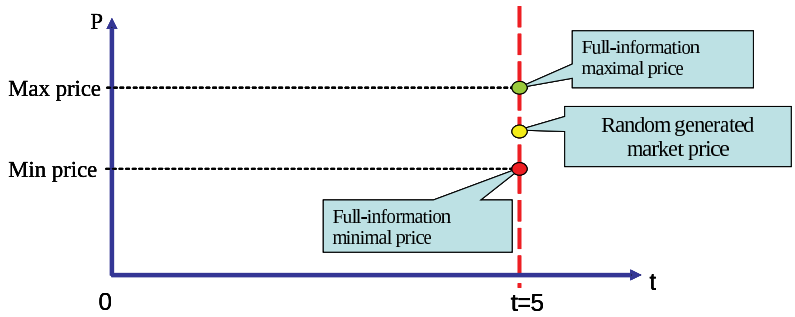

Figure 5.3.: Third Case of the BDM Mechanism.

We expected that, if people are certain in their choices, they are also certain about their WTP for the chocolate bar. That is, maxWTP = minWTP, therefore, the WTP-Range is an interval with a length of zero and remains stable despite new information being aggregated.

No price was given within the experiment, it is formed individually within the information aggregation process, i.e, within the deliberation phase, just after each sense is triggered. For each participant, the program randomly generates a market price z_i at which the chocolate bar is sold. By means of the proposed mechanism, our participants will buy the chocolate bar at the individual randomly chosen market price, or retain their initial endowment.

5.5. Eliciting Risk Attitudes

When faced with a purchasing decision, a consumer perceives a certain degree of risk involved in the decision to purchase a particular product or brand (Stem et al., 1977). The first measurement of consumer perception of pre-purchase risk was reported by Cunningham in 1965 (Cunningham, 1965) followed by a significant amount of research (see Bettman, 1973; Spence et al., 1970; Cox, 1967) down to the present day.

Measuring the intensity of risk preferences is very important for theoretical predictions. Also, in experiments, individuals' decisions are often (partly) driven by their risk preferences. Therefore, we can state that risk attitudes are a good proxy of individual behavior in experimental settings. Risk preferences are important to decisions varying from career choice to stock picking (Barsky et al., 1997), as well as production decisions (Birol et al., 2006). If risk-neutrality is not a general characterization of the sample under investigation, it is important to know the subjects' pool preferences over risk. Several studies in the literature have examined many issues on risk preference elicitation, e.g., the stability of risk preferences across elicitation methods (Anderson and Mellor, 2009), risk preferences and physical prowess (Ball et al., 2010) as well as the complexity of the elicitation method (Dave et al., 2010; Andersen et al., 2010, 2011).

As introduced above in section 5.4, we modify the original BDM mechanism enabling it to elicit individual preferences in changing environments. Despite the

original BDM mechanism operating well regardless individual risk, changing scenarios introduce an additional uncertainty modifying the individual risk attitude for each experimental round, challenging the individual WTP for the object of choice. In the present experimental setting, our subjects are periodically acquiring information challenging their preferences for the offered good. This information induces additional uncertainty by changing the environment where the subjects make their decisions. In this new context, it is important to elicitate the risk attitudes of the subjects. In order to do so, we choose the price-lists-test proposed by Holt and Laury (2002) (hereafter HL) to find the risk preferences of our participants.

The HL procedure tests for risk attitudes across individuals by making choices from ten paired lotteries. If individuals choose more than five safe choices, (in this work the lotteries of type A), before changing to the more risky lotteries (here labeled as of type B), it indicates the presence of risk aversion, whereas fewer safe choices indicate individual preferences for risky choices. Individuals with risk-neutrality will exactly choose five safe choices.

The method of Holt and Laury (2002) has become the standard procedure in experimental economics. Major advantages that led to the popularity of the Holt and Laury procedure include its transparency to subjects (easy to explain and implement), its incentivized elicitation, and that it can be easily attached to other experiments where risk aversion may have an influence. The advantages of the method are due to its design. It is very easy to explain to subjects since they only have to choose between option A and option B in each row. As a common practice, one of the ten rows is randomly selected and paid out for real. And because it is so easy to implement, the HL table can be attached to other experiments where risk aversion may play a role.

Nevertheless, the method proposed by Holt and Laury (2002) has also its drawbacks. The major disadvantage is that it requires a specific utility framework such as the expected utility theory (EUT) in order to classify subjects as more or less risk-

averse.[3] If the individuals' risk preferences are heterogeneous in the way that some act according to EUT while others rather act according to non-EUT, it becomes problematic to use the HL tables in order to classify the subjects' risk attitudes. The reason is that the HL method is not based on a general notion of increasing risk which is satisfied by EUT and non-EUT models.

Because we want to explore the influence of information on the decision-making process, i.e., if information helps to reduce the individual uncertainty to choose, we implement the HL procedure to determine the risk attitudes of our subjects. Risk aversion is considered to be a strong influential factor to not reveal freely real purchase behaviors/intentions. Several studies show that prior subjective knowledge influences the level of the consumer's perceived risk (Laroche et al., 2003). Namely, the majority of studies suggest that prior subjective knowledge reduces the consumer's perceived risk (Laroche et al., 2003). On the other hand, some authors have found an unexpected positive link between the two constructs (Srinivasan, 1987).

The ten paired lotteries applied in this experiment were designed by the experimentalist following the mechanism proposed by Laury and Holt (2002), where the probabilities of earnings and the outcomes were systematically manipulated. The screen presented to the participants within the experiment can be seen in Appendix E. The same set of lotteries was applied in the four treatments.

[3] Holt and Laury (2002) use specific parametric forms of EUT in order to classify subjects.

6. Hypotheses, Model, and Experiment

The process of assimilation of new information and how it is individually incorporated to decision-making processes has been exhaustively studied in the literature (see Chapter 4), but so far, no satisfactory answers have been given to totally describe this phenomenon. A trial to extend the literature concerning this topic is given in the present work. This chapter introduces at the beginning the main *Working Hypotheses* to be tested in Chapter 7. These hypotheses are formulated in accordance with the research questions (see Chapter 1) and reflect the principal motivation of this thesis: to better understand the relevance and implications of sequentially changing information within the decision making process.

As introduced in Chapter 4, *information* can be approached from many perspectives, but the human mind is always at their center. Two important processes will be studied: first, *the individual processing of information in isolation* and second, *the influence that neighbors have on this individual process.* As has been remarked in previous sections, we want: (i) to observe how aggregated information operates within a decision-making process to improve individual choices and (ii) to study how additional information sources, in this case aggregated information via sensory experience and information exchange in groups, reduces/increases individual preference uncertainties at the moment of choice, yielding better individual outcomes.

This chapter is devoted to explaining in detail the *mathematical model*, the *working hypotheses* and the *experimental design.* A series of secondary hypotheses (z-

hypotheses) which will be tested as well can also be found here. These are seeking to complement the findings after testing the three working hypotheses providing a closer insight into our population and will be described below in accordance with the experimental design.

6.1. Model

6.1.1. Mathematical Model

The underpinnings of the utility function, as introduced in Chapter 2, are the possible set of choices that individuals could attain constrained by the budget that individuals determine to expend, that is, this function contains all the facts that individuals take into account for their decisions. Consumption is defined as the final using up of goods and services (the term excludes the use of intermediate products) and is different from buying acts. Consumption depends on time and space. Consumption habits are strongly related to cognitions (see Section 4.2) owned by individuals characterizing their behavior. The habit stock at time t is represented as a general adaptive process of the form:

$$h_t = h_{t-1} + \zeta \cdot (c_{t-1} - h_{t-1}). \tag{6.1}$$

Here, if consumption is positive and $0 < \zeta < 1$, h will always be positive. The parameter ζ indicates the speed with which habits 'catch up' with consumption. The individual utility function U_i could be written in general terms as:

$$U_i = \beta u_i(c, h, A_i, A_j), \tag{6.2}$$

where the own attitudes A_i are playing an important role adapting consumption to the individual preferences in a given time. The neighbors' attitudes A_j also contribute to the choice process providing the individual with an external source of information additional to the market. Because individuals are not living in isolation, this external influences are distorting the pure individual choice in almost

all situations, and (sometimes) are contributing to improve the individual choice, yielding higher utility levels. Indeed a consumer has the goal to solve the problem:

$$max \sum_{s=t}^{T} U_s^i = max \sum_{s=t}^{T} \beta^{s-t} u^i(c_s, h_s, A_i, A_j), \tag{6.3}$$

where h_s is the habit stock and c_s represents the consumption stock. The discount factor β is strongly related to the consumer's ability to adapt her consumption in time, therefore β will be tuned by the learning function L_i introduced below.

Given the hypothetical case where individuals make decisions without prior social interaction, that is, only collecting infromation by their own and forming alone her attitudes toward the object of choice, Equations 6.2 and 6.3 must be rewritten as a degenerate model in the form:

$$U_i = \beta u_i(c, h, A_i), \tag{6.4}$$

and its maximization takes the form:

$$max \sum_{s=t}^{T} U_s^i = max \sum_{s=t}^{T} \beta^{s-t} u^i(c_s, h_s, A_i) \tag{6.5}$$

This apparently simplified version of the model without taking into account attitudes from the neighbors A_j could be in reality more effort-demanding from the DM herself. This case is designed for our experiment as the control treatment T1, which will be explained in Section 6.5.1.

6.1.2. Multiagent System

Multi-agent systems have become a standard way to model populations of individuals in economics (Tesfatsion et al., 2006) and for this reason we use this technique in order to simulate the behavior of the individuals in a virtual experiment. For this simulation, we made the following assumptions:

First Each individual is equipped with senses that allow her to interact with her environment.

Second She owns a cognitive system that allows her to store and exchange information with neighboring individuals. With this two assumptions we want to firstly theoretically approximate the effect of the storage of information, and secondly the effect of the interaction with her environment.

Third The effect of the interaction between individuals.

Stochastic choice models, briefly introduced in Section 2.2, contain elements that can be further applied in our model, but should be adapted to allow the modelation of choices when the menu to choose is unknown or simply not given. Our aim in this research work is to understand the influence of attitudes themselves and attitude changes in the preference formation process. To achieve this, this model endowed individuals with the ability to process and store information. The information owned by our subjects is triggered by an external sensory experience (Tasting, Touching, Hearing, Seeing, or Smelling) introduced to the system in five different experimental rounds.

Information processing may introduce attitude changes affecting the individual preferences, an aspect that has an ulterior effect on the maximization of the individual utility function (see Chapter 3). An attitude can be measured as the affective valuation of that individual (Kahneman et al., 1999). This valuation is a measure of the intensity of the emotional response to objects by using a Likers' like scale. Other aspects, as, for instance, how cognitive processes and persuasion may have an influence on the attitudes (Greenwald et al., 1968), are not considered in this model.

In a similar way as defined by Kahneman et al. (1999), in our experiment, a scale reflects the intensity of the individual response towards chocolate. This scale has four different steps representing different grades of intensity in the sensory experience. The modeling of the intensity in the sensory experience is not represented within this model, since more details about the cognitive characteristics of the individuals are required; instead we represent changes in this intensity in a discrete way, i.e., when an individual decides to change (or not to change) her affective valuation. To

represent this changes, we define a state A_i assigned to each individual representing this attitude change. If there is a change, then $A_i = 1$; otherwise $A_i = 0$. We additionally assume that if there is a change in the individual WTP from one round to the next, then there is a high probability to observe an attitude change, with the result that the WTP and the attitude (affective valuation) are related.

A central problem is to relate the attitude change A_i with the mathematical definition of information. Naturally, in a mathematical model it is rather difficult to represent the way in which the individual interaction with the environment is stored in the individuals' mind (see Section 4.2). Similarly, the interaction between individuals, and the complexity of the cognitive aspects involved in the interpretation of the natural language, are problems that surpasses the goals of the present model (see, for instance, Perlovsky, 2011). For this reason, it is necessary to explicitly model some relevant mechanisms involved in the information processing (such as learning).

The individual i can learn from her sensory experiences. The learning process is defined in a similar way as a machine that is able to store one sensory experience s in a corresponding neuron-like state σ_{si} (where s corresponds to the number of sensory experiences); this one is similar to the definition of a percepton in learning theory (Engel and Broeck, 2001). This representation is also similar to a machine that has different sensors S, each sensor being connected to a single memory chip σ_{si}, which can store ($\sigma_{si} = 1$) or cannot store ($\sigma_{si} = -1$) the incoming information from the sensor.

We introduce a learning function which is defined as an interaction between the different neurons in the following way: $Ł_i = \sum_{s=1}^{\Lambda} \sigma_{s-1,i}\sigma_{si} + L_S$, where Λ is the total number of neurons, and L_S is the input of an external stimulus. Based on the Shannon definition of information (Engel and Broeck, 2001; Shannon, 2001), the total stored information is given by $I_i = e^{k\dot{L}_i}$, where k is the so-called learning factor (Engel and Broeck, 2001).

Once the individual i has a sensory experience S, the experience is stored in the neuron (her memory) σ_{si}. If there is a sensory experience S, then σ_{si} can change from $\sigma_{si} = -1$ (no information stored) to $\sigma_{si} = 1$ (information stored) if $I_i \leq r$, where r being a random number between 0 and 1. The number of the neurons Λ depends on the number of sensory experiences S. Observe that the factor k defines the disposition of the individual to learn: if $k = 0$, there is no change in the learning function because $I_i = 1$. We arbitrary set in this model $k = 0.5$, which allow us a continuous information storage. In other words, a sensory experience can be stored if the individual has a disposition to learn. The storage and subsequent reaction of the individual is related to the optimization of the stored information (Perlovsky, 2011).

The final step is to connect the stored information with the disposition to change the individual attitude A_i (remember that if $A_i = 1$, the agent has a disposition to a change of attitude; $A_i = 0$ otherwise). We assume that the learning function influences this attitude change: If $\frac{L_i}{\Lambda} < 0.5$ then $A_i = 1$; if not $A_i = 0$.

Similarly, if the agent considers the attitude change of her neighbors, then if $\frac{L_i}{\Lambda} + \sum_{j=N}^{N_R} \frac{L_j}{N_R} \cdot \Lambda > 0.5$ then $A_i = 1$, where N_R is the total number of neighbors j. In other words, with this definition, the individual uses her sensory experiences as well as the sensory experiences that she obtains (observes) from other individuals. Finally, we relate WTP with the attitude change assuming that the gaps of WTP are similar to $\sum_i A_i$.

The first step is relevant for the control treatment (making decisions in isolation), whereas the second definition is relevant for the other three treatments. Thus, information processing is related to the optimization of the learning process (Engel and Broeck, 2001) (by learning individuals could optimize their attitudes). Therefore, the individual's utility will be optimized through the attitude change (see, e.g., Manski, 1977).

6.2. Hypotheses

6.2.1. Working Hypotheses

Before now it was thought that one reason buyers search for information prior to purchase was to reduce their uncertainty about the decision to tolerable levels (Cox, 1967; Hansen, 1972). Greater uncertainty presumably should lead to a more extensive search (Lanzetta, 1963). The *uncertainty reduction theory* introduced by Berger and Calabrese (1975) argues that individuals are motivated to seek information to reduce uncertainty. The concept has implications for exploring communication as a means for resolving incompatibilities and inconsistencies in human relationships as well as experiences and behaviors in various settings. 'Human beings by nature do not like the unknown. Therefore we are endowed with an innate will and motivation to reduce it in order to feel more comfortable and at ease' (Berger and Calabrese, 1975, p.102). The persuasive power of information that triggers our senses play a very important role here. As already summarized in Chapter 4, there is plenty of research evidence suggesting that information gathered by the human senses is crucially to choose (see, for instance, Hultén et al., 2009; Krishna, 2009; Lindström, 2005; Soars, 2009) and that the better use of information can improve decision making (Petty and Cacciopo, 1986; Samuelson, 1938; Varian, 2006).

In the 1950's two contradictory views on decision-making processes were explicitly expressed: On the one hand, there is the *Homo Economicus* who makes rational choices after processing large amounts of information. This concept of perfect rationality, underlying neoclassical theory, states that the better informed the subjects, the more accurate their choices. On the other hand, there is the concept of *bounded rationality*, introduced by Simon (1955). He argues that since the individual capacity to process information is limited, individuals cannot make reasonable choices. In Simon's (1971) words, 'a wealth of information creates a poverty of attention'.

The following general hypotheses will be tested experimentally:

- **H1. Information helps to reduce individual uncertainties**. Individual

preference uncertainty decreases if new information is aggregated within the choice process. Therefore, individual choices are changing over time to close the uncertainty gaps and reach better outcomes from their decisions.

Groups of people are more complex than the individual herself, because of heterogeneity in individual behavior, which makes the outcomes of social processes uncertain. However, controlling social interaction could help individuals to improve utility outcomes. Therefore, it is relevant to test the following two hypotheses by a sequential experimental procedure, in which interactions between participants are allowed. The allowed forms to interact will be explained in the experimental design section.

- **H2. Interaction as reinforcement of additional information has strong effects on uncertainty reduction.** Interaction with neighbors implies that individuals exchange their impressions in between receiving additional information to decide. This way, the process of interaction strongly decreases the individual preference uncertainty.

- **H3. Interaction among individuals contributes to forming consumption trends.** Information exchange about individual attitudes towards objects of choice reduces the heterogeneity in individual choice behavior because of consensus formation.

Population dynamics imposed by preference interdependence are manifest in situations where individual preferences are the combined result of two components, one of which is *intrinsic*[1] and the other is *collective*[2] (Schelling, 1978). The neighbor's influence decreases with geographic and social distance.[3] Identification, including localization, is extremely difficult in many cases, especially when unobserved het-

[1]Intrinsic components make reference to individual behavior and own attitude formation.

[2]Collective components are social influences as, for instance, interpersonal comparisons or opinion sharing. These are also called 'Neighborhood effects' or 'Contagion' in the literature (see Lesourne et al., 2006).

[3]Glaeser et al. (1996).

erogeneity is present.[4] Also, an increment in the rate of adaptation destroys synchronicity between agents and produces small interdependent clusters of similar choice behavior, with the collective decision showing small fluctuations around the average.[5]

6.2.2. Secondary Hypotheses

Furthermore, the literature in consumer behavior remarks a series of facts influencing the individual decision making that can be tested by means of collected information. In which follows we present a short list of secondary hypotheses based on the following findings:

1. Risk Aversion and Gender Differences

The literature in consumption research strongly support the argument of differences between females and males. For example, in the document from OECD: Men and Woman in OECD countries (OECD, 2008) one can find the following research results: Single women (ie., women living alone) spend 10% of their food expenses on vegetables; 8% on fruit, milk, cheese and eggs. Single men on the other hand spend 7% on vegetables; 5% on fruit, milk, cheese and eggs. Men spend more on bread, rice, pasta, meat and alcoholic beverages (which constitutes 6% of their food expenses). Women tend to spend more on sweets (sugar, fruit and honey) and seafood. Men and women spend as much on oils. Other experimental results indicate, for instance, that women are more susceptible to starting point bias[6] than men, while men are more susceptible to hypothetical bias than women. This seems to be interrelated with women inherently being more uncertain than men when choosing from a choice set (see Ladenburg and Bye Olsen, 2010).

[4] '...[I]ncreased heterogeneity of beliefs will act to mitigate the potential for social factors to cause a community to form a consensus' (Brock and Durlauf, 1997, p. 17).

[5] This process is also known as 'Social Percolation' (Weisbuch and Stauffer, 2003).

[6] Starting point bias refers to starting bids by auctions that may apply (incorrectly) the appropriate range of bids for evaluating an environmental good. Therefore, the respondent may give different values for a good based on the initial bid suggested to her.

With regards to risk, theoretical evidence has found fewer women in sectors with variable pay instead of fixed wage (see Bonin et al., 2007; Dohmen and Falk, 2011). There is evidence that risk aversion has a genetic basis (Miles et al., 2001) and also that women tend be more risk-averse than men (Byrnes et al., 1999). From the evolutionary perspective, risk aversion is likely to have been selected for in women: A cautious, risk-averse mother would have had better chances of protecting her children, and therefore passing on her genes to future generations. A tendency toward risk taking, on the other hand, would have benefited ancestral men as they engaged in the competition for resources and mates (Wilson and Daly, 1985). For instance, women put more time and effort into shopping for Christmas presents than men (Fischer and Arnold, 1990), avoiding the risk of giving an unpleasant gift.

Women enjoy shopping in general more than men do (Rook and Hoch, 1985). Studies also show that women process information in advertising and product information messages in a more detailed and comprehensive manner than men (Meyers-Levy and Sternthal, 1991; Kempf et al., 2006; Laroche et al., 2000). Women also tend to make more impulse purchases than men (Coley and Burgess, 2003; Dittmar et al., 1995; Rook and Hoch, 1985). Kruger and Byker (2009) found that women tend to carefully scrutinize products before buying them, prefer to choose from an assortment of products, and are more likely than men to pay attention to when items are likely to be on sale.

Thus we can formulate the following secondary hypotheses:

- Z1. Women are likely to pay more for chocolates than men.
- Z2. Women are more uncertain in their preferences than men.
- Z3. Women are more risk-averse than men.
- Z4. The higher the risk-seeking behavior, the higher the individual WTP.
- Z5. The more risk-averse the individuals, the thinner the WTP-Range interval

2. Habits and Sensibility

Cigarettes and cigars contain chemicals that blunt the ability of the taste buds to register each of the four types of flavors, but do not destroy it altogether. Since a significant amount of smoke is exhaled through the nose, these same chemicals affect the olfactory nerve endings in a similar manner. The onset of these changes is sufficiently gradual to leave smokers unaware of them most of the time.

A study published in the journal BMC on Ear, Nose and Throat Disorders (Pavlos et al., 2009) reported the effects of smoking on the sensitivity of the tongue to a mild electrical current that produces a distinctive metallic taste. Out of 62 participants in the study, 28 were smokers, and this group scored significantly worse than did the 34 non-smokers. The researchers noted anatomical differences in the blood-flow supply to smokers' taste buds as well as the taste buds' shape. Indeed, we can formulate the following hypotheses:

- Z6. Smokers will also be less sensible to sensory experiences and, therefore, their WTP will remain more stable than for non-smokers.
- Z7. The WTP for Smokers is lower than for non-smokers.

3. Advertising and Signals from the Market

The old saying that any publicity is good publicity illustrates the belief that, even if viewers respond negatively to forced advertising exposure, they are still being exposed to the message, which will positively impact purchases. Ads do increase consumers' brand recall (De Pelsmacker et al., 2002; Mehta, 2000; Yoo et al., 2004), recognition (Drze and Hussherr, 2003), and awareness (Pieters et al., 2002), and could foster positive attitudes towards brands (Burns and Lutz, 2006; Cho and Cheon, 2004; DePelsmacker et al., 2002), translating into increased sales (Barry and Howard, 1990; Yoo et al., 2004). Deighton et al. (1994) describe this chain of cognition of an ad, attitude formation, and purchase behavior, as a hierarchy of effects (Aaker and Day, 1974). This description of ideal individual behavior in

markets, in particular to process information in the way that adverstisers desire, is reflected also in our experimental design. Then we are able to prove the following two hypotheses:

- Z8. Taking care about advertising leads to higher WTP.
- Z9. Taking care of market prices results in lower WTP.

Complementary to Z8 and Z9 and with regards to the knowledge about the object of choice, individual consumption attitudes and the enjoyment exerted by our participant by consuming chocolate, we can test the following secondary hypotheses:

- Z10. Individuals with a high level of initial knowledge about chocolates are less likely to change their WTP within the experiment. That is, the effect of the newly added information to the system does not affect the initial individual decisions.
- Z11. A more frequent consumption drives individuals to better know the purchased good. For this reason, it is expected that individuals with high consumption frequencies of chocolates are less likely to change their WTP for the chocolate.
- Z12. A more frequent consumption of chocolates reduces uncertainty in preferences about chocolates.
- Z13. Individuals with a high level of enjoyment when consuming chocolates are more likely to increase their WTP as sensory experiences are accumulating.
- Z14. The preference uncertainty of individuals with high level of enjoyment by consuming chocolates is more likely to increase as new senses were triggered.
- Z15. The more habits are followed, the lower the individual uncertainty level at the moment of choice.

6.3. Collection of Experimental Data

This economic laboratory experiment was entirely programmed using Z-Tree[7] and conducted at the *Labor für experimentelle und empirische Wirtschaftsforschung* at the University of Bremen in two blocks, the first one on 30th June and 1st July and the second on 10th and 11th December 2009.

This experiment was designed in four parts: In a first part, we have asked for habits, general knowledge and attitudes towards chocolate, in order to learn the participants' consistency between preferences and choices, and to observe the influence of new information on their choices. In a second part, subjects had to choose a Willingness-to-pay interval (maximal and minimal WTP to get the individual *WTP-range*, see Section 5.4) designed to catch the uncertainties at the moment to decide, and the uncertainty evolution after new information was aggregated. This second part was designed in five rounds, each experimental round aimed to aggregate a new piece of information to be integrated into the final decision. The third part was devoted to get a measure, or better say a classification of the individual risk preferences of our subjects. To conclude, our participants filled out a social-demographic questionnaire. These parts will be explained below in greater detail.

6.3.1. The Laboratory

The *Labor für experimentelle und empirische Wirstchaftsforschung* is located at the faculty of economics at the campus of the University of Bremen, Bremen, Germany. It consists of 20 computer stations working as a network and a central computer to control them. The computers were separated from each other by a wooden wall, isolating the participants. In this way, they were able to individually make choices, and only if the experimentalist allows, they could communicate in between by means of the computer interface. For each one of our eight experimental sessions, we made use of the full laboratory capacity. Furthermore, the lab has video and sound

[7] Zurich Toolbox for Ready made Economic Experiments; Fischbacher, U., 2009; version 3.3.6

facilities.

For our study we made use of 180 subjects recruited via ORSEE, the On-line Recruitment System for Economic Experiments (Greiner, 2004). Thanks to this On-line-Tool, we got students from the different faculties at the university campus, 40 students for each of the four treatments and a reserve of 20 subjects.

6.3.2. Chocolate: The Object of Choice

We deal with a very well-established product, which at least the majority of our participants should be familiar with (in general, the objects which influence the decisions of the participants may be no artificial products because the object of choice must have the possibility to be linked with 'real own experiences and memories'). Moreover, the objects should bring the possibility to guarantee identical tasks by the experimental subjects. Chocolate does not require any special explanation because most consumers are familiar with it. The countless features and taste directions owned by chocolate offer a wide range of actions which is crucial to develop the present project. Additionally, chocolate is suitable for direct consumption and allows a systematic sensory experience through all of one's senses (seeing, touching, hearing, smelling, tasting). These facts play a determinant role in the decision process and supply us with important knowledge for this research. However, we choose a not very common sort of chocolate, to makke sure that the individuals have to follow the whole sensory experience to make a more certain buying decision.

The consumption is conditioned by past experiences and new inventions are difficult to accept. Consumers always tend to unconsciously choose things which they are familiar with. Nevertheless, over the years the way in which individuals have consumed chocolate has changed and has become specialized. New flavors and new ingredients with different concentrations have been introduced, offering more possibilities to the consumers. Indeed, the number of consumers who consciously search chocolate bars made with high quality cocoa (and other ingredients) has increased in recent years. However, this kind of consumers remain a small minority. Maybe

it exists a strong resistance to change consumption habits, despite the efforts of chocolate producers.

6.3.3. The Basic Design

Considering the features introduced in Chapter 2, 3, and 4, the designed experiment is based on the processing of informational contributions of the five human senses, which are systematically stored in our memories after sensory experiences, and then used in upcoming choices. The importance of additional information to improve or distort choices contributing to reduce uncertainties is accounted for by allowing individuals to exchange information in between.

At the beginning of each session, subject were given audio instructions, followed by two welcome computer screens (in Appendix B). The experiment was divided in four parts as sketched in Figure 6.1.

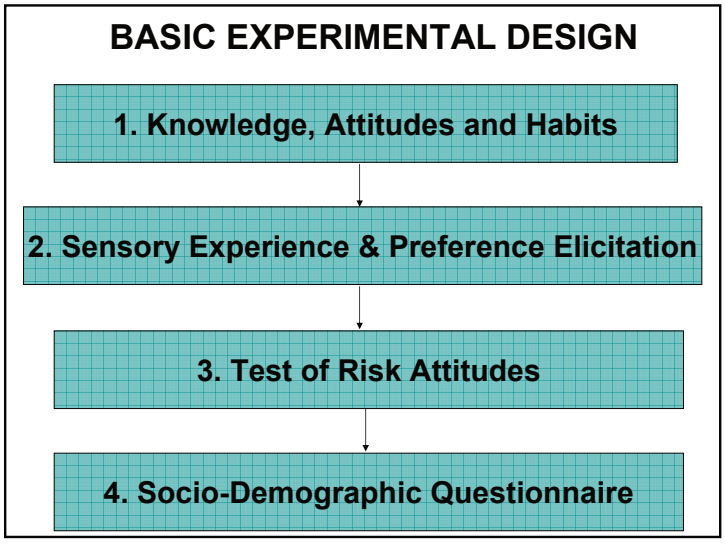

Figure 6.1.: Basic Experimental Design. Own Design.

