"Emotions in auctions: When and why bidders overbid"

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Abstract

Auctions have established themselves as an important and common market mechanism in the business world and consumer markets. However, they sometimes lead to astonishing results, e.g., when the auction revenues on an Internet platform significantly exceed the listed fixed-price-offer on the same site. Auction researchers attribute emotions and their influence on overbidding an important role in the bidding process. The objective of this thesis is to identify situations in which bidders overbid and to begin to explain emotionally motivated bidding behavior. Most of the current research dealing with emotions in auctions either focuses on physiological reactions or on one specific type of emotion. The specific challenge of this thesis is to identify the comprehensive range of types of emotions that influence the bidding behavior. While current research mostly refers to cognitive psychology, this thesis is based on different approaches in emotional psychology.

This thesis addresses several research questions. First, a deeper understanding of emotion psychology has to be gained: What is emotion and what types of emotions exist? Other research in this area concentrates on one very specific aspect such as"competitive arousal", "loser's regret" or "fear of losing". This work develops a general framework for discussing a plurality of emotions and identifying the relevant emotions for auctions. Second, factors leading to overbidding have to be understood. This involves clearly illustrating the decision making process to understand when and how the identified emotions influence the bidding process. The development of a formal bidding framework illustrates the sequence and the individual elements of this decision making process. The core result, the "emotional processing scheme", enables experimental research to discuss the emotional bidding process along a standard procedure. This formal foundation forms the basis for formulating initial hypotheses about the central question "When and why bidders overbid in auctions?". 14 out of 22 types of emotions play a relevant role in auctions. Especially the emotion types *Pride* and *Shame* may serve as an important emotional corrective to prevent bidders from overbidding.

In an analysis of existing and own experiments it is shown that intense winner or loser emotions lead to overbidding, whereas ambivalent emotions dampen overbidding.

Ambivalent emotions arise when bidders get information that makes winning bidders feel like losers, for example, because they learn that they could have won the auction at a better price. This is a starting point for further emotion-type-specific research. Additionally, the conducted experiment implements a new method of auctioning real goods in a controlled lab experiment. This method serves as an important foundation for further research on emotions in auctions focusing on the auction good as an emotion-triggering object.

Contents

List of Figures

List of Tables

Chapter 1

Introduction

1.1 Motivation and central research questions

Auctions have become significantly more important over the last decade. However, the chances of getting a good deal are small since bidders often pay more in auctions than they would pay in fixed price offers (cf. Lee and Malmendier, 2011; Ariely and Simonson, 2003). It is an open secret that bidders do not always bid according to game theoretical predictions, but what exactly influences bidding behavior? In what auction settings do people overbid and why? Classical lab experiments and resulting explanations like "risk aversion" or "joy of winning" do not answer this question adequately. In the last decade, research has moved toward behavioral explanatory approaches. The work of psychologists and behavioral economists has become more important and field research is more in focus. Some of the reported results from field studies are astonishing. Comparing auction prices with fixed price offers on the same platform for a popular boardgame, Lee and Malmendier (2011) find that 72% of the auctions result in higher total prices. Ariely and Simonson (2003, p. 118) conclude that "despite relatively low search cost, consumers often paid premiums for goods they 'won' in auctions."

It is fruitless to find purely rational explanations for this behavior, but concepts assuming cognitive restrictions also lack the necessary explanatory power. This is why another psychological state has attracted more focus in the recent past: emotions. Thaler (2000, p. 139) anticipated this development when he predicted that "homo economicus will become more emotional." And Elster (1998, p. 48) laid the foundation for this development when

he asked "How can emotions help us explain behavior for which good explanations seem to be lacking?" Although the notion of emotion is often mentioned when theorizing the reasons for overbidding, existing literature is still very unstructured and unclear regarding the notion of emotion and lacks a clear understanding of what exactly emotions are. Furthermore, the emotions relevant to auctions have not been identified through a systematic and wholistic approach. There seems to be a consensual will to explain bidding behavior deviating from (bounded) rational concepts via emotions. The desire to understand emotions in auctions extends beyond a few economists interested in psychology and has high relevance for the understanding and further development of electronic auction markets such as eBay. Weinhardt et al. (2003) define the shaping and development of electronic markets as market engineering. According to the authors, a market engineer defines the rules of interaction such that the anticipated behavior of the market participants lead to specific desirable market results. Understanding emotions is therefore important because it is necessary for anticipating market participants' behavior.

Research on emotions in auctions raise several research questions that cannot be explained by standard economic theory of cognitive restrictions.

First, what exactly are emotions? Is emotion arousal, like some research suggests (cf. Russell and Pratt, 1980), or is it a complex interaction of different processes, like Scherer (1984) proposes? Specifically, what types of emotions are there and which emotions influence bidding behavior?

Research question 1 *What are emotions, what types of emotions exist and which emotions influence bidding behavior in auctions?*

Second, what are the consequences of integrating emotional components into our economic bidding models? In most cases, auction experiments are based on static game theory and experimental results are tested against the derived game theoretical solution. Is this method appropriate when emotional processes are included? Or do economists have to change the way they model bidding behavior fundamentally? Maybe it is time to abandon the classical theoretic view that assumes a bidder with a comprehensive and consistent utility function who is aware of all available alternatives and who chooses the utility maximizing alternative (cf. Simon, 1997). Perhaps bidding frameworks should allow for

more realistic bidders who, for example, change their preferences based on emotional or other relevant triggers in the course of the auction.

Research question 2 *How can emotional bidding behavior be described and analyzed in a formal bidding framework?*

Third, after having laid the theoretical foundation for discussing emotions in auction experiments, the central questions guiding experimental research have to be discussed. What situations trigger emotions and what emotions get triggered? Consequently, what emotional reactions lead to certain bidding behaviors such as overbidding and do these reactions explain the observed bidding behavior adequately? Should economists therefore become more open to psychological approaches in experimental work?

Research question 3 *What situations trigger emotions and what emotions are triggered in auctions? What emotional reactions lead to bidding behaviors such as overbidding?*

To answer these three central research questions, a strong interdisciplinary approach is needed that integrates research from game theory, experimental economics, behavioral economics, and psychology. Opening toward other research directions also implies abandoning certain economic traditions. Building models with utility maximizing agents is different from building models with more realistic decision makers, who are multifaceted and in some ways more complex, even though this might not necessarily imply a mathematical complexity. Although some economists are still reluctant towards interdisciplinary approaches, Thaler (2000, p. 140) predicts that "as economists become more sophisticated, their ability to incorporate findings of other disciplines such as psychology improves." This thesis intends to be a step in that direction.

1.2 Interdisciplinary approach

This thesis takes an interdisciplinary approach. Classical auction theory relies heavily on game theory and equilibrium solution concepts. Newer findings from behavioral economics expand these solution concepts by adding "more realistic psychological foundations" (Camerer et al., 2004, p. 3). Experimental economics enables the theory to

be tested empirically. Psychology contributes the psychological foundation needed to incorporate cognitive and emotional aspects into behavioral economics.

1.2.1 Game theory and rationality in neo-classical theory

Game theory analyzes interactive decision situations among agents. Today, it is used widely in research analyzing economic and political decision making. Building on ideas developed by Zermelo (1913), game theory was established as an independent research area with the publication of one single book: "Theory of games and economic behavior", published by von Neumann and Morgenstern (1944). The notion of "game theory" results from the original closeness to strategic parlor games. Söllner (2001) objects that the notion is sometimes confounding and "interactive decision theory" would have probably been a better name. When John Harsanyi, John Nash and Reinhard Selten were awarded the Nobel Prize in Economic Sciences in 1994 for their equilibrium theories in non-cooperative game theory, the discipline became irrevocably established in modern economic theory. One integral part of game theory is the analysis of the initial situation, including assumptions about the characteristics of individual agents and their possible decisions. On this basis, (multiple) results are deducted, mostly with more or less complex mathematical methods. Thus, game theory can be used to predict the outcome of interactive decision situations. In contrast to other optimization calculi, the other agents' decisions are not taken as given. Instead they are unknown variables in one's own decision calculus.

Game theory differs from neo-classical economic theory in so far that its central assumption is the interdependence of decision making. Game theory works with many further assumptions that are in line with neo-classical economic theory. According to Weintraub (1993) neo-classical economic theory acts on the assumption that economic agents have certain preferences with respect to their outcomes and maximize their utility accordingly. In case of uncertainty, the "expected utility theory" is applied. In this thesis, references to rational decision making are associated with the neo-classical theoretical notion of global rationality:

> "Global rationality, the rationality of neo-classical theory, assumes that the decision maker has a comprehensive, consistent utility function, knows all the

> alternatives that are available for choice, can compute the expected value of utility associated with each alternative, and chooses the alternative that maximizes expected utility." (Simon, 1997, p. 17)

That is, a decision maker is assumed to have knowledge of the relevant aspects of his environment, he is assumed to have a stable system of preferences, and he is assumed to have computational skill that calculates which option will reach the highest point on the preference scale. This type of rationality stands in contrast to the concept "bounded rationality" introduced in the next subsection.

1.2.2 Behavioral economics and bounded rationality

Behavioral economics analyzes real human behavior in an economic decision making context. Thus, it stands in contrast to traditional economic theory, which assumes a rational, utility-maximizing agent. Simon (1955) was one of the important pioneers of behavioral economics, criticizing the concept of neo-classical rationality. He proposed that bidders have limited information-processing capabilities and introduced a more realistic idea of human problem solving abilities, described by the term "bounded rationality." Simon (1957, p. 198) described the principle of bounded rationality as following: "The capacity of the human mind for formulating and solving complex problems is very small compared with the size of the problems whose solution is required for objectively rational behavior in the real world – or even for a reasonable approximation to such objective rationality." According to Barros (2010), it was the first time that the notion "bounded rationality" was mentioned in the literature. The Nobel prize laureates Daniel Kahneman and Amos Tversky contributed a further seminal work regarding behavioral economics: "Prospect theory: an analysis of decision under risk" published in 1979 (cf. Kahneman and Tversky, 1979). Today, behavioral economics is a well established research area within economics.

Camerer et al. (2004, p. 3) claims that "behavioral economics increases the explanatory power of economics by providing it with more realistic psychological foundations." It does not result in a complete rejection of the standard economic theories basing their models on rational agents. Rather, it supplements these theories leading to greater psychological realism. Often this psychological realism concentrates on cognitive aspects, that is, to find

explanations for certain economic phenomena through a better understanding of human cognitive processes. Cognitive psychology has enriched the economic research significantly, for example in the application of prospect theory. And according to Thaler (2000, p. 137) there are still "an enormous number of exciting ways in which a better understanding of human cognition could help us do better economics." Other psychological research areas like emotion theory have played a minor role in behavioral economics so far.

According to Camerer et al. (2004, p. 47) behavioral economics is "a collection of tools and ideas." Experiments and game theory play an important role in this toolset. However behavioral economists are methodological eclectics. They employ different methodologies since they help to gain psychological insights when looking at economic phenomena.

1.2.3 Experimental economics

Compared to the natural sciences or psychology, the experimental method was adopted relatively late in economics. Initiated by pioneer Edward Chamberlin, the experimental method was popularized later by Vernon Smith, Heinz Sauermann, and Reinhard Selten in the 1950s and 1960s. According to Sauermann (1967), experimental economics received strong impulses from game theory. Generally, both research areas interact very strongly with each other. Experimental economics test game theory models, but also create new phenomena, thus triggering the development of new game theoretical or other considerations. Experimental economics test economic theories empirically. In contrast to econometrics, data are generated in controlled sessions in a laboratory, enabling abstract theories or situations which do not exist in the field to be tested and individual parameters to be varied.

1.2.4 Psychology

Psychology analyzes human behavior and mental processes with the goal of identifying general principles of human thoughts, feelings, and behavior. Psychology already played a central role in Greek philosophy. According to Myers (2010, p. 2) the Greek philosopher Aristotle "theorized about learning and memory, motivation and emotion, perception and personality."

Psychology established itself as an independent science in the course of the 19th century. Wilhelm Wundt, one of the central scientists in this time, founded experimental psychology and established the first laboratory, conducting the first psychological experiment in 1879 at the University of Leipzig. Further early development took place in different schools of thought, including the most famous ones: functionalism, psychoanalysis, and behaviorism. The functionalist William James focused on why our mental and behavioral processes function the way they do. He assumed that people adapt optimally to their environment to ensure their own and human survival. Psychoanalysis, founded by Sigmund Freud, focuses on unconscious thoughts and how they affect our behavior. Early childhood experiences play a significant role in this analysis. Behaviorism stands in strong contrast to psychoanalysis, dismisses introspection, and focuses purely on observable behavior instead of mental processes. In the early 20th century psychology focused on mental processes, then from the 1920s to the 1960s psychology was dominated by behaviorism. The cognitive revolution in the 1960s lead to a renewed focus on mental processes. Today, it can be said, that psychology has a rather balanced view, focusing on mental processes as well as behavior.

Psychology is a multifaceted science, integrating findings from very different disciplines. The fact that early researchers came from different disciplines like philosophy (William James), medical sciences (Sigmund Freud), or biology (Jean Piaget) reflects this interdisciplinarity. Myers (2010, p. 8) talks of an "integrated biopsychosocial approach", considering the "influence of biological, psychological and social-cultural factors." Behavior and mental processes have to be investigated from these different perspectives.

1.3 Structure

The thesis's goal is to identify the situations in which bidders overbid due to emotions and to explain this observed behavior. The intention is to give a structured overview of the relevant emotions and their underlying motivations.

Chapter 2 gives a broad overview of the literature dealing with overbidding from the economic, behavioral, or psychological perspective. It provides a classification of different overbidding behaviors and a review of different static and dynamic explanatory

approaches. The chapter does not exclusively focus on emotional explanations, but rather introduces the whole existing spectrum ranging from more economic concepts to purely emotionally motivated approaches. This chapter serves as the basis for all subsequent chapters.

Chapter 3 focuses on the first research question. It gives an overview of the emotion psychological literature to answer the question what emotions are introducing cognitive emotion psychology as a valuable aid in understanding emotionally motivated bidding behavior in auctions. The chapter also introduces a model and global structure of all relevant emotions developed by Ortony et al. (1988), discusses its applicability to auction theory and identifies the most relevant emotions for bidding behavior.

Chapter 4 addresses the second research question, investigating the consequences of integrating emotional processing into the bidding model, challenging the validity of the static model, and proposing instead a dynamic bidding framework. This dynamic framework illustrates decision making behavior in a dynamically developing environment demanding dynamically evolving decision processes.

While Chapters 3 and 4 lay the foundation for experimental work dealing with emotions, Chapters 5 to 7 focus on different aspects of concrete experimental research and testing emotions in the lab. First, the relevance of the theoretical work is tested applying the frameworks for real experiments. Second, practical aspects of auctioning real goods in the lab are discussed. And third, an experiment testing for emotions while auctioning off real goods is implemented.

Chapter 5 focuses on previously conducted lab experiments considered relevant to emotional bidding, following the developed framework and including the emotional processing schemes from Chapter 4.

Chapter 6 considers the relevance of attraction emotions and the resulting importance of auctioning off real goods, providing an overview of auctions with real goods in lab experiments, field experiments, and field studies. The objective is to give a recommendation regarding a suitable type of product and to develop method which is not limited by existing caveats when auctioning off real goods in the lab.

Chapter 7 tests the relevance of two identified emotional pattern in a lab experiment and introduces a new method for auctioning real goods in the lab.

Chapter 8 synthesizes the findings and concludes with recommendations for further research on emotions in auctions.

Chapter 2

Overview of overbidding research

Lee and Malmendier (2011) compare fixed price offers with final prices in auctions. Almost half of the auctions lead to overpayment by more than $10. 35% of bidders overpay more than $20 and 25% overpay more than $30. The average total price is $144.68. These results are astonishing and research is still looking for explanations. Overbidding is not a new phenomenon. The discussion started 30 years ago when experimental research began to test the risk neutral Nash equilibrium (RNNE) and the revenue equivalence theorem (RET) and found that bidders bid higher in first-price auctions (cf. Coppinger et al., 1980; Cox et al., 1982). Since then overbidding has not lost its topicality.

This chapter reviews the relevant literature on overbidding to give an overview of current research regarding the thesis's central question "When and why bidders overbid in auctions?". Since the term overbidding is used in very different contexts, the first section introduces a classification of different overbidding behaviors. Afterward, different influencing factors that favor overbidding are introduced, answering the question "When do bidders overbid?". A structure is developed along which existing explanatory approaches can be discussed, answering the question "Why do bidders overbid?". Each explanation and associated research papers are discussed in more detail. The last section concludes with a summary of the existing results, illustrating the research gap this thesis focuses on in the subsequent chapters.

2.1 Definition of overbidding

Auction fever, bidding frenzy, bidder's curse, or simply overbidding—all terms are used in order to describe the fact that bidders bid higher than certain benchmarks suggest. While terms like auction fever or bidding frenzy are more commonly used when emotional explanations are in focus, overbidding is usually used in more neutral contexts. Ockenfels and Roth (2006, p. 23) refer to auction fever as an "excited and competitive state-of-mind, in which the thrill of competing against other bidders increases a bidder's willingness to pay" and Popkowski Leszczyc (2004, p. 91) describes bidding frenzy as a mental state "characterized by a high level of arousal or excitement, a sense of competition, and a strong desire to win." While the first papers that test the RET and find that bidders bid higher than the equilibrium in a first-price auction prefer the term overbidding.

Given the inconsistent terminology, it is necessary to clarify what kind of overbidding this thesis focuses on. The term overbidding is used as a very generic term that subsumes all kinds of overbidding behavior in different contexts. According to Table 2.1, overbidding behavior is categorized along two criteria: what type of good is being auctioned and what reference point is used. Generally, experimental research prefers to work with induced values, either in an independent private value (IPV) or a common value (CV) auction. But with the establishment of online auction platforms like eBay, research has discovered the advantages of using real goods and has tried to establish this method not only in field experiments but also in the lab. The second important aspect is the type of reference applied. When studying overbidding, a basis is needed from which the extent of over- or underbidding can be measured. Sometimes an objective or subjective value can be taken as reference point, e.g., the recommended retail price or the cheapest offer found within five minutes of searching the Internet can be an objectively deduced value serving as reference point. The individual maximum willingness to pay can serve as a subjective value for the reference point. However, it is debatable whether individuals really have such a clearly measurable value. A further challenge is to determine this value without influencing the auction results. Another auction design and its results can also serve as a reference. Then overbidding is defined as bidding higher in some auction designs than in others. Most experimental works test this type of overbidding.

	Real good	Induced value (IPV good)	Induced value (CV good)
Bidding above objective or subjective value	Bidder's curse	Bidding above RNNE	Winner's curse
Bidding higher in some auction designs than in others		Relative overbidding	

Table 2.1: Classification of overbidding behavior

In this thesis bidding above an objective or subjective value in a real good auction is referred to as **"Bidder's curse"**. Similar to the winner's curse, this type of overbidding behavior is due to the fact that a few (uninformed) bidders who highly overestimate the value are enough to generate the effect: Lee and Malmendier (2011) conclude that a small number of bidders are enough to cause overbidding in many auctions.

In contrast to the bidder's curse experiments, a bidding equilibrium can be deduced and people's bidding behavior can be tested against a clear benchmark, when auctions work with induced values. In most private value auctions the RNNE serves as a benchmark and this type of overbidding is named **"Bidding above RNNE"**.

In common value auctions bidders do not know the value of the item. The value is uncertain but equal for all participating bidders. Bidders have to estimate the value based on signals or other private information. One can assume that the average estimate reflects the approximate value of the good. The **"Winner's curse"** describes the phenomenon that the bidder with the highest estimate wins the auction at an unprofitable price, if he fails to take this into account and does not adapt his estimate accordingly. In this case winning the auction is bad news and the winner falls prey to the winner's curse.

Most of the more recent experimental work does not compare bidding results to objective or subjective values, but rather across different auction formats. If bidders bid higher in some formats than in others even though theory predicts the same result for both formats, this is also a form of overbidding. This thesis denotes the behavior as **"Relative overbidding"**.

In the following work, overbidding is investigated in the context of independent private

value auctions selling one single good. The extension to auctions with common value goods and goods with interdependent values might provide further important insights into behavior in real good auctions. However, almost all experiments beyond the classical controlled lab experiment have been conducted in a private values context, so adopting this restriction is considered reasonable in a first step.

2.2 When bidders overbid

In order to understand the "Why" of overbidding, it is necessary to identify the situations in which bidders tend to overbid, i.e. the "When". Exploring the differences among auction designs is the first step towards a better understanding of bidding behavior and its influencing factors. Early authors started by comparing the auction results of the four basic auction formats in order to test the RNNE and RET. Later, Isaac and Walker (1985) varied the information feedback in different auction designs and found significant differences in the bidding results. Among others, Ariely and Simonson (2003) and Ku et al. (2005) tested the effect of starting prices and number of bidders and find that both factors influence overbidding.

In contrast to Adam (2010) this thesis concentrates on directly changeable auction design parameters like auction format, type of information given to the bidder, starting price, or number of bidders. Adam (2010) aggregates these directly changeable auction design parameters into three categories, so called emotional inducers: perceived competition, previous investments and perceived ownership. The drawback I see in this categorization is that such a classification builds on an interpretation that might be wrong. Specifically, the author assumes that bidders perceive a higher number of bidders and a longer duration of the auction as greater competition. This perceived competition leads to overbidding. I argue that the opposite could be the case and a low number of bidders could also lead to greater perceived competition.

2.2.1 Auction format

Auction research identifies four basic auction formats: English, Dutch, first-price and second-price auctions. Early experiments on bidding behavior by Coppinger et al. (1980),

Cox et al. (1982) and Kagel et al. (1987) compare the bidding behavior in these four auction formats. Bidding above RNNE is observed in first-price and second-price auctions, while bidders bid according to the RNNE in English auctions. The picture is still not clear in Dutch auctions. Relative overbidding, in the sense that bidders do not bid according the theoretical prediction of the RET, is also observed. Prices in first-price auctions exceed prices in Dutch auctions, and prices in second-price auctions exceed prices in English auctions. Kagel (1995) concludes that dynamic auctions (with induced values) raise lower revenues than static auctions—a fact that seems to be contraintuitive to the findings of much of the current literature, which considers the appearance of dynamic elements to be crucial for overbidding (cf. Ariely and Simonson, 2003; Heyman et al., 2004; Ku et al., 2006). Lucking-Reiley (1999) tests the RET outside the lab with real goods and finds evidence for higher revenues in dynamic auctions. In his experiment with Magic cards, Dutch auctions earned approximately 30% more revenue than first-price auctions. English auctions only earned an insignificant 3% more than second-price auctions.

2.2.2 Informational feedback

The results of three pivotal experiments conducted by Isaac and Walker (1985), Neugebauer and Selten (2006), Engelbrecht-Wiggans and Katok (2008) examining the influence of informational feedback on bidding behavior suggest, that bids are higher in auctions that limits the informational feedback to the winning bid. In most other experimental settings so far, it was common to restrict the information to the announcement of the winning bid.

Isaac and Walker (1985) tested for the price determination in repeated sealed bid auctions when all bids are revealed afterwards (Treatment *Full information*). They used a limited information setting, in which the subjects were given the winning bid from the previous period, as a control treatment (Treatment *Limited information*) and found prices under the limited information setting to be consistently higher than under the full information setting. Neugebauer and Selten (2006) tested the Nash equilibrium predictions in a first-price multi-period auction with three different information feedback treatments. In Treatment *TO* bidders received no information, in Treatment *T1* bidders were informed about the winning bid, and in Treatment *T2* bidders were informed about the

highest competitor's bid. Their data suggest that the frequently used information feedback revealing the winning bid only, fosters overbidding. Filiz-Ozbay and Ozbay (2007) conducted a one-shot game, concluding that bidders who know that all bidders are going to be informed about the winning bid, bid systematically higher than bidders with other informational feedback. Engelbrecht-Wiggans and Katok (2007) conducted a first-price auction with thousand repetitions and four different feedback treatments: *Loser's regret*, *Both* (information), *None* (information), *Winner's regret*. Each bidder plays against two computerized players that bid according to RNNE. In the loser's regret treatment the bidder receives the information about the winning bid if he loses the auction. If the winning bid is still below the losing bidder's valuation, the loser can quantify his missed opportunity to win. The knowledge that a bidder could have won the auction at a profitable price, can induce loser's regret. In the winner's regret treatment the bidder receives the information about the second highest bid in case of winning the auction. The winner is informed about the amount of money left on the table. That is, about the difference between his own bid and the next competitor's bid. Thus, winners realize that they could have won the auction at a lower price and may regret bidding too high (winner's regret). The loser's regret information setting leads to a higher bid/value ratio than the winner's regret information setting. In the additional two treatments bidders either receive no information at all (Treatment *None*) or all information (Treatment *Both*).

The three experiments presented above were conducted with induced values. It is difficult to achieve similar results in field experiments due to standard informational feedback procedures on platforms like eBay. Table 2.2 summarizes the results, sorting from the information feedback treatment with the highest degree of overbidding to the information feedback treatment with the lowest degree of overbidding, whereby it should be noted that overbidding is measured differently. Isaac and Walker (1985) compare the price/value ratio with each other (but do not publish the concrete numbers in their paper), Neugebauer and Selten (2006) measure the likelihood to bid above RNNE. And Engelbrecht-Wiggans and Katok (2008) calculate the bid/value ratio. All numbers are shown in brackets. Consistent pattern across the three central experiments on informational feedback can be found: bidders bid highest when the given information is restricted to the winning bid.

Type of information	**Isaac & Walker (1985) (price/value ratio)**	**Neugebauer & Selten (2006) (overbidding)**	**Engelbrecht-Wiggans & Katok (2008) (bid/value ratio)**
Only winning bid	Limited information (na)	T1 (75%)	Loser's regret (0.7660)
Highest competitor's bid (always)	-	T2 (48%)	Both (0.7265)
No information (only winner/loser)	-	T0 (41%)	None (0.7154)
Highest competitor's bid (only when winning)	-	-	Winner's regret (0.6973)
Full information (always)	Full information (na)	-	-

Table 2.2: Overview of findings on informational feedback in pivotal experiments by Isaac and Walker (1985), Neugebauer and Selten (2006), Engelbrecht-Wiggans and Katok (2008)

2.2.3 Number of bidders and bids

According to Vickrey (1961), the expected price in the basic auction formats increases with an increasing number of bidders. Experimental findings of a positive correlation between the number of bidders and the final price is fully in line with the theoretical predictions of a risk neutral equilibrium solution. Cox et al. (1988) confirm this correlation in a lab experiment by varying the number of bidders N with $N = 3, 4, 5, 6, 9$. The auctions with a higher number of bidders resulted in higher final results.

Auctions in field experiments are more dynamic. The number of bidders is not exogenously determined, but develops endogenously. Ariely and Simonson (2003) find, that final winning prices are positively related to the total number of bids and total number of bidders. And Heyman et al. (2004), manipulating the number of bids and rebids by using computerized bidders, conclude that bids are higher when many bidders bid and rebid in a dynamic multi-period auction. Again, the findings are in line with the theoretical considerations. More bidders increase the likelihood of higher valuations and thus of higher

final prices (cf. Ku et al., 2006).

Heyman et al. (2004) find that the endogenously developing number of bidders can be influenced by certain factors in a very systematic way. Once there is a high level of active bidders, those bidders attract even more bidders. Dholakia and Soltysinski (2001) identify the tendency to bid for auction listings with one or more existing bids, ignoring comparable or even more attractive listings, which are available at the same time but not bid on. Ku et al. (2006) conclude that people use bidding activity in assessing an item's value.

According to Zajonc (1968) even passive spectators might have an influence on active bidders' bidding behavior due to the audience effect. Ku et al. (2006) report higher results in live auctions for fiberglass animals than in Internet auctions conducted in parallel. The authors theorize that the feeling of being observed by an audience might be one reason for higher results.

2.2.4 Starting prices

The level of the starting price plays an important role in determining whether an auction attracts rather few or many bidders, and as a consequence potentially results in lower or higher prices. Ku et al. (2006) find that lower starting prices are more likely to result in a completed transaction, generate higher final prices, and lead to more bids and bidders. Simonsohn and Ariely (2008) find that, conditioning on current price, low starting price auctions are more likely to receive additional bids. That is, the results of Ku et al. (2006) and Simonsohn and Ariely (2008) support the assumption that auctions with low starting prices lead to higher final prices than auctions with high starting prices. They argue that low starting prices imply a reduced barrier to entry, which increases bidding activity. And an increased bidding activity leads to higher final prices.

Other research contradicts these findings and support the hypothesis that high starting prices lead to high final prices, at least when anchoring is in play because comparable items are not directly available. According to Ariely and Simonson (2003), higher starting prices lead to higher winning bids, but only when comparable items are not available in the immediate context. Auctions with a low starting prices attract more bidders (8.2 bidders versus 5.3) and increase the average number of bids per bidder from 8.3 to 15.3. Following

these results it can be concluded that high bidding activity does not necessarily lead to high final prices.

The conflicting theories can be summarized as follows: Ku et al. (2006) and Simonsohn and Ariely (2008) assume that a low starting price enhances the attractiveness of entering the auction leading to higher final prices. They conclude that lower starting prices lead to higher final prices or at least to significantly more bidding activity. Ariely and Simonson (2003), in contrast, find that low starting prices can serve as an anchor and produce low final prices whereas high starting prices lead to high final prices— a phenomenon they observe in real estate markets. Ariely and Simonson (2003) believe that "both processes might operate, and their relative weights might depend on factors, such as whether the product offered is such that the allure of its low starting price has the potential to generate emotional involvement and cause a bidding frenzy." The different results might be explained by the fact that these results are mainly derived from field study experiments. In contrast to theory or controlled experiments, subjects in field study experiments have access to several auctions with potential competition among auctions where it seems reasonable that people choose the auction with the lowest starting price. All studies conclude that lower starting prices lead to more bidding activity, which is not surprising since all participants with a valuation between the low and the higher starting price have an incentive to bid. The question is, conditioning on current price, whether low starting price auctions are more likely to receive additional bids, as supported by Simonsohn and Ariely (2008).

2.2.5 Duration of auction

English auctions can establish a hard or soft ending rule. eBay uses a hard end, which means that the auction ends at a specific time. Sellers can choose between a seven and a ten day duration. As a consequence, most of the bidding activity takes place in the last hour. Ockenfels and Roth (2006) observe sniping: 20% of the bids are submitted in the last hour and 8% of the bids in the last minute. Other platforms choose a soft ending rule, that is, the auction ends only after a certain period of time has passed after the last bid was submitted. The effect of auction duration on overbidding behavior has been tested in several experiments. Ariely and Simonson (2003) analyzed the auction of Rose-Bowl

game tickets and found that auction duration is negatively correlated with the final price. Short auctions yield higher results. The authors suggest that shorter auctions might lead to increased competition, which drives up prices. Heyman et al. (2004) manipulate the duration of the auction by allowing one bidder to participate in each out of nine rounds while the other bidder is allowed to join the auction in the eighth round. Both bidders are informed about the complete bidding history, ensuring the same information across both treatments. Bidders bid $6.39 in the long duration treatment and $4.02 in the short duration treatment, a highly significant result. Ku et al. (2005) confirm this tendency. Bidders bid higher when they had invested more time in the auction.[1] Adam (2010) varies the clock speed in a Dutch auction. He shows that a fast descending Dutch auction leads to lower results and explains this behavior with the concept of "utility of suspense".

2.2.6 Auction platform and type of good

20 years ago, most people associated an auction with the classical live auction of fine art like those conducted at Sotheby's or Christie's. Nowadays, most people auction quotidian goods on online platforms like eBay. Both the auction platform as well as the type of good being auctioned might have an influence on bidding behavior. Ku et al. (2005) find that final prices in live auctions for fiberglass animals were higher than in the corresponding Internet auctions. Heyman et al. (2004) auctioned four different goods and found no significant differences in the price level across the four products. Wolf et al. (2008) examined the duration of exposure to a good. They found that bidders who investigated a mug for 30 seconds instead of for 10 seconds before the auction starts, bid significantly higher. The mere length of physical contact seems to stimulate bidding behavior. In summary, study results suggest that especially the context in which a good is auctioned has a significant influence on bidding behavior.

[1] Strictly speaking, the duration of the auction does not vary in both experiments, but rather the duration that one bidder actively participates in an auction.

2.3 Why bidders overbid: Classifications of explanations

The previous section gives an overview of factors that influence bidding behavior. In lab experiments, static auction formats lead to higher prices than dynamic auction formats. This trend is reverse in online experiments. The type of informational feedback has a clear influence on bidding behavior, while the effect of a starting price is ambivalent. An increasing number of bidders and bid activity generally leads to higher prices, which is in line with theoretical predictions. These findings build the starting point for possible explanations for overbidding.

Explanations can stay within the tradition of neo-classical theory undergoing some minor modifications. But explanations can also overcome the narrow traditional neo-classical view and incorporate findings from other research areas like behavioral research, cognitive or even emotional psychology. Staying in the tradition of neo-classical theory also implies that bidders follow a static predetermined action plan. Bidders are assumed to be homo oeconomicus, characterized by rationality, willpower, and self-interest. Integrating findings from behavioral research and psychology leads to a decision process which evolves during the auction and is constantly updated. Bidders change or supplement their original thought-through action plan. The valuation for the good might change in the course of the auction. This change does not follow a predetermined path but depends on the other bidders' bidding behavior and the general auction settings. Cognitive processes other than rational thinking play a more relevant role in dynamic explanations and emotions become more important.

2.3.1 Static explanations in a rational world

The first experimental results in auctions (cf. Coppinger et al., 1980; Cox et al., 1982; Kagel et al., 1987) have led game theorists to rethink their models. They have started to search for explanations that are in line with expected utility theory and the rationality of neo-classical theory introduced in Subsection 1.2.1, while releasing the strict assumptions, which were developed by Vickrey (1961) to deduct the equilibrium solution, and extending the standard utility function by including non-standard preferences.

Utility maximization with relaxed assumptions

Vickrey (1961) developed four central assumptions to derive the RNNE and formulate the RET in an independent private value auction: bidders are risk neutral, they are *a priori* symmetric, each bidder has an independent valuation, and the bidders' payment depends only on the bid. With risk averse bidders the RET no longer holds as first-price and Dutch auctions generate greater revenues than second-price and English auctions. Bidders in second-price and English auctions still have the dominant strategy to bid their valuation, but bidders in first-price and Dutch auction have an incentive to forego some profits just to increase their probability of winning the auction. Risk averse bidders would thus at least explain for the observed overbidding, in the sense of "Bidding above RNNE", in first-price auctions.

Cox et al. (1982, p. 62-67) acted on this idea and developed the constant risk aversion model (CRRAM) to explain overbidding. While risk aversion might be one factor in overbidding, the CRRAM does no sufficiently explain deviations between experimental results and theoretical solutions. First, the model only explains overbidding in first-price auctions, and it "fails as a maintained hypothesis even in terms of characterizing risk aversion in first-price auctions" (Kagel, 1995, p. 524). Second, Harrison (1989) argues that the conclusions are not well supported since the expected cost of deviating from RNNE bidding is quite small. Subjects have little to lose (less than USD 0.05 at the median) from such a deviation ("flat maximum critique"). In spite of the massive critique, Cox et al. (1982) defended their idea and a vigorous debate was launched among experimentalists.

Utility maximization with non-standard preferences

Utilitarists in the eighteenth and nineteenth centuries had a broad understanding of utility based on cardinal utility theory. Bentham ([1780] 1970), for example, defined fourteen different components of utility, including ideas like pleasure of sense, wealth, skill, power, or relief. Only in the last century did a radical shift towards a material-based, rational utility theory take place. Today's approaches accept that a purely monetary driven utility concept is too limited in explaining many economic phenomena. Utility functions are

supplemented by non-standard preferences like joy, spite, or regret. That is, these newer models maintain the rational utility maximizing agent, but bidders just maximize more complex utility functions. Overbidding can at least partially be explained by these non-standard preferences.