6.4. Knowledge, Attitudes, and Habits

6.4.1. Measuring Subjects' Knowledge

As introduced above, in the first part of the experiment our participants had to answer a series of questions aimed at revealing their general knowledge about chocolate, their attitudes towards the object of choice and the purchase habits they are normally following. Individual answers giving in this part of the experiment will be introduced as controls for the statistical analysis. The first two questions were designed to reveal the initial level of knowledge owned by our subjects about chocolate.[8]

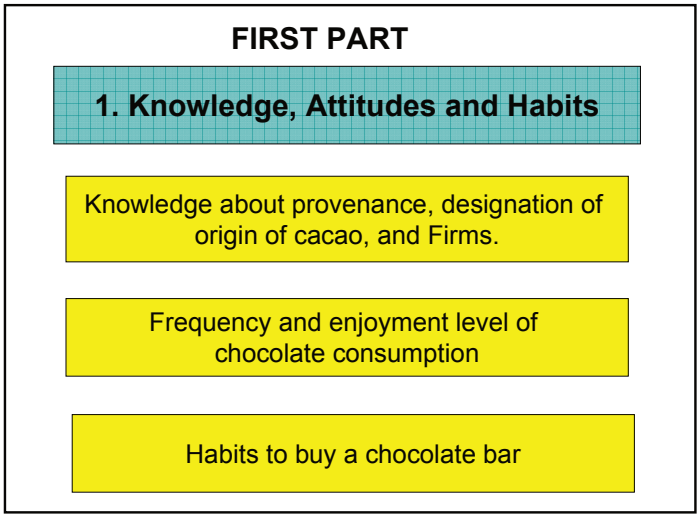

Figure 6.2.: First Part of the Experiment.

- First, they must choose from a list of names to discern which of them are real names of cacao.

[8] A translation of this set of questions into English can be found in Appendix B .

- Then, they were confronted with a list of countries to choose the one producing the best cacao.

6.4.2. Hedonic Questions: Attitudes

The second set of questions were aimed at inducing the subject to reveal the frequency and level of enjoyment of chocolate consumption.

- Here, our aim was to extract how often do individuals consume the product. In other words, are they familiarized with its consume? For this purpose, we used a frequency scale from 0 to 4, 0 indicating no consumption, and 4 indicating a very frequent consumption (at least once a day).

- How pleasant is the consumption of the product for the subjects? For answering this question the subjects qualify in a hedonic scale from 0 to 7 the amount of pleasure they perceive when they consume chocolate.

This set of questions demands perceptually (and cognitively) a different task and should therefore not be mixed with a sensory analysis. That is why we apply these questions in the first part of the experiment and before the subjects participate in sensory experiences.

6.4.3. Habits

The next set of questions was designed to identify which habits the participants employ to make purchase decisions about a chocolate bar.[9] Normally a 'conscious' consumption is more likely to yield higher satisfaction levels and thus is easier to attain through familiarity. That is why habits predict future behavior better than intentions do (see Ronis et al., 1989, p.221). The more habits the individuals are following, the higher the affiliation with the consumed good and therefore, there will be a low desire to replace the habitually consumed good with a new one (switch

[9] See Appendix B for the translation into English of the applied questions.

preferences to a new good). Furthermore, the more habits, the stronger the relationship of the consumer with the product and, therefore, the consumer has a high level of knowledge about this product.

6.5. Sensory Analysis and Sensory Experience

Each of our five senses, *sight, smell, touch, hearing and taste*, contributes to a different experience. The sum of the contributed experience of each of our senses as a whole concept is called a *sensory experience*. A sensory experience is the result of the reactions of the senses to different impulses or triggers normally used in marketing research. These triggers are called *stimuli* in a traditional psychological context.

In order to understand under which informational conditions the subjective preferences are stable and which kind of information generates instabilities in individuals, we directed the participants through a sensory experience with high quality chocolate. In the same way as a wine tasting is conducted, we divided this part into five experimental rounds, each round being devoted to incentivize (trigger) one of the five human senses, as shown in Figure 6.3.

Following Figure 4.3, each round was subdivided into three parts. In the first part, we trigger one of our subjects five senses (*information phase*), in the second part the subjects process this experience and produce new information to be added to the purchase criteria (*deliberation phase*). In the third part, the subjects make declarations about their willingness to pay for a whole chocolate bar of 100 gr of the same sort they had 'experienced' (*implementation phase* according to their preferences and memories.

6.5.1. The Four Treatments

We conduct four different treatments aimed at understanding the way in which new information (after subjects have gone through sensory experiences) affect the

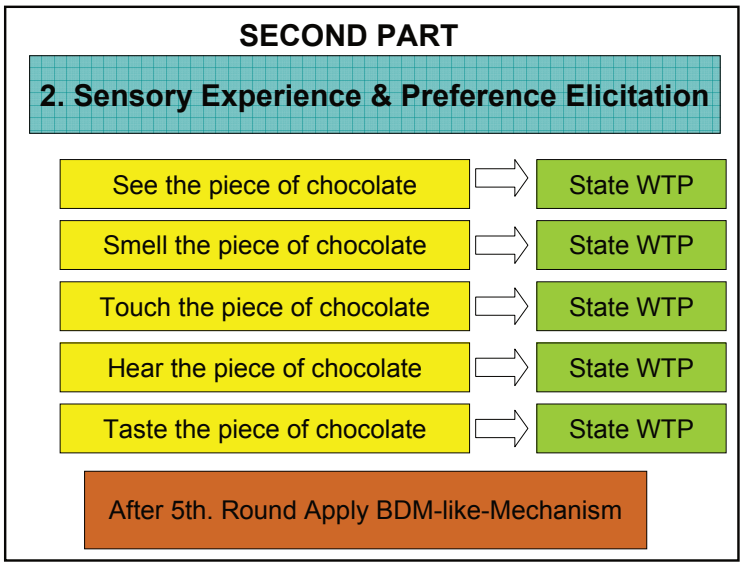

Figure 6.3.: Second Part of the Experiment: Information Aggregation Through Sensory Experiences.

stability of individual preferences and affect individual uncertainties. As already introduced in Chapter 4, information is crucial to make decisions and the higher the persuasive power of information, the more likely it becomes that individuals improve their subjective utilities. In Section 6.1.1, we made use of four different dynamics of information aggregation, implementing one of them in each experimental treatment. By these different information dynamics, the information exchange between subjects and the amount of aggregated information were controlled by changing the composition of groups and the assignation of partners for the different treatments. We allowed our subjects to receive information from two different sources: from the *experimenter*, via computer screens, leading the participants through a sensory experience, and via information exchange through *chat interfaces* which appear automatically on their computer screens after the corresponding sense was triggered.

The *first* treatment has been designed as benchmark treatment, in which subjects were not able to exchange information with anyone else. Instead, they only receive

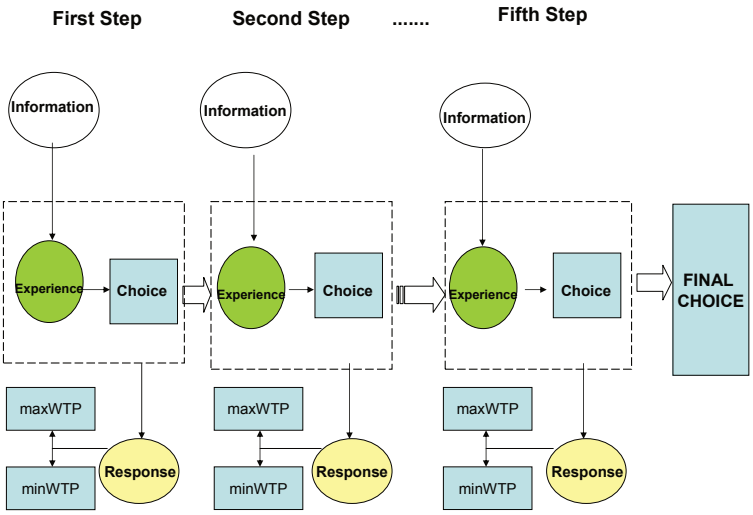

Figure 6.4.: Design of control treatment. After aggregation of information, individual i makes a choice and gives a response (in terms of maximal and minimal WTP). After i has given five responses, she must make her final choice. Dashed lines and boxes indicate the process in the subject's mind during each experimental round.

information from the experimenter and the decisions are made individually (see Figure 6.4). This treatment is called *T1*.

For the second (T2), third (T3), and fourth (T4) treatments, we allow the subjects to communicate with a randomly selected partner via chat. After each round of information aggregation, a chat interface appears. Through this chat interface, they are allowed to exchange attitudes, impressions, or even their individual decisions in form of a *cheap talk* where bidirectional communication was possible. Figure 6.5 shows the process of information exchange between participants for one experimental round.

The T2 treatment has been designed under a *partner* protocol, that is, groups of two people were matched at random for the first round and remained fix within the five rounds. The time assigned to each chat session (each experimental round) was

limited to 60 seconds. To guarantee anonymity, revealing an individual's identity was not allowed. Participants were encouraged to feel free to express their feelings, expectations and attitudes with their partners. After the information exchange via chat, each subject made her decisions individually.

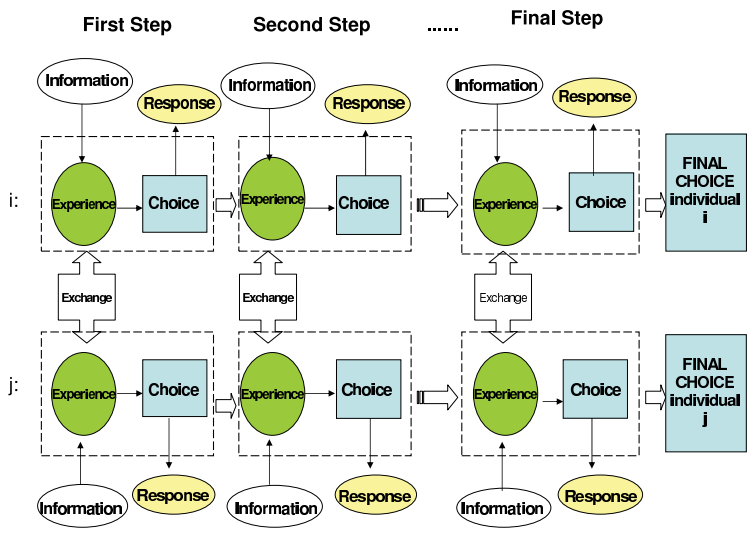

Figure 6.5.: Basic Design of T2, T3 and T4. After information is aggregated, individual i is able to share experiences with her partner j. Then, they give individual responses (in terms of WTP). After the fifth and last round they individually make a final choice. For T3, individuals become a new partner for each experimental round.

T3 differs from T2 only in the protocol applied to match participants: a *stranger* protocol. By this, groups are selected at random from the participants pool separately for each round. The used chat interface, the group size (two persons), the time to chat and the rules are the same as in T2. Subjects make all their decisions individually. This slight difference introduces a different dynamic, in which individual i does not remain fix (thus, she cannot learn from her partner j or easily imitate her behavior in more than a round) inhibiting the raising of a trust feeling among the group within time.

For the treatment T4, we increase the group size to five people. Here, after the first round of information aggregation, five people are allowed to communicate with each other within the group via chat. As the group size was increased, the time to chat was incremented to 150 seconds. Here, as in the Partner treatment, our subjects our subjects follow a *partner* protocol, in which the group members remain the same along the five rounds. The decisions at the end of each round are made individually.

Table 6.1 summarizes the experimental design showing the similarities and differences across treatments. We run each of the four treatments with 40 participants in two sessions; each session was held with 20 participants and lasted approximately 40 minutes. Each participant received a first endowment of 500 ECU; 1 ECU=1/100 EUR, enabling her to make purchase decisions without spending her own budget.[10] Additionally, we ensured the same initial budget conditions for all our subjects. In all treatments, each experimental round decisions were made individually.

Table 6.1.: Experimental Design by Treatments

Treatment	Number of Subjects	Group Size	Chat Interaction	Group Matching
T1	40	1	not allowed	no matching
T2	40	2	yes	Partner protocol
T3	40	2	yes	Stranger protocol
T4	40	5	yes	Partner protocol

No show-up fee was paid. Payment was based on the buying behavior (preferences) plus an extra payment earned in a lottery designed to estimate the individual risk attitude following Holt and Laury (2002), as introduced in Chapter 5, Section 5.5. One of the chosen lottery from ten pairs proposed is randomly drawn and played. If an individual wins, she additionally receives the lottery outcome. Otherwise she receives only the outcome from the sensory experience part.

[10]This fact is particularly important to be remarked, because people spending their own budget behave more cautious avoiding losses. We expect that choices are made freely from this feelings by giving some money to our participants at the beginning.

6.5.2. Questionnaire

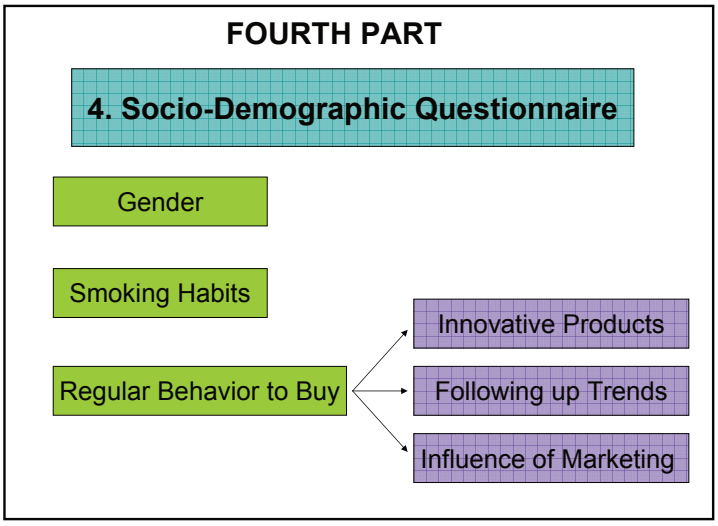

Figure 6.6.: Fourth Part of the Experiment.

At the end of the experimental session, and after our subjects completed the whole lottery task, they would complete a social-demographic questionnaire, corresponding to the fourth part of the experiment, as presented in Figure 6.6, aiming at a better characterization of our subject pool, and their general purchase attitudes. The results and findings will be described in the next chapter and computer screens applied in the experiment with the original questions can be seen in Appendix F.

7. Results and Discussion

7.1. Generalities About Our Population

The chocolate experiment was completed by a total of 160 subjects, divided into four treatments. Descriptive statistics for the whole sample and for each group of subjects allocated in the different treatments are summarized in Table 7.1. The participation of female and male subjects were relatively balanced (nearly 50% for each gender). The treatment with the highest percentage of women participating in it was T4 with 55%. The percentage of smokers was relatively small, with a remarkable difference for T1, in which the smokers represented more than a quarter of the total. The averaged number of companies producing chocolates that our participants knew was almost the same for all treatments and the dispersion of these data was also similar across treatments.

Table 7.1 summarizes the answers given to the questionnaire applied at the end of the experiment. To analize the attitudes and certainty of a subject's preferences, we applied two different categories of questions: the first set of questions was aimed to measure the individual attitudes at the moment when a chocolate bar is bought. Here we ask about the individual sensibility to advertisement of chocolates and the market price of them. The second category was devoted to revealing individual attitudes influencing purchase choices in general as well as the individual tendency to consume innovations, follow up trends and/or to positively react to advertisement via mass media.

To buy chocolates, our participants react stronger to the market price (up to 90%)

Table 7.1.: Summary of Socio-demographic Statistics

	All Treatments	Alone	Partner	Stranger	Group
Gender (female=1)	46.88%	42.50%	45%	45%	55%
Smokers	16.25%	27.50%	7.50%	15%	15%
Average of Brands Known	4.30	4.40	4.42	3.97	4.42
	(1.96)	(1.85)	(2.06)	(1.94)	(2.06)
Subjective Attitudes to Purchase					
Reaction to Chocolates' Advertisement	40.62%	50%	42.50%	25%	45%
Reaction to Chocolates' Market Price	95.62%	97.50%	97.50%	90%	97.50%
General Reaction to Innovations	2.04	1.47	2.32	2.35	2
	(0.98)	(0.55)	(1.09)	(0.97)	(0.98)
General Reaction to Follow Trends	1.88	2.07	1.72	1.72	2
	(1.01)	(0.82)	(1.02)	(1.54)	(0.98)
General Reaction to Advertisement	1.67	1.65	1.85	1.62	1.67
	(1.09)	(1.12)	(1.,12)	(1.02)	(1.14)
Individual Risk Attitudes					
Average of Option A following H&L Test	4.75	5.27	4.22	4.90	4.60
	(2.37)	(2.08)	(2.39)	(2.35)	(2.58)

Notes: This table reports the percentage of the sample belonging to a particular category or sample means (with standard deviations in parentheses).

than to advertisement. The participants in T3 were the less sensitive (only 25% of this population took advertisement into account). With regards to general subjective attitude to buying (in a scale from 0 to 4), we found out that our participants reacted stronger to innovations introduced to the market and to trends than to advertisement in general. This last result confirms the low level of reaction to advertisement of chocolates.

As already mentioned in Section 5.5, the subjective risk was measured through the procedure suggested by Holt and Laury (2002). In average the more 'risk seeking' participants were found at T3, whereas the more conservative group were the participants in T1. However, this averaged results present a high standard deviation. The results of this part will be applied to the econometric analysis as controls (see

mainly tables A.1, A.2, and A.4) and discussed in greater detail in Section 7.1.3.

7.1.1. Knowledge, Enjoyment and Habits Apriori

In the first part of the experiment, we seek to outline a portrait about how individuals normally behave when they are confronted to a chocolate purchase decision. For this purpose, as introduced in Section 6.4, we divide this part into three subparts, the first being devoted to examining the knowledge level of our individuals about chocolate, the second subpart is focused on the enjoyment and frequency in which they usually consume chocolate, and in the third subpart, individuals chose from a list the attributes taken into account at the moment of buying a chocolate bar.

Pre-Knowledge

In the first subpart of the experiment, we ask a couple of questions aimed to reveal the level of knowledge of our participants about our object of choice (see Section 6.3.3 and Appendix B).

In the first question, individuals were asked about the names designating cocoa after its provenance (designation of origin of cacao). For this purpose, individuals have to choose from a list of five different names. In general, individuals do not have a significant level of knowledge about these designations. Only for chocolate from Venezuela (Chocolate Maracaibo) the amount of right answers was relatively high. The percentage of people choosing the 'No-Idea' option was relatively high, especially for T1.[1] In average, for T1, our participants showed the lowest initial knowledge, while the highest level was found in T3 (Stranger Treatment). The results for the four applied treatments are displayed in Table 7.2. The right possible answers are in black, the wrong in red and the 'No-Idea' field was offered to encourage people to be honest in their answers.

The second question was designed to explore the level of knowledge about coun-

[1] It is interesting is to note that individuals have chosen this last option after they had already chosen other options from the list. This fact explains why our results are over 100%.

Table 7.2.: Names of Chocolate (%)

Treatment	Trinitario	Amazonas	Guaraná	Alpujarra	Maracaibo	no idea
T1	9	10	10	7.5	22.5	70
T2	10	18	20	12.5	42.5	38
T3	10	23	33	5	47.5	38
T4	10	13	28	5	37.5	47
All	9.75	16	22.75	7.5	37.5	48.25
Treatment	Bolivia	Grenada	Venezuela	Ivory Coast	Madagascar	no idea
T1	42.5	2.5	45	0	22.5	35
T2	47.5	0	45	23	30	25
T3	40	2.5	48	28	22.5	10
T4	45	2.5	55	28	25	15
All	43.75	1.87	48.25	19.75	25	21.25

tries producing high quality cocoa around the world. The results are summarized in Table 7.2 (red for wrong options, and black for right options). The percentage of people choosing wrong options was higher than for the first question, but in general individuals were more confident to choose the 'no-Idea' option less frequently. In average, the higher level of initial knowledge about cocoa names and its provenance is to find in the Group treatment.

Initial Attitudes Towards Chocolate Consumption

As already introduced in section 6.4, we also asked also our participants about the frequency in which they consume chocolates and the level of enjoyment that they experience by consuming them. We employ a consumption-scale between 0 and 4, with 0='never'; 1= 'at least once a year'; 2= 'at least once a month'; 3= 'at least once a week'; 4='at least once a day'. We found out that, in average, our individuals consumed chocolate quite often. The highest rate of consumption was found in the subjects participating in the Partner treatment with a comsumption-

frequency-average of 3.[2] The lowest consumption rate was found in T1, with an average consumption of 2.65 (relatively high consumption) between 'At least once a mounth' (2) and 'At least once a week' (3). These results are shown in Table 7.3.

Table 7.3.: Enjoyment of Chocolate

Treatment	Frequency Consumption (0-4)	Enjoy Scale
T1	2.65 (Relative often consumption)	71.47
T2	3 (Often consumption)	81.92
T3	2.92 (Often consumption)	72.25
T4	2.97 (Often consumption)	79.87
All	2.88 (Often consumption)	76.377

With regards to the hedonic question about the level of enjoyment experienced by chocolate consumption, in a scale from zero to hundred (0 = no pleasure at all; 100 = infinite pleasure) we found out that in average, the level of enjoyment is relatively high. The highest pleasure was found in the individuals participating at the Partner treatment (in concordance with the results of the question about frequency of consumption) with an average level of 81.925 points. The lowest level was given for the participants in the Alone treatment with 71.475 points. The averages for the four treatments are summarized in Table 7.3.

Consumer Buying Habits Regarding Chocolate

The next step was to ask our participants about some attributes to take into account when they face purchase decisions about a chocolate bar. The list of these attributes is presented in Appendix B.

In average, the attributes 'Percentage of Cocoa', 'Recommendation from other people', and 'Appearance' of the chocolate bar are the attributes more taken into account for our participants, with 'Appearance' has the highest percentages. The

[2]See Appendix B for the translation of this set of questions.

Table 7.4.: Habits to Buy Chocolates (%).

Treatment	Cocoa	Fat	Organic farming	Recommended	Appearance	Provenance
T1	57.5	15	10	47.5	77.5	5
T2	77.5	20	25	45	77.5	2.5
T3	52.5	10	25	50	65	12.5
T4	52.5	10	15	37.5	70	5
All	60	13.75	18.75	45	72.5	6.25

participants in T2 appear to make in average more *conscious* choices, as they attain the highest scores of answers, despite the last asked attribute, the 'Provenance' appears to be negligible for them (for the four groups of participants, the less important attributes are 'Fat' and 'Provenance'). The averaged results are summarized in Table 7.4.

7.1.2. Preliminary Information and Decisions

To account for the amount of pre-information owned by our participants and the way this information was accumulated, the following method has been applied: As explained in the former section, in the first part of the experiment we asked the participants about their knowledge about chocolate, i.e., about its provenance and the habits they are following up to buy a chocolate bar. We asked our participants two questions about *knowledge*. For the first question there were three right answers and for the second there were two. For each right answer, each individual earned one 'informational' point. Additionally, we gave them a list of six *habits* and their only task was to reveal which of these habits they are following up to buy chocolate. For each habit they would also earn one point. It is possible to approximate individual answers to earned points taking into account that each accepted information could be reduced to a 'bit' of information. We account only for 'habits' and 'knowledge' categories given the hedonic nature of the enjoyment of consumption. This mechanism was only applied to analyze the answers in these categories and it had not

influence in experimental earns.

Table 7.5.: Full Pre-informed ('ideal') Consumer.

Knowledge	Habits
11111	111111

If individuals reach a maximum of eleven points, we can call them 'well-informed' participants, who are not likely to change their decisions when additional information is given, because they already 'know' what they want (this case is illustrated in Table 7.5). Averaged answers given within the experiment have been summarized in Tables 7.2 and 7.4. 'Habits' and 'knowledge' are more likely to be directly influenced by new information, whereas the level of enjoyment will change only after repeated trials of the product.[3]

The distributions of the initial information in these two categories of our participants as percentage of the eleven and total informational points and its distribution among the population is summarized in Figure 7.1. We found out that, despite a high degree of heterogeneity, the individuals have similar low levels of preliminar information. The maximal frequency of answers summarized in the histograms is around 30%, that means, we could only give three to four points for right answers and habits from a total of eleven.

The highest level of heterogeneity among the population is to find at the T1 in which the mass of the distribution is concentrated on the left of the figure. For T2, the distribution appears to be 'more distributed' around the mean, and the left and right tails are relatively more symmetric and shorter, indicating a clusterization of individual answers. Flat-topped distributions reveals a higher heterogeneity for T3 an T4. A summary of the descriptive statistics for these data is to find in Appendix

[3]To evaluate the pre-informational level of our participants, we are only taking into account the amount of habits and the general knowledge. However, given the kind of information we were aggregating, and the way we chose to make it, the individual attitude will be also susceptible to change according to the individual enjoyment and vice-versa.

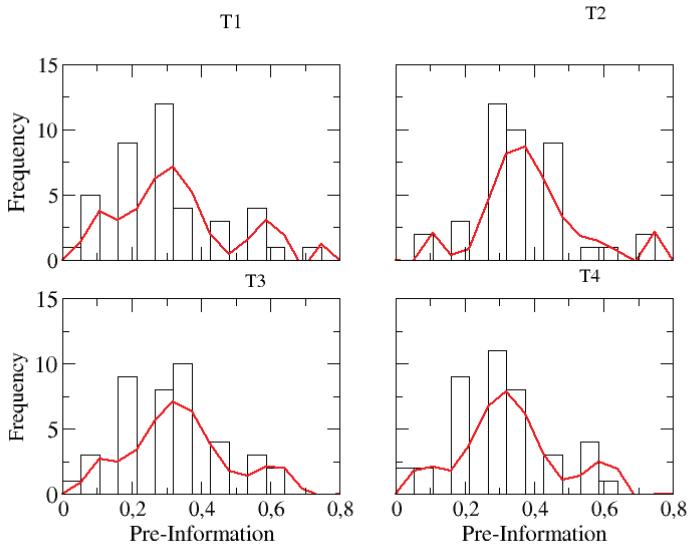

Figure 7.1.: Pre-Information Owned by Our Participants and its Distribution (Percentage).

G in Table G.1.

Table 7.6.: Shapiro-Wilk Normality Test for the Initial Information. H0: The data set is normally distributed.

Treatment	W	p-Value	H0
T1	0.92**	0.016	reject
T2	0.921***	0.008	reject
T3	0.956	0.128	not reject
T4	0.953*	0.094	reject

Notes: *, **, *** indicate significance at $\alpha = 10\%$, 5% and 1% respectively.

A Shapiro-Wilk normality test for each treatment was conducted (see Table 7.6).[4] These results do not allow us to handle the data as usual. To analize the variances of the initial information between treatments, a Friedman Test was run, yielding a p-

[4] $W \in [0, 1]$. The closer W is to one, the more 'normal' are the data distributed. However, the level of statistical significance is more helpful to interpret it.

value of 0.1991. *At a significance level of 5%, we cannot conclude that the variances of the initial information are different between treatments.* In a nutshell, for our four treatments we have had a heterogeneous subject pool with a low level of knowledge, a relatively high level of consumption and of enjoyment by consuming chocolates. Additionally, all the treatments are sharing similarities in their composition.

7.1.3. Risk Attitudes

The individual risk attitude of our participants is distributed as in table 7.7. The average for the four treatments is around 5, indicating that in average, the participant is changing from the sure option A to the other option B after the 5th par of lotteries was offered. The most risk-neutral participants are to find in T1, whereas the more risky ones are to find in T2, where the average of option A lies at only 4.22. In T1, our benchmark treatment, the majority of subjects chose the safe option when the probability of the higher pay-offs was small, and then crossed over the option B without even going back to option A. Option A, the safe option, yield in average 5.27.

Table 7.7.: Distribution of Risk Attitudes in the Participants Following the Laury and Holt Test (2002).

Treatment	Risk Averse	Risk Neutral	Risk Seeking	Average	Zeros
T1	22	8	10	5.27	0
T2	20	7	13	4.22	5
T3	18	8	14	4.90	5
T4	14	9	17	4.60	5
Mean	18.5	8	13.5	4.75	3.75

Comparing the results for this part of the experiment between treatments, we found out that for T1, in which individuals made all decisions without prior information exchange, individuals are more risk-averse than in the other three treatments.

For T2, where a partner protocol was implemented, the information exchange makes people more confident about changing their risk attitude. In T3, where individuals got a new partner for each round, the result again that the subjects were increasing the risk attitude, and for T4, where individuals interact in groups of five people, their self-confidence level increases again. The column named 'Zeros' shows the amount of people in each treatment that never choose the sure option A.

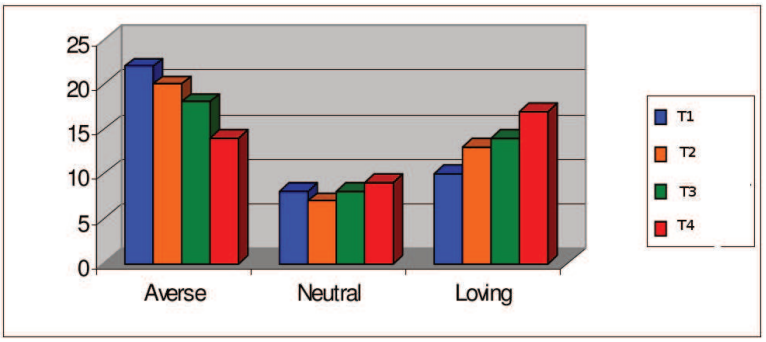

Figure 7.2.: Risk Attitude of the Population.

In decision environments like the present experiment, risk attitudes over a wide range of payoffs help to characterize the population and to predict their behavior. Here, we can expect that the most risky participants, namely those in the partner treatment, are more likely to change their decisions after new information is given. Our payoff for the lotteries were between 0.13 EUR and 5 EUR, and the probabilities of the lotteries where increased in 10%. For detailed information, see Figure E.2.

Figure 7.2 shows the risk attitudes of our participants for the four treatments. We found a higher amount of risk-averse participants for T1. It is interesting to observe that this decrease in risk aversion remains unchanged as we move across

treatments. This result may obey that this risk aversion test was applied after the decision-making process where the individuals were exposed to different amounts of information. We can conclude that the more information the participants receive, the higher the risk they are ready to take. There was no significant difference between risk attitudes across treatments ($F_{(3,156)} = 1.425, p > .05$).