For example, bidders bidding above the RNNE might be explained by the concept "joy of winning". The mere fact of winning the auction adds an extra utility to the bidder's utility function. Cox et al. (1988) expanded their basic model CRRAM to CRRAM*, which they presented in Cox et al. (1982). Cox et al. (1992, p. 1397) concluded that "CRRAM* attributes higher than risk-neutral bids to risk aversion or utility of the event of winning the auction." Holt and Sherman (1994, p. 642) also mentioned the possibility that overbidding in a common value context might be "due to a 'utility of winning' instead of being the result of an irrational failure to anticipate the information content of a bid's acceptance." They neutralized the winner's curse effect and found no strong evidence for the utility of winning hypothesis. Other authors like Ding et al. (2005), Cooper and Fang (2008) and Ertaç et al. (2011) have tested this theory further. Ertaç et al. (2011) found that a model that allows for joy of winning and risk aversion can explain overbidding better than a model that only allows for joy of winning or that only allows for risk aversion. Ding et al. (2005) incorporated not only "excitement of winning" but also "frustration of losing" into their overbidding model, such that losing the auction implicates a certain negative utility.

Morgan et al. (2003) introduced the concept that bidders overbid when they incorporate a disutility in their utility maximization for the rival's surplus. This is interpretable as spiteful behavior. The disutility is not a fixed value, but rather depends on the winning bid. The authors formulated optimal bidding strategies for all four basic auction formats on the basis of the utility function introduced. Their model predicts that bidders bid more aggressively in first-price and Dutch auctions when spite motives are present. Morgan et al. (2003) restricted their work to a "best fit discussion" of the theoretical model, concluding that their model explains overbidding better than risk aversion[2] or joy of winning. They did not test their model in an experimental setup. The fact that

[2]Risk aversion has the same explanatory power for first-price auctions like their concept of spite, but it cannot explain overbidding in second-price auctions

different informational feedback, especially about the winning bid, influences bidders' decisions suggests that comparison to the winning bidder is relevant. Spite as an underlying motive is one but not the only possible explanation. Cooper and Fang (2008) came to the conclusion that joy of winning and spiteful bidding contribute to overbidding in second price auctions. Joy of winning has greater explanatory power when bidders believe that other bidders have similar values, and bidders behave more consistently with the spite motive when they assume that other bidders have much higher values.

Overbidding can also be motivated by "loser's regret" as suggested by Engelbrecht-Wiggans and Katok (2007) and introduced in Section 2.2. Bidders overbid when they fear they could lose the auction while their valuation exceeds the winning bid. That is, they could have won the auction at a profitable price if they had bid higher than the current winning bid, but lower than their own valuation. Bidders anticipate this form of regret and incorporate it into their utility function (anticipated loser's regret). They can also suffer from the so-called "winner's regret". This form appears when the winning bidder realizes that he could have won the good for a cheaper price and made an even greater profit. Winner's regret leads to underbidding. The authors show, that if bidders incorporate both aspects into their utility function and do not overweigh one aspect, the anticipated regret has no influence on the optimal bidding strategy.

Engelbrecht-Wiggans (1989) introduced the effect of regret on the bidding behavior in auctions. He suggested that the bidder's utility depends not only on own profit but also on the regret he anticipates and subsequently takes into account when making his decision. Engelbrecht-Wiggans and Katok (2007) extended the model. Engelbrecht-Wiggans and Katok (2008) based the experimental design on their previous theoretical works but, in contrast to those works, which clearly take an anticipated regret approach, they repeated their lab experiments 1,000 times. Thus static and dynamic aspects interfered, since previously experienced regret might influence the decision for the next round. Filiz-Ozbay and Ozbay (2007) pointed out the difference between anticipated and experienced regret and focused explicitly on anticipated regret. They conducted a one-shot auction experiment and concluded that the loser's regret treatment led bidders to bid more aggressively. The bid/value ratio (0.87) is clearly higher than in the no regret condition (0.79) and in the winner's regret condition (0.77).

2.3.2 Beyond a purely rational world: Dynamic cognitive explanations

Just "repairing" assumptions or utility functions within the economic theory does not give satisfactory explanations for overbidding. Simon (1955, p. 99) sees the necessity "to replace the global rationality of economic man with a kind of rational behavior that is compatible with the access to information and the computational capacities that are actually possessed by organisms." A better understanding of human cognition makes a richer and more realistic characterization of agents possible. Consequently, the plurality of cognitive processes underlying an economic decision should be understood.

A more realistic characterization of the economic agent starts with some restrictions the homo oeconomicus does not face. Key scholars in economics (cf. Vickrey, 1961; Simon, 1957; Kahneman, 2003) agree on the following. First, humans face computational restrictions. They do not have the intellectual capabilities to develop and solve complex utility maximization problems. Second, since humans have to make many decisions, they usually do not have the capacity to apply algorithms to every decision problem they encounter during the day. And third, decision makers do not have perfect information about their valuation and preferences. Empirical research on human behavior suggests that evaluations of objects are usually not certain but rather uncertain and subjectively constructed (cf. Edwards, 1954; Fiske and Taylor, 2013). According to Myers (2010), agents therefore use different strategies to solve problems. Some can be solved with trial and error; others with a sudden flash of insight. For some problems, algorithms are applied. And often simple strategies in form of heuristics are used. For example, agents can follow a standard rule, a routine, or they can try to solve a problem by drawing parallels to a similar problem they solved in the past. Those processes do not follow a predetermined action plan, but rather develop over time and change our decision processes accordingly. For example, bidding is not static, it develops dynamically throughout the auction. The plurality of approaches allow us to solve many problems fast and efficiently. While all these strategies help to cope with the plurality of daily life decisions, they come with a drawback: They are also more error-prone. Some of these errors are systematic and are known as certain decision biases. The most relevant biases for bidding can help to explain

overbidding behavior.

This subsection outlines the restrictions economic agents face when finding the right bidding strategy in an auction and illustrates possible ways to solve the decision making problem, such as through heuristics. Further it illustrates the biases common among bidders during the auction process.

Leaving the homo oeconomicus behind: Restrictions of rational thinking and the possibilities of heuristics

Vickrey (1961, p. 20) admits that bidders might be "insufficiently sophisticated to discern the equilibrium-point strategy." Therefore, individuals choose simplifications to bring the model within the range of their computing capacities. Then utility functions might be more simple than the ones formulated above. This also includes that bidders approximate solutions instead of calculating them exactly. As a consequence, they might be systematically wrong with their solutions. Dorsey and Razzolini (2003) find that bidders systematically misperceive their winning probabilities and overbid for this reason. In an auction setting the considerations of a utility maximizer with restricted computational skills might be the following: The bidder i has to submit a bid in a first-price auction and knows his valuation v_i. The bidder knows that he has to bid below v_i in order to make a profitable deal. He additionally knows that while his profit is increasing; the lower the submitted bid, the lower the probability to win the auction. But instead of solving this computation problem, he approximates the solution. Although the bidder has understood the basic concept, he probably will not end up with the exact equilibrium solution.

Individuals also choose simplifications to ensure that many processes can be solved effortlessly. Developing exact algorithms for simple cotidian decisions would require to much effort in the face of the many decisions that have to be taken during a day. Heuristics can help to solve those decision problems in an efficient manner. In this context Kahneman (2003) talks of a two system structure. Agents base their decisions on two systems: System one is fast, automatic, and effortless. System two is slow, controlled, and effortful. Both cognitive systems correspond with two types of cognitive processes: intuition and reasoning. Solving the maximization calculus of a first-price auction correctly and deriving the resulting bidding strategy is a reasoning process. But it goes beyond human capacities

to calculate every decision that has to be made in daily life. Often intuition is applied to avoid complex mathematical operations. E.g., a bidder solves the decision problem in a first-price auction as follows: He should bid below his real value to secure a certain profit, but he should also bid a relevant amount to increase his probability of winning. And his intuition might come to the conclusion, that a 10% discount from his valuation is a good compromise.

According to Ariely and Simonson (2003, p. 115) "preference uncertainty and construction are fundamental characteristics of consumer decision making, and there is no reason to believe that they will not apply to decisions involved in online auctions." For a detailed review on choice construction the reading of Bettman and Payne (1998) is recommended. Considerations on common values, interdependent values and independent values with uncertainty cover the aspect of value uncertainty in standard auction theory. However, a very systematic and calculable way is usually proposed to deal with the different kinds of uncertainty. Due to the restricted computational skills, discussed above, this is usually not the way bidders deal with uncertainty in reality. In a retail shop consumers have to decide whether to buy a good at a certain price or not. Sometimes this decision making is difficult enough. In an auction they have to decide how high to bid, a decision making process that is far more complex, since most bidders do not know the exact value of a good. Subsequently, they are uncertain what to bid and try to use the auction to find out the good's real value. Intuitive processes seem to play a very relevant role. Bidders enter the auction with an exploratory mindset, trying to conclude from the course of the auction and especially from other bidders' behavior how high to bid. Thus, depending on the course of the auction and other bidders' behavior, bidders can fall prey to overbidding. Ariely and Simonson (2003, p. 115) assume that participants are "influenced by various value indicators, which will impact their preferences and willingness, to bid for an auctioned item." They consider the starting price, the reserve price, the number of bids bid up to that point, and the seller's reputation as relevant. Dholakia and Soltysinski (2001) and Simonsohn and Ariely (2008) find herd-like behavior in bidding processes. Before entering the auction, bidders observe other bidders' behavior. They tend to enter auctions with more active bidders and end up bidding higher amounts. That is, auctions with more participating bidders might have a positive influence on the

individual's value construction, leading to higher prices. Bidders also often tend to derive the optimal solution by learning from previous auction rounds. That is, bidders start with a trial-and-error concept, hoping to gain some insights to help them bid correctly in the course of the auction. While one-shot auctions do not support a trial-and-error procedure, repeated auctions or dynamic auctions do. Bidders get started and hope to find the right bidding behavior in the course of the auction. Neugebauer and Selten (2006) find that almost all bidders in a first-price auction behave in line with learning direction theory. This is a rather simple theory, developed by Selten and Buchta (1999) following a trial-and-error concept. Bidders tend to decrease their bid after having won the previous auction round and they tend to increase their bid after having lost the previous auction round. Learning theory can lead to overbidding when unilateral feedback is given, that is the fact of losing the auction is emphasized more that the fact of winning, or when bidders often receive the losing feedback.

Biases in cognitive processes

Heuristics help to solve decision problems which could not be solved otherwise given our restricted computational capabilities and capacities. But often homo sapiens underly some biases when applying intuitive assessments. In the 1950ies, Allais (1953) presented a behavior anomaly which can be attributed to the certainty effect, the so-called Allais paradox. Tversky and Kahneman (1974) introduced a dozen different biases agents fall prey to when assessing probabilities and predicting values with different heuristics. Frey and Benz (2007) give an overview of the most important anomalies, summarizing sunk cost fallacy, the opportunity cost effect, the endowment effect, and the preference reversal effect as most important anomalies in economics. Loss aversion, sunk cost fallacy, anchoring, and framing effects play an important role in auctions and will be introduced in more detail below.

Anchoring: According to Tversky and Kahneman (1974), three heuristics play an important role when assessing probabilities and predicting values: representativeness, availability, and anchoring. When agents have to predict values they often start from a given point, make certain adjustments, before they yield the final estimate. The anchoring effect occurs, when insufficient adjustment takes place. That is, when different starting

points lead to different final estimates, which are biased towards the initial starting point's value. A first experiment was conducted by Tversky and Kahneman (1974). A wheel of fortune with numbers ranging from 0 to 100 was spun and participants were asked to estimate various quantities, e.g., the percentage of African nations belonging to the United Nations. Estimates are biased towards the randomly drawn number. In this example, the median estimate is 25%, when participants receive the number 10 as starting point. The median estimate is 45%, when participants receive the number 65 as a starting point.

The fact that bidders bid highest, when only the winning bid is announced, supports the anchoring effect. In contrast to an auction design, where the losing bids are announced, the starting point, i.e. of the winning bid, is higher. According to the effect, higher starting points lead to higher final results. The selection of a starting prices can have a similar effect. Ariely and Simonson (2003) support this. In their experiments higher starting prices lead to higher final bids, when comparable items are not available in the immediate context. Participation fees can have a similar effect.

Loss aversion: According to Kahneman and Tversky (1979, p. 279) "losses loom larger than gains", that is losses are overestimated compared to gains. Thaler (1980) finds that the willingness to pay (WTP) is smaller than the willingness to accept (WTA), that is, decision makers value a good more when it is part of their own endowment. This discrepancy can be explained by prospect theory and its idea of loss aversion. The subject's current endowment serves as a reference point. Given this reference point, it is consequent to demand a higher compensation for the loss than the same person is willing to pay in order to gain the item.

According to Ariely and Simonson (2003) loss aversion might be relevant in auctions. As long as the auction is ongoing no one owns the item, but during the process of the auction psychological ownership might take place and increase the willingness to raise the bids in order to reclaim the endowment. This is called the pseudo-endowment effect. Probably due to the fact that the endowment effect and its explanation loss aversion is one of the very widely discussed phenomenon in behavioral economics, it also attracts significant attention in auction theory and experiments.

According to Ehrhart et al. (2013), subjects view their decision making problem from two different perspectives: From the X perspective, which is acquiring the good and from

the Y perspective, which is giving up the good. By putting weight on the two different questions, in dependence of their subjective "nearness" to Y, subjects combine the both perspectives in one decision problem. They find a significant price increase when an endowment effect was introduced by declaring the high bidder after each round.

Heyman et al. (2004) varied the length of duration. The average bid for the subjects in the long duration of ownership condition is \$6.39 as opposed to \$4.02 for those people who came in just prior to the last round (short duration of ownership). This difference of \$2.37 is statistically significant and the authors take it as evidence for the quasi-endowment effect.

Wolf et al. (2008) tested to what degree the duration of physical contact to an item affects a bidder's valuation in an English open bid auction. In a lab experiment participants could either examine the product for ten seconds or for 30 seconds before the auction starts. Wolf et al. (2008, p. 479) summarize that "the average winning bid was \$3.70 for short duration groups, with the winning bid exceeding the mugs retail price only once (\$7.50). The average winning bid was \$5.80 for the longer duration groups, with winning bids exceeding the mugs retail price four out of seven times." They tested the same effect in a static auction and find the same results regarding the difference between short and long exposure albeit on a lower level (\$2.24 vs. \$3.07).

Framing: Decision makers perceive problems differently depending on the angle from which they look at the problem. That is, two equivalent versions of the same problem lead to different choices depending on how the problem is framed. Tversky and Kagel (1981) introduced the framing effect and triggered a vivid debate (cf. Camerer, 1995; Levin et al., 1998). Tversky and Kagel (1981) illustrated the biased decision making in their "lives lost, lives saved" example. Decision makers have the choice between two public health programs, one of which has to be put in place because an epidemic disease threatens 600 lives. In the first decision problem, program A saves 200 lives for sure, program B has a chance of one third to save all 600 lives versus a chance of two third to save none. 72% favor program A. In the second problem, program C let 400 people die and program D let no one die with a chance of one third versus 600 die with a chance of two third. 78% decide for program D. Although people wish to give consistent answers, they also remain risk averse in the "lives saved" version and risk seeking in the "lives lost" version when

re-reading and re-thinking the problem.

The possibilities in auctions to influence the auction results by using different framings are manifold. One possibility is to talk about losing and winning the auction instead of using neutral formulations. This might increase competitive feelings among bidders which lead to higher results. E.g., Ariely and Simonson (2003) show that bidders perceive an auction as competitive, referring to other bidders as competitors and speaking of winning and losing when referring to the auction outcome.

Sunk cost fallacy/Escalation of commitment: Sunk cost fallacy describes the psychological inability to ignore sunk costs and is "manifested in a greater tendency to continue an endeavor once an investment in money, effort, or time has been made" (Arkes and Blumer, 1985, p. 124). According to economic theory, rational agents should ignore sunk costs. Only incremental costs are relevant for the current decision. Bidders justify a previous decision by investing more instead of leaving the auction. Bidders who have invested time, energy, etc. in an auction may feel a need to justify their actions and escalate their commitments, leading them to bid past their limits (Ku et al., 2005). Ku et al. (2005) and Heyman et al. (2004) interpret the fact, that the duration a bidder participates in an auction has a positive influence on the price, as evidence for escalation of commitment. And also the positive correlation between length of exposure and final price level (cf. Wolf et al., 2008) can be ascribed to sunk cost fallacy. Another example for escalation of commitment could be Shubik's $20 Auction. Although it has to be borne in mind that this auction has a very special set up, in which the second highest bidder pays his bid and receives nothing.

2.3.3 Dynamic emotional explanation

Thaler (2000) predicts a development from homo oeconomicus to homo sapiens. Analyzing the complex cognitive processes a normal decision maker is usually subject to is one important step in this direction. But one essential component that influences the decision making of a homo sapiens is still missing: emotions. Bosman and Riedl (2004, p. 1) conclude, that "for a good understanding of bidder behavior the emotions have to be taken into account." According to Myers (2010) emotions are a mix of physiological arousal, expressive behaviors, consciously experienced thoughts and feelings. The most

relevant tendencies in the context of auctions, overbidding, and its possible explanations are introduced.

Classical experimental setting: Regret and arousal

One research fraction approaches the topic emotion from the rather traditional economic perspective. Engelbrecht-Wiggans (1989) started by adding a regret component to the standard utility function and solving this supplemented utility function like the classical homo oeconomicus. The previous part "Utility maximization with non-standard preferences" introduces this paper. It shows that overbidding in first-price auctions can be explained by bidders overweighing loser's regret compared to winner's regret. That is, bidders are especially concerned about losing the auction when the winning bid is below their own valuation. Twenty years later, Engelbrecht-Wiggans and Katok (2008) introduced an experiment which again included a standard utility maximization calculus supplemented by a regret component. However, the experimental design with its 1,000 repetitions explicitly allowed for dynamically evolving emotions during the auction. Regret is no longer an exactly quantified disutility component, but an emotion that occurs unexpectedly and uncontrollably during the bidding process.

Ku et al. (2005) developed a "competitive arousal model" which suggests that overbidding is the result of arousal, since arousal can impair calm and rational decision-making. According to Ku et al. (2005, p. 92) "numerous factors—rivalry, social facilitation, time pressure, and the uniqueness of being first—might increase arousal and lead individuals to bid past their limits." Especially the competitive nature of auctions is emphasized. Competition is more than the question of winning or losing the auction. This point might be sufficiently covered by the concept joy of winning introduced in Subsection 2.3.1. Competition also leads to bidders being highly aroused due to the existence of time pressure (e.g. Dutch auction) or the mere presence of other individuals. Bidders are more likely to bid past their limits "in the heat of the moment", when the end of the auction is near and when rivalry is particularly high among a few remaining bidders.

Physioeconomics: Suspense and regret

Some of the previously discussed literature suggests an interaction between physiological arousal and bidding behavior. Adam (2010) examined this interaction more deeply. He extends the existing approach in experimental economics, including the possibility to measure the nervous system activity using physiological correlates of human emotional processing. Adam (2010, p. 60) denotes this approach "physioeconomics" and defines it as following: "Physioeconomics extends existing methods of experimental economics by measuring autonomic nervous system activity using well-established psychophysiological methodology, in order to gain a profound understanding of the dynamic process of human economic decision-making." Skin conductance and cardiovascular activity serve as proxies for the measurement of nervous system activity.

Adam (2010) conducted Dutch auctions in which he alters the clock speed. The author intends to provide physiological evidence for the hypothesis, that bidders bid lower in Dutch auctions due to the "utility of suspense". He finds that auctions with a faster clock speed increase excitement among bidders and lead to lower prices. A higher average skin conductance level and a higher average heart rate in the fast speed design indicate a higher average level of physiological arousal. This higher physiological arousal is taken as evidence for higher excitement.

Astor et al. (2011) examined the influence of different levels of informational feedback. The common explanation why bidders bid differently in different information settings is winner's and loser's regret. The authors measured the physiological reaction and found that skin conductance rate was higher when bidders received the information in a loser's regret treatment. They interpreted this physiological reaction as evidence for regret.

Neuroeconomics: Fear of losing

Delgado et al. (2008) combined neuroeconomics with behavioral economic techniques. Using functional magnetic resonance imaging (fMRI), they measured the blood-oxygen level-dependent (BOLD) response that serves as a proxy for the neural activity. They designed an experiment, in which participants were informed about losses and gains in social competition games, but no actual loss or gain occurred at the moment they were

informed. They find that participants react to loss information with a significant decrease in BOLD response relative to the response to information about gains. Delgado et al. (2008, p. 1851) cautiously interpret this behavior as an indicator that "fear of losing a social competition may be linked to overbidding." They subsequently designed a second experiment with a loss, a bonus, and a baseline treatment. The loss treatment results in greater revenues. Delgado et al. (2008) interpret the result as evidence for their hypothesis that bidders bid higher because they fear losing the auction. However, the experimental design can also foster the endowment effect, since bidders in the loss treatment receive money at the beginning which they are allowed to keep if they win the auction, and which they lose if they lose the auction.

2.4 Conclusion

This chapter provides an overview on different types of overbidding and the auction parameters that enhance overbidding. It can be concluded that some parameters, such as the selected auction format or informational feedback, can lead to overbidding. The chapter summarizes the existing explanations for overbidding as illustrated in Figure 2.1. First approaches that tried to explain overbidding within the standard expected utility theory have proven too unilateral to describe human agents' behavior. Approaches that allow for a human agent with certain cognitive restrictions, but a wider set of tools for finding solutions, provide helpful explanations. Especially the work of Daniel Kahneman and Amos Tversky provide a solid theoretical fundament on which ideas regarding human decision making, the role of heuristics, and cognitive biases have been developed.

Following approaches which include emotional decision making further enriches the possibilities to understand overbidding in auctions. However, such approaches are sill in their infancy. First papers on regret and arousal have good ideas but lack a thorough theoretical background of emotions. For example, the study by Engelbrecht-Wiggans and Katok (2008) focused solely on regret. If their work had been grounded in the broad set of different possible emotions that exist in emotion psychology, emotions such as self-reproach or spite could have served as additional emotional motives for overbidding. Arousal, as included in a simple definition of emotion, is an integral part of emotion,

	Categorization	Concrete explanation
Static explanations	• Utility maximization with relaxed assumptions	• Risk aversion
	• Utility maximization with non-standard preferences	• Joy of winning • Fear of losing • Spite • Loser's regret
Dynamic, cognitive explanations	• Restrictions of rational thinking	• Simplifications or systematic errors due to limited computational capabilities • Heuristics for valuation due to imperfect information • Heuristics for efficient decision making
	• Cognitive biases	• Framing • Anchoring • Loss aversion • Sunk cost fallacy
Dynamic, emotional explanations	• Field/Lab experiment	• Arousal • Regret
	• Physioeconomics	• Suspense • Regret
	• Neuroeconomics	• Fear of losing

Figure 2.1: Overview on explanations for overbidding based on literature review

but arousal alone does not constitute an emotion. Russell and Pratt (1980) suggested a model that categorizes emotions along two independent dimensions: arousal and pleasure/valence. That is, arousal defines the intensity of an emotion, but not the quality. However, the bidding behavior might differ depending on whether bidders are highly aroused due to joy or due to anger.

As discussed above, Adam (2010) introduced a very profound methodology for measuring physiological correlates of human emotional processing, called physioeconomics. If it is assumed that higher skin conductance rate and higher cardiovascular activity are indicators of stronger emotional processing, situations can be identified which foster high emotional involvement. But since the physiological reaction is only one dimension of emotional processing, it is difficult to identify the qualitative aspects in more detail.

Delgado et al. (2008) conducted an auction experiment in a still very young discipline, called neuroeconomics. I consider neuroeconomics a very promising field, but given its

high time and monetary costs, I recommend thorough testing in classical experimental designs before.

I see a great opportunity to understand human bidding behavior much better, if emotional auction research base their further experimental setups on a profound theoretical framework which emphasizes the qualitative aspect of emotions. It is the objective of this thesis, to develop such a framework and to demonstrate its explanatory power when discussing auction results.

Chapter 3

Emotion psychology and its relevance for auction theory

As illustrated in Chapter 2, most scholars agree on the increasing importance of emotions in economic decision making. Loewenstein and Lerner (2003, p. 619) state that "incorporating affect in models of decision making can greatly increase their explanatory power." To date, there is a lack of profound theoretical background on emotion research in economics and a lack of systematic approaches to investigating how emotional processes can be integrated into auction theorists' bidding models or frameworks. Researchers in this field neither share a clear definition of emotion, nor have they identified the most relevant emotions for bidding behavior that should be considered in such a framework. It is the objective of this chapter to define the notion "emotion" and to identify an emotion theory that serves as a solid theoretical basis for investigating emotionally driven decision making in economics, especially in auction theory. The objective is to develop an approach that clearly defines the notion of emotion while concentrating on the qualitative aspects of emotions. That is, it should be established what emotion exactly is, what emotions exist and what emotions influence bidding behavior in auctions.

The chapter's first part reviews the most relevant research on emotion theory—from an economic and a psychological point of view. Such a review should help us understand the origins of emotion theories and the wide array of elaborate concepts in both fields. Subsequently, the selection of the most appropriate emotion theory is discussed and the selected emotion theory is introduced in more detail. In the last part it is demonstrated

how a clear structure of emotions can enrich the discussion of bidding behavior and help identify the most relevant emotions for auctions.

3.1 Emotion: The economical point of view

As introduced in Chapter 2, in the the last years, emotions have started to play a more important role in economics. This section gives an overview of the most relevant theoretical literature in the interdisciplinary field of emotion and economics. Elster (1998) was the first to discuss the relevance of emotions in economic theory. Loewenstein (2000) discussed several phenomena in decision behavior (decision making under risk, intertemporal choice and social preferences), focusing on expected and immediate emotion. Bechara and Damasio (2005) and their somatic marker hypothesis show that emotions contribute to advantageous decision making. None of these works discuss the applicability to auction theory.

Elster (1998) criticized that emotion plays a negligible role in the economist's toolkit. Contemporaneously, Rabin (1998) published an article on "Psychology and Economics" in which emotions do not play any role. This gap between economists and emotion psychologists can be explained by the absence of interdisciplinary researchers such as Daniel Kahneman and Amos Tversky in the field of cognitive research. Elster (1998) gave a comprehensive answer to the question: What are emotions? Cognitive antecedents, intentional objects, physiological arousal and expressions, valence, and action tendencies are the six features that characterize emotion. He further discusses whether emotions can be chosen consciously, respectively, how they are induced. Elster (1998) is explicitly interested in the question, to which degree emotions can explain existing behavior. Astonishingly, this is a rather untypical question for emotion theorists. Elster (1998, p. 47) found, that emotion theorists are especially concerned with "action tendencies rather than with observable behavior."

Rick and Loewenstein (2008) investigated the degree to which emotions influence decision making. They established an important approach to integrating emotions into economic research and discussed the influence of emotions on different standard decision making situations like decision making under risk, intertemporal choices, and social pref-

erences. Rick and Loewenstein (2008) distinguished between *Immediate emotions* and *Expected emotions*, picking up on the work of Mellers et al. (1997), who first introduced the notion of anticipated pleasure as one not perceived at the moment of choice. The concept of Mellers et al. (1997) can be transferred to all emotions not only pleasure. (Rick and Loewenstein, 2008, p. 138) state that "the key feature of expected emotions is that they are experienced when the outcomes of a decision materialize [...] at the moment of choice they are only cognitions about future emotions." Joy of winning is a typical expected emotion in an auction. The bidder, when deciding how high to bid, might imagine the joy he will experience in the case of winning. This notion of expected emotions is perfectly consistent with a static utility maximizing approach and a rational decision maker. The bidder just enlarges his preferences by a non-standard preference: the utility he gains from winning.

In contrast to expected emotions, *Immediate emotions* are experienced at the moment of choice. Rick and Loewenstein (2008) distinguishes between two categories: *Integral emotions* and *Incidental emotions*. Integral emotions develop during the decision making process. They arise when bidders think about the consequences of their decisions. For example, when the bidder has to decide whether to quit the auction or increase his bid, he might experience immediate fear when thinking about quitting and thus probably losing the auction. Incidental emotions develop at the moment of decision making, but they are not directly related to the decision task. Agents might for example experience joy due to a wonderful sunny day. Interestingly the distinction in experienced and immediate emotion can not be found in the relevant research on emotion theory developed by psychologists (as becomes evident the next section). Rick and Loewenstein (2008) base their ideas on psychological research that comes from the cognitive side (focusing on judgment and choice) and thinks about "the influence of feelings on cognitive processes" rather than the "reverse influence of cognition on emotion" (Schwarz and Clore, 2007). It seems that among psychologists there is a gap between emotion theorists and cognitive theorists. Both accept that there is an interaction between emotions and cognitions, but they approach the problem from different angles coming to different solution concepts.

Bechara and Damasio (2005) focused on the physiological aspect of emotion. The key idea of their somatic marker hypothesis is that the decision making process is influenced

by certain marker signals that arise in bioregulatory processes. Bechara and Damasio (2005, p. 339) define emotion "as a collection of changes in body and brain states triggered by a dedicated brain system that responds to specific contents of one's perceptions, actual or recalled, relative to a particular object or event." Their understanding of emotions does not follow the idea that emotion interferes with sound rational decision making. On the contrary, they suggest that emotional processes play a fundamental role in making advantageous decisions. This is what studies in neuroscience suggest, when finding that patients with a restricted emotion processing capability (due to certain neurological damages) take disadvantageous decisions.

It can be concluded that the economic literature has at least started to incorporate emotions into their decision making models. The approach comes from different directions. While Rick and Loewenstein (2008) based their ideas on cognitive psychological research, Bechara and Damasio (2005) focused on evidence from neuroscience. Still a qualitative description of different emotion is missing. The next section focuses on relevant findings in emotion psychology.

3.2 Emotion: The psychological point of view

Psychologists can look back on almost 150 years of systematic emotion research. "What is emotion?" was the title of an essay published in 1884 by William James. Although emotional psychology was neglected in the first half of the 20th century, it later experienced a "revival" and many psychologists have attempted to answer this question. However, to this day, there are different directions and a consensual definition is not at hand. The following section introduces the most relevant emotion theories and the historical development.

3.2.1 Introduction: What is emotion?

Kleinginna and Kleinginna (1981) attempted to categorize the definitions of emotion and to come up with a consensual definition. They analyzed 92 different definitions and put them into ten different categories. Some of these definition approaches cover only behavioral aspects, others concentrate on physiological terms, and still others seek a com-

promise. Some definitions are relatively precise, while others are quite vague. Reviewing the different types of definitions, Kleinginna and Kleinginna (1981, p. 355) came to the conclusion that a consensual definition should "include all traditionally significant aspects of emotion, while attempting to differentiate it from other psychological processes." The working definition mainly fulfills the first requirement. The general characteristics are quite similar to the ideas of Elster (1998) introduced in Section 3.1.

> "Emotion is a complex set of interactions among subjective and objective factors, mediated by neural hormonal systems, which can (a) give rise to affective experiences such as feelings of arousal, pleasure/displeasure; (b) generate cognitive processes such as emotionally relevant perceptual effects, appraisals, labeling processes; (c) activate widespread physiological adjustments to the arousing conditions; and (d) lead to behavior that is often, but not always, expressive, goaldirected, and adaptive." (Kleinginna and Kleinginna, 1981, p. 355)

Although there is at least some consensus in the definition and the characteristics of emotion, there are still several complications. First, emotion and cognition are still seen as something that is contrasting rather than interacting (cf. Scherer and Peper, 2001). Second, the term "emotion" is used in a highly undifferentiated manner. Often affective phenomena like emotion, mood, affect, or preferences are treated as synonyms. In this context it is reasonable to recall the central characteristics of emotion. Emotions are a current status or process, either triggered by an event or an object. They are not a general disposition. They usually, as e.g. opposed to moods, have a "sharp rise time, limited duration, and often high intensity" (Schwarz and Clore, 2007, p. 385). Third, the terms emotion and feelings are used as synonyms. "In some definitions, the essence of emotion is feeling, notably those of pleasure and pain" summarizes Frijda (2008). A confusion which is very common in the economic literature, but also appears in psychological research. In fact, feeling is only one aspect of emotion. Scherer (2005, p. 699) comments on this confusion, noting: "Using the term feeling, a single component denoting the subjective experience process, as a synonym for *emotion*, the total multimodal component process, produces serious confusions and hampers our understanding of

the phenomenon." Fourth, while most researchers acknowledge that emotion is a process they still talk about emotional states elicited by an event.

3.2.2 Literature review and classification of emotion theories

Attempts to define emotion makes evident, that emotions have many facets. To achieve a better understanding, the most recognized emotion theories are introduced. This subsection follows a structure similar to Meyer et al. (2001), Meyer et al. (2003) and Reisenzein et al. (2003), which are standard textbooks in emotional psychology. The most important directions in emotion theory are introduced. First, there is the rather historical perspective with the early emotion theories, namely Watson (1919)'s behavioristic view, the James-Lange theory, and the Schachter-Singer-theory. Second, there are evolution-psychological emotion theories. And third, cognitive emotion theories are introduced. Most of the latest research has focused on cognitive theories, so called appraisal theories. Reisenzein et al. (2003, p. 156) state that appraisal theories are the only emotion theories that explain emotion psychological facts in a plausible way.

Historical perspective

Watson (1919) represents a pure behavioristic view by reducing emotion to aspects which are intersubjectively observable. Thus, emotion becomes a hereditary pattern-reaction involving visceral and glandular changes. According to Watson (1919) the basic pattern reaction are fear, rage, and love, each caused by a specific set of conditions (stimuli). Adults develop more complex pattern through learning and especially through conditioning. Although Watson's view is fruitful in some dimensions, it is too restrictive to reflect and explain the wide set of evident emotions. Nowadays, a purely behavioristic view of emotion is outdated.

Another focus has been established by cognitive-physiological emotion theories. Those theories share the opinion that it needs cognitive as well as physiological processes for the existence of emotions, whereby experts disagree on the question in which sequence both processes take place. James (1884) and Lange and Kurella (1887 (reprinted 2010)) developed their theories independently, but due to great similarity it is commonly known

as “James-Lange-theory”. They discuss especially the sequencing of physiological change and feelings, considering emotions the result of a physiological change. That is, a person feels afraid, because she trembles, or she feels angry, because she strikes. This theory has become less important over the years, but regained its importance with new findings by neurophysiologists such as Zajonc (1984), LeDoux (1996), and Bechara and Damasio (2005).

Cannon (1927) criticized the complete visceral formulation of emotion such as suggested by James (1884). Marañón (1924) provided experimental evidence for one major criticism by inducing a certain physiological change by adrenaline injections. If the physiological change were responsible for emotions, then the experiment participants should have reported experiencing emotions. However, around 70% reported “as-if-feelings”. That is, they felt as if they were afraid, but they were not afraid. Schachter (1964) picks up on this critique and develops an own theory, focusing mainly on emotion as cognitive-physiological process and showing that people can have different emotional reactions despite being placed into the same physiological state. The intensity depends on the physiological state, but the quality of the emotion depends on the cognitive process. Thus, emotion becomes a post-cognitive phenomenon.

Having Scherer’s critique in mind, these theories acknowledge the interaction of cognition and emotion, but they are not very precise in their definition of emotion. Scherer for example postulates that it is largely due to James (1884) article “What is emotion?” that the notion of emotion and feelings are constantly mixed up. According to de Sousa (2010), those theories belong to the class of theories that regards emotions as a class of feelings: “The simplest theory of emotions, and perhaps the theory most representative of common sense” (de Sousa, 2010). De Sousa (2010) summarizes the previous theories as feelings theories, showing that a further development of emotion theory is necessary, since “feeling theories, by assimilating emotions to sensations, fail to take account of the fact that emotions are typically directed at intentional objects.”

Evolution-psychological emotion theories

Meyer et al. (2003) emphasized evolution-psychological emotion theories focusing on how evolution may have equipped organisms to respond automatically to significant events.

More than 100 years ago, Darwin and McDougall established a significant basis for this direction of emotion theory. According to Reisenzein et al. (2003), these two scholars are meaningful not only from a historical perspective, but also laid the basis for the modern emotion theories. Their most important more recent representatives include Robert Plutchik, Silvan Tomkins and Carroll Izard. All these theories share the understanding that the disposition for certain emotions have developed phyolgentically. That is, individuals that are disposed to show a certain reaction pattern when seeing for example a wild animal are more likely to survive than others. In such a situation, it is helpful to experience fear and react with flight. Plutchik argues that "mayor types of emotions can be derived from evolutionary continuous motivational primitives as described by ethologists" (Scherer, 1999, p. 24). Thus, emotion becomes especially evident through the resulting action tendency, facial, or vocal expression.