7.2. Willingness to Pay, Incentives and Uncertainty

As introduced in Sections 5.4 and 6.5.1, after our subjects are exposed to a sensory experience, they should state five times the maximal and minimal amount of money they are willing to pay for a 100 gr chocolate bar. The data obtained from this part of the experiment for the four treatments are summarized in Figures 7.4 and 7.6 and their average values are presented in Figures 7.3 and 7.5.

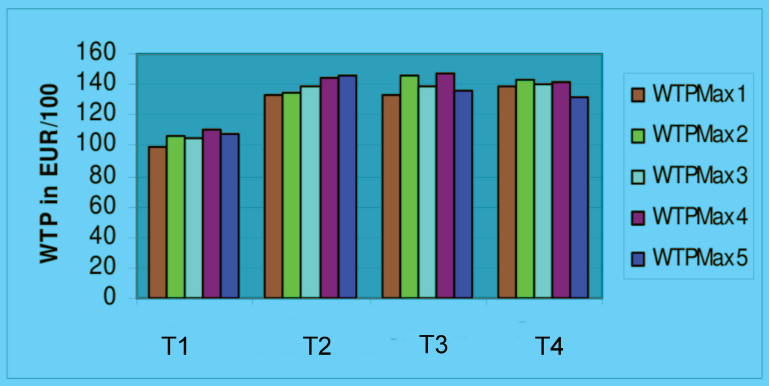

Figure 7.3.: Average of the Maximal WTP for the Four Treatments and the Five Experimental Rounds.

7.2.1. Maximal WTP for the Four Treatments

The Treatment T1 shows in average a lower maximal WTP compared to the other three treatments (see Figure 7.3). Comparing the first (R_1) and the fifth and last rounds (R_5), we observe that for T1, T2 and T3 treatments the maximal WTPs increases, whereas the participants in T4 are reducing their maximal WTPs as individuals' senses are triggered. The highest average of maximal WTP was found in T2 where the average of maximal WTPs increased after each round. It is interesting to note that in average the maximal WTP does not reach 150 ECU (its maximum is reached in the fourth round of T3 and is exactly 147.175 equivalent to 1.47 EUR, still below the real market price of the chocolate applied in the experiment). A F-Test ($F(19, 781) = 1.843, p = 0.015$) showed that the variances of the maximal WTPs differ from treatment to treatment.

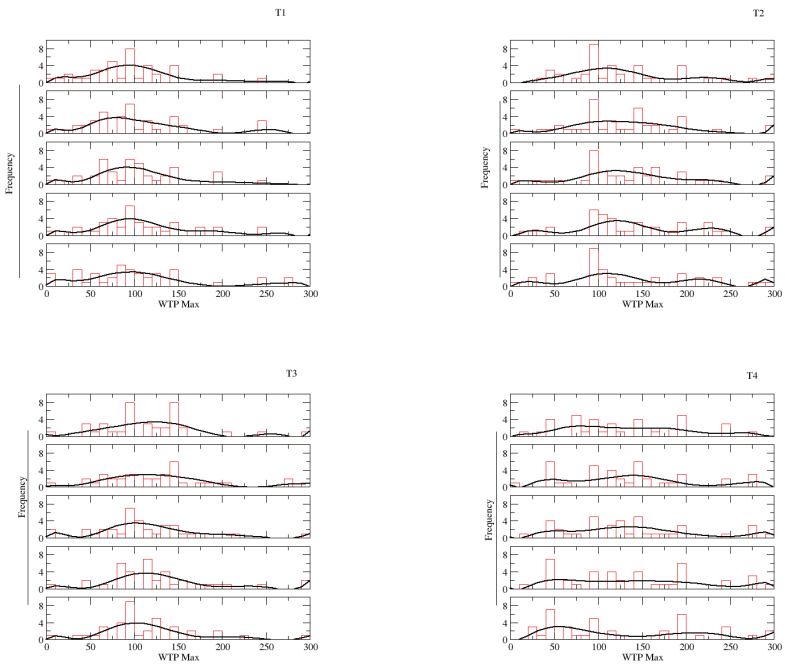

Figure 7.4.: Distribution of the Maximal WTP Among the Population of i Individuals for the Five Experimental Rounds and T1, T2, T3 and T4.

The distributions of the maximal WTPs among the population as a function of

time (five subfigures from R_1 to R_5) for the four treatments are shown in Figure 7.4. Here, several changes in the structure of the histograms can be observed, especially for the three treatments where information exchange was allowed (T2, T3 and T4). For T2 and T4, we found a high frequency of answers around 50 ECU, 100 ECU and 200 ECU. However, for T2 the higher frequency was found around 100 ECU and for T4 around 50 ECU and 200 ECU.

The evolution of T1 and T3 within the experiment is similar: almost all individual answers in R_5 have been concentrated around an interval. However, in T3 we found a higher concentration of answers around 100 ECU and there are less outliers in comparison to T1, where the answers are less concentrated oscillating between 0 ECU and 150 ECU. Here one could observe a clear difference in the answers in each treatment, where the structure and the dynamics of the information exchange inside each network generates differences in the individual answers. The descriptive statistics for these data are summarized in Appendix G, in Tables G.2, G.4, G.6, and G.8.

A Shapiro-Wilk normality test was conducted for the four treatments and the five experimental rounds to closer study the shapes of their histograms. For the five rounds of T3, one can reject the normality hypothesis at a significance level of 1%. For the other treatments the p-values oscillate between 0 and 0.18. These results are summarized in Tables G.3, G.5, G.7, G.9 in Appendix G.

After the qualitative analysis of the data collected in the four treatments, a formal econometric analysis needs to be done in order to test the statistical significance of these results. With the aim to prove the differences in individual behavior across treatments and the influence of personal characteristics and attitudes in the composition of groups, we conducted an ANCOVA regression analysis with the Maximal WTP as dependent variable. To allow for heteroscedasticity of the error term, we apply an OLS regression with a White's hetereroscedacity robust covariance matrix.

Table A.1 summarizes the results for eight different econometric models. Models I to IV contain only the dummy Alone (corresponding to T1). Here the models

are only different in in including or not including the personal characteristics and attitudes of our participants as controls. This treatment represents the hypothetical situation of decision making in isolation. The models V to VIII contain the three dummy variables Partner, Stranger and Group and also differ in the inclusion of the control variables Personal Characteristics and Attitudes. The experimental design does not allow to include the four treatments in the same group of regressions for three reasons:

1. It is expected that the allowed information exchange in T2, T3 and T4 modifies the individual attitudes and therefore, their final choices. Therefore, own (A_i) and incoming (A_j) attitudes (revealed through the chat interface), and the times of individual interactions in each experimental round must be included to prove the modulation effect of these three variables on individual choices.

2. T1 treatment was conceived in the design as benchmark and must be handled as standard from which the other treatments differ.

3. To avoid perfect multicolinearity in the panel data.

Models I and V only consider the dummy variables. Models II to IV and VI to VIII also include the controls for attitudes and personal characteristics of our participants. The treatment variables considered in the regression for models I to VIII were:

- **Period**: refers to the experimental rounds.

- **Alone**: Dummy variable for T1, where the participants take their decisions in isolation. It will be analyzed in models I to IV and considered as the benchmark variable for models V to VIII.

- **Partner**: Dummy variable for T2 where the interaction with an individual was allowed. As its name indicates, this treatment was conducted under a partner protocol, where the assigned partner remains the same over the five experimental rounds.

- **Stranger**: Dummy variable for T3. Here, as in the Partner treatment, our participants could interact with a partner. For each experimental round, a new partner was assigned.

- **Group**: Dummy variable for T4. Within this treatment, individuals exchange information in groups of five people. This treatment was conducted under a partner protocol.

- **Attitude of** i: Quantifies the attitudes of individual i exchanged by the chat interface within T2, T3 and T4. After disentangling the information exchanged, we account for attitudes by using a Likert's scale (see Section 6.3.3) and add the scale values.

- **Attitude of** j: Quantifies the attitudes of individual j exchanged via chat interface within T2, T3 and T4. After disentangling the information exchanged, we apply a Likert's scale.

- **Interactions**: Times that each individual interact in chats for each experimental round. It is a measure of individual information gathering aimed to reduce uncertainty.

The variables entering regressions in models II to IV and VI to VIII (see Table A.1) are mainly divided into two groups: Personal Characteristics and Attitudes. As already introduced at the beginning of this chapter, the personal characteristics can be subdivided into three subcategories: the first two items physically characterize our participants, the following three items extract their knowledge about chocolate and the next two items ask about chocolate consumption. The Attitudes can also be divided into three subgroups, where the first item describes the risk attitudes for lotteries of our participants following the methodology proposed by Laury and Holt (2003). The following five items in the list are depicting the subjective risk self-conception by asking for their attitudes by facing decisions in the marketplace. The last six items refer to the habits followed by our subjects' individual purchase

decisions for chocolate bars. Additionally, Table A.5 summarizes regressions for these variables for the subsamples, that is, for the four treatment variables, and the variables are listed in Table 7.9.

We found out that the critical values of F are always smaller than the F-values in the regressions, the statistical hypothesis that a regressor is significantly different from zero should be rejected. This result indicates that a dependence exists between the independent and the dependent variables in the regression. To quantify the severity of multicollinearity in the data, we calculate the Variance Inflation Factor test, VIF. Here, the highest value was 3.079 (see Table 7.8), enough to ensure that the collinearity present in the data sets will not cause problems in the regressions.[5]

Table 7.8.: Variance Inflation Factor for Models V to VIII

	Partner	Stranger	Group	Attitude of i	Attitude of j	Interactions
VIF	2.257	2.276	3.079	1.057	1.010	2.201

For the eight models considered, the four treatment dummies have statistically significant parameters (see table A.1). The Alone variable presents negative and significant parameters for the four estimated models, whereas the other three treatment dummies are always positive (except the Group parameter in model VI). As already shown in table 7.3, there is an increment in the maximal WTP for the Partner, Stranger and Group treatments.

With regard to the attitude of the information exchanged in chats, it can clearly be seen that the own attitudes have a positive and significant effect by determining the individual maximal WTP. It is interesting to observe that the parameters of the others' attitudes are negative and non-significant for all models. The size is small in respect of the own attitude parameters.

As statistically expected, by including the individual attitudes and personal char-

[5] $VIF > 10$ reveals severe multicollinearity, enough to cause problems in the regression. $VIF > 30$ indicates problems in the data. (See Kutner et al., (2004), for an in-depth discussion about this topic.)

acteristics, the fit of the regressions increases. However, the effect of these variables is not only due to the increasing amount of regressors. By including the individual characteristics in the different regression models, we wanted to analyze the homogeneity of these characteristics for each group participating in each treatment and, at the same time, its influence to choose the maximal WTP. By introducing the individual attitudes, it is possible to better modulate the individual preferences of our participants. For this purpose, we introduce the questions applied before the sensory experience and the answers to the questionnaire.

By means of the incremental F-Test, it can be seen that changes of $\overline{R}^2$ in model II, III and IV (corresponding to T1 with personal characteristics), model VI, VII and VIII (considering together T2, T3, and T4) are significant, revealing that the introduction of new variables improves the fitness of the models.[6] However, the introduction of these controls for both regression sets implies a loss of explanatory weight of the treatment variables.[7] Here, we also found several interesting effects, summarized in Table A.5.

The attitude coefficients in the models can be interpreted as follows: if attitude of individual i increases in one unit, the maximal WTP of i will increase in 0.15 EUR with a significance level of 0.01. If the incoming attitude from j to i increases in one unit, the neighbor's attitude implies that the maximal WTP of i will decrease to 0.022 EUR, non-significant. These results reveal that *individual maximal WTP depends on the group structure in which individuals interact to exchange information and changes of own attitudes towards the object of choice will alterate the final purchase decision.*

[6]The importance of this fact can be summarized as follows: $\overline{R}^2$ is used as a conservative reduction to R2 to penalize for adding variables and is required when the number of independent variables is high relative to the number of cases. $\overline{R}^2$ is an adjustment for the fact that when one has a large number of independents, it is possible that R2 will become artificially high simply because chance variations of some independent variables "explain" small parts of the variance of the dependent variable.

[7]The magnitude of beta weight reflects its relative explanatory importance controlling for other independent variables in the equation. The magnitude of a variable's R2 increment reflects its additional explanatory importance given that the common variance it shares with other independents entered in earlier steps has been absorbed by these variables.

Table 7.9.: Variables in Regressions of Personal Characteristics and Attitudes.

Variable	Answer given as (experimental task)	Introduced in the regression as
GENDER	dichotomous variable 1=woman, 0=man	Dummy
SMOKING	dichotomous variable 1=smoking, 0=not smoking	Dummy
Knowledge about Companies producing Chocolates	Write down a list with the companies they know	scalar*
Knowledge about Cocoa Names	Multiple-choice	z-value
Knowledge about countries cultivating high quality cocoa	multiple choice	z-value
Frequency of Consumption	Enter number from the interval [0,4]	z-value
Pleasure of Consumption	choose from [0,7], 7= maximum of pleasure	scalar*
Risk Attitude by Lottery choice	enter number between 1 and 10	z-value
Care about Advertising	dichotomous variable (1=yes, 0=not)	Dummy
Care about Price	dichotomous variables (1=yes, 0=not)	Dummy
Consumption of Innovations	Enter number from the interval [0,4]	z-value
Follow up Consumption Trends	Enter number from the interval [0,4]	z-value
Consumption obeys Marketing	Enter number from the interval [0,4]	z-value
Care about the Contain of Cocoa	dichotomous variables (1=yes, 0=not)	Dummy
Care about the Amount of Fat	dichotomous variables (1=yes, 0=not)	Dummy
Care about Organic Cultivation	dichotomous variables (1=yes, 0=not)	Dummy
Care about Recommendations	dichotomous variables (1=yes, 0=not)	Dummy
Care about the Appearance	dichotomous variables (1=yes, 0=not)	Dummy
Care about Provenance	dichotomous variables (1=yes, 0=not)	Dummy

Notes: The variables marked with * can be entered as scalars (z-value is not needed) .
We collected lists with up to 11 companies.
The variable Pleasure of consumption was intern transformed so that we observe a scala from 0 to 100.

7.2.2. Minimal WTP for the Four Treatments

The averages of the minimal WTPs for the four treatments and the five experimental rounds reach their maximum in the Stranger treatment (in the same way as the maximal WTPs) in the second experimental round, reaching a mean value of 76.70 ECU. The highest average was found in the Stranger treatment, in R_2, R_4, and R_5. These answers have lower variances compared to the maximal WTPs.

The distributions of the minimal WTPs for the four treatments and the five experimental rounds are summarized in Figure 7.6. Here, the distribution of minimal WTPs among the participants obtained for each treatment are shown (the histograms were fitted with a polynomial regression). Our control treatment T1 shows no significant changes in its distribution in time. For T2, we found out an increment of the variance of the minimal WTP. In R_3, one can distinguish a clear formation of two clusters, one around zero and the second around the statistical mean value (66.05).

The strongest effect of the added information over the minimal WTP could be

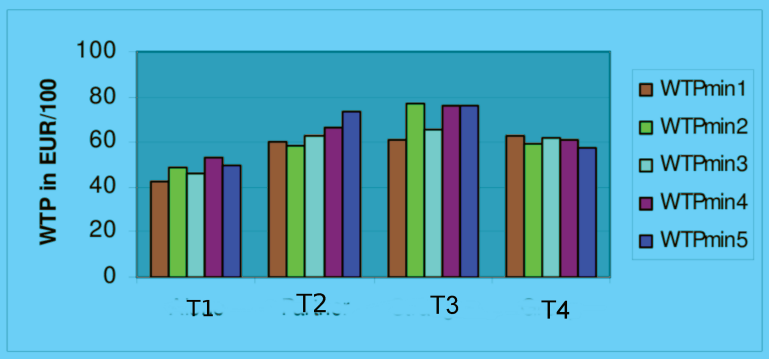

Figure 7.5.: Average of the minimal WTP for the Four Treatments.

observed in T3, where the peakness of the first curve is reduced revealing a larger heterogeneity level, where relatively high values of minimal WTP disapear. For T4 we observe two main tendences: one part of the data is distributed around zero (the mode for T4 in R_2, R_3, and R_5 is zero) and the other with a maximal frequency around 70 (the recalculated mean value after discounting the mode). For the four treatments, the differences from one round to the next are not dramatical at all.[8]

For the minimal WTP, we also conduct a Shapiro-Wilk normality test for each treatment and for the five experimental rounds to analyze the evolution of the shapes of these distributions by giving additional information to the system. Except for R_4 in T2 and for R_2 and R_3 in T3, we can reject the normality hypothesis at a statistical significance level of 5%. The p-value for the three mentioned rounds are just overpassing this mark. These results can be seen in tables G.11, G.13, G.15, and G.17.

As for the maximal WTP, we perform an econometric analysis of the answers given

[8]For these descriptive statistics in detail, see section G, in tables G.10, G.12, G.14, and G.16.

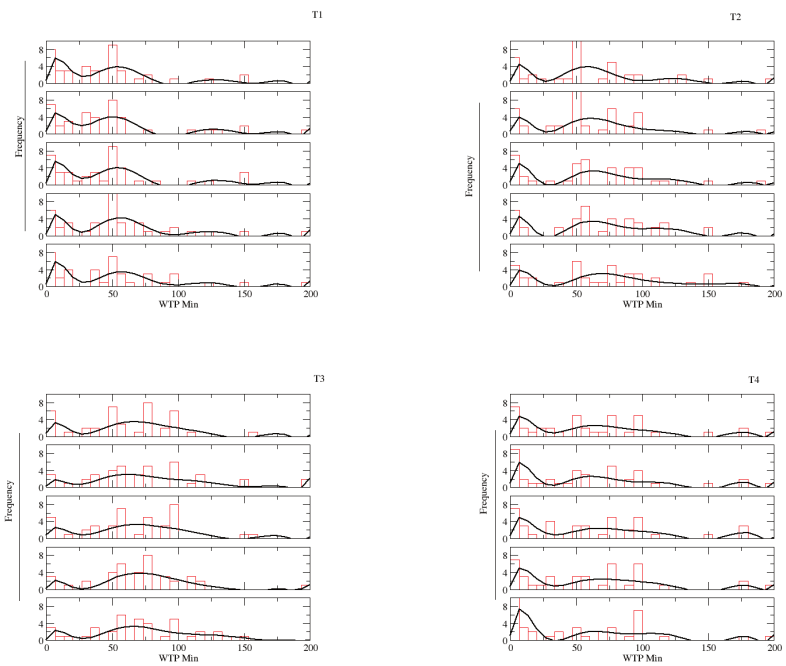

Figure 7.6.: Distribution of the minimal WTP Among the Population of $n = 40$ Individuals for T1 (upper case left), T2 (upper case right), T3 (lower case left) and T4 (lower case right) for the Five Experimental Rounds.

within the experiment. OLS regressions were conducted and are summarized in table A.2, where Models I to IV are designed to analyze T1, the benchmark treatment of the experiment and Models V to VIII were made to catch the treatment effect. Model I only regress the dummy Alone, Model V regress the dummies' Partner, Stranger and Group, and in models II to IV and VI to VIII personal characteristics and individual attitudes, as for maximal WTP, are also entering.

Negative and statistically significant parameters were calculated for the Alone dummy in the four regressions. For Model I, this parameter is strongly significant with a relatively high weight. This influence weight and the significance are decreasing as more variables have been aggregated to the regressions. The inclusion in Model II of personal characteristics, individual attitudes (Model III) and both variable sets (Model IV) increase the $\overline{R}^2$ in the regression. Through the Incremental

F-Test, we observe that these variables contribute to a better fitness of the models.

For the next set of regressions in models V to VIII, the dummies are positive and significant for all treatments. The coefficients of Attitudes from individual i are positive and significant, revealing the influence of these variables in the individual decisions. The attitudes from j, the neighbor's influence is negative and not significant. The variable Interactions is positive and significant for models V and VII, revealing the influence of seeking information to make decisions. The Incremental F-Test shows a significant improvement of the fitness of the models VI, VII, and VIII thanks to the inclusion of personal characteristics and attitudes. Here, as shown in Table A.2, the treatment dummies of the treatments runned under a *partner protocol*, T2 and T4 have less weighted parameters than Stranger (dummy variable of T3, runned under a stranger protocol), confirming the result already found for maximal WTP: **the way in which information is exchanged leads to different individual decisions.**

7.2.3. The Averaged Willingness to Pay

The average of WTP (hereafter avWTP) was calculated as the average between maxWTP and minWTP ($maxWTP + minWTP/2$). This middle point is used as unified measure of the WTP of our participants and enable us to compare the evolution of individual WTP in time and to compare this with the whole sample.

We need to introduce this new variable in order to better understand the way in which individual decisions change after sensory experiences. As this measure preserves the original dimensions of maximal and minimal WTP, it is a good proxy to straighforward conclude after statistical treatments. In the same fashion as for maximal and minimal WTP, Table A.3 summarizes OLS regressions of the average of WTP. Following the same structur, Models I to IV include only the Alone variable, whereas models V to VIII consider the other three treatment variables, Partner, Stranger, and Group, joined by the attitudes revealed in chats after each sense was triggered.

Models I and V only consider the dummy variables and for the other six models the variables of Personal Characteristics and Attitudes have been systematically aggregated. The coefficients of Alone (Models I to IV) are always negative, significant at a 0.01 level and have a relatively strong influential weight. By including the variables in the categories Personal Characteristics and Attitudes, the influence weight remains relatively stable and their signs are preserved. The incremental F-Test shows that by entering personal characteristics and attitudes (Model IV), there is no improvement of the regression fitness.

For Models V to VIII, parameters of dummy variables are always positive and only in some cases significant. However, the magnitude of these parameters is different, revealing a treatment effect.[9] The own attitudes also had a positive influence on the average of WTP and the parameters of attitudes of j are negative and non-significant. The interaction variable also seems to play an important role here because of its positive and significant parameters. By comparing Model V with Model VIII through the incremental F-Test, the entrance in the regression of Personal Characteristics and Attitudes has a positive effect on the fitness of the regression.

7.2.4. Information and Preference Uncertainty: WTP-Range

The WTP-range were calculated from the maximal and minimal WTPs for each individual and each treatment by subtracting the minimal WTP from the maximal WTP. This measure represents the *uncertainty* that individuals face at the moment to decide. The process of uncertainty reduction could be observed in the evolution of the WTP-range . For T1, the distribution of the WTP-range becomes flat in time (see Figure 7.7 where the WTP-range for the four treatments in the five experimental rounds are shown), that is, the level of uncertainty is more distributed among the participants. For T3, the distribution of WTP-range is more concentrated around the [0ECU, 100ECU] interval and, despite the presence of fat tails, one can observe

[9] For each treatment the answers are different, although the general environment of the experiment were the same, except for the protocol used to exchange information and the group size in which individuals exchanged information and attitudes.

a reduction of uncertainty among these participants (Figure 7.7).

On the other hand, for T2 and T4, the uncertainty appears more distributed in almost the whole interval [0ECU, 150ECU], that is, the uncertainty is increasing in time (the initial peak around zero disappears). The consequences of the aggregation of information on uncertainty reduction clearly depend on the structure and dynamic of the exchange of information between the individual and her neighbors (and thus, on the structure of the network).

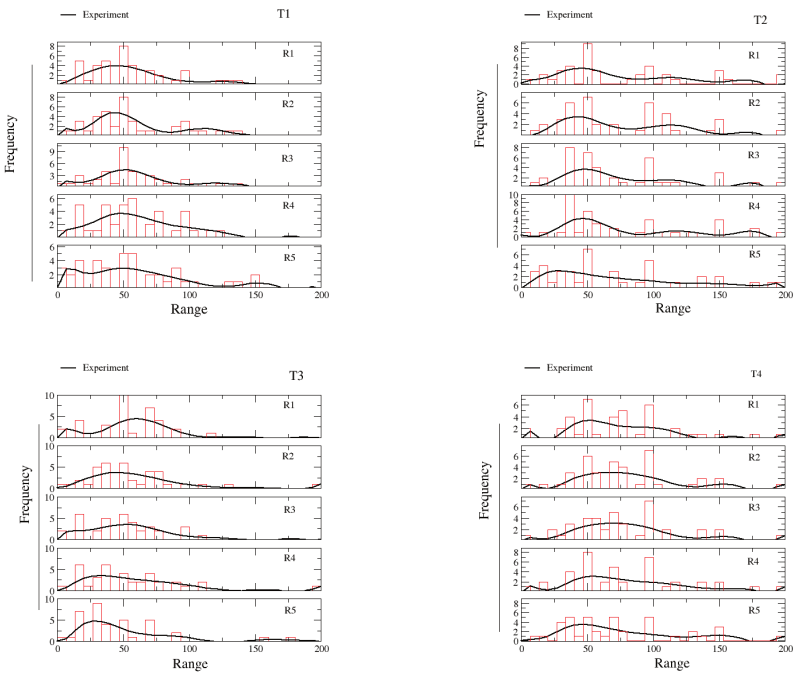

Figure 7.7.: Distribution of WTP-range Among the Population. Upper case left: T1, upper case right: T2, lower case left: T3, and lower case right: T4.

In T3, the uncertainties in the population decrease as time is passing, despite a longer right tail (compare this finding with the results summarized in Figures 7.3 and 7.5). Comparatively, in R_5, the distribution of uncertainties in T1, T2 and T4 is more flat-topped, revealing the presence of several individuals with several levels of uncertainty. T4 (conducted by means of a partner protocol in the experiment, where people belonging to a group of five people were fixed for the five experimental rounds)

should be related to a higher uncertainty reduction. A summary of descriptive statistics for this part is shown in section G in Tables G.19, G.21, G.23.

From these results two aspects can be extracted: first, the distribution of WTPs is changing if *individuals change their attitudes*. These attitude changes could obey the inputs that individuals receive from their neighbors through the exchanged sentences in chats.[10]

The second aspect is that after our subjects exchange information, some individuals may also change their attitudes by being persuaded by others. This is clearly observed in deviations of the WTPs from the mean value. Here by *contagion* or *herding* the changes in attitudes could increase significantly, if new groups with own trends appear. These variety of new opinions split the population leading the group far from a consensus.

Table A.4 summarizes OLS regressions of WTP-range. As for maximal WTP and Minimal WTP, Models I to IV include only the Alone variable, whereas Models V to VIII consider the other three treatment variables, Partner, Stranger, and Group, joined by the attitudes revealed in chats after each sense was triggered.

The coefficients of Alone (Models I to IV) are always negative, significant at a 0.01 level and have a strong influence weight in the regression. By including the variables in the categories Personal characteristics and Attitudes (asked before and after the sensory experience was conducted), the influence weight remains relatively stable and their signs are preserved. The incremental F-Test shows that by entering personal characteristics and attitudes, the improvement of the regression (Model IV) fitness is driven for the representativeness of these variables for the regression.

For Models V to VIII, parameters of dummy variables (Partner, Stranger and Group) are always positive, strongly significant and highly influential on the regression. However, the magnitude of these parameters is different, revealing a treatment effect.[11] The own attitudes have also been positively influencing the size of the

[10] Imitation/comparison between individual (intrinsic) attitudes and others' opinions (external informational sources) influencing the individual decisions.

[11] For each treatment the answers are different, despite the general environment of the experiment were the same, except for the protocol used to exchange information and the group size in which individuals exchanged information

WTP-range and the parameters of attitudes incoming from the neighborhood are negative, but no significantly. By comparing Model V with Model VIII through the incremental F-Test, the entrance in the regression of Personal Characteristics and Attitudes has a positive effect on the fitness of the regression (increments of $\overline{R}^2$).

7.3. Test of Hypotheses

7.3.1. Working Hypotheses

H1. Information helps to reduce individual uncertainties. In order to test this hypothesis we make use of the variable WTP-range. We compare the results of the OLS regression for T1 and All-Treatments in Table A.4. As we already described above, Model IV (corresponding to T1) and Model VIII (All-Treatments), both consider Personal Characteristics and Attitudes to be the models that better fit our experimental data. Comparing the four dummy variables, we can state that for T1 the WTP-range decreases, whereas in the other three treatments WTP-range increases. This effect is stronger for T2 and T4, suggesting that the exchange of information with the same partner within the whole experiment does not contribute to reduced uncertainties.

The behavior of T1 suggests that when individuals receive information from only one source, this information helps to alleviate uncertainties. Looking at the performance of information exchange, the variable Attitude of i is positive, strongly weigthed and significant, showing that individuals increase their uncertainty level by following their own attitudes. Comparing this aspect with T1, we can conclude that information exchange appears to puzzle personal attitudes toward the chocolate. The variable Attitude of j is negative and lightly weighted, suggesting a contribution of this to reduce WTP-range, but this interaction is not significant. The last variable, Interactions, here is also small and non-significant.

We can conclude that sensory experiences as have been conducted in the exper-

and attitudes.

Table 7.10.: Summary WTP for Gender

	T1	T2	T3	T4
R1 vs R2	1.114	0.780	0.899	1.194
R2 vs R3	0.918	1.002	1.597**	0.710*
R3 vs R4	0.866	1.255	0.674*	1.243
R4 vs R5	1.707**	1.115	0.932	0.970

*, **, *** indicate significance at $\alpha = 10\%$, 5% and 1% respectively.

iment contribute to reducing the uncertainty level, but when other informational sources are aggregated, it results in confusion. However, the performance of T3 suggests that individuals can make more accurate decisions if the additional informational source is more diverisfied. These results corroborate the behavior of the distributions of WTP-range in Figure 7.7, where the evolution within the five rounds shows better performances for T1 and T3.

H2.Interaction as reinforcing of additional information has strong effects on uncertainty reduction.

We calculate a set of F-Tests to compare the variances from one experimental round to the next of the WTP-range for each treatment, and we find significant results for T1 from R4 to R5 (F(1,39)=1,707, p=0.049; the variance increases and is significantly different from R4 to R5), T3 from R2 to R3 (F(1,39)=1.597, p=0.074; where the variance increases) and from R3 to R4 (F(1,39)=0.678, p=0.095; the variance decreases from R3 to R4 significantly) and for T4 from R2 to R3 (F=0.710, p=0.099; the variance decreases). The other results oscillate between increases and decreases regarding the variance, but they are not significant (see Table 7.10).

To test this hypothesis, we analyze regressions of the variable WTP-range for each period of time and for each treatment. A total of 16 models have been proposed and shown in Tables A.9, A.10, A.11, and A.12. Models I to IV refer to T1, models V to VIII to T2, models IX to XII to T3, and models XIII to XVI to T4. Models

I, V, IX, XIII and XVII only consider the dummy variables corresponding to each treatment (Alone, Partner, Stranger and Group). Additionaly, for the treatments with interpersonal communication, T2, T3 and T4, we include the variables Attitude of Individual i, Attitude of Individual j, and Interactions. The other models include the variables Personal Characteristics, Attitudes and both. For each model, we consider five OLS regressions including the same set of independent variables, but different experimental rounds, i.e., each equation regressing one experimental round.

H3. Interaction among individuals contributes to forming consumption trends. Taking a closer look at the evolution of the variance for maximal and minimal WTP, we observe in Figure 7.8 that the variances increase in time as more information is aggregated to the system. That means that the aggregation of new information, in contast to what we want to test in hypothesis **H3**, is the reason why the differences in their answers increase over time, which makes it impossible to form a 'global opinion' among individuals. Here, the variances of the maxWTPs in all the treatments are less stable and higher than the results for the variances of the minWTPs.

We expected that by allowing information exchange between individuals, we would contribute to forming a consensus in consumption, but for T2 the variance increases in time (see Figure 7.8. The same was observed in T4, where after an increment of the variance in R_2 and a reduction in R_3, it increases in the subsequent rounds overpassing the variance measured in R_1. For T3 the dynamic is different. Here a subsequent raising of the variance in R_2 and R_3 was followed by a large decrement in R_4 under the variance of R_1. However, the variance measured in R_5 is larger than in R_1.

As we want to test the variance reduction of the individula decisions by information exchange between individuals, we calculate a new variable: *Stdv*. This is the standard deviation of the WTP-range for the five experimental rounds and has been calculated for each individual and for each treatment separately and for T2, T3 and T4 simultaneously. Additionally, we introduce the variables $Cummatt_i$ and

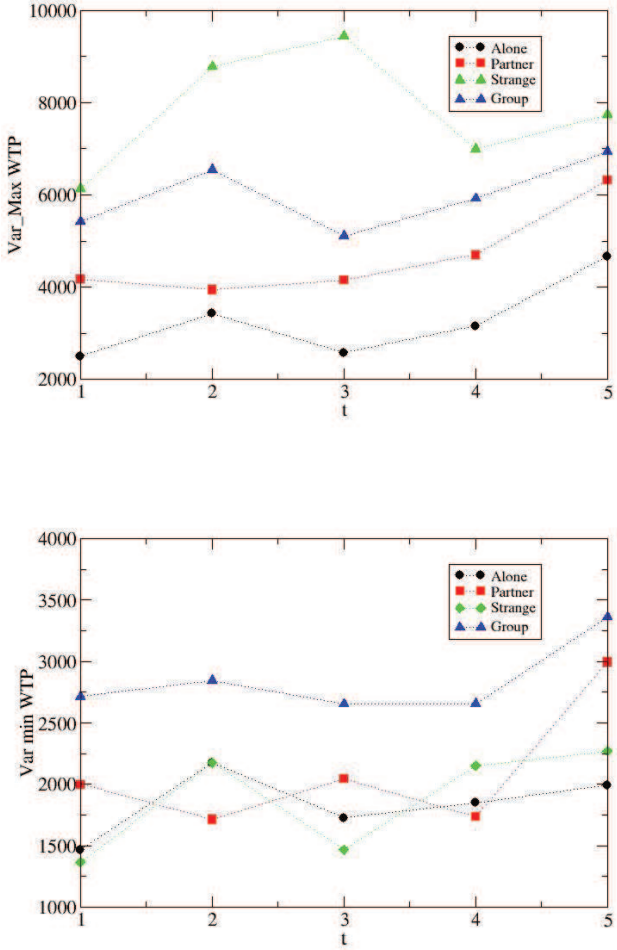

Figure 7.8.: Average of Variance of the Maximal (above) and Minimal (below) WTP as a Function of Time.

$Cummatt_j$ corresponding to the cummulated attitudes in time of an individual i and her neighbor(s) j after having disentagled the utterances exchanged in chats.

We calculated again 20 models, four corresponding to each treatment, shown in Tables A.13, A.14, A.15, A.16, and A.17. The negative sign appearing in the coefficient of $StdvT1$ indicate a reduction of the individual variance for the four proposed models for our benchmark treatment. For T2 and T3 we found a positive coefficient. However, the coefficient of T2 is smaller indicating a better performance of

additional information to reduce uncertainties. For T4 the coefficient is negative. However, these results in T2, T3 and T4 are not significant. The variable *cummatti* is positive, small and significant for the three treatments with interaction between individuals. The variable *cummattj* has the same size and signs of the variable *cummatti* for these treatments but without statistical significance, suggesting that interactions between individuals do not contribute directly to improve the uncertainty at the moment of choice.

For the last group of models (XVII to XX) we regress the variable standard deviation of the WTP-range for each individual at T2, T3 and T4, $StdvT2$, $StdvT3$ and $StdvT4$, simultaneusly. From here we can observe that the greater contribution to reduce the individual standard deviation of the WTP-range is given by the treatment T4. However, if we analyze the reduction of the variance in all the population we found out that the treatment with the better performance is T3, as have been already shown in Figure 7.7 for the WTP-range of the different treatments. We can conclude that the individual behavior differs from the group behavior, but there are not a formation of consumption trends, that is, the heterogeneity to consume chocolates observed at the beggining of the experiment does not dissapear despite the fact that the individuals became the same information and that information exchange within the experiment was allowed.

7.3.2. Z-Hypotheses

As introduced in Section 6.2.2, this set of hypotheses was carefully chosen to closer study the influence of attitudes and personal characteristics of our participants in the decision that they made. In order to prove this set of hypotheses we made a series of panel data regressions of the Attitudes and Personal Characteristics of our participants for each treatment in time of the maxWTP (in Table A.5), minWTP (Table A.6), avWTP (summarized in A.7) and WTP-range (see Table A.8).

- Z1. *Women are likely to pay more for chocolates than men.* In Table 7.11, we summarized the results corresponding to the variable Gender. We can observe

Table 7.11.: Summary WTP for Gender

	All Treatments	T1	T2	T3	T4
maxWTP	18.922***	0.431	-1.640*	16.758***	4.101*
minWTP	9.464**	5.545*	-2.441*	7.391**	-5.745*
avWTP	15.40***	3.159*	-1.308*	11.329***	2.224

Notes: Extracted from Tables A.5, A.6 and A.7. Values are in EUR/100 (euro cent). OLS regression with White's heteroscedasticity-robust covariance matrix.
*, **, *** indicate significance at $\alpha = 10\%$, 5% and 1% respectively.

that except for T2, all three variables are positive and almost all of them are significant. The variable Gender is for the regression of avWTP is positive and significant for the regression of avWTP containing all scenarios, revealing that in general women are willing to pay significantly more (0.155 EUR) for the chocolate bar than men. For the treatment regressions, the same effect is observed in T3 (0.113 EUR; significant at 0.01) and in T4 (0.023 EUR; not significant). For T1, women are willing to pay more (0.032 EUR; not significant), but for the Partner treatment the effect is reverted (0.131 EUR less; not significant). Then for T1, T3, and T4 the hypothesis can be accepted.

Correlating the variables Gender and maxWTP, we obtain $\rho = 0.162, n = 800$; Gender and minWTP $\rho = 0.142, n = 800$; and Gender and avWTP, $\rho = 0.164, n = 800$. Then, *we accept Z1 at* $\alpha = 0.01$

- Z2. *Women are more certain in their preferences than men.* To prove this, we examine the regression results in Table A.8 of the variable Gender. For T1 (-5.825***) the hypotheses can be accepted, whereas for the other three treatments, it cannot (the results are all positive and, except for T2, significant).

  To prove the hypothesis in the whole population and to be able to reject Z2, we conduct a Pearson correlation test of the variables Gender and WTP-range.

Table 7.12.: Summary WTP for H&L

	All Treatments	T1	T2	T3	T4
maxWTP	-10.022***	3.268*	-10.681***	3.046*	-5.673**
minWTP	-2.150*	2.635**	-4.667***	2.109*	-2.236*
avWTP	-6.434***	3.253**	-7.451***	1.083	-4.039**

Notes: Extracted from Tables A.5, A.6 and A.7. Values are in EUR/100 (euro cent). OLS regression with White's heteroscedasticity-robust covariance matrix.
*, **, *** indicate significance at $\alpha = 10\%$, 5% and 1% respectively.

We obtain $\rho = 0.107$, $n = 800$, at a significance level of $\alpha = 0.01$. This positive correlation allows us to conclude that women are more uncertain in their preferences for chocolate than men.

- Z3. *Women are more risk-averse than men.* Examining the mean value of the H&L test separately for women and men, we obtain a value of $M_{men} = 4.89$, $SD_{men} = 0.262$ and $M_{women} = 4.6, SD_{women} = 0.268$, showing that women are only slightly more risk-averse than men. Statistically comparing both mean values through t-tests (2 tails) we obtain $t = 0.40, p = 0.70$. As $p_{critic} = 2.027$, we reject hypothesis Z3 that $M_{women} > M_{men}$.

- Z4. *The higher the risk seeking behavior, the higher the individual WTP.* Comparing the results from Tables maxWTP, minWTP and avWTP for the variable H&L, only in T1 and T3 increases the WTP in accordance with the risk attitude. See Table 7.12.

  Conducting a Pearson test of correlation between the results of H&L and maxWTP, minWTP and avWTP, we obtain: $\rho_{(maxWTP,HL)} = -0.131$; $\rho_{(minWTP,HL)} = -0.043$ (significant for $\alpha = 0.01$); and $\rho_{(avWTP,HL)} = -0.103$. These negative results indicate that if H&L increases (the risk attitude increases), the WTP

decreases. Indeed, hypothesis Z4 should be rejected.

- Z5. *The more risk-averse the individuals, the lower the WTP-range interval.* To prove this hypothesis, we study the results for the variable H&L in the WTP-range regression in Table A.8. Here, the WTP-range decreases for T2 and T4 and also for the regression of all treatments. For T1 and T3, the result is positive but close to zero. More formally, by a Pearson correlation test, we found a $\rho_{WTP-range,HL} = -0.155, p > 0.05$. The negative correlation suggests that hypotheses Z5 could be accepted. The interaction effect was non-significant.

- Z6. *Smokers will also be less sensible to sensory experiences, and, therefore, their WTP will remain more stable than for non-smokers.* Looking at Tables A.8, and A.7 we observe that this variable changes for all treatments. Thus we cannot be sure that smokers have a lower sensitivity to sensory triggers to state their WTP and Z6 must be rejected.

- Z7. *The WTP for Smokers is lower than for non-smokers.* We extract the results from the variable Smoking in Tables A.5, A.6, and A.7. We observe that for maxWTP, smokers pay less than non-smokers in T2, T3 and T4. Also the result regress of all treatments combined is negative. MinWTP shows another dynamic, where the result is positive and significant for T3. The regression for the averaged WTP shows that the variable smoking has also a representative weight in all regressions, revealing that smokers are willing to pay less than non-smokers, except for T1. These results are significant for the regression with all scenarios and T2 at a 0.01 level, for T1 at a level of 0.05 and for T3 and T4 this parameter is not significant. This result is negative for T2 and T4, but also for all treatments. Thus we can only accept this hypothesis only for T2 and T4 (see summary of results in Table 7.13).

  Running a correlation test between the variable Smoking and the maxWTP and minWTP, we found out: $\rho_{Smoking,maxWTP} = -0.056, p > .05$; $\rho_{Smoking,minWTP}$

Table 7.13.: Summary WTP for Smoking

	All Treatments	T1	T2	T3	T4
maxWTP	-20.077***	13.604**	-29.551***	-1.352	-9.972*
minWTP	-13.184***	-1.732	-12.925***	7.391**	-5.745*
avWTP	-10.945***	8.981**	-17.540***	1.784	-4.169**

Notes: Extracted from Tables A.5, A.6 and A.7. Values are in EUR/100 (euro cent). OLS regression with White's heteroscedasticity-robust covariance matrix.
*, **, *** indicate significance at $\alpha = 10\%$, 5% and 1% respectively.

$= -0.057$, $p > .05$. The negative signs indicate that smokers are likely to expend less money in chocolates than non-smokers. However, the interactions are non-significant. Taking into account the average of maxWTP and minWTP, our avWTP variable we get a $\rho_{Smoking,avWTP} = -0.061$, $p = .05$, then we do accept hypothesis Z7.

- Z8. *Taking care about Advertising drives to higher WTP*. Examining the summarized data in Table 7.14, this hypothesis is only valid for T4. However, increments in WTP have also been observed for maxWTP and avWTP for T1 and the regression of all treatments combined.

  A Pearson test indicates that only the maximal WTP increases with statistical significance due to advertising ($\rho_{Advertising,maxWTP} = 0.065$, $p < .05$. The minimal WTP decreases, but not significantly ($\rho_{Advertising,minWTP}$ = -0.022, $p > .05$).

- Z9. *Taking care of market prices result in a lower WTP*. The results correspond with this hypotheses in treatment T3 and for all treatments, both being statistically significant. The results for the corresponding regressions are summarized in Table 7.15.

Table 7.14.: Summary WTP for Advertising

	All Treatments	T1	T2	T3	T4
maxWTP	7.682**	8.319*	-6.786	8.617***	14.547***
minWTP	-13.305***	-0.812*	-9.169***	-9.019***	5.706
avWTP	2.329	4.899	-6.097	-8.458***	11.985***

Notes: Extracted from Tables A.5, A.6 and A.7. Values are in EUR/100 (euro cent). OLS regression with White's heteroscedasticity-robust covariance matrix.
*, **, *** indicate significance at $\alpha = 10\%$, 5% and 1% respectively.

Table 7.15.: Summary WTP for Prices

	All Treatments	T1	T2	T3	T4
maxWTP	-65.468***	11.997	6.945*	-79.793***	9.736
minWTP	-25.463***	1.412*	-2.820*	-28.365***	4.987
avWTP	-19.911**	9.874*	11.966*	-66.811***	22.061***

Notes: Extracted from Tables A.5, A.6 and A.7. Values are in EUR/100 (euro cent). OLS regression with White's heteroscedasticity-robust covariance matrix.
*, **, *** indicate significance at $\alpha = 10\%$, 5% and 1% respectively.

Table 7.16.: Summary WTP for Knowledge

	Variable	All Treatments	T1	T2	T3	T4
Know Brands	WTP-range	-1.335	-1.690***	-0.139*	-3.996***	1.095
	avWTP	-0.621	1.549**	-1.042	-3.559***	2.430**
Know Cocoa Name	WTP-range	-2.155	1.964*	-2.258*	2.354	-0.187
	avWTP	-5.320***	-5.549**	-1.042	-3.559***	2.430***
Know Provenance	WTP-range	1.119	0.678	-2.396*	0.694	2.665*
	avWTP	-1.447	0.983	-4.697***	-1.181	3.448

Notes: Extracted from Tables A.5, A.6 and A.7. Values are in EUR/100 (euro cent).
OLS regression with White's heteroscedasticity-robust covariance matrix.
*, **, *** indicate significance at $\alpha = 10\%$, 5% and 1% respectively.

For T1, T2, and T4, the results were positive, suggesting that knowledge about market prices is irrelevant to decide the amount to expend for chocolates at the moment to decide. For the whole sample, we found out a significant but weak negative correlation $\rho_{avWTP,Prices} = -0.01, p < .01$ ($n = 800; t = -2.782, p = 0.003$), confirming only a small effect of the variable Prices in the WTP reduction.

- Z10. *Individuals with a high level of initial knowledge about chocolates are less likely to change their WTP within the experiment.* That is, the effect of the newly added information to the system does not affect the initial individual decisions. Table 7.16 summarizes the results of regressions for avWTP and WTP-range for the variables belonging to this category: Knowledge about Brands producing chocolates, knowledge of cocoa names after their denomination of origin and knowledge abut countries producing cocoa. Both, WTP-range and avWTP are changing for this three variables, indicating that this hypothesis cannot be accepted. However, the variable Knowledge about Countries for T1 and T3 and the variable Knowledge about Brands are small.

  Comparing statistically these variables, we found out a significant and positive interaction between the variables Knowledge and WTP-range ($F(1, 799) = 650.55, p < .01$) and for the variables Knowledge and avWTP ($F(1, 799) = 849.19, p < .01$), indicating that Knowledge about the market and the object of choice does not contribute to more stability in preferences, but tends to

Table 7.17.: Summary WTP for Frequency

	All Treatments	T1	T2	T3	T4
avWTP	7.456***	-3.585*	-3.744	9.607***	5.178**
WTP-range	2.192	-4.193***	-0.365	4.713**	1.933

Notes: Extracted from Tables A.5, A.6 and A.7. Values are in EUR/100 (euro cent). OLS regression with White's heteroscedasticity-robust covariance matrix.
*, **, *** indicate significance at $\alpha = 10\%$, 5% and 1% respectively.

increase the WTP in average and the uncertainty. Information could result in confusion at the moment of choice. This is why hypothesis Z10 should be rejected.

- Z11. *Individuals know more about a purchased good if they consume it on a regular basis. For this reason it is expected that individuals with high consumption frequencies of chocolates are less likely to change their WTP for the chocolate.* From Tables A.8 and A.7, we observe that this hypothesis cannot be accepted. Despite a high frequency of consumption, we found out important changes in avWTP and WTP-range (see Table 7.17). These results were confirmed by a F-Test between avWTP and Frequency ($F(1, 799) = 5302.87, p < .01$) and between WTP-range and Frequency ($F(1, 799) = 4.076, p < .01$), showing that a more frequent consumption will increase the WTP for the chocolate bar.

- Z12. *More frequent consumption of chocolates reduces uncertainty in preferences about chocolates.* Table 7.17 summarizes the results of regression of the WTP-range presented in Table A.8 for the variable Frequency of consumption of chocolates. We found out an uncertainty reduction only for treatments T1 and T2, the last being non-significant. Statistically, we obtain a $F(1, 799) = 4076, 87, p < 0.01$ calculated for all treatments and all periods of time, suggesting that a more frequent consumption contributes to stable

Table 7.18.: Summary WTP for Pleasure

	All Treatments	T1	T2	T3	T4
maxWTP	-10.839***	-17.891*	15.271*	-13.428	5.747
minWTP	-16.539***	-12.649***	14.392**	-17.736**	0.106
avWTP	6.887***	-5.494**	25.715***	-28.703**	15.369

Notes: Extracted from Tables A.5, A.6 and A.7. Values are in EUR/100 (euro cent). OLS regression with White's heteroscedasticity-robust covariance matrix.
*, **, *** indicate significance at $\alpha = 10\%$, 5% and 1% respectively.

preferences ($M_{(freq)} = 2.88, SD = 0.78$).

- Z13. *Individuals with a high level of enjoyment by consuming chocolates are more likely to increase their WTP as sensory experiences are accumulating.* This hypothesis can be accepted only for treatments T2 and T4. However, for T4, it is not significant. The summary of the results of the regressions for maxWTP, minWTP and avWTP can be seen in Table 7.18. The correlation values for all treatments and all periods of time are $\rho_{(maxWTP,Pleasure)} = 0.130$; $\rho_{(minWTP,Pleasure)} = 0.114$ (significant for $\alpha = 0.01$); and $\rho_{(avWTP,Pleasure)} = 0.132$. Hence, higher levels of pleasure by consuming chocolate lead to higher minimal WTPs (significant) but tend to increase the maximal and, therefore, the average of the WTPs.

- Z14. *The preference uncertainty of individuals with a high level of enjoyment by consuming chocolates is more likely to increase as new senses are triggered.* In the regression of WTP-range in Table A.8, we observe that the enjoyment variable has a positive influence on the WTP-range for all treatments, except for T1. These results are, however, non-significant. After a t-test of the whole sample between the variables Enjoyment and WTP-range we get a $t(799) = 39,25, p < 0.01$ ($M = 0.783, SD = 0.81$), showing that the exerted pleasure

by eating chocolates will increase the preference uncertainty.

- Z15. *The more habits are followed, the lower the individual uncertainty level at the moment of choice.* Correlating the two variables WTP-range and Total of habits, we get a statistical value of $\rho = 0,127$, $n = 800$, which is statistically non-significant. The variable Total of Habits was not included in the regression in Table A.8. For its calculation, each one of the habits followed to buy chocolates for each individual was marked with a point. The sum of these points (maximal six) constitutes this variable.

  After a t-test ($\mu_1 \neq \mu_2$) between Habits and WTP-range we are able to conclude that Habits contribute to reduce the uncertainty to choose: $t = 38.46, p < 0.01$; ($M_{(Habits)} = 2.14, SD = 1.1$).

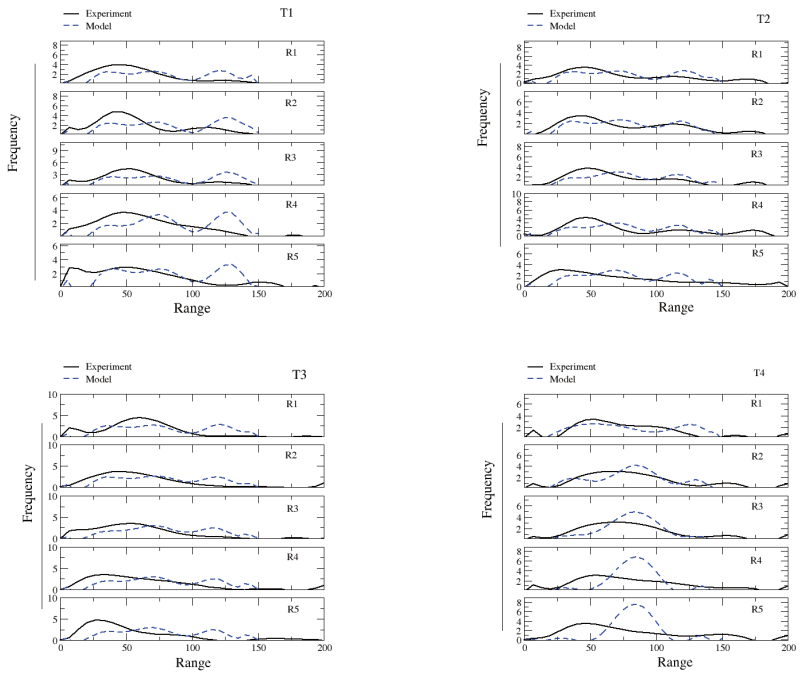

Figure 7.9.: Distribution of WTP-range Among the Participants. Upper case left: T1, upper case right: T2, lower case left: T3, and lower case right: T4.

With the formulation of the mathematical model in Chapter 6 we basically want to modelate the individual behavior, i.e., to approach a herding behavior, as assumed in the third hypothesis. Depending on the treatment we can reproduce different collective behavior: from T1 (a heterogeneous distribution of WTP among the individuals) to T4 (a tendency to the formation of a normal distribution of WTPs), indicating a collective behavior which reproduce consumptio trends. In Figure 7.9 we compare the theoretical predictions with the experiments. However, it is qualitatively clear that in the experiments there is only a weak tendency to form a consumption trend. The computational experiments show a better agreement in T2 (and T3) than in T4, indicating that individuals are influenced by infromation exchange with only one partner rather than by a group of individuals. This result is econometrically corroboated by the results in Tables A.13, A.14, A.15, A.16, and A.17, by showing only a low statistical significance.

8. Conclusion

8.1. Satisfaction, Utility and Attitudes

The history of economics has been mainly dominated by the concept of utility, and the implicit assumption that individuals continuously try to optimize it in a rational way. However, the core of the economic theory has been challenged by the fact that agents are much more than rational machines continuously computing the optimal value of a utility function. If agents are not simply rational, which is thus the role of the psychology of the agents? Can the agents have an attitude towards products, and can this attitude, which is essentially irrational, influence their willingness to pay?

This work contributes demonstrate that the concept of utility must be combined to the concept of attitude. Despite both concepts stem from different disciplines, there exist as parallel lines of development of the concepts in each discipline. The concept of valuation, specially after choices, is common to both, utilities and attitudes. The aim of a decision-making process is to attain the highest possible satisfaction level, and here individual valuation plays a decisive role. Satisfaction, as stated by economic theory, is a way of making a decision about a set of alternatives with respect to the limitations of human time and knowledge.

However, some forms of satisfaction can still require a large amount of deliberation from the decision maker, for instance to set an appropriate aspiration or reference level in the first place, or to calculate how a current option compares to the aspiration level (Simon, 1956). Economic decisions must be made between alternatives

and based on information about those alternatives. In different situations, those alternatives and pieces of information may need to be found through active search.

By integrating both attitudes and utility, and using the concept of the utility function, we find a way to alleviate individual uncertainties in the marketplace. Here, attitudes appear as individual reactions to added information and to sensorial triggers toward one object of choice, in our case, a chocolate bar.

The findings in this work corroborate the limited capacity to process and store information owned by human beings. The more information is incorporated to the system, the higher the risk that uncertainty levels increase yielding poor outcomes from choices pushing down the resulting utility. These findings agree with several studies about information processing and decision making [cite?]

As has been shown in chapter 6, the kind of information given to the participants was designed under a 'chocolate tasting protocol' by using the same procedure as a wine tasting. By this method, the information was not only based on statements that the participants have to memorize and react upon. Our participants receive sensory impulses by dealing with a real product. Each sensory impulse goes to the human mind, recovers memories and then a reaction is expressed as a response, in our case a WTP interval enabling us to evaluate the effect of the aggregated information through sensory triggers.

Hence, the provided information has an external origin, but is internally reconstructed. In order to get a close analysis to real human behavior in choice situations and in permanently changing environments by acquisition of new information, we designed four different environments with different amounts of incoming information. T1, our control treatment, seeks to imitate a poor information environment, in which only one source of information was provided. In opposition, T4 represents a rich information environment, in which five informational sources were provided, one from the experimenter side and four from other partners to exchange information in chats. The other two treatments, T2 and T3, are allocated in the middle, with only two informational sources.

However, the amount of incoming information is not only determined for the structure of the network, but also (and mainly) for the amount of interchanged information, that is, the dynamic inside each network. The learning, or better said, the capacity of absorbing information from the environment, and the individual adaptation to the new environment were reflected in the personal decisions the individuals made. The evolution of the individual behavior was registered several times by stating preferences as WTPs.

As explained in Section 6.3.3, individual attitudes reflecting their beliefs were exchanged through a computer interface. Each message could be classified as positive, negative or neutral. However, it was not the amount of messages exchanged, but the cummulated attitudes received by participants that had a major impact on the individual answers. Given the size of the group, we expected more dynamic in T4. As observed in Figure 7.7, the uncertainty levels are more heterogeneous. Additionally, in A.4, the T4 dummy is positive and highly weighted,showing that more information will increase the uncertainty.

Therefore, **H1. Information helps to reduce uncertainties** should be rejected.

8.2. Attitudes

The capacity of any organism to respond to external and internal stimuli such as weather changes or new environments is called 'behavior'. The essential part of this mechanism are the sensory elements receiving signals and the processing system consisting of simple chemical feedbacks to cognitive processes. The combination of these two elements could result in behavioral changes.

Learning was introduced into economical theory as a way to explain why the behavior of individuals and groups is changing over time. When a situation is changing, normally individuals adjust their behavior in a well-known process called *adaptation*. This learning mechanism appears as a non-linear process. Adaptation is important

for economics, and for this project, because through adaptation, individuals can fix their preferences after having changed their behavior. The problem to implement this mechanism is the required time horizon, because it can not be universally defined: some people require more time than others to adapt themselves to changes. A plausible alternative, which is widely used, is the mechanism of imitating the success of other agents typically followed as a mechanism to achieve the own success. However, the questions as how can we effectively learn to be successful, or how can we choose the most suitable behavior to imitate in each situation, remain without answers. The experiment here presented is an attempt to approach these questions from another perspective by understanding how attitudes, being an irrational part of human beings, influence the decision-making process to be either successful or fruitless.

Usually, we cannot distinguish how attitudes determine individual choice. We argue that individual behavior is strongly related to individual attitudes: as the variance of individual attitudes is very high, preference could change very fast. Therefore, the behavior at the moment of choice is changing. This fact points out that there are cognitive influences generating different intensities of the relationship between cognition and choice.

The results from this experiment show us that our own attitudes operate as a strong modulator to change decisions, whereas the attitudes from others (neighbors) are not statistically significant revealing poor influences on final decisions. However, the observed process of changes in one's own attitude and its consequences does not reveal the influence that the attitude of others may have.

The own attitudes in T2, T3, and T4 are statistically significant and their influence weight is strong, whereas the attitude of the neighbors for these treatments is less weighted and not statistically significant to choose for a maximal WTP (see Table A.1). The same situation is observed in the minimal WTP summarized in Table A.2.

Regarding the habits, 'recommendations' are strongly weighted and statistically

significant in the regressions in Tables A.8, A.6, and A.5, as a signal that recommendations are important to make purchase decisions, suggesting that the direct influence of attitude exchange has a weaker effect than people asking the neighbors or relatives about their opinion regarding a certain good or service before they faced the choice situation. It reveals again a poor capacity to process information in short time intervals.