Cognitive emotion theories

Cognition played an important role in early emotion theoretical work, but according to Reisenzein et al. (2003), either the assumption that emotions are evoked through cognitive processes played a minor role compared to the main theses of these authors, or the early appraisal theories did not receive the attention they deserved. Meinong developed an appraisal theory in the late 19th century, and Aristotle (around 350 B.C.) and Thomas von Aquin (1225-1274) also wrote about cognitive elements in emotions. Nowadays, most psychologists refer to Arnold (1960) and Lazarus (1966) as foundation for the currently relevant appraisal theories. According to Reisenzein et al. (2003), both authors indicate the "cognitive revolution" in emotion theory and psychology in general. While the behavioristic view was predominant between 1920 and 1960, cognitive aspects regained popularity afterward.

Arnold (1960) was the first to refer to the notion of "appraisal" to discern the main differences among emotions. *Appraisal models* suggest that "the nature of an emotional reaction can be best predicted on the basis of the individual's subjective appraisal or evaluation of an antecedent situation or event" (Scherer, 1999). According to Arnold (1960), differences in emotions can be traced back to differences in the factual and evaluative beliefs (summarized as appraisal). In contrast to simpler dimensional models (cf.

Russell and Pratt, 1980), this evaluation can involve much more criteria than valence and arousal. Additionally, emotions are always object-directed. As such, objects are, for example, appraised according to three criteria: 1) presence vs. absence of an object, 2) valence and 3) coping potential. Certain appraisal patterns result from the combination of different characteristics of individual criteria, which leads to specific emotions. For example, a situation can be evaluated as present, positive, and easy to attain. The resulting emotion is joy. While a situation which is appraised as absent, positive, and attainable with difficulties, results in the emotion hope.

According to Lazarus (1966) emotions are elicited in a two-stage appraisal process. In the primary appraisal the subject builds beliefs about actual or anticipated relevant events and their meaning for the subject's motives. In the secondary appraisal the subject checks how she can deal with the situation. This approach is very similar to the one laid out by Arnold (1960). The secondary appraisal is comparable to the criteria coping potential and the primary appraisal summarizes appraisal about the presence and valence of an object in one step. In contrast to Arnold (1960) Lazarus considers emotions not merely as emotional states but as organized pattern of psychological and physiological components. That is, emotions are comprised of four components: 1) a cognitive component, 2) a subjective experience component, 3) a conative component, that is the impulse or wish to perform a certain action and 4) a physiological component. Consequently emotion is not merely the cause, but an integral part of the emotional reaction (cf. Reisenzein et al., 2003, p. 69). Lazarus (1966) allows for a dynamic reappraisal process.

Scherer is one important representative of the appraisal theorists and in 1984 he introduced his idea to describe emotion as a multi-dimensional component process (Scherer, 1984).

> "There now seems to be a growing consensus among emotion theorists that emotion is best treated as a psychological construct consisting of several aspects or components: a) the component of cognitive appraisal or evaluation of stimuli and situations, b) the physiological component of activation or arousal, c) the component of motor expression, d) the motivational component, including behavior intentions or behavioral readiness, and e) the component of subjective feeling state." (Scherer, 1984, p. 294)

His theory suggests that during an emotion a constantly operating appraisal process performs evaluations on a specific object or event (stimulus). This appraisal process follows a hierarchical order using five different appraisal criteria, so-called, stimulus evaluation checks (SECs). The result of these five appraisals form a specific appraisal pattern, which can then be associated with a certain emotion.

An alternative approach was developed by Ortony et al. (1988). In both models, cognitive processes play a very central role in the context of the emotion building process. But in contrast to Scherer (1984), Ortony et al. (1988) view cognitive processes as antecedents of emotional processes and not as integral components. Emotion is not the interaction of several interdepending subsystems like in Scherer's component theory. Rather, emotions are defined as "valenced reactions to events, agents, or objects, with their particular nature being determined by the way in which the eliciting situation in construed" (Ortony et al., 1988, p. 13). That means that the particular nature of an emotion (the emotion type) is determined by the way in which the eliciting situation is construed. Therefore the emotion relevant construction principles of an eliciting situation have to be understood. The authors extract the most relevant elements and depict them in their "cognitive structure of emotions'.

3.3 Selection of an appropriate emotion theory transferable to auctions

This chapter defines the notion "emotion" and identifies an emotion theory that will serve as a solid theoretical base for investigating emotionally driven decision making in economics, especially in auction theory. The previous two sections introduced the most relevant emotion research, both from the economical perspective and the psychological perspective. In emotional psychology many theories, especially the appraisal models, take a broad but also detailed perspective on emotion. In the following, one emotion theory will be selected based on certain criteria as the most suitable to be applied for auction theory. Subsequently the selected emotion theory will be discussed in more detail.

3.3.1 Selection criteria for an appropriate emotion theory

The presentation of the different emotion theories in the previous two sections make evident that different emotion theories emphasize different aspects of emotions. In order to serve as the theoretical basis for analyzing emotional behavior in auction theory, the following criteria are, in my estimation, the most important.

First, the theory should have a broad understanding of the notion emotion. That is, it should reflect that emotions consist of different aspects and should not only focus on one specific characteristic like the physiological arousal. With such a broad approach, researchers coming from different fields can potentially work with the same theory.

Second, emotion and cognition coexist and interact with each other. Agents in auctions do not turn off their minds the moment they become emotional. Rather, emotions interfere with cognition and both processes play a significant part in decision making. In a first step, it is sufficient to know that both systems are interacting. How this interaction functions can be left for further research. This thesis focuses on the different qualitative aspects of emotions and their transferability into auctions. Introducing a further complexity would be counterproductive with respect to this objective.

Third, the emotion theory should give a very structured and systematic overview of the most relevant emotion types and their eliciting situations, since it is one of the thesis's central objectives to give a holistic overview on the different emotions and their influence on bidding behavior.

Among appraisal theorists there is a strong consensus regarding the definition of emotion. In contrast to the earlier works introduced in the previous section, they share a rather broad understanding of emotion. Emotions are object-directed and differences in emotions can be lead back to differences in the appraisal of a certain emotion-eliciting object. It is a core belief of appraisal theory that emotion and cognition interact. Since appraisal models also favor a rather broad definition of emotion, they seem to be the direction that meets our first two criteria best. Reisenzein et al. (2003, p. 11) considers the appraisal theories as a central theoretical approach within emotion psychology.

The different appraisal theories develop appraisal dimensions to evaluate a certain eliciting situation. Depending on the evaluation of the situation along different dimensions, a

certain appraisal pattern results which can be related to a certain emotion type. Ortony et al. (1988) gave a very structured and systematic overview on the most relevant emotion types, resulting in a holistic overview of all relevant emotions. The other appraisal theories develop appraisal pattern only eclectically. As a result, certain emotion types like regret develop randomly but others might get forgotten. This is one of the points I most criticize in current research work on emotions in auctions. Additionally, Ortony et al. (1988) discuss the emotion-eliciting situations in a very differentiated manner. Based on that knowledge more specific emotion eliciting auction designs can be construed, and the existing auction designs can be better understood with respect to the emotions they elicit. The authors identify variables that influence the emotion types' intensity. Based on that, factors that additionally enforce emotions can be better understood.

3.3.2 The cognitive structure of emotions

Since Ortony et al. (1988) serve as the theoretical base for our further considerations, their cognitive structure of emotions is introduced in more detail. Ortony et al. (1988) develop a structure according to which emotion-triggering situations can be classified. Events, agents, and objects can trigger emotions, resulting in three different emotion classes: event-based, agent-based, and object-based emotions. The particular nature of an emotion, the emotion type, is determined by the way in which the eliciting situation is construed. Therefore the emotion-relevant construction principles of an eliciting situation have to be understood. The authors extract the most relevant elements and depict them in their "cognitive structure of emotions".

Figure 3.1 shows that events and agents are further differentiated before resulting in a specific emotion type. Ortony et al. (1988) suggest that the most relevant questions regarding events are, whether they have only consequences for oneself or also for others, and if they only have consequences for oneself, how prospect-relevant they are. With respect to agents, the authors differentiate between own actions as an agent and actions of other agents. There is no further differentiation regarding the objects. Five different emotion groups result from this classification structure: Fortunes-of-others emotions, prospect-emotions, and well-being emotions belong to the class of event-based emotions. Attribution emotions belong to the agent-based emotion and attraction emotions belong

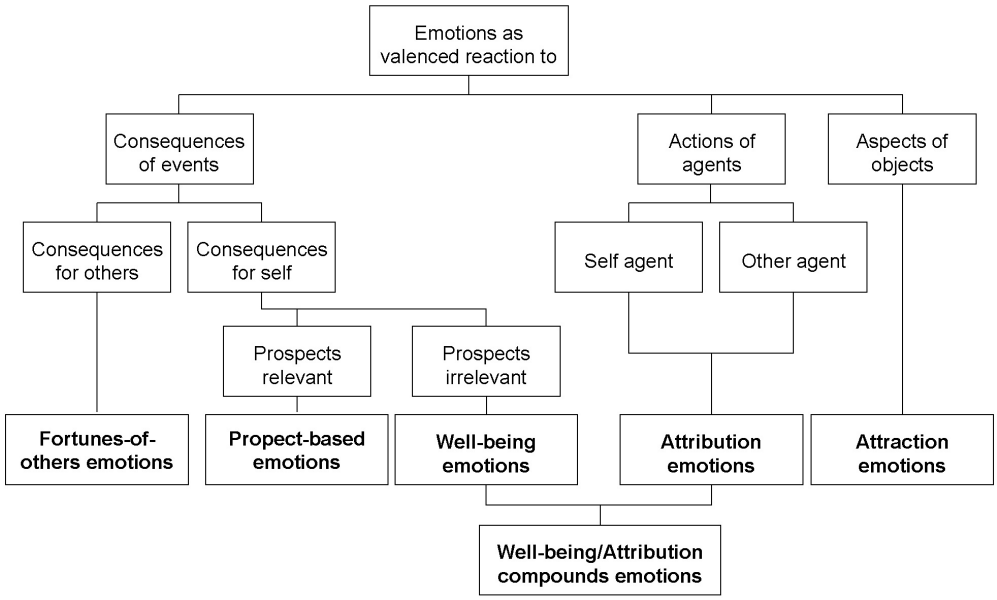

Figure 3.1: Global structure of emotions according to Ortony et al. (1988, p. 19)

to the object-based emotion. Each emotion group then comprises specific emotion types.

This structure can easily be applied to the situation in auctions. All emotion classes are relevant in auctions since an auction is a sequence of events influenced by the bidders' actions and having the goal to win an object. The auction process is a sequence of events. The acquaintance with the auction environment can be considered an event, as well as the bid submittal in each round, the declaration of the bid outcome after each round, and finally the declaration of the final outcome. Each of these events is evaluated with respect to the focal goal, to win the auction at a (highly) profitable price. Through this evaluation certain event-based emotions can develop. Bidders are agents who additionally elicit certain emotions. They perform certain actions, mostly in the form of bid decisions. Bidders can either evaluate their own actions or the actions of others. Through this evaluation certain agent-based emotions can develop. Some auction literature also suggests that bidders can be perceived as objects who elicits emotions. Nielek et al. (2010) even talks of a "spiral-of-hatred effect" that can be elicited between

sellers and buyers in online auctions. Finally, the auction is conducted to win a certain object. The object-based emotion class makes evident that it is very essential to perform real-good auctions when testing emotions in auctions. With induced value auctions, one emotion eliciting situation would be completely neglected.

According to Ortony et al. (1988), people have a structure of goals, standards, and attitudes that underlie their behavior, the so called appraisal structure. They evaluate events, actions, and objects with respect to this structure. The evaluation is based on three central variables, which influence the emotional intensity. Events are evaluated according to their *desirability*, actions with regard to their *praiseworthiness*, and objects with respect to their *appealingness*. These criteria are uniquely associated with their according class of emotion and they play such a central role that they are called *central variables*. This concept is very similar to the primary appraisal suggested by Lazarus (1966). In a first step, a rather simple appraisal takes place. Its central outcome is whether something is perceived as positive or negative (valence). Bechara and Damasio (2005, p. 340) talks in this context of primary inducers that trigger "pleasurable or aversive states".

The three basic emotion classes are not necessarily totally isolated from each other. Sometimes the same situation can lead to different cognitive processes, since the subject concentrates on different aspects. The authors take a simplified example, the child-beating neighbor, for illustrative purposes. One might concentrate on the consequences of the *event*, the beat child, and feel pity. One might concentrate on the *agent's* action and contempt his beating. And one might focus on the child-beating neighbor as *object* and feel hatred towards him. Transferring this situation to auctions, a bidder might first be displeased about the consequences of an event, the loss of the auction. Afterward he might focus on the action of another bidder, who overbid him at the last second, and blame him because of this strategic late bidding. Then he focuses on the winner of the auction and decides to dislike him. In contrast, the bidder likes the auction good throughout the auction.

In addition to the three central variables, four *global variables* influence the emotion's intensity independent of a certain emotion type. *Sense of reality* is one variable which has a global influence on emotions' intensity: The intensity of an emotion depends on the degree to which a subject perceives an emotion-inducing situation as real. A further

related influence factor is *proximity*. It emphasizes the relevance of the temporal, spatial, or psychological closeness of an emotion-inducing situation. Sometimes the variables *sense of reality* and *proximity* are related with each other. An emotion inducing situation which just happened (temporal proximity) is often perceived as more real than a situation which already happened a year ago. *Unexpectedness* is assumed to be an important global variable that correlates positively with the intensity of an emotion. It describes how surprising a certain emotion-inducing situation is perceived. It is not to be confused with the local variable likelihood, which estimates the probability of certain events in the future and is forward-looking, whereas *unexpectedness* is backward-looking. *Arousal* is an already discussed variable, which uses to play a more central role in other emotion theories. Russell and Pratt (1980) identified arousal, besides valence, as the second dimension that determine the intensity and quality of an emotion. Ku et al. (2005) picked up the concept and suggested that overbidding in auctions is the result of arousal. Further discussion with regard to auctions can be found in Section 2.3. Concentrating on the cognitive aspects of emotion eliciting situations, arousal as a physiological component is not in focus of Ortony et al. (1988). However, they assume "that changes in one's level of arousal may be roughly proportional to the subjective importance of an emotional situation" (Ortony et al., 1988, p. 65).

Emotions are valenced reactions to consequences of events, actions of agents, or aspects of objects. The applied appraisal pattern finally lead to 22 different emotion types. Each emotion type belongs to a specific emotion class, depending on whether the emotion is elicited by events, agents, or objects. The twelve event-based emotions belong to three different emotion groups. Figure 3.2 illustrates the according structure.

When interested in the qualitative aspects of emotions, the emotion type is the central element of the structure of Ortony et al. (1988). The authors describe each emotion type in detail, including the type identification, the type specification, the partial list of tokens, and the variables affecting intensity. Table 3.1 presents this systemization for the emotion type *Joy*, belonging to the emotion group well-being emotions and the emotion class of event-based emotions. This example illustrates that each emotion specification consists of five components. The type identification serves as a label of the emotion type being considered. Talking of joy as one resulting emotion, *Joy* is used as a representative

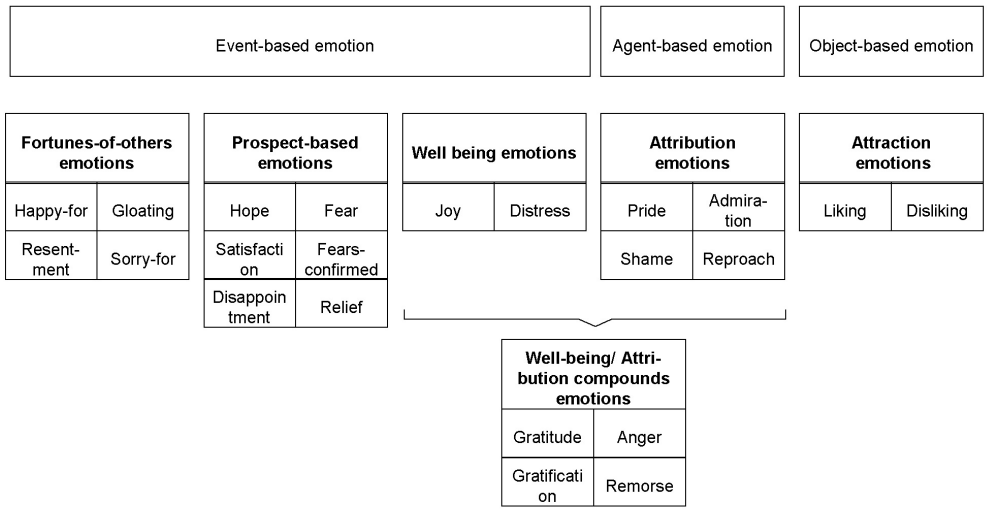

Figure 3.2: Structure of emotion types according to Ortony et al. (1988)

for all kinds of different values of this emotion type[1]. The partial list of tokens makes this evident. All of these words share the same type specification but it can result in a rather calm contented emotion or also in a very ecstatic emotion. The type specification is central when describing an emotion type. It defines the eliciting condition (here: a desirable event) and thus identifies the location of the emotion within the structure (here: well-being emotion: *Joy*). The local variables then determine the intensity of the emotion type. Sometimes several relevant local variables can be identified. Additionally the global variables play a role, but since they are relevant across all emotion types, they are not mentioned for each individually. Here, only the central local variable *desirability* plays a role. Ortony et al. (1988) conduct such an emotion specification for each of the 22 identified emotion types.

[1]Emotion words that represent an emotion type begin with a capital and are written in italic.

Component	Example	Comments
Type identification	*Joy* emotion	label for the emotion type being considered
Type specification	(Pleased about)an desirable event	approximate specification of the necessary conditions for experiencing that emotion type
Tokens (partial list)	contented, cheerful ecstatic, glad, happy	list of words that constitute the family of emotions of that type and share the same type specification
Variables affecting intensity	1) degree to which the event is desirable	statement of the major local variables affecting the intensity
Example	Pleased about being the auction winner	

Table 3.1: Emotion specification with five major components according to Ortony et al. (1988, p. 87)

3.4 Identification and clustering of relevant emotion types in auctions

The selected emotion theory of Ortony et al. (1988) provides a structure containing 22 different emotion types. Ortony et al. (1988) developed a general theory with no link to auctions, even with no explicit reference to economic research. The contribution of this thesis is to transfer the general structure of Ortony et al. (1988) on the specific situation of auctions. Thus, an overview can be given which emotions play a relevant role in auctions. In favor of a thorough but not too complex discussion, in the first step the four compound emotions are neglected.[2] Among the remaining 18 emotion types the ones

[2]The compound emotion are different to the other emotion types, since they arise, when subjects focus both on the praiseworthiness of the agent's action and the desirability of an event. Ortony et al. (1988) propose that then the subjects do not experience two emotions in parallel. Instead a new distinct emotion type arises. E.g. when an event is appraised as desirable, resulting in emotion type *Joy*, and the own auction is appraised a praiseworthy, resulting in *Pride*, the eliciting situation for *Gratification* is given.

relevant in auctions are selected and introduced in more detail. This discussion is enriched by literature dealing with emotions in auctions. It makes evident that the current research has developed in the past years in selecting single emotional aspects and discussing them in more detail. E.g., Engelbrecht-Wiggans and Katok (2008) concentrate on winner's regret and loser's regret, Malhotra (2010) discusses the "desire to win". Astor et al. (2013) contrast "joy of winning" with "frustration of losing". It is fully comprehensible, that research focuses on specific emotion types, when testing them in experimental setups. However, it is the thesis's strong belief, that the context in which each single emotion stands should be known. This is only possible, when all possible emotions that typically occur in auctions are known, making sure that no emotion, that plays a relevant role in human decision making, is forgotten. This is ensured by the systematic approach chosen in this thesis. In order to identify the relevant emotions a simple approach is taken. The following considerations are structured along the three guiding questions: Which emotions do bidders experience in case of winning the auction? Which emotions do bidders experience in case of losing the auction? Which emotions do bidders experience during the course of an auction?

3.4.1 What emotions do bidders experience when they win?

As introduced in the third section of Chapter 2, bidding research suggests two emotions bidders might experience when they win: joy of winning and winner's regret. A systematic review of the different emotion types introduced by Ortony et al. (1988) shows that auctions fulfill the conditions required to elicit many more emotion types than joy and regret. This subsection introduces the full spectrum in more detail, focusing for each emotion type first on Ortony et al. (1988)'s definition, then on the transferability of these elements onto auctions, and finally on the relevant literature.

Joy

According to Ortony et al. (1988), events are evaluated foremost based on their general desirability. An event is desirable when it serves the realization of the person's goals. If the prospects are irrelevant, it is a clear case of the emotion group ***Well-being emotions***. A person experiences the emotion type *Joy* when the event is perceived as desirable,

implicating that it contributes to the realization of her goals. Ortony et al. (1988) assume that the intensity of experienced *Joy* depends on the degree of the event's desirability. The more desirable the event, the more intense the emotion *Joy*.

How can these considerations be transferred onto auctions? Bidders generally participate in an auction with the goal to win the auction. Although there might be additional motivations like the joy of participating, the primary goal is generally to win the item. hence, winning the auction is a desirable event and the emotion type *Joy* is the resulting emotion. More precisely, he bidder's goal is to win the auction, but not at any price. This is reflected by the expression "I won the auction but don't want the prize," which Bazerman et al. (1983) chose as the title of an article on bidding behavior in common value auctions. Although this thesis explicitly concentrates on private value goods, the dilemma is the same. It is assumed that bidders are especially pleased about winning the auction when they regard it as a good deal. This more precise formulation implicates that winning is not unrestrictedly perceived as desirable. *Joy* can be dampened when bidders realize that they have failed to get a good deal.

Joy in the context of winning the auction is a rather common emotion. As already discussed in Subsection 2.3.1, Cox et al. (1988) introduced the idea of a "utility of winning". Other authors like Ding et al. (2005), Cooper and Fang (2008) and Ertaç et al. (2011) tested this theory further, describing a utility function containing a parameter that reflects additional utility in the case of winning the auction. However, none of these papers discusses the emotional experience of *Joy* in more detail. Astor et al. (2013) measure physiological reactions in order to measure the extent to which bidders experience joy of winning or frustration of losing, finding that stronger physiological reactions are measured in the case of winning than in case of losing the auction.

Satisfaction and Relief

People who gamble hope to win money, while a student preparing an exam fears that he could fail. In both cases, emotions arise from expectations about future outcomes. These expectations about outcomes can either be confirmed or disconfirmed. According to Ortony et al. (1988) emotions resulting from considerations about prospects and their subsequent confirmation or disconfirmation belong to the emotion group ***Prospect-based***

emotions. Prospect-based emotions can be characterized as a reaction to the prospects of an event, respectively to their confirmation or disconfirmation. Here again, desirability is the most important variable according to which the event is evaluated. In addition, the status of the event is the second relevant dimension along which the emotion type can be classified. The status of the event can either be unconfirmed, confirmed, or disconfirmed. All possible resulting emotion types are depicted in Table 3.2.

	Appraisal of prospective event	
Status of event	Desirable	Undesirable
Unconfirmed	*Hope*	*Fear*
Confirmed	*Satisfaction*	*Fears-confirmed*
Disconfirmed	*Disappointment*	*Relief*

Table 3.2: Prospect-based emotions according to Ortony et al. (1988, p. 110)

The emotions *Hope* and *Fear* consistently play an important role in auctions. They appear directly at the beginning of an auction and are resolved when the auction is won. Bidders who fear losing the auction experience *Relief* because the prospect of an undesirable event is disconfirmed. Bidders who hope to win the auction experience *Satisfaction* because the prospect of a desirable event is confirmed.

Cheema et al. (2005) suggest that bidders who imagine winning the auction anticipate emotions like *Relief* and *Satisfaction*, however, they do not further elaborate this idea.

Gloating

Often events have consequences beyond for oneself. Ortony et al. (1988) establish a third emotion group within the emotion class of event-based emotions for this kind of emotions: ***Fortunes-of-others emotions***. They are classified according to the extent to which the event's consequences are perceived as desirable for oneself and the extent to which they are perceived as desirable for someone else. Table 3.3 summarizes the resulting four possible emotion types. Ortony et al. (1988, p. 107f) identify four variables that affect the intensity of Fortunes-of-others emotions: "1) the desirability of the event for oneself, 2) the desirability of the event for the other person, 3) the deservingness of the other person, and 4) one's liking for the other person." E.g., *Gloating* can express itself in a

slightly triumphant feeling, when winning a chess game against a good friend, who may have made a foolish move. But it can also express itself as strong schadenfreude, for example when a political opponent who has attacked you has to withdraw from office.

	Presumed value for other	
Reaction of self	Desirable	Undesirable
Pleased	*Happy-for*	*Gloating*
Displeased	*Resentment*	*Sorry-for*

Table 3.3: Fortunes-of-others emotions according to Ortony et al. (1988, p. 92)

According to Ariely and Simonson (2003) most auction participants perceive an auction as a competitive environment in which desirability for oneself typically precludes desirability for another person. Competition in a one-good auction implicates that two or more people are following the same goal (to win the auction), but only one person can reach the goal. When a bidder wins the auction the result is automatically undesirable for the other bidders. The emotion type *Gloating* can be experienced by the winning bidder. I assume that *Gloating* is experienced when bidders are very aware of the presence of other bidders. This awareness can be triggered through the mere physical presence of other bidders or through the information about other bidders' bidding behavior.

Mead (2002, p. 17) distinguishes between competition and rivalry. Competition is a behavior oriented toward reaching a goal and competitors are secondary. In contrast, rivalry is primarily oriented toward outperforming the competitor and reaching the goal is secondary. Malhotra (2010) concludes that individuals start with a "competitive motivation", that is, the primary goal is to have the good. However, during the course of the auction, the motivation often shifts toward a "desire to win" and the primary goal consists of outbidding the other competitors, even at a personal loss. Rivalry also plays a relevant role in the research of Ku et al. (2005). Rivalry increases arousal and let bidders bid past their pre-set limits. Bidders experiencing rivalry experience *Gloating* when they finally win the auction and are pleased that others lost the auction.

Pride and *Shame*

With these two emotion types, events and their desirability are no longer in focus, but rather agents' actions and their praiseworthiness. These emotion types fall into the emotion group ***Attribution emotions***. According to Ortony et al. (1988), the eliciting condition for the emotion class of agent-based emotion is a praiseworthy or blameworthy action, either performed by oneself or performed by others. Generally the subject's (moral) standards determine the degree to which an action is judged as praiseworthy or not. The praiseworthiness of an action is also influenced by the invested effort, the responsibility and the intention with which the action has been performed. In addition to the central variable praiseworthiness Ortony et al. (1988) identify two further local variables: the strength of the cognitive unit, i.e. to what degree the agent identifies with a person or an institution whose action he is evaluating, and the "deviation from the person- or role-based expectations of the agent" (Ortony et al., 1988, p. 155). The emotion types *Pride* and *Shame* develop when subjects evaluate their own actions as either praiseworthy or as blameworthy.

Pride plays a role when the bidder focus not only on the desirability of the outcome, but also on the praiseworthiness of the action. Ortony et al. (1988, p. 138) states that "praiseworthiness is often assessed in terms of the social value of the agent's action." It can be assumed that winning is a state that is perceived as socially valuable in our society. Thus, bidders perceive the bid decision that lead to this result as a praiseworthy action and experience *Pride*. Engelbrecht-Wiggans and Katok (2008) also discusses the fact that winning bidders might judge their action as blameworthy, such as when the winner of the auction realizes that he did not bid optimally and could have won the auction at a more profitable price. If the winning bidder bid too much higher than the second highest bidder, she may experience *Shame*. In this case, the individual bid decision (the action) is judged as blameworthy although the bid result (the event) is perceived as desirable.

In the structure developed by Ortony et al. (1988), the emotion experienced above belongs to the emotion type *Shame* which Engelbrecht-Wiggans and Katok (2008) calls "winner's regret", as discussed in Subsection 2.3.3. According to Engelbrecht-Wiggans and Katok (2008), winner's regret occurs when the winner of an auction regrets paying too much once she knows the second highest bid. There is usually a certain amount

the winning bidder could have bidden lower if he had known the second highest bid in advance. Ortony et al. (1988) sometimes replace the proxy *Shame* by *Self-Reproach*. In this context, self-reproach is more accurate than *Shame*. Connolly and Zeelenberg (2002) discuss self-blame for having made a poor decision as one component in decision-related regret. In summary, research supports the idea that bidders experience *Shame* (or self-reproach) when they know that they could have won the auction at a more profitable price.

Liking

Subjects focus on characteristics of objects. According to Ortony et al. (1988), the eliciting condition for the emotion class of object-based emotions is an appealing or unappealing object. The degree to which an object is evaluated as appealing or unappealing depends on the subject's attitudes. Since no further differentiation takes place, two emotion types result: *Liking* and *Disliking*, belonging to the emotion group ***Attraction emotions***. Besides the central variable appealingness, one additional local variable is relevant for the intensity of the attraction emotion: the degree of familiarity with the object. Zajonc (1968) showed that the mere length of exposure to an object influences its perceived attractiveness. According to Ortony et al. (1988, p. 165), the effect of familiarity has been investigated in some studies "in terms of the frequency of presentation of a stimulus."

The two relevant objects in a standard online auction or lab experiment are the auction good and the participating bidders. In the following I focus on the effect of the auction good, since other bidders' actions trigger emotions (then agent-based emotions) but usually the bidders themselves do not, although in Subsection 3.3.2 it was suggested that there can be aversive emotions among bidders. For example, Nielek et al. (2010) talks of a "spiral-of-hatred effect" among bidders. However, with respect to other priorities in the current research I assume that object based emotions towards other bidders play a negligible role. Since standard online auctions or lab experiments take place among bidders who do not know each other personally and who are separated from each other. Whereas the auction good triggers the object-based emotion type *Liking*. The further discussion does not consider *Disliking* since is seems counterintuitive that bidders participate in an auction for an item for which they experience disattraction.

Only Heyman et al. (2004) and Wolf et al. (2008) have conducted lab experiments with real goods which would allow for the emotion type *Liking*. Wolf et al. (2008) show that a greater familiarity with the object leads to higher bid results. Heyman et al. (2004) show that a longer duration of ownership triggers higher bids. Both experiments and further experiments from the field will be introduced in more detail in Chapter 6.

Summary

The systematic discussion of different emotions bidders are likely to experience in case of winning is summarized in Table 3.4. The table summarizes the emotion class and group to which the individual emotion types belong according to the "Global structure of emotions" developed by Ortony et al. (1988), as well as the type specification and the variables that influence the intensity of the individual emotion type. Subsection 3.3.2 explains the theory of Ortony et al. (1988) in greater detail. This section refers to the small body of literature that deals explicitly with emotions in auctions, excluding studies that added emotion only as an extra utility. I argue that merely "reparing" the utility function does not contribute to a better understanding of emotional experiences that trigger overbidding (see also the discussion in Section 2.3).

Emotion	**Emotion class/group**	**Type specification**	**Variables**	**Selected literature**
Joy	Event-based/Well-being	Pleased about a desirable event	Desirability	Astor et al. (2013)
Relief	Event-based/Prospect	Pleased about the disconfirmation of the prospect of an undesirable event	Intensity of *Fear* Invested effort Degree of realization	
Satisfaction	Event-based/Prospect	Pleased about the confirmation of the prospect of a desirable event	Intensity of *Hope* Invested effort Degree of realization	
Gloating	Event-based/ Fortunes-of-Others	Pleased about an event undesirable for someone else	Desirability for oneself Desirability for others Deservingness Liking for other person	Malhotra (2010) Ku et al. (2005)
Pride	Agent-based/Attribution	Approving of one's own praiseworthy action	Praiseworthiness Cognitive unit strength Expectedness	
Shame	Agent-based/Attribution	Disapproving of one's own blameworthy action	Praiseworthiness Cognitive unit strength Expectedness	Engelbrecht-Wiggans and Katok (2008)
Liking	Object-based/Attraction	Liking an appealing object	Appealingness Familiarity	Heyman et al. (2004) Wolf et al. (2008)

Table 3.4: Summary of emotions bidders experience in case of winning

3.4.2 What emotions do bidders experience when they lose?

The research findings outlined in Chapter 2 also suggest possible emotions that can be experienced in case of losing an auction. Ding et al. (2005) talk of "frustration about losing", while Engelbrecht-Wiggans (1989) coin the term "loser's regret" and Morgan et al. (2003) the term "spiteful bidding". Often these emotions are the opposite of the emotions experienced in case of winning the auction. It could be concluded that the motivation to win an auction is either to experience the joy of winning or to avoid the frustration of losing. This section first reviews the different emotion types relevant to auctions along the categorization of Ortony et al. (1988), the transferability of these considerations onto auctions, and finally reviews the relevant literature. Since some of the discussions were already conducted in the previous subsection, some interpretation can be kept short.

Distress

As outlined above, according to Ortony et al. (1988), events are evaluated based on their general desirability. An event is undesirable when it does not support the realization of the person's goals. The resulting emotion type *Distress* is the counterpart of *Joy*. It belongs to the same emotion group (Well being emotions) and has the same variable influencing intensity (the degree of the event's desirability). The less desirable the event, the more intense the emotion *Distress*.

Bidders enter an auction with the primary goal to win. Losing the auction implicates that they have not reached that primary goal. Even if they lost, because winning the auction would have come at a monetary loss, they still failed to achieve this primary goal. Thus losing an auction is an undesirable event, eliciting the emotion type *Distress*.

In addition to the joy of winning, Ding et al. (2005) considers the frustration resulting from losing as the most common emotion in an auction and models it as a negative utility component in case of losing the auction. Astor et al. (2013) measured weaker physiological reactions in case of losing than in case of winning the auction. They interpret the smaller but significant physiological reaction as evidence for the frustration of losing. Adam et al. (2013) also measured the physiological reaction of bidders participating in a Dutch

auction, finding a stronger reaction when losing than when winning the auction. The authors suggest that bidders mentally prepare to win the auction when they decide to drop out of the Dutch auction. This makes the emotional reaction less intense than the sudden (sometimes unexpected) end of the auction if they lose.

Fears-confirmed and Disappointment

As described above, *Fear* and *Hope* can be resolved to *Relief* and *Satisfaction* if an undesirable event (i.e. losing an auction) is disconfirmed, but they can also lead to *Fears-Confirmed* and *Disappointment* if that undesirable event is confirmed. For example, when a bidder loses the auction, the *Fear* of losing is confirmed and bidders experience *Fears-confirmed*. And the *Hope* to win the auction disappears resulting in *Disappointment*.

Delgado et al. (2008) introduce *Fear* as the primary reason for overbidding, interpreting the significant decrease in the blood-oxygen level-dependent response in case of losing the auction as an indicator for fear of losing a social competition. The experiment is described in more detail in Section 2.3.3.

Resentment

As described above, according to Ortony et al. (1988), a person evaluates an event according to the extent to which the event's consequences are perceived as desirable for oneself and the extent to which they are perceived as desirable for someone else. An event that is perceived as undesirable for oneself and desirable for someone else can trigger the emotional type *Resentment*. The resulting emotion type *Resentment* is the counterpart of *Gloating*. Please see the previous subsection for a discussion of the intensity variables and the classification.

When a bidder loses the auction the result is automatically desirable for another bidder. I assume that other bidders who also lost the auction play a minor role regarding emotions. The losing bidder focus his attention to the comparison with the winning bidder and experiences *Resentment*. Analogous to *Gloating*, awareness of other bidders is a prerequisite for *Resentment*.

As discussed in Chapter 2, Morgan et al. (2003) introduce the concept of spiteful bidding. Bidders include a disutility for the rival's surplus in their own utility maximiza-

tion. Then bidders experience *Resentment* when they lose, since the event is perceived as undesirable for oneself (reflected by the included disutility) and desirable for someone else.

Pride and Shame

As *Pride* and *Shame* were introduced in the previous subsection, I focus here on their transferability onto losing an auction.