8.3. Homogeneity and Trend Formation

Here, we implement a sequential aggregation of information with a subsequent interaction in groups after each information unit has been added. In the literature, it is shown that this process of information aggregation causes an externality effect that gives rise to the emergence of informational cascades. This informational cascades are situations in which people herd because they don't take into account their private information revealed by the history of past actions (see for example, Banerjee, 1992). We expected that bearing of trust feelings could give rise to such cascades in T2 and T4.

In opposition to this cascade formation the individuals in our experiment do not enter one by one to take an irreversible decision. They belong to a group of interacting subjects who can exchange their decisions in time, but individuals in the group are not forzed to follow the group's trend. Additionally, during the experiment, information was available to all participants, and all of them received the same amount of information. Therefore, no costs for information search arose.

As already pointed out in Section 7.2.4, the distribution of WTPs is changing as individuals change their attitudes. Here, the amount of incoming information plays an important role. However, as can be seen in Figure 7.7, individuals are increasing their uncertainty as time is passing in all treatments. Hence, *the way in which individuals exchange and aggregate information (the network structure and dynamics) applied in T3 reduces the uncertainties of the individuals participating in*

it.

8.3.1. Does Social Influence in Form of Direct Opinion Sharing Between Individuals Decrease the Heterogeneity of Individual Preferences?

T3 appears as the more suitable form of opinion sharing, promoting the reduction of uncertainties to choose from the first to the last round. This result could appear because when an individual exchanges information with a stranger, it is difficult to form an opinion, whereas within a partner design, *this opinion is reinforced by the group members and will bias the individual answers.* Additionally, if individuals are trying to remember the whole history of their actions, they will fail in their decisions. Economical models so far make use of this assumption. By this way, the commonly known history of actions, as in T2 and T4, can dominate private beliefs and prevent agents from revealing their private information. However, this assumption goes too far when the number of periods considered is large or if for each experimental round the subjects are exposed to a large amount of information. If the common memory prevents the diffusion of private information, a restriction to the observation of past actions may be efficient. This was imposed in the applied experimental design for T3. The diversity of observations may facilitate social learning because there is no common public history that dominates all individual beliefs.

In general, if individuals observe only a part of their past actions, the convergence to social learning may be faster. This phenomenon is observed in T3, where only the information of the present period (experimental round) was available to be exchanged between couples, and for each experimental round, a new partner was assigned. Here, the reduction of the size of the WTP-ranges was given faster than for the other treatments (see Figure 7.8). Human memories are limited and selected the most accurate information to decide. If the history to be taken into account is too large, important private information won't be revealed, resulting in an increase of

the individual uncertainty. In general we can conclude that, ***to learn, one needs to forget***.

H2. Interaction as reinforcing of additional information has strong effects on uncertainty reduction can partially be rejected. It depends by and large on the network structure where the additional information is exchanged.

We face a paradox. Despite all participants in the treatments, in which information exchange was allowed, having the same right to communicate among their groups, i.e., there were no hierarchy or order of entrance to exchange information, only few individuals received the necessary attention to influence decision by changing the attitudes of their contacts. The exchanged information does not impose obligations to the participants to fix or change their decisions in order to attune them to someone else's opinion.

This pluralistic system, where all individuals could decide freely without externally imposed controls, shows that individuals are not able to form consumption trends, i.e., members have not a greater persuasion power to fall into line with her decision. Also the rise of trust feelings, as expected for T2 and T4, does not took place and the attitudes from others were almost neglected in the decision-making process.

Therefore, **H3. Interaction among individuals contributes to form consumption trends** can be rejected. The heterogeneity levels have not been improved by interaction. The influence of the amount of interaction in our results appears almost non-significant.

8.3.2. Findings from Our Subjects

In order to understand the processes underlying the decision that individuals make, we also studied some features to delineate a picture of our participants. From the studied Personal Characteristics and Attitudes, it is important to remark that:

Women are willing to pay more for the chocolate bar than men for the maximal and minimal WTP categories. The result of the regression of this variable for avWTP

confirms that women are willing to pay more for the chocolate bar than men, and the distance between maximal and minimal WTP increases as time is passing, tending to increase the uncertainty. These results are in line with the design and the literature already introduced in Chapter 6.

Smokers' coefficients are negative for the two directly asked WTPs (maximal and minimal) regressions influencing the WTP-range. Because of scientific studies on a lost of sensibility of the sense of taste by smoking, these result were expected.

Habits have shown differing impacts. Recommendations, Appearence and Organic Cultivation have positive weights in the regressions, whereas Cocoa and Provenance have negative weights. We expected that the more the habits were followed, uncertainty would exert. However, the results are not at all on line with our expectations.

Subjects worring about the amount of fat inside the chocolate are willing to pay more. The same trend is observed in subjects which are looking for organically cultivated cacao. These results are in accordance with contemporary marketing research. Provenance has positive significant parameters indicating that subjects are willing to pay more for the chocolate bar. The amount of cacao and organic cultivation parameters have a stronger positive influence on regressions. The amount of cacao showed negative and significant effects in T3 and T4, whereas a positive influence showed regarding the other three regressions ('All treatments', T1 and T2). In a nutshell, following habits implies a positive potentiality to increase the willingness to pay in changing environments. This result appears as a contradiction, because habitual consumption implies more stable preferences.

The subjective risk preferences elicited by Laury and Holt (2002) are expected. As the parameters show negative signs, the higher the risk aversion, the more cautious are consumers about stating a WTP. These results are particularly remarkable for T2 and T4, showing that the exchange of individual attitudes with the same partner does not contribute to improving individual risk attitudes, but appears to have the opposite effect.

The variable 'Care about Advertising' increases the uncertainty (WTP-range).

This behavior is expected as individuals, who take into account what advertisers are saying, are expected to be less risk-averse. This effect is especially remarkable for T1 and T4, the treatments with the lowest and the highest number of informational sources.

On the other hand, we expected that the variable 'Care about Prices' reduces the uncertainty as individuals taking it into account tend to act more cautious in the market place. However, this phenomenon is only observed in T3. The other studied scenarios show an increased WTP-range as signal of an increment in individual uncertainty to choose. 'Follow-up Trends' tend to increase the uncertainties, which was also to be expected, because of the uncertainty involved when people only act as a consequence of herding behavior.

Consumption by 'following-up marketing campaigns' has negative coefficients showing a positive influence to reduce the uncertainty. This result is not at all expected: on one side, marketing campaigns try to permanently persuade new consumers to buy, but on the other side, this helps consumers to learn more about the market place, including about products and prices. The same result is observed in all studied scenarios.

A. Regressions

Table A.1.: OLS for Maximal WTP.

Variable	Model I	Model II	Model III	Model IV	Model V	Model VI	Model VII	Model VIII
	Coefficient (Standard Error)							
Constant	135.904***	127.141***	130.484***	110.386***	106.101***	103.816***	113.530***	96.307***
	(6.238)	(12.704)	(15.068)	(17.217)	(7.174)	(13.262)	(15.771)	(18.030)
Alone	-34.018***	-26.607***	-32.665***	-27.530***				
	(5.965)	(6.122)	(5.760)	(5.869)				
Partner					19.360**	15.826**	17.014**	15.181**
					(8.499)	(8.584)	(8.239)	(8.240)
Stranger					22.018***	21.516**	18.253**	18.076**
					(8.537)	(8.530)	(8.605)	(8.575)
Group					14.301*	12.648*	17.540*	15.443*
					(8.843)	(7.822)	(9.628)	(8.492)
Attitude of individual i					15.609***	23.989***	23.556***	22.104***
					(2.904)	(2.875)	(2.761)	(2.731)
Attitude of individual j					-2.268	-2.001	-2.490	-2.484
					(2.848)	(2.801)	(2.699)	(2.649)
Interactions					3.579***	2.473*	3.335***	2.623**
					(1.320)	(1.315)	(1.275)	(1.266)
	Control Variables							
Personal characteristics	No	Yes	No	Yes	No	Yes	No	Yes
Attitudes	No	No	Yes	Yes	No	No	Yes	Yes
n	800	800	800	800	800	800	800	800
$\overline{R}^2$	0.037	0.087	0.145	0.195	0.139	0.172	0.234	0.268
F	16.49***	8.64***	11.50***	10.26***	19.33***	12.09***	14.60***	12.31***
Breusch-Pagan χ^2	32.43***	83.13***	11.50***	195.54***	126.19***	166.41***	232.05.17***	277.10***

Notes: Dependent Variable is the Maximal WTP for the chocolate bar in EUR/100 (euro cent).

Least Squares with Group Dummy Variables. OLS regression with White's heteroscedasticity-robust covariance matrix.

*, **, *** indicate significance at $\alpha = 10\%$, 5% and 1% respectively.

Table A.2.: Pooled OLS Regression for minimal WTP.

	Model I	Model II	Model III	Model IV	Model V	Model VI	Model VII	Model VIII
Variable				Coefficient				
				(Standard Error)				
Constant	59.788***	54.017***	38.216***	25.668**	44.757***	39.378***	27.195***	14.817
	(3.960)	(8.154)	(9.630)	(11.131)	(4.624)	(8.617)	(10.244)	(11.809)
Alone	-17.166***	-13.866***	-15.189***	-12.832***				
	(3.787)	(3.929)	(3.688)	(3.794)				
Partner					8.558*	7.463	3.288	2.441
					(4.478)	(5.576)	(5.352)	(5.396)
Stranger					16.841***	16.661***	12.752**	11.869**
					(5.504)	(5.542)	(5.590)	(5.616)
Group					2.236	1.768	4.210	2.810
					(6.411)	(6.382)	(6.253)	(6.218)
Attitude of individual i					13.269***	12.774***	12.326***	11.667***
					(1.873)	(1.868)	(1.793)	(1.789)
Attitude of individual j					-0.692	-0.747	-0.528	-0.765
					(1.836)	(1.819)	(1.652)	(1.635)
Interactions					1.877**	1.286	1.941**	1.699
					(0.851)	(0.854)	(0.841)	(0.829)
				Control Variables				
Personal characteristics	No	Yes	No	Yes	No	Yes	No	Yes
Attitudes	No	No	Yes	Yes	No	No	Yes	Yes
n	800	800	800	800	800	800	800	800
$\overline{R}^2$	0.025	0.055	0.12	0.155	0.101	0.123	0.189	0.212
F	11.49***	5.73***	9.71***	8.03***	13.81***	8.46***	11.35***	9.30***
Breusch-Pagan χ^2	22.74***	56.10***	119.11***	156.91***	972.10***	120***	185.95***	217.70***

Notes: Dependent Variable is the Minimal WTP for the chocolate bar in EUR/100 (euro cent).

OLS regression with White's heteroscedasticity-robust covariance matrix.

*, **, *** indicate significance at $\alpha = 10\%$, 5% and 1% respectively.

Table A.3.: Pooled OLS Regression for averaged WTP.

	Model I	Model II	Model III	Model IV	Model V	Model VI	Model VII	Model VIII
Variable				Coefficient				
				(Standard Error)				
Constant	97.847***	90.580***	84.351***	68.027***	75.429***	71.597***	70.362***	55.163***
	(4.779)	(9.744)	(11.541)	(13.215)	(5.493)	(10.160)	(12.067)	(13.824)
Alone	-25.593***	-20.237***	-23.928***	-20.182				
	(4.570)	(4.695)	(4.420)	(3.794)				
Partner					13.959**	11.645*	10.151	8.811
					(6.507)	(6.575)	(6.310)	(6.317)
Stranger					19.200***	19.089***	15.502**	14.972**
					(6.538)	(6.534)	(6.591)	(6.575)
Group					8.269	7.208*	10.875*	9.127
					(7.613)	(7.123)	(6.373)	(6.278)
Attitude of individual i					19.148***	18.380***	17.941***	16.886***
					(2.224)	(2.202)	(2.116)	(2.094)
Attitude of individual j					-1.479	-1.374	-1.509	-1.625
					(2.080)	(2.045)	(2.067)	(2.031)
Interactions					2.728***	1.879*	2.637***	2.161**
					(1.010)	(1.007)	(0.977)	(0.970)
				Control Variables				
Personal characteristics	No	Yes	No	Yes	No	Yes	No	Yes
Attitudes	No	No	Yes	Yes	No	No	Yes	Yes
n	800	800	800	800	800	800	800	800
$\overline{R}^2$	0.036	0.084	0.145	0.192	0.139	0.171	0.235	0.268
F	16.28***	8.38***	11.47***	10.05***	19.37***	12.05***	14.59***	12.20***
Breusch-Pagan χ^2	32.02***	80.77***	138.97***	191.94***	126.39***	165.97***	231.94***	275.15***

Notes: Dependent Variable is avWTP for the chocolate bar in EUR/100 (euro cent).

OLS regression with White's heteroscedasticity-robust covariance matrix.

*, **, *** indicate significance at $\alpha = 10\%$, 5% and 1% respectively.

Table A.4.: Pooled OLS Regression for WTP-Range.

	Model I	Model II	Model III	Model IV	Model V	Model VI	Model VII	Model VIII
Variable				Coefficient				
				(Standard Error)				
Constant	76.116***	73.123***	92.267***	84.718***	61.128***	48.968***	99.020***	88.512***
	(4.228)	(8.721)	(10.332)	(11.924)	(5.003)	(8.299)	(10.396)	(12.236)
Period	-0.583	-0.583	-0.583	-0.583	-1.204	-1.078	-1.163	-1.050
	(1.237)	(1.220)	(1.179)	(1.156)	(1.220)	(1.211)	(1.165)	(1.148)
Alone	-16.851***	-12.741***	-17.475***	-14.697***				
	(4.042)	(4.203)	(3.956)	(4.065)				
Partner					10.521*	8.058*	13.424**	12.428**
					(5.918)	(5.042)	(5.808)	(5.856)
Stranger					5.431*	4.648**	5.253	5.969**
					(5.449)	(6.009)	(6.069)	(6.099)
Group					11.824*	10.636	13.051**	12.370**
					(6.929)	(6.919)	(6.790)	(6.752)
Attitude of individual i					11.740***	11.189***	11.242***	10.447***
					(2.027)	(2.029)	(1.950)	(1.945)
Attitude of individual j					-0.164	0.150	-0.725	-0.602
					(1.679)	(1.668)	(1.601)	(1.583)
Interactions					1.757**	1.236	1.455*	0.980
					(0.918)	(0.824)	(0.877)	(0.898)
				Control Variables				
Personal characteristics	No	Yes	No	Yes	No	Yes	No	Yes
Attitudes	No	No	Yes	Yes	No	No	Yes	Yes
n	800	800	800	800	800	800	800	800
$\overline{R}^2$	0.019	0.045	0.109	0.144	0.071	0.086	0.154	0.178
F	8.80***	4.84***	8.55***	7.41***	9.62***	6.06***	9.07***	7.65***
Breusch-Pagan χ^2	17.47***	47.63***	105.77***	145.95***	65.28***	87.81***	151.90***	183.19***

Notes: Dependent Variable is the WTP-Range for the chocolate bar in EUR/100 (euro cent).

OLS regression with White's heteroscedasticity-robust covariance matrix.

*, **, *** indicate significance at $\alpha = 10\%$, 5% and 1% respectively.

Table A.5.: Influence of Personal Characteristics and Attitudes on the Maximal WTP.

Variable	All Treatments	Alone	Partner	Stranger	Group
	Coefficient (Standard Error)				
	Personal Characteristics				
Gender	18.922***	0.431	-1.640	16.758***	4.101*
	(5.126)	(4.098)	(5.141)	(5.316)	(5.422)
Smoking	-20.077***	13.604**	-29.551***	-1.352	-9.972*
	(6.490)	(5.184)	(6.510)	(5.863)	(6.866)
Knowledge about Companies producing Chocolates	-1.624**	2.241**	-1.363	-5.379***	-2.844**
	(1.304)	(1.041)	(1.307)	(1.352)	(1.379)
Knowledge about cocoa names	-4.931*	-2.472	-1.057	0.556	-1.853
	(2.457)	(1.951)	(2.464)	(2.548)	(2.579)
Knowledge about countries cultivating	-1.667	1.060	-6.435***	-0.523	4.203*
high quality cocoa	(2.466)	(1.970)	(2.473)	(2.557)	(2.601)
Frequency of consumption	8.984***	-4.794*	-3.542	10.568***	6.634**
(0,...,4)	(3.309)	(2.643)	(3.319)	(3.432)	(3.401)
Pleasure of consumption	-10.839	-17.891*	15.271	-13.428	5.744
	(11.893)	(9.506)	(11.929)	(12.334)	(12.581)
	Attitudes				
Risk attitude by lottery choice	-10.022***	3.268*	-10.681***	3.046*	-5.673**
	(2.461)	(1.961)	(2.468)	(2.051)	(2.602)
Care about Advertising	7.682**	8.319*	-6.786	-8.617	14.547***
	(4.762)	(4.579)	(5.779)	(5.975)	(6.095)
Care about price	-65.468***	11.997	6.945	-79.793***	9.736
	(10.885)	(9.652)	(10.917)	(11.289)	(11.515)
Consumption of innovations	-0.579	-6.027***	-0.424	-10.734***	-6.264**
(0,...,4)	(2.659)	(2.154)	(2.667)	(2.757)	(2.813)
Follow up consumption trends	6.160**	0.692	-1.478	-2.443	9.387***
(0,...,4)	(2.766)	(2.211)	(2.774)	(2.869)	(2.626)
Consumption obeys marketing	-9.838***	-3.075	5.261	-5.002*	-6.925**
(0,...,4)	(3.083)	(2.461)	(3.093)	(2.198)	(3.262)
Care about the contain of cocoa	-0.938	8.306**	20.207***	-17.168***	-12.286**
	(5.251)	(4.192)	(5.265)	(5.444)	(5.553)
Care about the amount of fat	11.206*	4.234	2.966	12.810**	-8.747
	(6.726)	(5.370)	(6.741)	(6.870)	(7.109)
Care about organic cultivation	23.439***	-12.641***	20.131***	14.965**	0.996
	(6.357)	(5.072)	(6.376)	(6.593)	(6.725)
Care about recommendations	22.597***	8.425***	-1.764	25.230***	-8.943**
	(4.955)	(3.954)	(4.970)	(5.139)	(5.242)
Care about appearance	9.590*	4.952	14.212***	-9.970*	0.300
	(5.659)	(4.497)	(5.676)	(5.869)	(5.986)
Care about provenance	-0.203	-5.992	-26.126***	30.059***	1.985
	(9.866)	(7.864)	(4.895)	(10.232)	(10.436)
n	800	800	800	800	800
$\overline{R}^2$	0.400	0.347	0.294	0.336	0.276
F	26.39***	23.40***	16.92***	20.28***	14.16***
Breusch-Pagan χ^2	430.26***	360.89***	300.94***	349.31***	259.01***

Notes: Dependent Variable is the Maximal WTP for the chocolate bar in EUR/100 (euro cent).
OLS regression with White's heteroscedasticity-robust covariance matrix.
*, **, *** indicate significance at $\alpha = 10\%$, 5% and 1% respectively.

Table A.6.: Influence of Personal Characteristics and Attitudes on the Minimal WTP.

Variable	All Treatments	Alone	Partner	Stranger	Group
	Coefficient (Standard Error)				
	Personal Characteristics				
Gender	9.464**	5.545*	-2.441	7.496***	-1.108
	(3.381)	(2.277)	(2.644)	(2.749)	(2.829)
Smoking	-13.184***	-1.732	-12.925***	7.391**	-5.745*
	(4.281)	(2.881)	(3.348)	(3.482)	(3.582)
Knowledge about Firms producing Chocolates	-0.284	0.554	-1.219*	-1.375**	1.752**
	(0.860)	(0.578)	(0.672)	(0.699)	(0.719)
Knowledge about cocoa names	-2.770*	-0-503	1.205	-1.793	-1.661
	(1.620)	(1.084)	(1.267)	(1.318)	(1.356)
Knowledge about countries cultivating	-3.579	0.389	-4.031***	-1.480	1.555
high quality cocoa	(1.626)	(1.094)	(1.272)	(1.323)	(1.361)
Frequency of consumption	6.775***	-0.616	-3.192*	5.839***	4.685***
(0,...,4)	(2.183)	(1.469)	(1.707)	(1.775)	(1.726)
Pleasure of consumption	-16.539**	-12.649**	14.392**	-17.736**	0.106
	(7.845)	(5.283)	(6.134)	(6.381)	(6.564)
	Attitudes				
Risk attitude by lottery choice	-2.150*	2.635**	-4.667***	2.109*	-2.236*
	(1.523)	(1.089)	(1.269)	(1.211)	(1.358)
Care about Advertising	-13.305***	-0.812	-9.169***	-9.019***	5.706
	(3.800)	(2.545)	(2.972)	(3.091)	(3.180)
Care about price	-25.463***	1.412	-2.820	-28.365***	4.987
	(7.180)	(4.820)	(5.614)	(5.839)	(6.007)
Consumption of innovations	0.798	-3.110***	-1.327	3.956***	-1.457
(0,...,4)	(1.754)	(1.180)	(1.371)	(1.426)	(1.467)
Follow up consumption trends	1.561	-2.918**	0.484	-0.615	4.693***
(0,...,4)	(1.824)	(1.228)	(1.427)	(1.484)	(1.526)
Consumption obeys marketing	2.236	0.375	6.031***	-1.718	-2.426
(0,...,4)	(2.034)	(1.367)	(1.591)	(1.654)	(1.702)
Care about the contain of cocoa	5.105	5.959***	11.311***	-5.425**	-6.707**
	(3.463)	(2.331)	(2.708)	(2.616)	(2.897)
Care about the amount of fat	9.068**	-3.579	2.956	10.706***	-0.861
	(4.433)	(2.984)	(3.466)	(3.605)	(3.709)
Care about organic cultivation	12.261***	-5.815**	5.749*	8.723***	3.774
	(4.193)	(2.819)	(2.279)	(3.410)	(3.508)
Care about recommendations	10.252***	6.971***	-0.520	9.343***	-5.390**
	(3.268)	(2.201)	(2.556)	(2.658)	(2.735)
Care about appearance	8.326**	4.326*	7.434***	-3.948	0.666
	(3.733)	(2.499)	(2.919)	(3.035)	(3.123)
Care about provenance	2.752	4.576	-11.869**	11.611**	-1.209
	(6.508)	(4.371)	(5.089)	(5.292)	(5.445)
n	800	800	800	800	800
$\overline{R}^2$	0.484	0.605	0.558	0.545	0.468
F	36.71***	66.38***	49.03***	46.62***	34.56***
Breusch-Pagan χ^2	550.86***	769.63***	674.48***	651.74***	527.19***

Notes: Dependent Variable is the Minimal WTP for the chocolate bar in EUR/100 (euro cent).
OLS regression with White's heteroscedasticity-robust covariance matrix.
*, **, *** indicate significance at $\alpha = 10\%$, 5% and 1% respectively.

Table A.7.: Influence of Personal Characteristics and Attitudes on the Average of WTP.

Variable	All Treatments	T1	T2	T3	T4
	Coefficient (Standard Error)				
	Personal Characteristics				
Gender	15.403***	3.159*	-1.308	11.329***	2.224
	(4.071)	(3.114)	(3.786)	(3.929)	(4.049)
Smoking	-10.945***	8.981**	-17.540***	1.784	-4.169
	(5.313)	(4.064)	(4.941)	(5.126)	(5.284)
Knowledge about chocolates brands	-0.621	1.549**	-1.042	-3.559***	2.430**
	(1.033)	(0.791)	(0.961)	(0.998)	(1.028)
Knowledge about cocoa names	-5.320***	-1.365	-0.164	-1.702	-2.089
	(1.935)	(1.480)	(1.799)	(1.867)	(1.924)
Knowledge about countries cultivating	-1.447	0.983	-4.697***	-1.181	3.448
high quality cocoa	(1.957)	(1.497)	(1.820)	(1.888)	(1.947)
Frequency of consumption	7.456***	-3.585*	-3.744	9.607***	5.178**
(0,...,4)	(2.623)	(2.006)	(2.439)	(2.531)	(2.609)
Pleasure of consumption	6.887**	-5.494**	25.715***	-28.703**	15.369
	(10.195)	(7.800)	(9.481)	(9.836)	(10.640)
	Attitudes				
Risk attitude by lottery choice	-6.434***	3.253**	-7.451***	1.803	-4.039**
	(1.949)	(1.491)	(1.812)	(1.880)	(1.938)
Care about Advertising	2.329	4.899	-6.097	-8.458**	11.985***
	(4.551)	(3.482)	(4.232)	(4.391)	(4.526)
Care about price	-19.911**	9.874	14.966*	-66.811***	22.061**
	(9.603)	(7.346)	(8.930)	(9.265)	(9.550)
Consumption of innovations	-1.497	-4.916***	-0.440	8.895***	-5.036**
(0,...,4)	(2.139)	(1.636)	(1.989)	(2.063)	(2.127)
Follow up consumption trends	3.306	-1.460	-1.031	-0.747	6.545***
(0,...,4)	(1.998)	(1.681)	(2.044)	(2.120)	(2.186)
Consumption obeys marketing	-4.525*	-1.374	5.145**	-4.025*	-4.672**
(0,...,4)	(2.437)	(1.865)	(2.267)	(2.351)	(2.424)
Care about the contain of cocoa	4.117	7.186**	16.342***	-10.895**	-8.518**
	(4.126)	(3.179)	(3.865)	(4.010)	(4.133)
Care about the amount of fat	16.287***	2.825	6.174	8.580*	-1.290
	(5.430)	(4.154)	(5.049)	(5.008)	(5.400)
Care about organic cultivation	25.829***	-6.297*	16.869***	8.574**	6.682
	(5.179)	(3.901)	(4.815)	(4.995)	(5.149)
Care about recommendations	20.587***	9.425***	0.685	15.160***	-4.684
	(3.974)	(3.040)	(3.696)	(3.834)	(3.952)
Care about appearance	17.926***	8.058**	15.457***	-10.694**	5.106
	(4.685)	(3.584)	(4.356)	(4.519)	(4.659)
Care about provenance	14.976*	6.141	-10.543**	10.613	8.763
	(8.350)	(6.388)	(7.765)	(8.055)	(8.305)
n	800	800	800	800	800
$\overline{R}^2$	0.172	0.054	0.114	0.168	0.063
F	9.73***	3.36***	6.38***	9.46***	3.79***
Breusch-Pagan χ^2	170.16***	62.87***	115.60***	165.82***	70.70***

Notes: Dependent Variable is the avWTP ((Maximal WTP + Minimal WTP) / 2) for the chocolate bar in EUR/100 (euro cent). OLS regression with White's heteroscedasticity-robust covariance matrix.
*, **, *** indicate significance at $\alpha = 10\%$, 5% and 1% respectively.

Table A.8.: Influence of Personal Characteristics and Attitudes on the WTP-Range.

Variable	All Treatments	T1	T2	T3	T4
	Coefficient (Standard Error)				
	Personal Characteristics				
Gender	9.471**	-5.825***	0.814	9.275***	5.223*
	(3.578)	(2.217)	(3.044)	(3.164)	(3.073)
Smoking	-6.816	15.415***	-16.548***	-1.370	-4.149
	(4.531)	(2.804)	(3.854)	(4.007)	(3.891)
Knowledge about chocolates brands	-1.335	1.690***	-0.139*	-3.996***	1.095
	(0.910)	(0.562)	(0.774)	(0.804)	(0.781)
Knowledge about cocoa names	-2.155	1.964*	-2.258*	2.354	-0.187
	(1.715)	(1.055)	(1.259)	(1.516)	(1.473)
Knowledge about countries cultivating	1.919	0.678	-2.396*	0.964	2.655*
high quality cocoa	(1.721)	(1.066)	(1.464)	(1.523)	(1.478)
Frequency of consumption	2.192	-4.193***	-0.365	4.713**	1.933
(0,...,4)	(2.311)	(1.431)	(1.965)	(2.043)	(1.984)
Pleasure of consumption	5.925	-5.014	1.104	4.533	5.863
	(8.303)	(5.143)	(7.063)	(7.342)	(7.130)
	Attitudes				
Risk attitude by lottery choice	-7.864***	0.641	-6.007***	0.944	-3.429**
	(1.717)	(1.061)	(1.461)	(1.519)	(1.475)
Care about Advertising	21.007***	9.153***	2.402	0.421	8.861**
	(4.022)	(2.477)	(3.421)	(3.357)	(3.454)
Care about price	-39.761***	-3.161	10.010*	-51.184***	4.993
	(7.599)	(4.693)	(6.464)	(6.719)	(6.525)
Consumption of innovations	-1.401	-1.660	-1.774	6.756***	-4.828***
(0,...,4)	(1.856)	(1.149)	(1.579)	(1.641)	(1.594)
Follow up consumption trends	4.589**	3.599***	-1.974	-1.839	4.782***
(0,...,4)	(1.931)	(1.196)	(1.642)	(1.707)	(1.658)
Consumption obeys marketing	-12.071***	-3.448***	-0.767	-3.281*	-4.495**
(0,...,4)	(2.152)	(1.331)	(1.831)	(1.903)	(1.848)
Care about the contain of cocoa	-6.040*	2.350	8.900***	-11.739***	-5.575*
	(3.665)	(2.268)	(3.117)	(3.241)	(3.147)
Care about the amount of fat	2.198	7.875***	0.070	2.164	-7.825*
	(4.691)	(2.905)	(3.991)	(4.148)	(4.029)
Care about organic cultivation	11.248**	-6.754**	14.451***	6.311*	-2.708
	(4.438)	(2.744)	(3.775)	(3.924)	(3.811)
Care about the recommendations	12.383***	1.313	-1.204	15.924***	-3.514
	(3.459)	(2.142)	(2.942)	(3.059)	(2.970)
Care about the appearance	1.344	0.708*	6.858**	-5.941*	-0.285
	(3.950)	(2.433)	(3.361)	(3.493)	(3.392)
Care about provenance	-2.785	-10.395**	-14.087**	18.618***	3.359
	(6.887)	(4.255)	(5.859)	(6.090)	(5.914)
n	800	800	800	800	800
$\overline{R}^2$	0.468	0.633	0.483	0.505	0.475
F	34.56***	73.54***	36.60***	39.86***	35.51***
Breusch-Pagan χ^2	527.19***	821.25***	549.66***	584.28***	537.73***

Notes: Dependent Variable is the WTP-Range (Maximal WTP - Minimal WTP) for the chocolate bar in EUR/100 (euro cent). OLS regression with White's heteroscedasticity-robust covariance matrix.
*, **, *** indicate significance at $\alpha = 10\%$, 5% and 1% respectively.