Shame plays a role when the bidder focuses not only on the desirability of the outcome but also on the praiseworthiness of the action. Bidders perceive a bid decision that results in losing the auction as a blameworthy rather than as a praiseworthy action, leading bidders to experience *Shame*. Engelbrecht-Wiggans and Katok (2008) discuss the fact that losing bidders judge their action as blameworthy, especially when the loser of the auction realizes that he did not bid optimally and could have won the auction at a profitable price if he had bid closer to his valuation. According to Engelbrecht-Wiggans and Katok (2008) bidders experience loser's regret in this situation. They regret the missed opportunity to win. On the other hand bidders can experience *Pride* when they realize that they acted right, even though it led to the unpleasurable result of losing the auction. In this way, action-based emotions differ from event-based emotions like *Distress*. Although bidders know that they acted right, they always perceive losing as an undesirable event since they could not reach their primary goal of winning the auction good and experience *Distress*. However, bidders do not necessarily perceive their actions as blameworthy even if they lost the auction. They can perceive their action as praiseworthy and experience *Pride* if they realize that bidding higher to win the auction would have come at a personal loss. To sum it up: Bidders experience *Shame* when they perceive their action as blameworthy since they could have won the auction at a profitable price. They experience *Pride* when they perceive their action as praiseworthy, since they know that bidding higher would have come at a personal loss.

Reproach

Along with *Pride* and *Shame*, *Reproach* belongs to the attribution emotions. The emotion type *Reproach* develops when subjects evaluate the action of someone else as blameworthy.

In auctions, this is the case when a losing bidder blames another bidder for his bidding decision, such as for outbidding the own bid. Since*Reproach* is directed towards another bidder, it is assumed that bidders are aware of the presence of other bidders. Similar to *Gloating* and *Resentment*, this awareness can be triggered through the mere physical presence of other bidders or through the information about other bidders' bidding behavior.

Reproach is evident in but not central to the discussion of Malhotra (2010). According to Malhotra (2010), the bidding behavior of a competitor can be perceived as a "personal attack" or a "personal affront".

Liking

Thoughts on the emotion *Liking* are the same in case of losing the auction as in case of winning the auction. Please refer to the above discussion of the emotion *Liking* in case of winning the auction.

Summary

The discussion of the emotions experienced in case of losing the auction is summarized in Table 3.5. It is structured in the identical way like Table 3.4. It is evident that little research deals with emotions in auctions.

Emotion	**Emotion class/group**	**Type specification**	**Variables**	**Selected literature**
Distress	Event-based/Well-being	Displeased about an undesirable event	Desirability	Astor et al. (2013)
Fears-Confirmed	Event-based/Prospect	Displeased about the confirmation of the prospect of an undesirable event	Intensity of *Fear* Invested effort Degree of realization	
Disappointment	Event-based/Prospect	Displeased about the disconfirmation of the prospect of a desirable event	Intensity of *Hope* Invested effort Degree of realization	
Resentment	Event-based/ Fortunes-of-Others	Displeased about an event desirable for someone else	Desirability for oneself Desirability for others Deservingness Liking for other person	Malhotra (2010)
Pride	Agent-based/Attribution	Approving of one's own praiseworthy action	Praiseworthiness Cognitive unit strength Expectedness	
Shame	Agent-based/Attribution	Disapproving of one's own blameworthy action	Praiseworthiness Cognitive unit strength Expectedness	Engelbrecht-Wiggans and Katok (2008)
Reproach	Agent-based/Attribution	Disapproving of another blameworthy action	Praiseworthiness Cognitive unit strength Expectedness	
Liking	Object-based/Attraction	Liking an appealing object	Appealingness Familiarity	Heyman et al. (2004) Wolf et al. (2004)

Table 3.5: Summary of emotions bidders experience in case of losing

3.4.3 What emotions do bidders experience in the course of the auction?

In the course of an auction, the result is uncertain and prospect-based emotions *Hope* and *Fear* are relevant. The emotion *Liking* is important since it influences how much the bidder is attracted by the auction good. All other relevant emotions in the case of winning or losing the auction can be experienced by the participating bidders, when the auction consists of several auction rounds. Then a bidder might already experience winner or loser emotions, as introduced in the previous subsections, when he wins or loses an auction round.

Hope* and *Fear

As discussed in the context of the emotions *Satisfaction*, *Relief*, *Fears-confirmed* and *Disappointment*, prospect-based emotions can be characterized as reaction to the prospects of an event. As long as the prospects are neither confirmed nor disconfirmed, people experience *Hope* and *Fear*.

In a dynamic auction, *Hope* and *Fear* are present throughout the auction. But they are probably experienced with different intensities during the course of the auction, appearing with the beginning of the auction. Depending on how bidders appraise the probability of winning or losing the auction, they may experience *Hope* (to win the auction) or *Fear* (of losing the auction). Both emotions resolve when the prospects are confirmed or disconfirmed.

Delgado et al. (2008) introduce fear of losing as a possible reason for overbidding, interpreting the significant decrease of the BOLD response when being informed about a loss as indicator for fear. Since the BOLD response get measured after the information about the loss, this can be rather interpreted as an indicator for the emotion type *Distress*. If evidence is to be found that bidders experience *Fear*, the physiological reactions should be measured in the course of the auction.

3.5 Conclusion

This chapter reviews the most relevant research on emotions in general and their recent influence on auction research, both from an economic and psychological standpoint. While the economic research is still in its infancy, research from emotion psychology offers a plurality of ideas and systematic approaches. It can be concluded, that although there are different definitions of emotion, there is a consensus on the basic characteristics of emotions. According to Scherer (1984), the characteristic features of emotion include cognitive appraisal, physiological arousal, motor expression, action tendencies and subjective feelings. After an assessment of several different emotion theories, the appraisal theory of Ortony et al. (1988) has been selected based on certain selection criteria. According to the authors, emotions are valenced reactions to consequences of events, actions of agents, or aspects of objects. They introduce a structured categorization approach resulting in 22 different emotion types. Seven emotions (*Joy*, *Relief*, *Satisfaction*, *Gloating*, *Pride*, *Shame*, *Liking*) are identified as relevant when winning the auction. Eight emotions (*Distress*, *Fears-confirmed*, *Disappointment*, *Resentment*, *Pride*, *Shame*, *Reproach*, *Liking*) are relevant in case of losing the auction. During the course of the auction, *Hope*, *Fear*, and *Liking* play an important role. The deeper understanding of relevant emotion types for auctions, their eliciting situations and their intensifying factors, is the important basis for developing a bidding behavior framework with emotional processing as central component.

Chapter 4

A framework for (over-)bidding behavior

The literature review in the second chapter and the discussion of emotion theories in the third chapter illustrate that human decision making processes are less straightforward than static auction theory suggests because emotions make the process more dynamic. The previous chapter provides initial insights into how auctions can be interpreted using emotion theory identifying a lack of research systemizing this complex decision making behavior. The objective of this chapter is to develop a standardized framework that reflects the human decision making process adequately and that enables the emotional aspects in bidding behavior to be interpreted. Such a framework can be used to understand the complex interactions involved in decision making in auctions in greater detail and to describe bidding behavior systematically. The chapter will thus answer the second central research question of this thesis: "How can emotional bidding behavior be described and analyzed in a formal bidding framework?"

First an overview on the existing literature is given and four different approaches are presented. Subsequently, I develop my own dynamic framework that models the cognitive and emotional aspects of the bidder's decision making processes. This framework, which reflects the general decision making process, is then condensed into a simplified framework, the "Emotional processing scheme".

4.1 Research review

The first section of this chapter reviews key literature that systemizes bidding behavior. Milgrom (2004) represents the classical static view of auction theorists on bidding behavior. Ariely and Simonson (2003) systemize bidding behavior using a dynamic approach, while Ehrhart et al. (2013) models over-bidding behavior with regard to the endowment effect. And Adam et al. (2011) focus on a conceptual framework that sketches the influence of emotions on auctions. The existing frameworks are then critiqued and the need for further research is identified.

4.1.1 Milgrom (2004): Mechanism design in auctions

An auction is a market institution. Following a clear system of rules, goods get distributed based on bidders' bids and payments have to be executed. In a demand auction, buyers bid for a good being sold, that is, the bidder has to pay a price determined by the auction process. In a supply (or reverse) auction, sellers offer a good that a buyer requests, that is, the bidder receives a price determined by the auction process. Auctions usually are described as non-cooperative games with incomplete information. The auction is characterized by the number of bidders, the rule system, and the information bidders gain during the auction. Bidders are characterized by their preferences, beliefs, and the information they have regarding the value of the good.

Milgrom (2004)'s mechanism design approach describes the auction and the bidding behavior using formal language. The first part is the environment that describes the relevant circumstances which are beyond the designer's control. The environment is a triple (N, Ω, Θ), consisting of the set of participants $N = \{1, ..., n\}$[1], the set of possible outcomes Ω over which the participants have preferences, and the set of *type profiles*, which Milgrom (2004, p. 39) identifies as the most abstract: "$\Theta = \Theta^1 \times \cdots \Theta^n$ is the set of *type profiles* $\vec{t} = (t^1, \ldots, t^n)$, which includes a type for each participant. Participants i's type (t^i) indexes the participant's information, beliefs, and preferences."[2] The second part describes the mechanism which consists of rules governing what the participants are

[1] Set N contains all sellers and buyers in an auction.

[2] Milgrom (2004) uses the index N instead of n, although referring to a set of participants $N = \{1, ..., n\}$. For the sake of consistent nomenclature, I replaced N by n.

permitted to do and how these permitted actions determine outcomes.

> "A (strategic form) mechanism is a pair (S, ω) where $S = S^1 \times \cdots \times S^n$ is the set of possible strategy profiles (S^j is the set of possible strategies of a typical player j) and $\omega : S \to \Omega$ maps strategy profiles to outcomes. [...] For each mechanism and each realization t of the type vector, we can define a corresponding strategic form game." (Milgrom, 2004, p. 41)[3]

Such a mechanistic design enables the performance of different mechanisms to be predicted and evaluated. Based on a game theoretic solution concept, e.g., the Nash Equilibrium solution concept, it can be predicted that one (or several) particular strategy profiles will be played. The strategies serve as an argument for the payoff function u mapping strategy profiles into payoffs with $u^i(\sigma^1, \ldots, \sigma^n) = u^i(\omega(\sigma^1, \ldots, \sigma^n), \vec{t})$. Denoting the outcome as $\xi \in \Omega$, the payoff can also be written as $u^i(\xi, \vec{t})$. It can be concluded that bidders in a real auction context only have to retrieve the ex-ante deduced optimal bidding strategy and act accordingly, since the actions for every point of time and every possible information status are determined in the bidding strategy.

In a static solution concept like the mechanistic design of Milgrom (2004), every decision step can be predicted and the outcome is known before the auction starts.[4] Although this is certainly a strong simplification of human decision behavior, it can lead to very complex solutions and can cover many important aspects of bidding behavior. For example, it can include emotional components in a payoff function. Concepts like joy of winning or loser's regret, introduced in Section 2.2, do not necessarily contradict the concept of an expected utility maximizer. A classical game theoretic solution concept can cope with emotions as long as they can be transferred into a static payoff function. However, treating emotion as something a bidder can perfectly calculate beforehand is illusionary. Bidders might expect joy of winning and also attribute it a certain utility, but some emotions intensify during the auction and some preferences only become evident in the course of the auction, such as envy when a bidder has been outbid. Thus, there is a

[3] Again Milgrom (2004) uses the index N instead of n. To ensure consistent nomenclature, I replaced N by n.

[4] With the exception that most auctions do not have one single solution, but rather multiple equilibria and one cannot predict how players will decide among these different equilibria.

need to extend this static model and develop a model that reflects the realities of bidding behavior better.

4.1.2 Ehrhart et al. (2013): A model of reference-dependent utility theory

Ehrhart et al. (2013) concentrate on one explanation for (over-)bidding behavior and develop a model of the pseudo-endowment effect. The pseudo-endowment effect is when psychological ownership develops during an auction and increases the willingness to raise bids in order to reclaim the endowment (see subsection 2.3.2 for further discussion). Ehrhart et al. (2013) base their model on an extension of the reference-dependent utility theories, as developed by Kahneman and Tversky (1979), Sugden (2003), and Köszegi and Rabin (2006), as an alternative theoretical basis for describing bidding behavior in auctions. Essentially, the phenomenon of overbidding can be described by a bidder's reference point shifted due to the pseudo-endowment effect. According to Ehrhart et al. (2013), subjects view their decision problem from two different perspectives: the X perspective acquiring the good and the Y perspective giving up the good. By weighting the two different perspectives in dependence of their subjective nearness to Y, subjects combine both perspectives into one decision problem. Ehrhart et al. (2013) tested the pseudo-endowment effect in the lab with induced values, comparing a static auction with two types of dynamic ticker auctions. Once the bidders in the ticker auction bid without declaring a high bidder and once one of the bidders is declared as high bidder. They find a significant price increase in the second type of ticker auction, which they attribute to auction fever induced by the dynamics of auctions and the pseudo-endowment effect.

4.1.3 Ariely and Simonson (2003): An analytical bidding behavior framework

Ariely and Simonson (2003) began to systemize dynamic bidding behavior in order to "propose an analytical framework for studying bidding behavior in online auctions" (Ariely and Simonson, 2003, p. 113). Their framework concentrates on three key dimensions that influence decision making in auctions: the multi-stage process, value assessments,

and decision dynamics. They discuss several phenomena regarding value assessment or decision dynamics along the multi-stage process. Value assessment assumes that bidders might receive value cues during the auction and react to these cues by adapting their bidding behavior. Just the mere fact that other bidders submit bids can be a value cue. Additionally, bidder behavior is influenced by the bias of the sample, that is, bidders focus only on the few bidders still participating and not the many who have already left the auction. They focus on the set of local options presented to them (local context focus), instead of paying attention to the wider context, in which other auctions or fixed price offers might take place. Value assessment takes place in the first two stages of an auction, when entering an auction and during the middle phase. Decision dynamics focus on how earlier decisions dynamically impact later decisions. Decision dynamics apply in the middle phase and at the end of an auction and can be attributed to cognitive and emotional processes. Ariely and Simonson (2003) introduced many effects mentioned above, such as endowment, escalation, competitive arousal, and strategic late bidding.

The framework gives an overview of the cognitive processes that play a role in auctions. They reflect the considerations in the second chapter regarding the restrictions of rational thinking and the possibilities of heuristics. Bidders pick up value cues given by other bidders to construct their own value and are also prone to biases like the local context focus, loss aversion or sunk cost fallacy (for further discussion see Subsection 2.3.2). Ariely and Simonson (2003) do not discuss the concrete decision making process, rather they focus on a summary of possible heuristics and biases in the decision making process assigned to a specific time interval in the auction. They do not discuss emotional processes.

4.1.4 Adam et al. (2011): An emotional bidding behavior framework

Adam et al. (2011) propose a conceptual framework that systematically sketches the influence of emotions on bidding behavior. Emotional processing can be triggered at three different stages in an auction: the auction environment, auction events during the auction, and the auction outcome. Adam et al. (2011, p. 4) consider the traditional view of auction theory with its fully rational bidding process as a useful benchmark but

"believe that the picture is not complete, in particular with respect to real-life bidding phenomenon, such as auction fever." Their extension of the traditional bidding framework follows the conceptual model of Rick and Loewenstein (2008) on emotions in economic behavior, introduced in Section 3.1. Rick and Loewenstein (2008) distinguish between immediate and expected emotions. Immediate emotions get triggered by an emotional stimulus, thus being direct responses to relevant auction events, and expected emotions are expected emotional reactions to the anticipation of an auction outcome. E.g., a bidder might expect to win the auction, although he is still in the bidding process and has not experienced the winning situation yet. Anticipated emotions can trigger immediate emotions. Figure 4.1 depicts the relations.

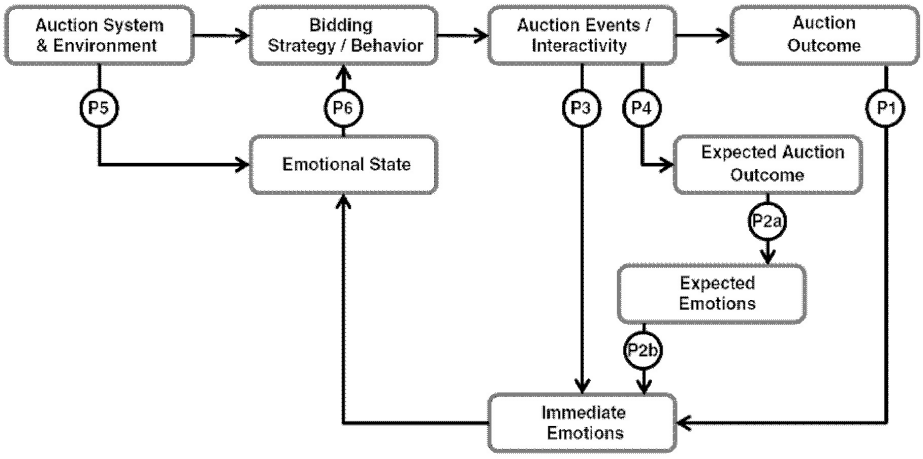

Figure 4.1: Bidding framework of Adam et al. (2011)

Adam et al. (2011) develop a formal bidding framework, discuss emotion inducers and, to some degree, possible resulting emotions. The auction environment often determines the degree of perceived competition among bidders. Competitive arousal can develop through factors like time pressure, spotlight effects, and rivalry. Adam et al. (2011) discuss

especially the higher arousal which results from a high competitive level. Emotions like envy, which have their origin in personal rivalries, are only mentioned briefly. Auction events can trigger the escalation of commitments. Imagine a bidder who has already invested a significant amount of time, effort (and sometimes money) in the auction. Being outbid might lead to the expectation to lose the auction. According to Adam et al. (2011, p. 202) the "expected emotion to this anticipated loss gets more intense the more resources the bidder has previously invested." Thus, the fear of losing the auction might intensify and lead to more aggressive bidding behavior. This effect intersects strongly with the pseudo-endowment effect. Adam et al. (2011, p. 203) states, that "the expectation of losing something that has already been perceived as owned is expected to feel much worse than something that has not been subjectively endowed." Here again, the fear of losing the auction might lead to overbidding. The auction outcome can also influence the bidding behavior. Adam et al. (2011) focus on the expected auction outcome. Bidders who anticipate future regret due to losing the auction try to avoid this emotion and bid higher. Alternatively, bidders sometimes bid higher because they expect an extra utility when winning the auction.