Table A.9.: Pooled OLS Regression Models for the WTP-Range for each Experimental Round and T1

			Experimental Rounds				
			R1	R2	R3	R4	R5
Treatment	Model	Variable	Coefficient (Standard Error)				
T1	Model I	Constant	70.952***	70.833***	70.762***	70.776***	70.823***
			(1.811)	(1.812)	(1.812)	(1.811)	(1.812)
		Alone	-14.952**	-13.583*	-12.161	-12.452	-13.373**
			(7.898)	(8.101)	(8.104)	(8.103)	(8.101)
			Control Variables				
		Personal characteristics	No	No	No	No	No
		Attitudes	No	No	No	No	No
		n	800	800	800	800	800
		$\overline{R}^2$	0.031	0.022	0.015	0.017	0.021
		F	3.41**	2.81*	2.25*	2.36*	2.72*
		Breusch-Pagan χ^2	3.41**	2.81*	2.25*	2.36*	2.73*
T1	Model II	Constant	70.081***	70.046***	70.011***	70.019***	70.042***
			(7.933)	(7.936)	(7.938)	(7.937)	(7.936)
		Alone	-10.871*	-9.482	-8.038	-8.332	-9.267
			(7.018)	(7.020)	(7.023)	(7.022)	(7.021)
			Control Variables				
		Personal characteristics	Yes	Yes	Yes	Yes	Yes
		Attitudes	No	No	No	No	No
		n	800	800	800	800	800
		$\overline{R}^2$	0.037	0.038	0.036	0.037	0.038
		F	4.50***	4.45***	4.40***	4.41***	4.40***
		Breusch-Pagan χ^2	39.99***	39.55***	39.15***	39.23***	39.48***
T1	Model III	Constant	90.910***	90.918***	90.925***	90.924***	90.919***
			(9.799)	(9.803)	(9.806)	(9.806)	(9.803)
		Alone	-14.848**	-13.468**	-12.036**	-12.328	-13.256**
			(7.758)	(7.761)	(7.765)	(7.764)	(7.752)
			Control Variables				
		Personal characteristics	No	No	No	No	No
		Attitudes	Yes	Yes	Yes	Yes	Yes
		n	800	800	800	800	800
		$\overline{R}^2$	0.092	0.091	0.091	0.091	0.091
		F	7.78***	7.71***	7.66***	7.67***	7.71***
		Breusch-Pagan χ^2	89.63***	88.97***	88.36***	88.48***	88.88***
T1	Model IV	Constant	83.236**	83.242***	83.248***	83.247***	83.244***
			(11.481)	(11.485)	(11.489)	(11.487)	(11.484)
		Alone	-11.919*	-10.520*	-9.067	-9.364	-10.463*
			(7.032)	(7.035)	(7.037)	(7.037)	(7.039)
			Control Variables				
		Personal characteristics	Yes	Yes	Yes	Yes	Yes
		Attitudes	Yes	Yes	Yes	Yes	Yes
		n	800	800	800	800	800
		$\overline{R}^2$	0.133	0.133	0.133	0.132	0.133
		F	7.15***	7.12***	7.09***	7.10***	7.11***
		Breusch-Pagan χ^2	134.86***	134.31***	133.81***	133.91***	133.96***

Notes: Dependent Variable is WTP-Range for the chocolate bar in EUR/100 (euro cent).
OLS regression with White's heteroscedasticity-robust covariance matrix.
*, **, *** indicate significance at $\alpha = 10\%$, 5% and 1% respectively.

Table A.10.: Pooled OLS Regression Models for WTP-Range for each Experimental Round and T2

Treatment	Model	Variable	Coefficient				
T2	Model V	Constant	60.290***	61.005***	60.615***	61.113***	61.013***
			(2.701)	(2.661)	(2.681)	(2.660)	(2.653)
		Partner	10.792	0.616	7.649	-3.176	0.522
			(7.874)	(7.873)	(7.848)	(7.980)	(7.916)
		Attitude of individual i	11.347***	11.196***	11.196***	11.281***	11.181***
			(2.001)	(1.997)	(1.998)	(2.017)	(2.005)
		Attitude of individual j	-1.268	-1.278	-1.197	-1.203	-1.139
			(1.977)	(1.981)	(1.980)	(1.983)	(1.977)
		Interactions	2.878***	2.826***	2.804***	2.839***	2.813***
			(0.626)	(0.625)	(0.626)	(0.628)	(0.631)
			Control Variables				
		Personal characteristics	No	No	No	No	No
		Attitudes	No	No	No	No	No
		n	800	800	800	800	800
		$\overline{R}^2$	0.070	0.069	0.068	0.068	0.068
		F	16.02***	15.77***	15.57***	15.56***	15.51***
		Breusch-Pagan χ^2	62.01***	60.08***	60.35***	60.29***	60.13***
T2	Model VI	Constant	62.951***	63.366***	63.167***	63.392***	63.357***
			(8.051)	(8.047)	(8.048)	(8.045)	(8.046)
		Partner	7.896	-0.499	5.473	-3.791	-0.517*
			(7.860)	(7.823)	(7.818)	(7.926)	(7.863)
		Attitude of individual i	10.810***	10.679***	10.695***	10.809***	10.662***
			(2.002)	(2.001)	(2.000)	(2.019)	(2.007)
		Attitude of individual j	-0.965	-0.857	-0.968	-0.937	-0.863
			(1.963)	(1.964)	(1.967)	(1.968)	(1.962)
		Interactions	2.190***	2.131***	2.143***	2.150***	2.133***
			(0.651)	(0.650)	(0.649)	(0.650)	(0.653)
			Control Variables				
		Personal characteristics	Yes	Yes	Yes	Yes	Yes
		Attitudes	No	No	No	No	No
		n	800	800	800	800	800
		$\overline{R}^2$	0.088	0.086	0.087	0.087	0.086
		F	7.36***	7.26***	7.30***	7.28***	7.26***
		Breusch-Pagan χ^2	85.04***	83.99***	84.49***	84.22***	83.99***

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Table A.10 -- continued from previous page

Treatment	Model	Variable	Coefficients				
T2	Model VII	Constant	85.269***	85.466***	85.409***	85.389***	85.515***
			(9.768)	(9.785)	(9.775)	(9.785)	(9.791)
		Partner	12.196	2.528	9.295	-1.113	2.172
			(7.584)	(7.573)	(7.552)	(7.671)	(7.625)
		Attitude of individual i	10.795***	10.534***	10.613***	10.591***	10.608***
			(1.934)	(1.932)	(1.930)	(1.948)	(1.941)
		Attitude of individual j	-1.602	-1.486	-1.631	-1.482	-1.460
			(1.899)	(1.901)	(1.902)	(1.905)	(1.900)
		Interactions	2.719***	2.630***	2.658***	2.654***	2.623***
			(0.607)	(0.609)	(0.606)	(0.609)	(0.612)
			Control Variables				
		Personal characteristics	No	No	No	No	No
		Attitudes	Yes	Yes	Yes	Yes	Yes
		n	800	800	800	800	800
		$\overline{R}^2$	0.152	0.149	0.151	0.149	0.149
		F	10.50***	10.30***	10.42***	10.30***	10.30***
		Breusch-Pagan χ^2	146.46***	143.94***	145.37***	143.85***	143.91***
T2	Model VIII	Constant	80.412***	80.444***	80.458***	80.332***	80.742***
			(11.438)	(11.454)	(11.443)	(11.453)	(11.462)
		Partner	10.074	2.028	7.795	-1.030	1.568
			(7.507)	(7.474)	(7.466)	(7.569)	(7.523)
		Attitude of individual i	9.993***	9.800***	9.843***	9.831***	9.837***
			(1.927)	(1.925)	(1.923)	(1.941)	(1.934)
		Attitude of individual j	-1.350	-1.245	-1.374	-1.242	-1.223
			(1.877)	(1.879)	(1.881)	(1.883)	(1.877)
		Interactions	2.153***	2.064***	2.096***	2.082***	2.060***
			(0.626)	(0.626)	(0.624)	(0.626)	(0.629)
			Control Variables				
		Personal characteristics	Yes	Yes	Yes	Yes	Yes
		Attitudes	Yes	Yes	Yes	Yes	Yes
		n	800	800	800	800	800
		$\overline{R}^2$	0.177	0.174	0.176	0.175	0.175
		F	8.44***	8.34***	8.40***	8.34***	8.34***
		Breusch-Pagan χ^2	178.52***	176.74***	177.79***	176.68***	176.71***

Notes: Dependent Variable is WTP-Range for the chocolate bar in EUR/100 (euro cent).
OLS regression with White's heteroscedasticity-robust covariance matrix.
*, **, *** indicate significance at $\alpha = 10\%$, 5% and 1% respectively.

Table A.11.: Pooled OLS Regression Models for WTP-Range for each Experimental Round and T3

Treatment	Model	Variable	Coefficient				
T3	Model IX	Constant	60.890***	61.214***	60.879***	61.296***	61.183***
			(2.667)	(2.679)	(2.667)	(2.671)	(2.653)
		Stranger	3.405	-3.806	3.744	-6.363	-8.419
			(7.861)	(7.842)	(7.853)	(7.893)	(7.947)
		Attitude of individual i	11.237***	11.220***	11.196***	11.350***	10.860***
			(2.004)	(2.001)	(1.998)	(2.010)	(2.019)
		Attitude of individual j	-1.117	-1.117	-1.197	-1.207	-1.163
			(1.977)	(1.978)	(1.980)	(1.978)	(1.975)
		Interactions	2.806***	2.817***	2.804***	2.832***	2.899***
			(0.626)	(0.625)	(0.626)	(0.626)	(0.631)
			Control Variables				
		Personal characteristics	No	No	No	No	No
		Attitudes	No	No	No	No	No
		n	800	800	800	800	800
		$\overline{R}^2$	0.067	0.068	0.068	0.068	0.069
		F	15.56***	15.58***	15.57***	15.69***	15.82***
		Breusch-Pagan χ^2	60.31***	60.36***	60.35***	60.78***	61.25***
T3	Model X	Constant	62.963***	63.807***	62.915***	64.005***	64.007***
			(8.088)	(8.103)	(8.089)	(8.094)	(8.068)
		Stranger	3.725	-3.597	4.108	-5.573	-7.702*
			(7.806)	(7.791)	(7.799)	(7.845)	(7.895)
		Attitude of individual i	10.747***	10.726***	10.701***	10.841***	10.392***
			(2.005)	(2.002)	(2.000)	(2.012)	(2.020)
		Attitude of individual j	-0.839	-0.842	-0.928	-0.922	-0.886
			(1.963)	(1.962)	(1.966)	(1.963)	(1.961)
		Interactions	2.114***	2.126***	2.112***	2.140***	2.205***
			(0.649)	(0.649)	(0.650)	(0.650)	(0.653)
			Control Variables				
		Personal characteristics	Yes	Yes	Yes	Yes	Yes
		Attitudes	No	No	No	No	No
		n	800	800	800	800	800
		$\overline{R}^2$	0.086	0.087	0.086	0.086	0.087
		F	7.28***	7.28***	7.29***	7.31***	7.35***
		Breusch-Pagan χ^2	84.22***	84.20***	84.27***	84.50***	84.95***

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Table A.11 -- continued from previous page

Treatment	Model	Variable	Coefficients				
T3	Model XI	Constant	85.112***	86.220***	85.015***	86.603***	85.915***
			(9.840)	(9.861)	(9.775)	(9.856)	(9.803)
		Stranger	2.112	-4.926	9.295	-7.395	-5.107
			(7.583)	(7.573)	(7.552)	(7.631)	(7.598)
		Attitude of individual i	10.591***	10.637***	10.565***	10.792***	10.618***
			(1.934)	(1.935)	(1.932)	(1.946)	(1.940)
		Attitude of individual j	-1.445	-1.431	-1.502	-1.539	-1.498
			(1.901)	(1.899)	(1.903)	(1.901)	(1.900)
		Interactions	2.639***	2.646***	2.636***	2.665***	2.637***
			(0.607)	(0.606)	(0.607)	(0.606)	(0.607)
			Control Variables				
		Personal characteristics	No	No	No	No	No
		Attitudes	Yes	Yes	Yes	Yes	Yes
		n	800	800	800	800	800
		$\overline{R}^2$	0.148	0.149	0.148	0.150	0.149
		F	10.30***	10.33***	10.30***	10.37***	10.30***
		Breusch-Pagan χ^2	143.90***	144.26***	143.96***	144.78***	143.96***
T3	Model XII	Constant	79.825***	81.229***	79.668***	81.607***	81.742***
			(11.533)	(11.560)	(11.539)	(11.556)	(11.501)
		Stranger	2.918	-4.042	3.628	-5.912	-8.884
			(7.489)	(7.482)	(7.485)	(7.542)	(7.573)
		Attitude of individual i	9.847***	9.867***	9.811***	9.993***	9.486***
			(1.928)	(1.928)	(1.924)	(1.941)	(1.941)
		Attitude of individual j	-1.202	-1.198	-1.281	-1.286	-1.253
			(1.877)	(1.877)	(1.880)	(1.878)	(1.875)
		Interactions	2.065***	2.075***	2.061***	2.092***	2.170***
			(0.625)	(0.624)	(0.625)	(0.624)	(0.629)
			Control Variables				
		Personal characteristics	Yes	Yes	Yes	Yes	Yes
		Attitudes	Yes	Yes	Yes	Yes	Yes
		n	800	800	800	800	800
		$\overline{R}^2$	0.174	0.175	0.174	0.175	0.176
		F	8.35***	8.35***	8.35***	8.37***	8.41***
		Breusch-Pagan χ^2	176.82***	176.97***	176.91***	177.30***	178.08***

Notes: Dependent Variable is WTP-Range for the chocolate bar in EUR/100 (euro cent).
OLS regression with White's heteroscedasticity-robust covariance matrix.
*, **, *** indicate significance at $\alpha = 10\%$, 5% and 1% respectively.

Table A.12.: Pooled OLS Regression Models for WTP-Range for each Experimental Round and T4

Treatment	Model	Variable	Coefficient				
T4	Model XIII	Constant	61.039***	61.010***	60.971***	61.034***	61.021***
			(2.650)	(2.648)	(2.653)	(2.651)	(2.651)
		Group	3.120	8.464	3.818	-1.491	-0.137
			(8.041)	(7.993)	(7.916)	(8.028)	(8.064)
		Attitude of individual i	11.259***	11.234***	11.180***	11.209***	11.166***
			(2.011)	(1.997)	(1.998)	(2.010)	(2.007)
		Attitude of individual j	-1.142	-1.339	-1.186	-1.160	-1.143
			(1.977)	(1.984)	(1.980)	(1.980)	(1.984)
		Interactions	2.765***	2.691***	2.776***	2.638***	2.820***
			(0.640)	(0.636)	(0.632)	(0.634)	(0.640)
			Control Variables				
		Personal characteristics	No	No	No	No	No
		Attitudes	No	No	No	No	No
		n	800	800	800	800	800
		$\overline{R}^2$	0.068	0.070	0.069	0.068	0.068
		F	15.55***	15.82***	15.58***	15.52***	15.51***
		Breusch-Pagan χ^2	60.28***	61.25***	60.36***	60.16***	60.13***
T4	Model XIV	Constant	63.473***	63.553***	63.393***	63.350***	63.373***
			(8.049)	(9.776)	(8.045)	(8.047)	(8.050)
		Group	3.380	8.612	3.655	-0.832	0.320
			(7.969)	(7.918)	(7.840)	(7.954)	(7.991)
		Attitude of individual i	10.774***	10.744***	10.686***	10.696***	10.682***
			(2.013)	(1.999)	(1.999)	(2.010)	(2.008)
		Attitude of individual j	-0.866	-1.066	-0.909	-0.876	-0.856
			(1.962)	(1.970)	(1.965)	(1.965)	(1.969)
		Interactions	2.068***	1.995***	2.086***	2.139***	2.123***
			(0.664)	(0.660)	(0.655)	(0.658)	(0.664)
			Control Variables				
		Personal characteristics	Yes	Yes	Yes	Yes	Yes
		Attitudes	No	No	No	No	No
		n	800	800	800	800	800
		$\overline{R}^2$	0.087	0.088	0.087	0.086	0.086
		F	7.28***	7.37***	7.28***	7.26***	7.26***
		Breusch-Pagan χ^2	84.17***	85.19***	84.21***	84.00***	83.99***

Continued on next page

Table A.12 -- continued from previous page

Treatment	Model	Variable	Coefficients				
T4	Model XV	Constant	85.470***	85.452***	85.368***	85.422***	85.399***
			(9.785)	(9.776)	(9.783)	(9.785)	(9.785)
		Group	2.942	8.619	3.814	-1.259	-0.388
			(7.715)	(7.671)	(7.596)	(7.709)	(7.737)
		Attitude of individual i	10.639***	10.613***	10.563***	10.589***	10.545***
			(1.944)	(1.931)	(1.391)	(1.943)	(1.941)
		Attitude of individual j	-1.463	-1.667	-1.509	-1.477	-1.469
			(1.899)	(1.906)	(1.901)	(1.902)	(1.906)
		Interactions	2.598***	2.520***	2.605***	2.664***	2.654***
			(0.620)	(0.617)	(0.613)	(0.615)	(0.620)
			Control Variables				
		Personal characteristics	No	No	No	No	No
		Attitudes	Yes	Yes	Yes	Yes	Yes
		n	800	800	800	800	800
		$\overline{R}^2$	0.149	0.150	0.149	0.149	0.149
		F	31***	10.39***	10.31***	10.30***	10.29***
		Breusch-Pagan χ^2	143.97***	143.94***	144.48***	143.85***	143.83***
T4	Model XVI	Constant	80.481***	80.600***	80.408***	80.352***	80.331***
			(11.456)	(11.444)	(11.450)	(11.451)	(11.456)
		Group	2.429	8.134	3.099	-1.125	-0.710
			(7.606)	(7.560)	(7.486)	(7.597)	(7.628)
		Attitude of individual i	9.868***	9.856***	9.804***	9.828***	9.779***
			(1.937)	(1.923)	(1.924)	(1.936)	(1.933)
		Attitude of individual j	-1.224	-1.417	-1.261	-1.239	-1.239
			(1.877)	(1.885)	(1.879)	(1.880)	(1.885)
		Interactions	2.035***	1.995***	2.044***	2.091***	2.089***
			(0.637)	(0.634)	(0.629)	(0.632)	(0.638)
			Control Variables				
		Personal characteristics	Yes	Yes	Yes	Yes	Yes
		Attitudes	Yes	Yes	Yes	Yes	Yes
		n	800	800	800	800	800
		$\overline{R}^2$	0.175	0.176	0.175	0.175	0.175
		F	8.34***	8.40***	8.35***	8.34***	8.35***
		Breusch-Pagan χ^2	176.77***	177.86***	176.84***	176.69***	176.67***

Notes: Dependent Variable is WTP-Range for the chocolate bar in EUR/100 (euro cent).
OLS regression with White's heteroscedasticity-robust covariance matrix.
*, **, *** indicate significance at $\alpha = 10\%$, 5% and 1% respectively.

Table A.13.: OLS for Standard Deviation of WTP-Range for T1

Variable	Model I	Model II	Model III	Model IV
	Coefficient (Standard Error)			
Constant	16.563***	17.878***	12.498***	13.451***
	(1.436)	(4.771)	(4.650)	(4.650)
StdvT1	-6.678***	-4.745	-6.793***	-5.138**
	(2.279)	(2.281)	(2.377)	(2.236)
	Control Variables			
Personal characteristics	No	Yes	No	Yes
Attitudes	No	No	Yes	Yes
n	800	800	800	800
$\overline{R}^2$	0.031	0.037	0.085	0.100
F	6.08 **	1.68**	2.23**	1.87**
Breusch-Pagan χ^2	4.77**	50.11***	42.76***	91.25***

Notes: Dependent Variable is the Standard Deviation of WTP-Range for the chocolate bar in EUR/100 (euro cent). Least Squares with Group Dummy Variables. OLS regression with White's heteroscedasticity-robust covariance matrix. *, **, *** indicate significance at $\alpha = 10\%$, 5% and 1% respectively.

Table A.14.: OLS for Standard Deviation of WTP-Range for T2

Variable	Model V	Model VI	Model VII	Model VIII
	Coefficient (Standard Error)			
Constant	11.478***	15.220***	10.491**	13.075
	(1.836)	(4.895)	(3.922)	(5.872)
StdvT2	1.105	0.085	1.392	0.343
	(2.552)	(2.569)	(2.604)	(2.485)
$Cummatt_i$	0.411**	0.356*	0.367**	0.304
	(0.188)	(0.169)	(0.178)	(0.193)
$Cummatt_j$	0.254	0.268	0.257	0.271*
	(0.208)	(0.193)	(0.207)	(0.131)
	Control Variables			
Personal characteristics	No	Yes	No	Yes
Attitudes	No	No	Yes	Yes
n	800	800	800	800
$\overline{R}^2$	0.049	0.059	0.092	0.108
F	3.71***	1.89**	2.15***	1.87
Breusch-Pagan χ^2	6.79***	59.01***	47.61***	108.19

Notes: Dependent Variable is the Standard Deviation of WTP-Range for the chocolate bar in EUR/100 (euro cent). Least Squares with Group Dummy Variables. OLS regression with White's heteroscedasticity-robust covariance matrix. *, **, *** indicate significance at $\alpha = 10\%$, 5% and 1% respectively.

Table A.15.: OLS for Standard Deviation of WTP-Range for T3

Variable	Model IX	Model X	Model XI	Model XII
	Coefficient (Standard Error)			
Constant	11.093***	14.318***	8.490**	10.542
	(1.477)	(4.838)	(5.010)	(7.149)
StdvT3	2.841	2.657	3.068	3.126
	(3.387)	(3.471)	(3.373)	(3.407)
$Cummatt_i$	0.410**	0.345**	0.356**	0.286*
	(0.125)	(0.202)	(0.174)	(0.144)
$Cummatt_j$	0.246	0.247	0.258	0.255
	(0.235)	(0.217)	(0.227)	(0.201)
	Control Variables			
Personal characteristics	No	Yes	No	Yes
Attitudes	No	No	Yes	Yes
n	800	800	800	800
$\overline{R}^2$	0.055	0.065	0.098	0.116
F	4.05***	1.99**	2.23***	1.94**
Breusch-Pagan χ^2	15.84***	62.01***	48.38***	101.13***

Notes: Dependent Variable is the Standard Deviation of WTP-Range for the chocolate bar in EUR/100 (euro cent). Least Squares with Group Dummy Variables. OLS regression with White's heteroscedasticity-robust covariance matrix. *, **, *** indicate significance at $\alpha = 10\%$, 5% and 1% respectively.

Table A.16.: OLS for Standard Deviation of WTP-Range for T4

Variable	Model XIII	Model XIV	Model XV	Model XVI
			Coefficient	
			(Standard Error)	
Constant	11.931***	15.405***	11.103***	13.114**
	(1.859)	(4.907)	(3.942)	(5.855)
StdvT4	-1.528*	-1.941	-1.542	-1.918
	(2.368)	(2.434)	(2.246)	(2.393)
$Cummatt_i$	0.426**	0.366**	0.383**	0.316*
	(0.183)	(0.166)	(0.174)	(0.188)
$Cummatt_j$	0.282	0.284	0.290	0.291
	(0.219)	(0.203)	(0.214)	(0.198)
			Control Variables	
Personal characteristics	No	Yes	No	Yes
Attitudes	No	No	Yes	Yes
n	800	800	800	800
$\overline{R}^2$	0.050	0.062	0.093	0.111
F	3.77***	1.94**	2.15**	1.90***
Breusch-Pagan χ^2	8.44**	57.51***	45.49***	103.76***

Notes: Dependent Variable is the Standard Deviation of WTP-Range for the chocolate bar in EUR/100 (euro cent). Least Squares with Group Dummy Variables. OLS regression with White's heteroscedasticity-robust covariance matrix. *, **, *** indicate significance at $\alpha = 10\%$, 5% and 1% respectively.

Table A.17.: OLS for Standard Deviation of WTP-Range for All Treatments

Variable	Model XVII	Model XVIII	Model XIX	Model XX
	Coefficient (Standard Error)			
Constant	9.886***	14.251**	6.792	10.028
	(1.769)	(5.017)	(6.048)	(7.672)
StdvT2	3.520	0.935	4.117	1.905
	(3.381)	(3.419)	(3.719)	(3.491)
StdvT3	4.704	2.979	5.347	3.933
	(4.622)	(4.554)	(4.902)	(4.716)
StdvT4	1.545	-0.561	1.925	0.219
	(3.188)	(3.274)	(3.172)	(3.117)
$Cummatt_i$	0.371**	0.345*	0.312*	0.273
	(0.167)	(0.205)	(0.184)	(0.207)
$Cummatt_j$	0.173	0.239	0.164	0.220
	(0.266)	(0.242)	(0.268)	(0.244)
	Control Variables			
Personal characteristics	No	Yes	No	Yes
Attitudes	No	No	Yes	Yes
n	800	800	800	800
$\overline{R}^2$	0.048	0.053	0.092	0.105
F	2.60**	1.68*	2.01**	1.77**
Breusch-Pagan χ^2	19.42***	61.51***	57.97***	99.96***

Notes: Dependent Variable is the Standard Deviation of WTP-Range for the chocolate bar in EUR/100 (euro cent). Least Squares with Group Dummy Variables. OLS regression with White's heteroscedasticity-robust covariance matrix. *, **, *** indicate significance at $\alpha = 10\%$, 5% and 1% respectively.

B. Knowledge, Attitudes, and Habits

B.1. Original text of the audio tape to welcome the participants

Welcome to the chocolate experiment at the Laboratory for Experimental Economics.

The experiment consists of two parts:

In the first one, you will be asked about your knowledge about chocolates and your willingness to pay for a chocolate bar. To enable you to buy, you will receive an initial budget of 5 EUR. In case that you buy the chocolate bar, you will receive it at the end of the experiment together with the difference to your initial endowment.

In the next part, you will participate in a lottery where you can additionaly increase your money earned to a maximum of 5 EUR.

After you complete these two parts, you will be asked to individually complete a questionnaire. Please answer these questions carefully.

The rules about the procedure of the experiment will be exactly explained. Please, always follow the instructions appearing on your computer screen.

Make all you decisions unhurriedly. Quick answers will not influence the duration of the experiment.

Please keep quiet during the experiment otherwise the results of the experiment may lose their scientific validity. If you have any question, please raise your hand

and the experimentalist will help you.

Thank you in advance for your participation.

B.2. Questions Applied in the First Part of the Experiment: Original Screens and Corresponding Translations

B.2.1. welcome

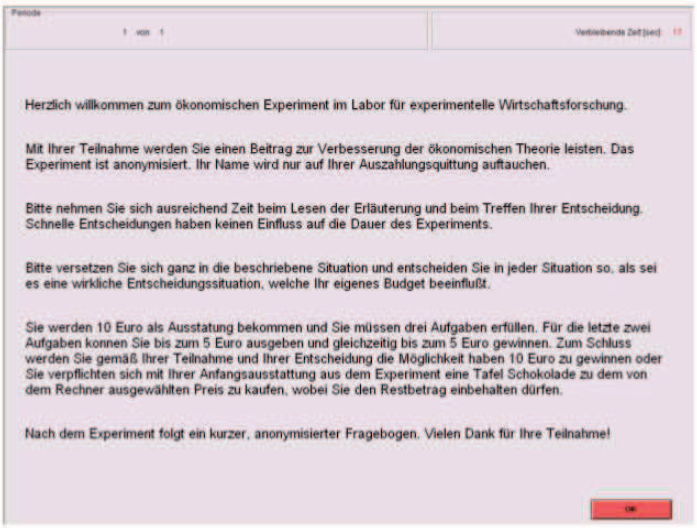


Figure B.1.: Screen 1.

Welcome to this economic experiment at the *Labor für experimentelle Wirtschaftsforchung*. With your participation, you will contribute to improving the economic theory. The experiment is completely anonymized. Your name will only appear in the receipt of payment.

Please take enough time to read the instructions and to make your choices. Quick choices do not influence the lasting of the experiment.

Please try to immerse yourself totally in the described situation and make your choices as if they were real choices influencing your budget.

In the first part, you will be asked about your knowledge and willingness to pay for a chocolate bar. To buy the chocolate bar, you will receive 5 EUR. In the expeirment, you will get the possibility to buy the chocolate bar. If you buy the chocolate bar, you will receive it at the end of the experiment together with your payment.

At the end of the experiment follows a short, anonymized questionnaire. Thank you for your participation!

B.2.2. Introduction and first part of the Experiment

Figure B.2.: Screen 2.

Within this part of the experiment, you will be asked about your knowledge and attitudes towards chocolate. Take enough time and make your choices unhurriedly.

For each question, there are more than one answer.

To begin the experiemnt please press START.

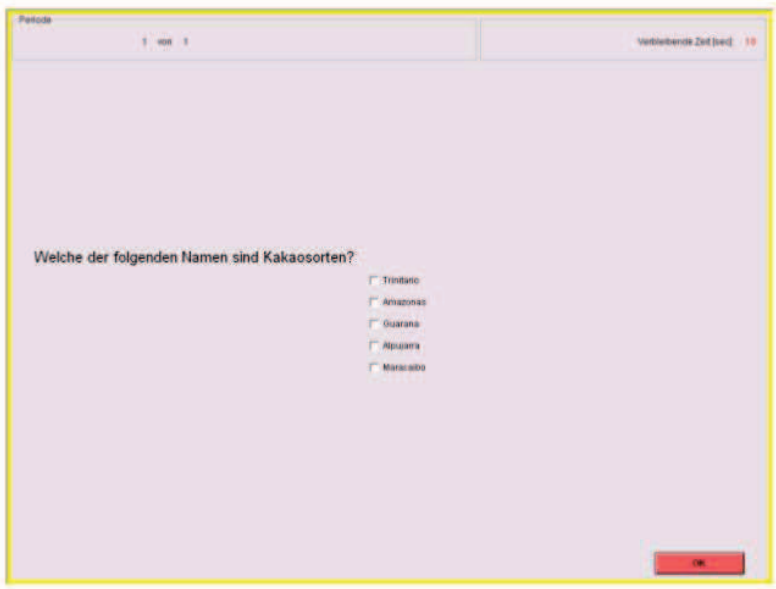


Figure B.3.: Screen 3.

1. From the following list of names, which of them are cacao names?

- a. Trinitario
- b. Amazonas
- c. Guarana
- d. Alpujarra
- e. Maracaibo
- f. No idea

Right answers: a, b and e.

2. From the following countries, which of them are known for producing high quality cacao?

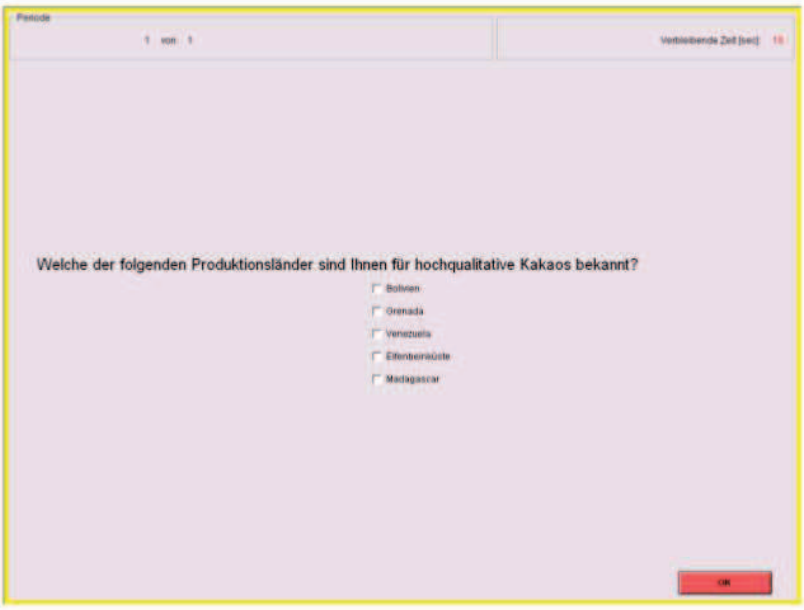


Figure B.4.: Screen 4.

- a. Bolivia
- b. Grenada
- c. Venezuela
- d. Ivory Coast
- e. Madagascar
- f. No idea

Right answers: c, d, and e.

3. How often do you eat chocolate?

- At least once a day (4)
- At least once a week (3)
- At least once a month (2)

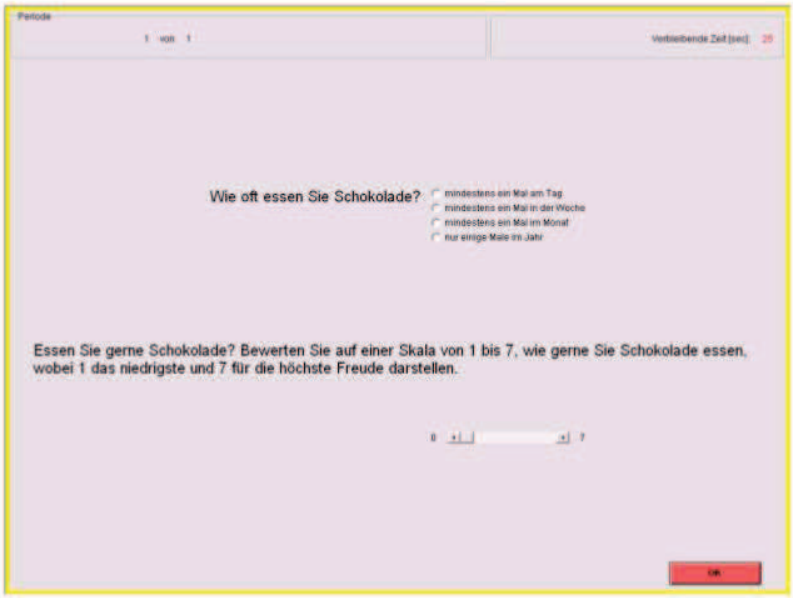


Figure B.5.: Screen 5.

- Only sometimes within the year (1)
- Never (0)

4. Do you like to eat chocolates? Choose from a scale from 0 to 7 the level of pleasure that you exert by eating chocolate

The following set of questions were designed as yes/no questions:

5. When you decide to buy a chocolate bar, do you care about the percentage of cacao contained in it?

6. Do you care about the fat contents of the chocolate bar?

7. Do you care about an organic cultivation of the cacao inside the chocolate bar?

8. Do you care about recommendations to choose chocolates?

9. Do you care about the package (presentation) of the chocolate bar?

10. Do you care about the provenance of the cacao contained in the chocolate bar?

Figure B.6.: Screen 6.

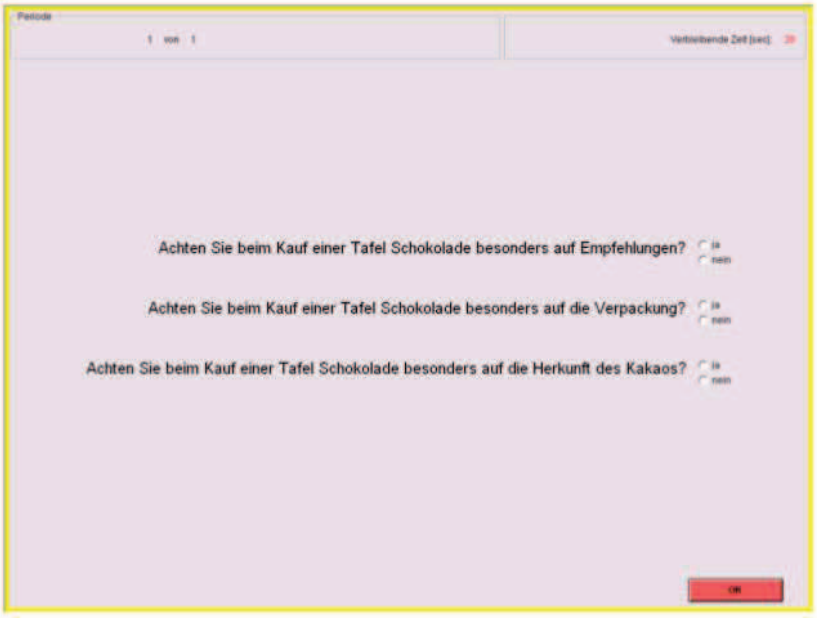


Figure B.7.: Screen 7.

C. Translation of Instructions for Payments

The whole experiment consists of three parts. The mechanism described below onlyrefers to the second part.

Your earnings in the second part of the experiment will be calculated as follows:

You will receive different infomation in a total of five experimental rounds. In each round, you will be asked for your maximal and minimal willingness to pay (WTP) for the offered chocolate. The minimal WTP refers to the minimal price that you will pay for the chocolate. The maximal WTP refers to the maximal price that you will pay for it.

Procedure:

You will get five subsequent bits of information, and after each information you will be asked about your maximal and minimal WTP. You can, therefore, adjust your WTP according to each additional information.

The fifth and last maximal and minimal WTP will be compared with a randomly generated market price, following the pattern described below. This mechanism will lead you to buy the chocolate at the randomly generated market price or to get your whole initial endowment back.

Figure 1. $Marketprice > MaxWTP > minWTP$. When the randomly generated market price is higher than your maximal WTP, you will buy nothing and retain your 5 EUR.

Figure 2. $MaxWTP > Marketprice > minWTP$. When the randomly gener-

ated market price is located between your maximal and minimal WTP, you will buy the chocolate bar with a probability of 50% at the market price and you will receive the rest of your endowment.

Figure 3. $MaxWTP > minWTP > Marketprice$. When the randomly generated market price is smaller than your minimal WTP, you will buy the chocolate bar for the market price and receive the difference to your initial endowment.

If you have any questions, please raise your hand. Someone from the eperimentalist team will come to you and assist you. Thank you.

Auszahlung für den zweiten Teil des Experimentes

Insgesamt besteht das Experiment aus drei Teilen. Der unten beschriebene Mechanismus bezieht sich auf den zweiten Teil des Experimentes.

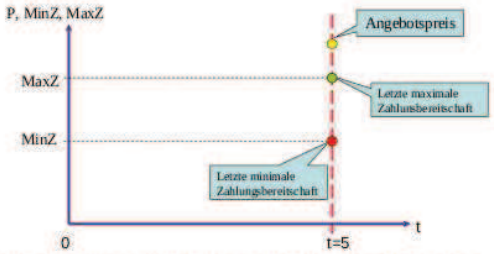
Ihre Auszahlung für den zweiten Teils des Experimentes wird wie folgt ausgerechnet:

Sie werden nacheinander fünf verschiedene Informationen erhalten und insgesamt fünfmal nach Ihrer gewünschten minimalen und maximalen Zahlungsbereitschaft gefragt. Wobei die minimale Zahlungsbereitschaft den Preis angibt, den Sie minimal (mindestens) zu zahlen bereit sind. Hingegen gibt die maximale Zahlungsbereitschaft an, welchen Preis Sie maximal (höchstens) zu zahlen bereit sind.

Ablauf:
Es werden Ihnen nacheinander 5 Informationen gegeben, nach jeder einzelnen Information werden Sie gefragt, wie hoch ihre minimale und maximale Zahlungsbereitschaft ist. Sie können also nach jeder zusätzlichen Information gegebenenfalls ihre Zahlungsbereitschaften anpassen.

Die fünfte und damit letzte maximale und minimale Zahlungsbereitschaft (in t=5) werden mit einem zufällig generierten Preis, dem Angebotspreis, nach unten beschriebenen Schema verglichen. Dieser Mechanismus führt entweder zum Kauf zum Angebotspreis oder dazu dass Sie ihren Geldbetrag behalten.

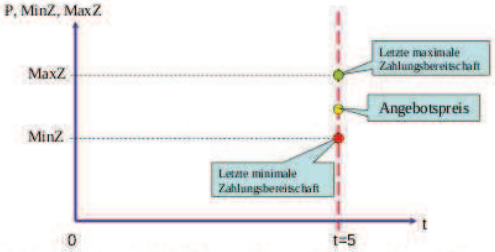
Abbildung 1: Angebotspreis > Max. Z. >Min Z.



Wenn der Angebotspreis größer als Ihre maximale Zahlungsbereitschaft ist, dann kaufen Sie nichts und behalten Ihre 5 Euro.

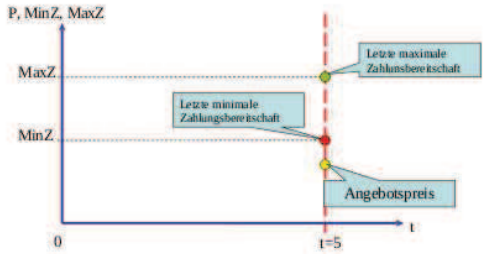
Figure C.1.: Instructions about the payment of our participants: first part.

Abbildung 2: Max. Z. > Angebotspreis >Min Z.



Wenn der Angebotspreis zwischen Ihrer angegebenen minimalen und maximalen Zahlungsbereitschaft liegt, dann kaufen Sie in 5 aus 10 Fälle (50% Warscheinlichkeit) die Tafel Schokolade zum Angebotspreis und behalten den Restbetrag.

Abbildung 3: Max. Z. > Min. Z > Angebotspreis



Wenn der Angebotspreis kleiner als Ihre minimale Zahlungsbereitschaft ist, dann kaufen Sie die Tafel Schokolade zum Angebotspreis und behalten den Restbetrag.

Falls Sie noch Fragen haben, dann heben Sie bitte die Hand. Es wird dann jemand zu Ihnen an den Platz kommen. Vielen Dank.

Figure C.2.: Instructions about the payment of our participants: second part.

D. Sensory Experience

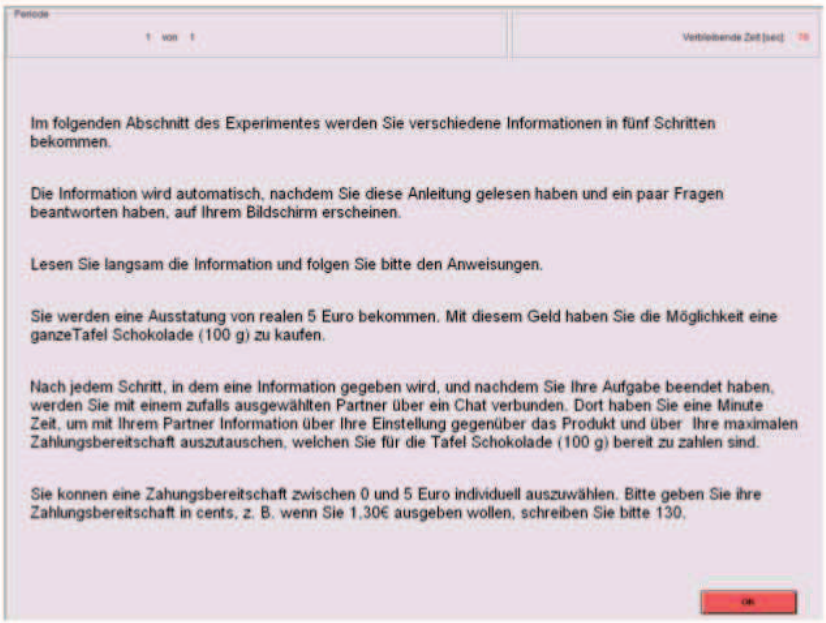


Figure D.1.: Screen 8. Instructions.

Screen 8. In the following part of the experiment, you will receive information in five steps. The information will be automatically displayed on your computer screen after you have finished reading these instructions and after you have answered two questions related to it.

Please read the information carefully and follow all the instructions. You will be endowed with five (5) EUR. With this money, you can buy a chocolate bar of 100 gr.

After each step of information aggregation, and once you finish the described task, you will be connected to a partner via chat. Thereafter, you have a minute to exchange information with your partner regarding your attitude and willingness to pay (WTP) for the whole chocolate bar of 100 gr. (This part appears only for T2, T3, and T4).

You can choose your WTP individually between zero (0) and five (5) EUR. Please state your WTP in cents. For example, if you want to expend 1,30 Euro, please write 130.

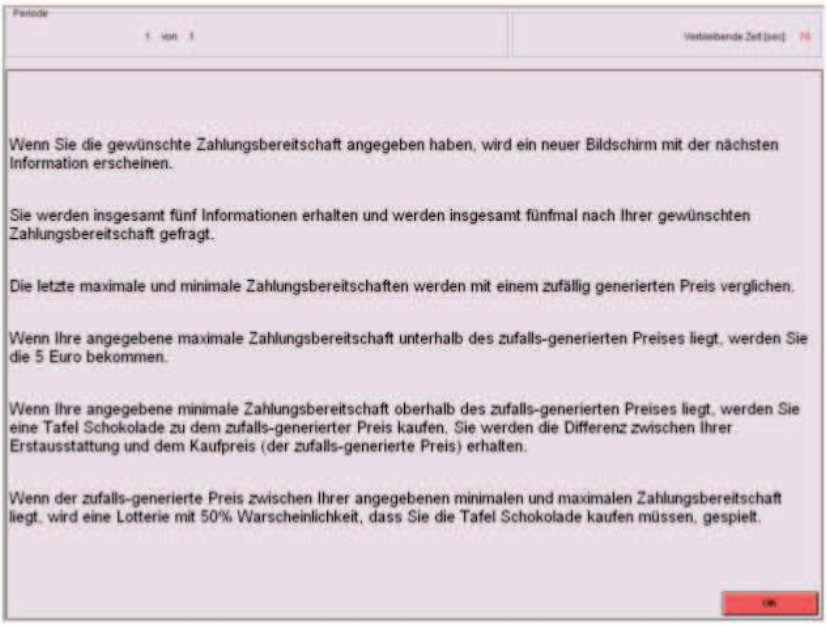


Figure D.2.: Screen 9. Instructions.

Screen 9. Once you have stated your WTP, a new screen will be displayed with the next information. You will get a total of five informational rounds and you will be asked five times to state your WTP.

The last maximal and minimal WTP will be compared with a randomly generated market price.

If your maximal WTP is below the randomly generated market price, you receive the five Euros at the end of the experiment.

If your minimal WTP is above the randomly generated market price, you will buy the chocolate bar at the randomly generated market price. At the end of the experiment, you receive the chocolate bar and the difference between your initial endowment and the purchase price.

If the randomly generated market price is between your minimal and maximal WTP, you automatically participate in a lottery with a 50% probability to buy the chocolate bar.

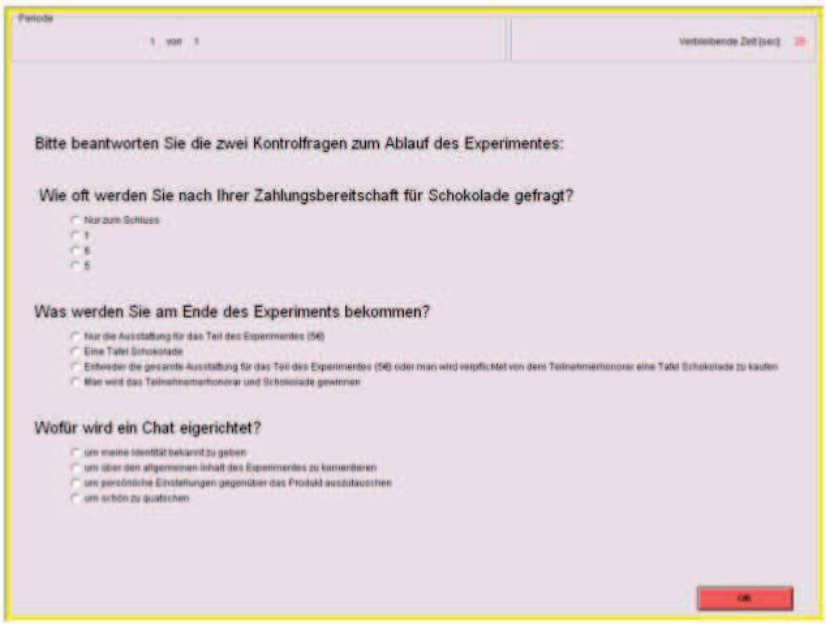


Figure D.3.: Screen 10. Control Questions.

Screen 10. Please answer the following control questions about the experimental process:

1. How many times will you be asked for your WTP for the chocolate bar?

- only at the end of the experiment
- 1
- 8
- 5

2. What will you get at the end of the experiment?

- Only the endowment for this part of the experiment (5 Euros)
- A chocolate bar of 100 gr.

- Either the whole endowment for this part of the experiment or you will be commited to buy the chocolate bar.
- One will win the experimental fee and chocolate.

3. For which purpose is a chat window available?

- To reveal my identity.
- To talk about the general content of the experiment.
- To exchange personal attitudes toward the product.
- To feel more confortable.

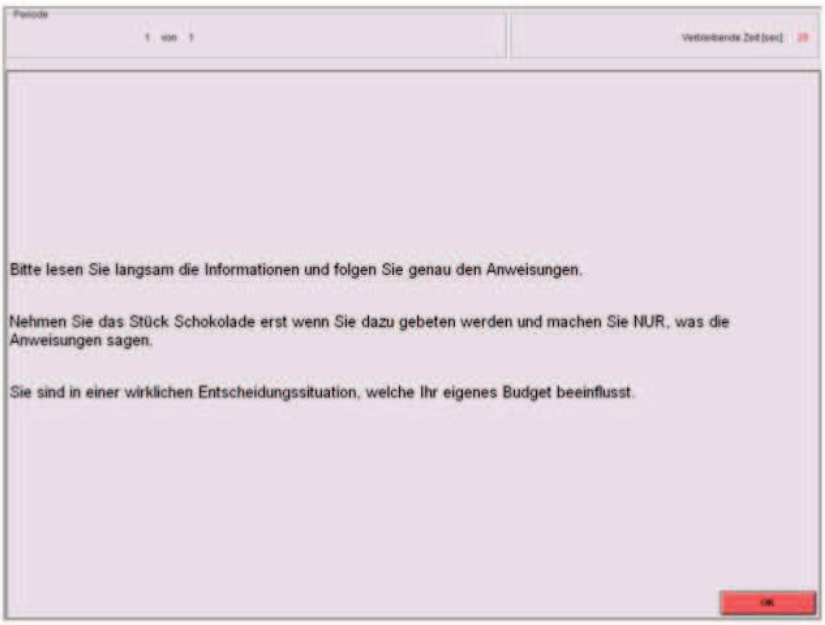


Figure D.4.: Screen 11. Instructions.

Screen 11. Please read the following information slowly and follow the instructions accurately. Only take the piece of chocolate, when you are asked to do so and only do what you are asked to do in the instructions. You are in a real decision situation, which will influence your budget.

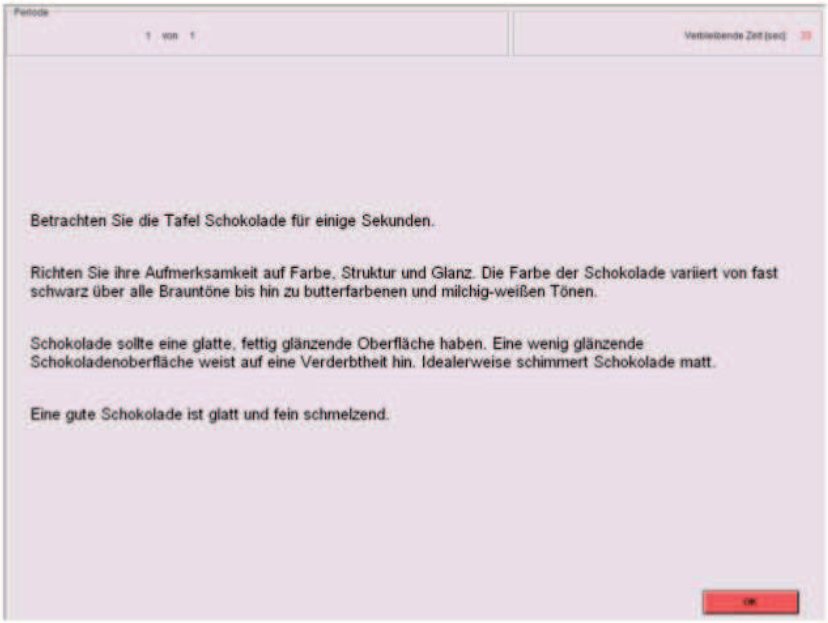


Figure D.5.: Screen 12. 1. Information: Seeing the Chocolate.

Screen 12. Examine the piece of chocolate for some seconds.

Concentrate your attention on the color, structur and brightness. The color of the chocolate may vary from almost black to all possible brown shades until butter and milky-white shades.

The chocolate should have a smooth, greasy surface. A barely shiny chocolate surface indicates that the chocolate has gone bad. Ideally, the chocolate should have a beamless and flat surface.

A good chocolate is smooth and tenderly melting.

Figure D.6.: Screen 13. 1. Action: Seeing the Chocolate.

Screen 13. Please take now the piece of chocolate and examine it for some seconds.

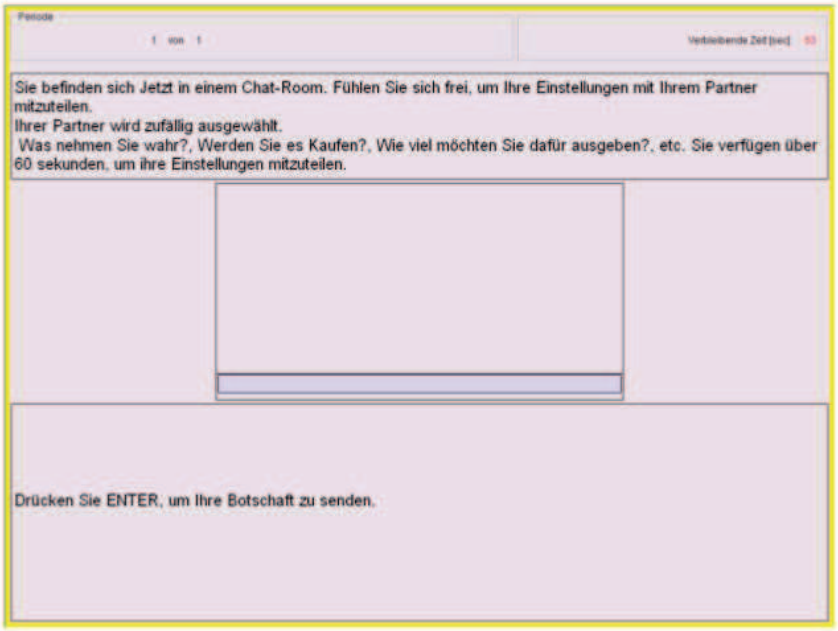


Figure D.7.: Screen 14. Chat Window.

Screen 14. You are now in a chat room. Please feel free to communicate with your partner concerning your attitudes and impressions. Your partner will be random assigned. What do you feel? Should you buy it? How much money are you ready to spend for it? You have 60 seconds to exchange your attitudes toward the chocolate.

Press ENTER to send your message.

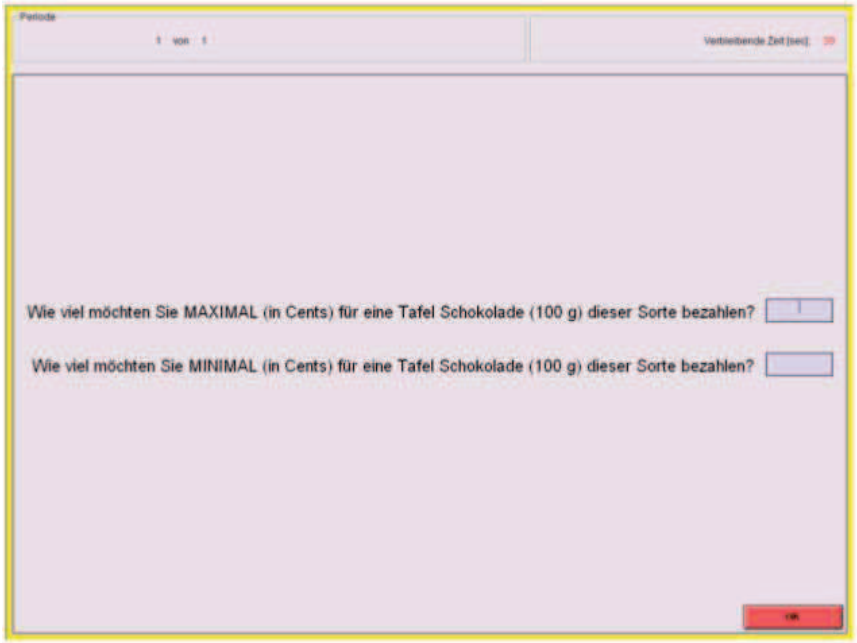


Figure D.8.: Screen 15. WTP Screen.

Screen 15.

- How much do you want to spend for a chocolate bar of 100 gr. like this oneat the maximum?
- How much do you want to spend for a chocolate bar of 100 gr. like this one at the minimum?

Figure D.9.: Screen 16. 2. Information: Smelling the Chocolate.

Screen 16. By means of your nose, you can experience the multifaceted flavors of chocolate. You can inhalate these flavors taking the piece of chocolate directly under your nose.

What does the chocolate smell of? Maybe you can evaluate its flavors as if it was wine. In the bouquet of chocolate, you can find gently rost flavors, honey or marzipan. Also you can identify caramel or vanila scents.

Chocolate with strong rost flavors and pronounced vanilla scents is, certainly, not the finest chocolate.

Figure D.10.: Screen 17. 2. Action: Smelling the Chocolate.

Screen 17. Please take the piece of chocolate and smell it now.

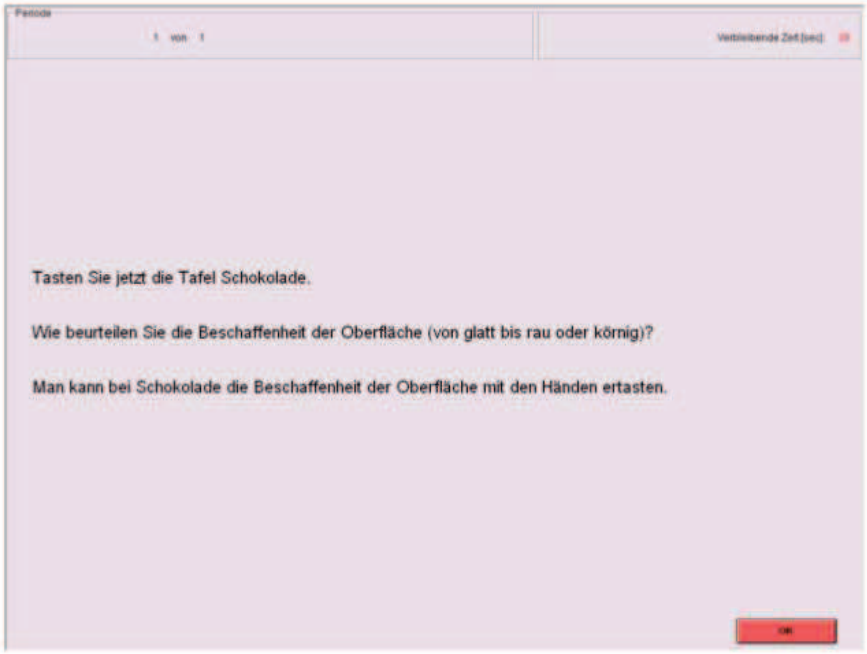


Figure D.11.: Screen 20. 2. Information: Touching the Chocolate.

Screen 20. Now you will touch the chocolate.

How can you judge the composition of the surface (from smooth to rough or grained)?

The best way to feel the texture of chocolate is to touch it with your hands.

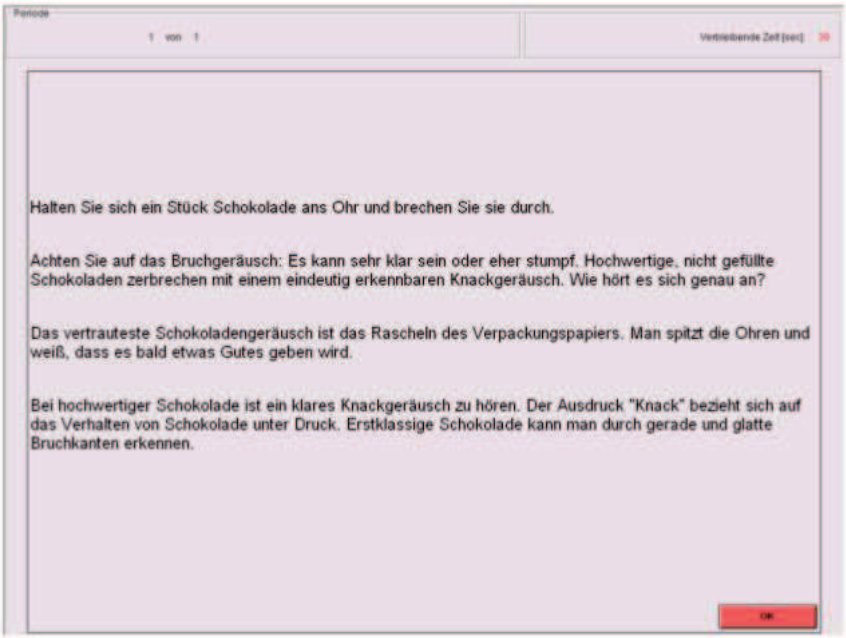


Figure D.12.: Screen 23. 4. Information: Hearing the Chocolate.

Screen 23. Keep the piece of chocolate close to your ear and break it.

Pay particular attention to the noise just when it breaks. It can be very clear or rather blunt. Chocolate of finest quality (and without filling) makes a clear noise when it breaks. What does this one sound like? Please describe the sound as exact as possible.

The best-known noise of chocolate is the noise of the wrapping paper. When hearing this sound, we prick up our ears, knowing that something very good is going to happen.

By high quality chocolate you can hear a very clear knack. The expression 'knack' refers to the behavior of chocolate under pression. First-class chocolate can be recognized by straight and smooth breaking edges.

Figure D.13.: Screen 24. 4. Action: Hearing the Chocolate.

Screen 24. Please take the chocolate now and break a piece of it off!

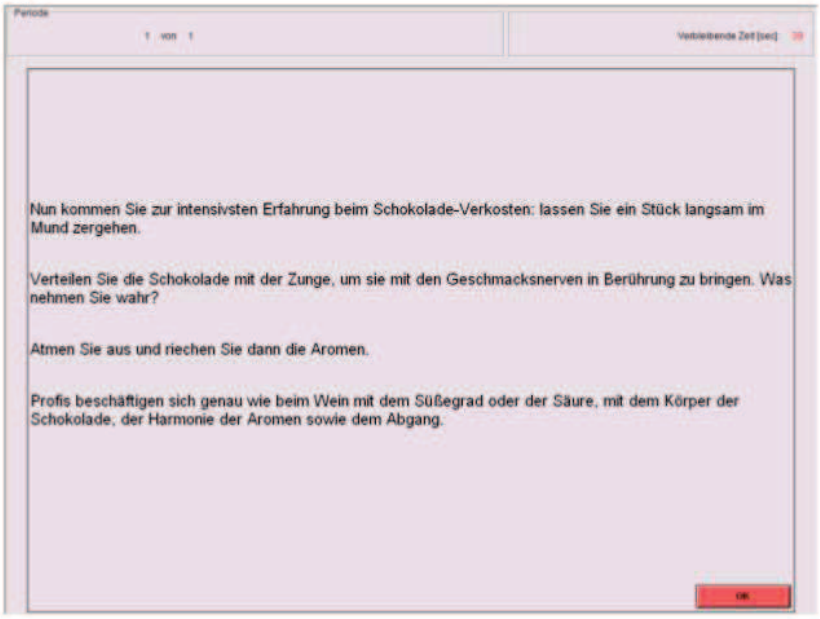


Figure D.14.: Screen 27. 5. Information: Tasting the Chocolate.

Screen 27. Now we get to the most intensive sensory experience. Let a piece of chocolate slowly melt in your mouth.

Distribute the chocolate with your tongue. This is the only way to reach all your gustatory nerves. What do you feel?

Then exhale and smell all the flavors.

Professionals in this field are studying in the same way as wine, in which grade the contains of sugar and acidity, are in harmony with the flavors and body of the chocolate as well as the chocolate's aftertaste.

Figure D.15.: Screen 28. 5. Action: Tasting the Chocolate.

Screen 28. Please take the chocolate and taste it now!

E. Testing Risk Attitudes

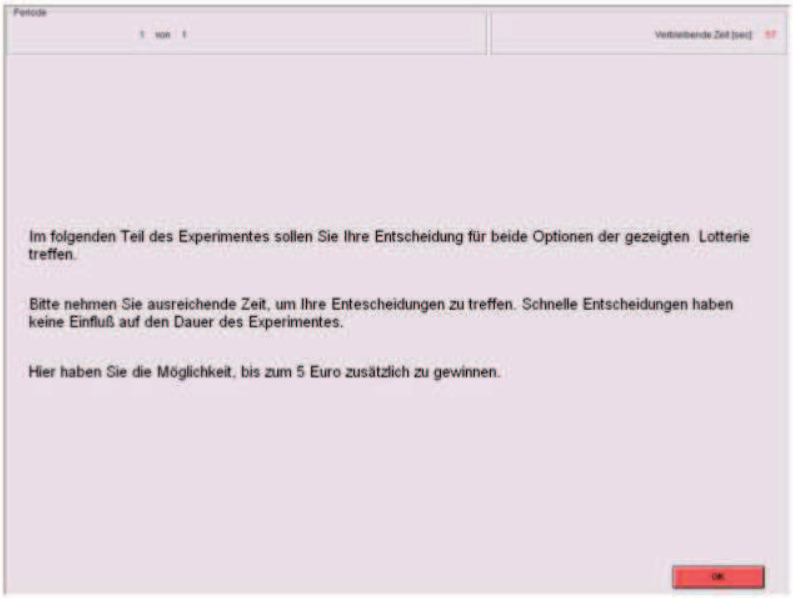


Figure E.1.: Screen 31. Risk Attitudes after Holt and Laury (2002)

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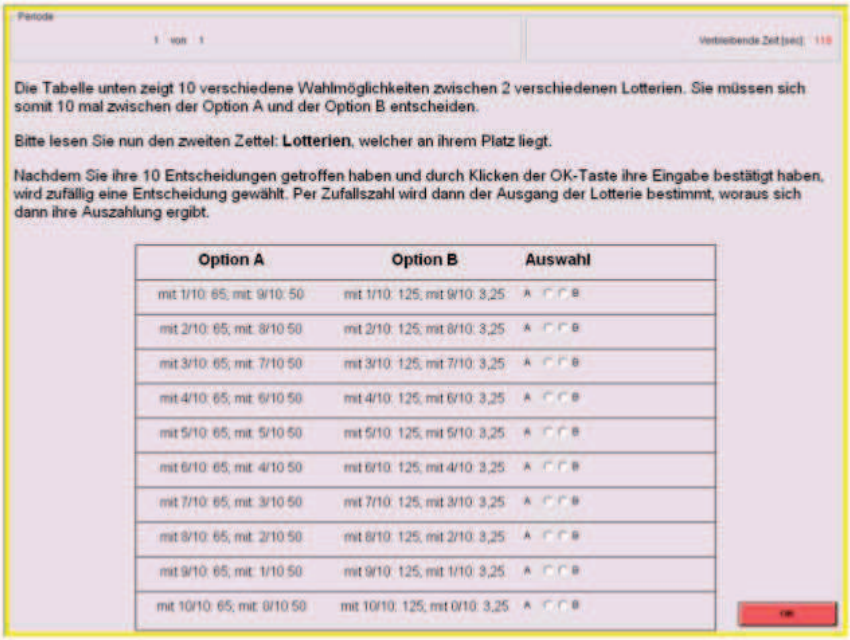
In the next part of the experiment, you will choose between the two options shown for each lottery.

Please take enough time to make your decisions. Quick decisions have no influence on the duration of the experiment.

Here, you have the opportunity to additionally earn up to five (5) Euros.



Periode

1 von 1

Verbleibende Zeit [sec]: 119

Die Tabelle unten zeigt 10 verschiedene Wahlmöglichkeiten zwischen 2 verschiedenen Lotterien. Sie müssen sich somit 10 mal zwischen der Option A und der Option B entscheiden.

Bitte lesen Sie nun den zweiten Zettel: **Lotterien**, welcher an ihrem Platz liegt.

Nachdem Sie ihre 10 Entscheidungen getroffen haben und durch Klicken der OK-Taste ihre Eingabe bestätigt haben, wird zufällig eine Entscheidung gewählt. Per Zufallszahl wird dann der Ausgang der Lotterie bestimmt, woraus sich dann ihre Auszahlung ergibt.

Option A	Option B	Auswahl
mit 1/10: 65; mit 9/10: 50	mit 1/10: 125; mit 9/10: 3,25	A B
mit 2/10: 65; mit 8/10: 50	mit 2/10: 125; mit 8/10: 3,25	A B
mit 3/10: 65; mit 7/10: 50	mit 3/10: 125; mit 7/10: 3,25	A B
mit 4/10: 65; mit 6/10: 50	mit 4/10: 125; mit 6/10: 3,25	A B
mit 5/10: 65; mit 5/10: 50	mit 5/10: 125; mit 5/10: 3,25	A B
mit 6/10: 65; mit 4/10: 50	mit 6/10: 125; mit 4/10: 3,25	A B
mit 7/10: 65; mit 3/10: 50	mit 7/10: 125; mit 3/10: 3,25	A B
mit 8/10: 65; mit 2/10: 50	mit 8/10: 125; mit 2/10: 3,25	A B
mit 9/10: 65; mit 1/10: 50	mit 9/10: 125; mit 1/10: 3,25	A B
mit 10/10: 65; mit 0/10: 50	mit 10/10: 125; mit 0/10: 3,25	A B

OK

Figure E.2.: screen32. Ten Paired Lotteries.

This Table shows 10 different choice options between two different lotteries. Thus you should choose 10 times between Option A and Option B.

Please read the printed sheet 'Instructions for Lotteries' that you can find on your desk.

After you have made the ten choices press OK to send them. Thereafter, one of your chosen lotteries will be randomly selected and played. This way it will be decided, how much you will get paid for this part of the experiment.

Figure E.3.: Screen 33. Final Payments.

- In the lottery you win: 65
- From the first part of the experiment you receive: 500
- For your participation you will receive a total of: 565

Hereafter, you should answer a short questionnarie. After you have completed it, you may pick up your earns from the neighboring room.

F. Socio-Demographic Questionnaire

ID Number: (received at the beginning of each experimental session)

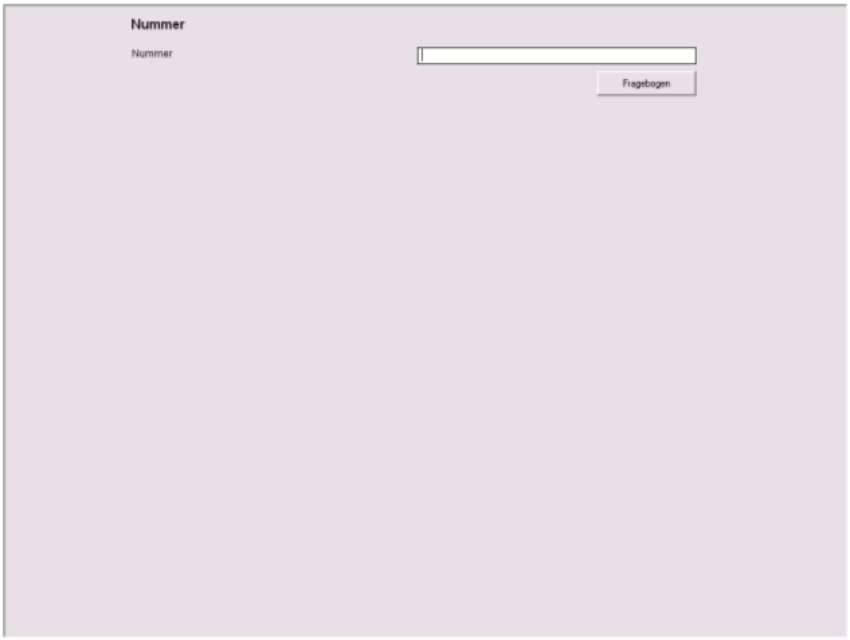


Figure F.1.: Questionnaire 1.

Gender: [Male/ female]

Do you smoke? [Yes/ No]

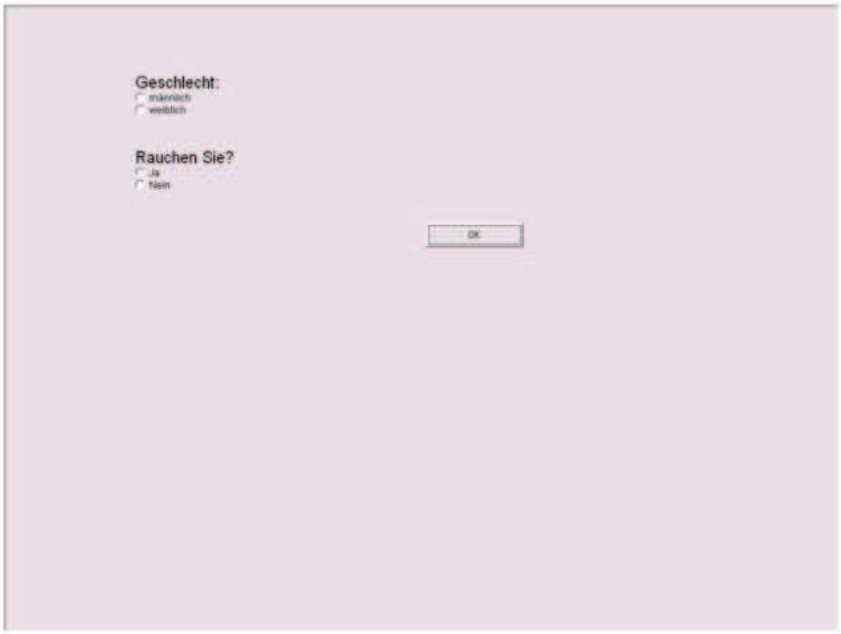


Figure F.2.: Questionnaire 2.

- Which chocolate brands do you know? Write down a short list of them
- In general, to make purchase decisions, do you care about advertising? [Yes / No]
- In general, to make purchase decisions, do you care about the price of the product? [Yes / No]

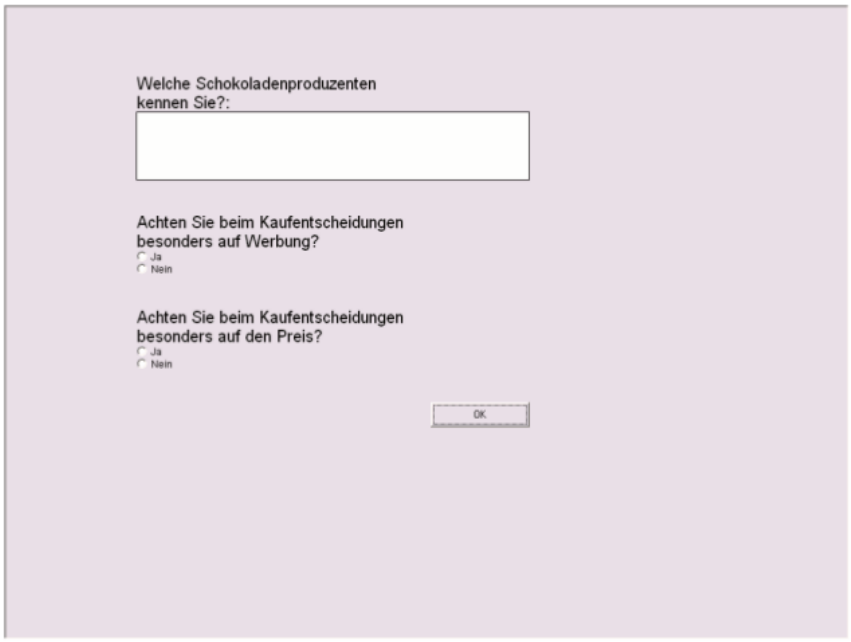


Figure F.3.: Questionnaire 3.

In the following statements please choose the answer that better suits your behavior:

- Innovative products are very important for me

  0 = Strongly disagree

  1 = Disagree

  2 = Neither agree nor disagree

  3 = Agree

  4 = Strongly agree

- I am a person who likes to follow up consumption trends

  0 = Strongly disagree

  1 = Disagree

  2 = Neither agree nor disagree

3 = Agree

4 = Strongly agree

- I am purchasing new products, just after they appeared in marketing campaigns

  0 = Strongly disagree

  1 = Disagree

  2 = Neither agree nor disagree

  3 = Agree

  4 = Strongly agree

Figure F.4.: Questionnaire 4.

Thank you for participating in the experiment and for completing the questionnaire.

Figure F.5.: Questionnaire 5.

G. Additional Tables

Table G.1.: Descriptive Statistics for the Initial Information for the four Treatments

Treatment	Mean	Median	Mode	St.Dev.	Kurtosis	Skewness	Min.Value	Max.Value
T1	0.298	0.25	0.1666	0.172	-0.198	0.662	0	0.70
T2	0.361	0.333	0.291	0.145	0.773	0.548	0	0.75
T3r	0.314	0.291	0.375	0.156	-0.323	0,260	0	0.666
T4	0.298	0.273	0.273	0.150	-0.167	0.222	0	0.636

Table G.2.: Descriptive Statistics for Maximal WTP for T1

Treatment	Mean	Median	Mode	St.Dev.	Kurtosis	Skewness	Min.Value	Max.Value
1. Round	98.625	100	100	50.028	1.371	0.749	0	250
2. Round	106.175	100	100	58.570	0.936	0.940	0	250
3. Round	105.025	100	100	50.801	0.939	0.662	0	250
4. Round	111	100	100	56.202	0.530	0.628	0	250
5. Round	107	99.5	90	68.343	0.941	0.973	0	279

Table G.3.: Shapiro-Wilk Normality Test for the Maximal WTP for T1

Round	W	H0
1. Round	0.956	not reject
2. Round	0.923***	reject
3. Round	0.959	not reject
4. Round	0.959	not reject
5. Round	0.914***	reject

Notes: *, **, *** indicate significance at $\alpha = 10\%$, 5% and 1% respectively. (H0: The data set is normally distributed.)

Table G.4.: Descriptive Statistics for Maximal WTP for the T2

Treatment	Mean	Median	Mode	St.Dev.	Kurtosis	Skewness	Min.Value	Max.Value
1. Round	133.725	120	100	64.610	0.204	0.856	40	300
2. Round	134.475	125	150	62.820	0.951	0.713	10	300
3. Round	138.125	130	100	64.477	0.537	0.525	10	300
4. Round	143.875	125	100	68.608	-0.074	0.426	15	300
5. Round	145.375	117.50	100	79.521	0.019	0.611	10	350

Table G.5.: Shapiro-Wilk Normality Test for the Maximal WTP for T2

Round	W	H0
1. Round	0.934**	reject
2. Round	0.954	not reject
3. Round	0.961	not reject
4. Round	0.959	not reject
5. Round	0.949*	reject

Notes:*, **, *** indicate significance at $\alpha = 10\%$, 5% and 1% respectively.(H0: The data set is normally distributed.)

Table G.6.: Descriptive Statistics for Maximal WTP for T3

Treatment	Mean	Median	Mode	St.Dev.	Kurtosis	Skewness	Min.Value	Max.Value
1. Round	132.675	120	150	78.345	3.816	1.713	0	400
2. Round	145.55	130	150	93.7	4.867	1.912	0	500
3. Round	139.275	110	100	97.183	4.862	1.938	0	500
4. Round	147.75	120	120	83.657	1.566	1.288	0	400
5. Round	136.275	105	100	87.985	3.262	1.765	0	410

Table G.7.: Shapiro-Wilk Normality Test for the Maximal WTP for T3

	W	H0
1. Round	0.835***	reject
2. Round	0.831***	reject
3. Round	0.818***	reject
4. Round	0.870***	reject
5. Round	0.809***	reject

Notes:*, **, *** indicate significance at $\alpha = 10\%$, 5% and 1% respectively.(H0: The data set is normally distributed.)

Table G.8.: Descriptive Statistics for Maximal WTP for T4

Treatment	Mean	Median	Mode	St.Dev.	Kurtosis	Skewness	Min.Value	Max.Value
1. Round	138.90	122.5	80	73.639	0.423	0.696	11	350
2. Round	143.10	134.5	150	80.900	1.367	0.9367	0	399
3. Round	140.70	130	100	71.492	-0.183	0.546	13	300
4. Round	142.20	127.5	50	76.974	-0.755	0.3867	13	300
5. Round	132.325	100	50	83.324	-1	0.523	30	300

Table G.9.: Shapiro-Wilk Normality Test for the Maximal WTP for T4

	W	H0
1. Round	0.959	not reject
2. Round	0.934**	reject
3. Round	0.953*	reject
4. Round	0.946*	reject
5. Round	0.902***	reject

Notes: *, **, *** indicate significance at $\alpha = 10\%$, 5% and 1% respectively.(H0: The data set is normally distributed.)

Table G.10.: Descriptive Statistics for Minimal WTP for T1

Treatment	Mean	Median	Mode	St.Dev.	Kurtosis	Skewness	Min.Value	Max.Value
1. Round	42.675	40	50	38.307	1.633	1.223	0	150
2. Round	48.925	40	50	46.647	2.201	1.502	0	200
3. Round	46.425	47	50	41.561	1.138	1.203	0	150
4. Round	52.675	50	50	43.009	2.592	1.295	0	200
5. Round	49.55	50	50	44.663	2.22	1.256	0	200

Table G.11.: Shapiro-Wilk Normality Test for the Minimal WTP for T1

	W	H0
1. Round	0.873***	reject
2. Round	0.835***	reject
3. Round	0.855***	reject
4. Round	0.89***	reject
5. Round	0.89***	reject

Notes: *, **, *** indicate significance at $\alpha = 10\%$, 5% and 1% respectively.(H0: The data set is normally distributed.)

Table G.12.: Descriptive Statistics for Minimal WTP T2

Treatment	Mean	Median	Mode	St.Dev.	Kurtosis	Skewness	Min.Value	Max.Value
1. Round	59.80	50	50	44.725	1.226	0.905	0	199
2. Round	58.675	50	50	41.429	1.488	0.765	0	190
3. Round	62.45	60	50	45.256	0.255	0.448	0	190
4. Round	66.05	60	60	41.698	-0.586	-0.037	0	150
5. Round	73.425	75	50	54.739	1.513	0.911	0	250

Table G.13.: Shapiro-Wilk Normality Test for the Minimal WTP for T2

	W	H0
1. Round	0.917***	reject
2. Round	0.923***	reject
3. Round	0.942**	reject
4. Round	0.950*	reject
5. Round	0.927**	reject

Notes: *, **, *** indicate significance at $\alpha = 10\%$, 5% and 1% respectively.(H0: The data set is normally distributed.)

Table G.14.: Descriptive Statistics for Minimal WTP for T3

Treatment	Mean	Median	Mode	St.Dev.	Kurtosis	Skewness	Min.Value	Max.Value
1. Round	61.10	60	50	36.99	0.0202	0.0115	0	160
2. Round	76.70	70	100	46.662	0.942	0.772	0	200
3. Round	65.45	60	60	38.309	0.132	0.095	0	160
4. Round	76.15	74.5	60	46.369	5.047	1.540	0	250
5. Round	75.775	70	100	47.638	3.345	1.120	0	250

Table G.15.: Shapiro-Wilk Normality Test for the Minimal WTP for T3

	W	H0
1. Round	0.942**	reject
2. Round	0.945*	reject
3. Round	0.947*	reject
4. Round	0.860***	reject
5. Round	0.926**	reject

Notes: *, **, *** indicate significance at $\alpha = 10\%$, 5% and 1% respectively.(H0: The data set is normally distributed.)

Table G.16.: Descriptive Statistics for Minimal WTP for T4

Treatment	Mean	Median	Mode	St.Dev.	Kurtosis	Skewness	Min.Value	Max.Value
1. Round	62.625	52.50	50	52.099	0.564	0.901	0	200
2. Round	59.525	50	0	53.336	0.493	0.923	0	199
3. Round	62.025	57	0	51.510	0.103	0.747.	0	180
4. Round	61.175	57.50	100	51.548	0.654	0.878	0	200
5. Round	57.425	49.50	0	47.958	1.256	1.147	0	230

Table G.17.: Shapiro-Wilk Normality Test for the Minimal WTP for T4

	W	H0
1. Round	0.911***	reject
2. Round	0.898***	reject
3. Round	0.911***	reject
4. Round	0.905***	reject
5. Round	0.861***	reject

Notes: *, **, *** indicate significance at $\alpha = 10\%$, 5% and 1% respectively.(H0: The data set is normally distributed.)

Table G.18.: Shapiro-Wilk Normality Test for WTP-Range for T1

	W	H0
1. Round	0.928**	reject
2. Round	0.929***	reject
3. Round	0.942**	reject
4. Round	0.971**	reject
5. Round	0.940**	reject

Notes: *, **, *** indicate significance at $\alpha = 10\%$, 5% and 1% respectively.(H0: The data set is normally distributed.)

Table G.19.: Descriptive Statistics for WTP-Range for T2 in the five Experimental Rounds

Treatment	Mean	Median	Mode	St.Dev.	Kurtosis	Skewness	Min.Value	Max.Value
1. Round	73.925	50	50	50.232	0.284	0.967	0	200
2. Round	75.80	60	40	44.374	0.006	0.755	10	199
3. Round	75.676	60	40	44.429	0.620	1.031	10	199
4. Round	77.825	55.5	40	49.758	-0.186	0.928	5	199
5. Round	71.95	50	50	52.506	-0.049	0.918	10	199

Table G.20.: Shapiro-Wilk Normality Test for WTP-Range for T2

	W	H0
1. Round	0.901***	reject
2. Round	0.921***	reject
3. Round	0.898***	reject
4. Round	0.877***	reject
5. Round	0.895***	reject

Notes: *, **, *** indicate significance at $\alpha = 10\%$, 5% and 1% respectively.(H0: The data set is normally distributed.)

Table G.21.: Descriptive Statistics for WTP-Range for T3 in the five Experimental Rounds

Treatment	Mean	Median	Mode	St.Dev.	Kurtosis	Skewness	Min.Value	Max.Value
1. Round	71.575	50	50	65.893	7.073	2.639	0	300
2. Round	68.85	50	40	62.486	7.001	2.547	0	300
3. Round	73.825	50	20	78.965	8.189	2.731	0	400
4. Round	77.825	55.5	40	49.758	-0.186	0.928	5	199
5. Round	60.50	40	30	62.698	6.871	2.560	0	300

Table G.22.: Shapiro-Wilk Normality Test for WTP-Range for T3

	W	p-Value	H0
1. Round	0.643***	reject	
2. Round	0.702***	reject	
3. Round	0.667***	reject	
4. Round	0.733***	reject	
5. Round	0.679***	reject	

Notes: *, **, *** indicate significance at $\alpha = 10\%$, 5% and 1% respectively.(H0: The data set is normally distributed.)

Table G.23.: Descriptive Statistics for WTP-Range for T4 in the five Experimental Rounds

Treatment	Mean	Median	Mode	St.Dev.	Kurtosis	Skewness	Min.Value	Max.Value
1. Round	76.375	70	50	43.238	0.977	0.850	1	200
2. Round	83.575	72	100	47.244	2.392	1.267	0	240
3. Round	78.675	70	100	39.797	1.161	0.814	0	200
4. Round	81.025	70	100	44.385	0.352	0.719	0	200
5. Round	74.90	65	50	43.711	0.330	0.927	10	200

Table G.24.: Shapiro-Wilk Normality Test for WTP-Range for T4

	W	H0
1. Round	0.943**	reject
2. Round	0.909***	reject
3. Round	0.951*	reject
4. Round	0.950*	reject
5. Round	0.917***	reject

Notes: *, **, *** indicate significance at $\alpha = 10\%$, 5% and 1% respectively.(H0: The data set is normally distributed.)

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