4.2 Development of a bidding framework

4.2.1 Requirements on the framework

The literature review in the previous section introduces first approaches to structure bidding behavior (cf. Ariely and Simonson, 2003; Adam et al., 2011) or to model certain bidding behavior in detail (cf. Ehrhart et al., 2013). Adam et al. (2011) comprehend several explanatory approaches for (over-)bidding which have been discussed in the literature in the context of emotional bidding, and Ariely and Simonson (2003) summarize cognitive processes and possible decision biases. The proposed bidding framework of Adam et al. (2011) fulfills some of the requirements I consider essential for a framework reflecting the real decision making process and enabling emotional aspects in auctions to be interpreted. Still, it neglects certain requirements I consider central.

First, like the frameworks of Ariely and Simonson (2003) and Adam et al. (2011), the

framework should allow for dynamically evolving bidding behavior. Over half a century ago, Simon (1955) expressed serious doubts whether decision makers act according to economists' assumptions and reasoned that research has to adopt this concept to more realistic conditions. The concept of bounded rationality implicates that decision makers do not have a clear bidding strategy in the sense that they follow a pre-determined action plan covering all possible developments in the auction depending on other bidders' actions. I agree with Adam et al. (2011)'s acknowledgment of the traditional view with a fully rational bidding process as a useful benchmark. In the framework developed here, the static approach presented by Milgrom (2004) is a special case in a bidding framework that assumes dynamically evolving bidding behavior.

Second, the framework should integrate emotional and cognitive decision making processes, thus reflecting the bidding behavior realistically. It should reflect the concrete sequences of the decision making process, which Ariely and Simonson (2003) fail to do. Instead, they summarize possible heuristics and biases arising in a multi-stage auction. Whereas Adam (2010) and Adam et al. (2011) discuss the concrete sequencing of decision processes. Adam (2010) further emphasizes the "interaction of cognitive reasoning and emotional processing." The bidding framework depicted in Figure 4.1 focuses principally on emotional processes. However, the explanations are still anchored in classical cognitive decision making and their heuristics and biases, as discussed in Chapter 2. The purely emotionally motivated explanations like regret (cf. Engelbrecht-Wiggans and Katok, 2008), fear of losing (cf. Delgado et al., 2008), or joy of winning (cf. Cox et al., 1988; Ding et al., 2005; Ertaç et al., 2011) are not discussed in enough detail From my point of view, the qualitative aspects of different emotions deserve a much deeper analysis.

Third, the framework should be based on a structure that distinguishes clearly among different emotions and their eliciting factors, such as the structure developed by emotional psychologists. Adam et al. (2011) distinguish between immediate and expected emotion, which is an established concept among cognitive psychologists (cf. Rick and Loewenstein, 2008) and is described in Section 3.1. However, this distinction is too simple for our discussion because it does not address concrete emotions and their eliciting situations. With regard to auctions, Adam et al. (2011) discuss concrete situations in an auction and possibly appearing emotions like regret, fear of losing, or joy of winning. But their dis-

cussion does not follow a systematic emotion structure, but rather is based on knowledge sampled from various sources. I argue that a systematic emotion structure is needed first before discussing single emotions in more detail in a second step.

4.2.2 Development of a dynamic bidding framework

The framework developed here intends to illustrate human bidding behavior in a standardized but realistic manner. I begin by establishing a clear, non-ambiguous nomenclature before introducing the actual bidding framework.

Many auction researchers test their hypotheses using repeated, one-shot auctions (e.g., Isaac and Walker, 1985; Neugebauer and Selten, 2006; Engelbrecht-Wiggans and Katok, 2008), while others work with one-shot dynamic auctions (e.g., Ehrhart et al., 2013) or one-shot, static auctions (e.g., Filiz-Ozbay and Ozbay, 2007). In order to cover all different experimental setups, my framework uses the following clear and non-ambiguous nomenclature. In a repeated, multi-period auction, each repetition is called an *auction round*. In each auction round, bids are asked for, the bidder makes a bid decision and the resulting *auction round outcome* is announced. In a dynamic auction, each auction round consists of several *bid rounds*. The bid round ends with a *bid round outcome* and the last bid round ends with the *auction round outcome*. After all auction rounds have been played, the auction ends with the *final outcome*. The final outcome subsumes the last outcome and the outcomes from all rounds, the *total outcome*, marking the end of the auction. In a repeated auction, the sequence of all auction rounds can be considered an interrelated unit. That is, each single auction round has emotional implications for the next auction round. Therefore the whole experiment with all repetitions should be discussed as one interdependent sequence.

Auction incidences are information bidders receive during the course of the auction which are determined through the design of the auction and which may be associated with a demand to act, usually when bidders are asked to submit a bid. The outcome of one auction round can be seen as an auction incidence which is highly relevant in the course of the auction and which certainly get consciously interpreted by the participating bidders. As discussed in Subsection 3.3.2, the structure developed by Ortony et al. (1988) can be applied to auctions. The auction is a sequence of events. Bidders' actions elicit emotions,

just as the object elicits emotions. The notion of incidence includes information about events, actions and objects. Computer-based bidding (as is standard in online auctions and lab experiments) does not allow bidders to observe other biddes' actions directly, nor can the auction good be presented live. In this setting, auction incidences therefore do not only provide information about events, but also about other bidders' actions and about the characteristics of the auction good. Recall the example with the child-beating neighbor in Subsection 3.3.2. Observing the same situation can lead to different and also mixed emotional reactions. One might concentrate on the consequence of the event and feel pity (event-based emotion). One might concentrate on the neighbor's action and feel contempt for his behavior (agent-based emotion) or one might focus on the neighbor as an object and feel hatred (object-based emotion). Since auction incidences inform about the situation, the informed bidder can focus on the consequences of the event. In addition, he can focus on the other bidders' action that lead to this event and/or the object's characteristics.

The upper part of Figure 4.2 depicts a typical time sequence in an auction. An auction consists of a sequence of different *auction incidences*. *Bid decisions* influence this sequence. The dotted lines illustrate the sequence of the different incidences and the bid decisions. Figure 4.2 is a modification of the sequence laid out in Adam et al. (2011), whereby "auction event" is replaced by "auction incidence" because the notion event has a determined meaning in the context of the theory of Ortony et al. (1988). The next section describes the decision making process triggered through the depicted sequence in Figure 4.2 and resulting in bid decisions. The section explains each single component and each single process in more detail, focusing especially on the interaction between emotional and cognitive processes and the updating process of the subset of bidding behavior.

A rough delineation summarizes the decision making process as following. According to Ortony et al. (1988) events, actions, and objects trigger emotional and cognitive processes. Transfered to auctions this implies, that auction incidences trigger emotional and cognitive processes (Proposition P1). While processing the information, bidders access their current *subset of bidding behavior* (the term will be introduced in more detail in in the next paragraph.) The emotional and cognitive processes might change, reformulate, or supplement this subset of bidding behavior. Vice versa, the current subset of bidding

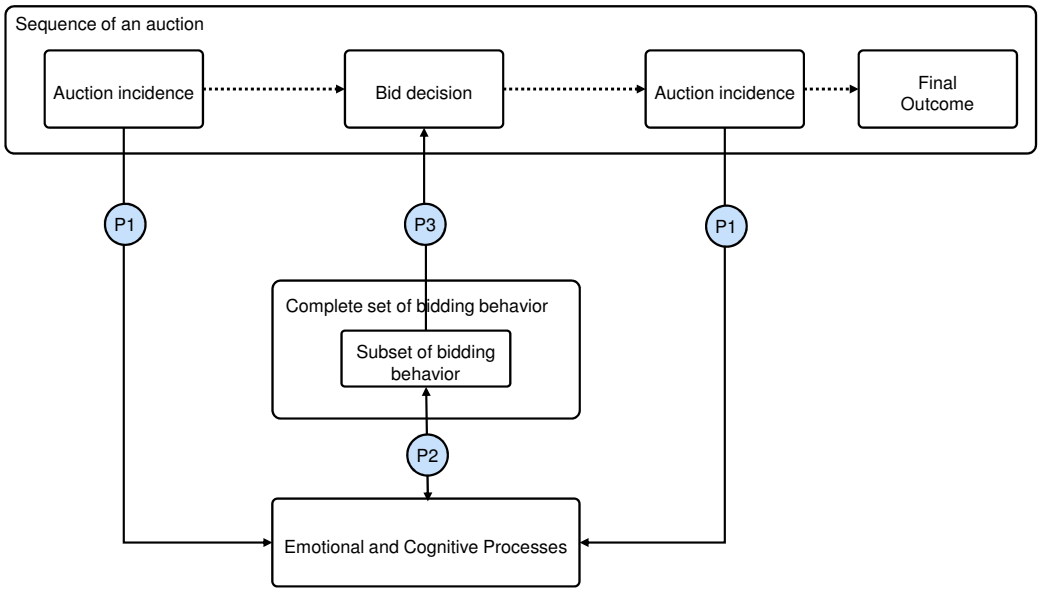

Figure 4.2: Dynamic bidding framework

behavior can lead to new emotional or cognitive processes (Proposition P2). This interaction finally results in a current subset of bidding behavior, that determines the bid decision (Proposition P3). The bid decision of all participating bidders determine the next auction incidence. If it results in a final outcome, the auction ends. If it does not result in a final outcome, the decision making process starts again.

Auction incidences trigger emotional and cognitive processes (P1): According to Ortony et al. (1988) events, actions, and objects trigger emotional and cognitive processes. Transfered to auctions this implies, that auction incidences trigger emotional and cognitive processes. One cognitive process is the appraisal of the incidence regarding its central, global, and local variables. Following the argumentation of Ortony et al. (1988) and other appraisal theorists, emotions result from such appraisal. Other cognitive processes can take place in parallel but they are not subject to further discussion in this thesis.

Emotional and cognitive processes interact with the subset of bidding behavior (P2): Auction incidences trigger emotional and cognitive processes, which ultimately lead to a bid decision. Usually, bidders enter an auction with previous experience and can access existing behavior patterns, such as discussed in Section 2.3. Decision makers access a wide range of tools in finding solutions, sometimes basing their solution on rational reasoning and sometimes on rather intuitive processes (cf. Kahneman, 2003). Here, the directly accessible bidding behavior is denoted the *subset of bidding behavior*, because I assume that before entering the auction a bidder applies of a subset of bidding behavior chosen from the complete set of bidding behavior, which comprises all possible bidding behavior for an auction. This concept is rooted in the ideas of Simon (1955), who states that models of rational decision behavior relies on a set of behavior alternatives, represented by a point set A, and a "subset of behavior alternatives that the organism 'considers' or 'perceives.' [...] The 'considered' subset can be represented by a point set $\mathring{A}$, with $\mathring{A}$ included in A ($\mathring{A} \subset A$)." The emotional and cognitive processes might change, reformulate, or supplement this subset of bidding behavior. Vice versa, the current subset of bidding behavior can lead to new emotional or cognitive processes

Emotional and cognitive processes determine the bid decision (P3): The individual's decision making process finally results in a subset of bidding behavior, that determines the bid decision. The individual's bid decision influences the next auction incidence and the bid decisions of all participating bidders together determine the next auction incidence.

The core process in the framework is the interaction of emotional and cognitive processes with the subset of bidding behavior. In the simplest case, cognitive processes access this subset of bidding behavior to determine a bid decision. In more complex situations emotional and cognitive processes influence this subset of bidding behavior in the sense that they change, reformulate, or supplement the subset. This interaction finally results in a bid decision. This process is illustrated in more detail using three examples.

First, an assumed rational bidder has a clear bidding strategy in the sense that he follows a pre-determined action plan covering all situations that might occur in the auction depending on other bidders' actions. This is claimed a *subset of rational bidding behavior*. This notion is analogue to the concept of Simon (1955): the set of behavior alternatives

represented by a point set A. Then the only cognitive process that has to take place is to process the information given by the auction incidence and to access the right bidding behavior out of the subset of rational bidding behavior. Imagine a chess play with a instruction book, that includes all possible formations and the prescribed next move. The chess player's cognitive achievement is to lookup the right solution in this instruction book.

Second, a more realistic bidder in the sense of Subsection 2.3.3 with the normal restrictions of rational thinking is assumed. This bidder does not have a pre-determined action plan covering all situation that might occur in the auction depending on other bidders' actions. However, he usually has some idea what bidding behavior could look like and hones this bidding behavior in the course of the auction. Thus bidders can usually access an initial subset of bidding behavior out of a complete set of bidding behavior. This subset of bidding behavior is subject to change during the auction. Cognitive processing helps to access this initial subset, however, it also constantly changes, reformulates and supplements this subset of bidding behavior. During the auction, bidder's preferences, information, and/or beliefs might also change without triggering an emotional process. Bidders neither experience *Disappointment* or *Joy* they just adapt their values since they think having received valuable signals. For example, a bidder realizes after being outbidden that he is more risk averse or values the good more than he originally assumed. A bidder who realizes his higher risk aversion was not totally aware of his "real preferences" until certain events occurred and made them evident. A bidder who realizes a higher value of the good changes his valuation because he receives some valuation hints from others. Assuming a private value good, he should not care about other's valuation, however, in real life the frequency of bids seem to trigger certain cognitive processes and may influence valuations. This decision loop does not end until the auction is over, when bidders are informed about the outcome.

Third, assume a bidder who reacts emotionally. The auction incidences trigger specific cognitions and might lead to a reformulation in the set of bidding behavior and the selection of a certain bidding behavior. Following the argumentation of most appraisal theorists, emotions result from certain cognitive processes. Ortony et al. (1988) assume that the cognitive process is the appraisal of an event, action or object, regarding its

desirability, praiseworthiness or attractiveness (among other less relevant criteria). This appraisal elicits certain emotions, which lead to certain action tendencies. For example, bidders might escape negative emotions associated with losing the auction and bid higher. They might also seek positive emotions linked with winning the auction and bid higher. Adding emotional aspects makes the cognitive processes much more complex and leads to a much wider range or greater set of bidding behavior.

Pure cognitive processes or the combination of cognitive and emotional processes, both can be captured by one single framework, which provides the structure according to which the bidding behavior can be discussed. Whether the processes are purely cognitively or also emotionally motivated is not relevant in the first step. However, this question is, of course, relevant when investigating the concrete processing more deeply, as will be done in the next step. This framework stands in strong contrast to static models in that a predetermined action plan is no longer assumed. Instead, the action plan can develop throughout the course of the auction. Bidders start with a vague idea and become more precise in the course of the auction. However, it is to be emphasized that this behavior does not lead to a completely arbitrary bidding behavior.

4.2.3 Emotional processing in a dynamic bidding framework

The chapter's objective is to develop a standardized framework that reflects the human decision process adequately and enables emotional aspects in auctions to be interpreted. The dynamic bidding framework illustrates along which structure the bidder's decision process can be discussed. In a second step a more detailed and concrete interpretation scheme get developed. It focuses more on the specific aspects this research work is interested in: the emotionally motivated decision processes in the course of the auction. The resulting *emotional processing scheme* serves as a foundation for discussing experiments in a very concrete manner.

In Figure 4.3 the sequence of a standard auction is depicted on the horizontal axis. After getting acquainted with the auction design the bidders are asked for their first bid, they make a bid decision, submit their bid, and receive an outcome. The individual bid decision is depicted with a triangular shaped dot. In a dynamic auction usually several bid rounds follow. In a repeated auction several auction rounds are played. Each auction

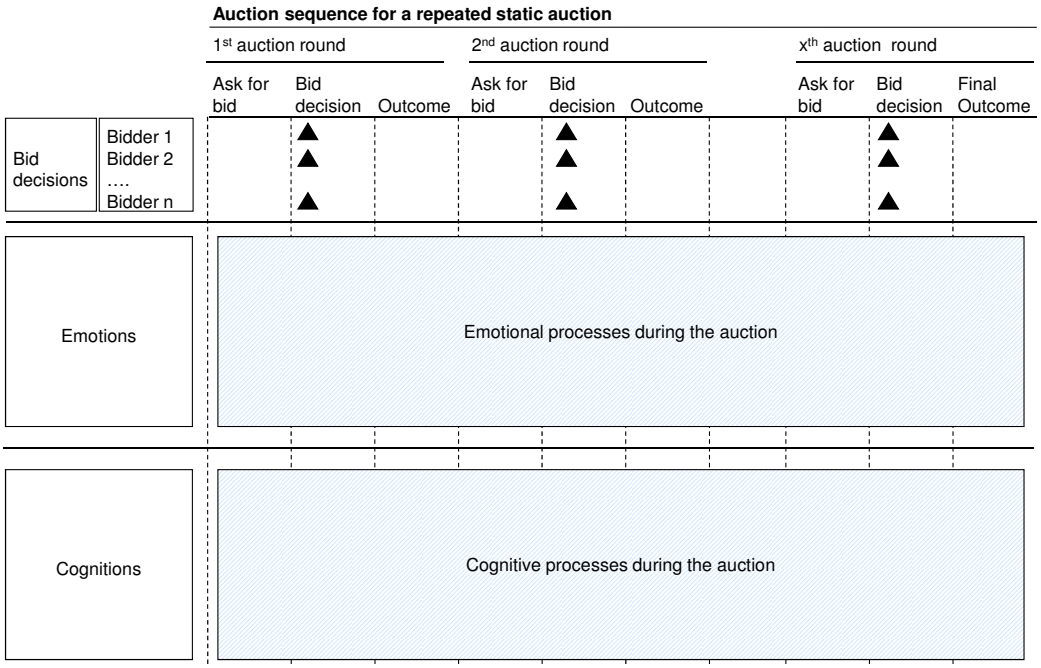

Figure 4.3: Schematic structure of emotional and cognitive processing

round ends with an auction round outcome and the complete auction sequence ends with the final outcome. As discussed above, during the auction, auction incidences trigger emotional (and cognitive) processing. Thus the experimentalist's way to induce certain emotional processes is in selecting a certain sequence of auction incidences.

The current subset of bidding behavior interacting with cognitive and emotional processes results in a bid decision, which get submitted by the bidder. This process is an ongoing process till the end of the auction. This schematic structure can be used independent of the concrete emotion theory referred to and can be applied flexibly to different types of auctions, such as static auctions or dynamic auctions. It can also be used to discuss cognitive processes in more detail while ignoring emotional processes. The following discussion uses the structure to focus on emotional processes.

The emotional processing scheme explicitly does not integrate the subset of bidding behavior as an extra component. The current research objective is to investigate the

degree to which auction incidences trigger certain emotional processes. It is of lesser interest with which subset of bidding behavior bidders enter the auction. This rather narrow focus mimics classical auction experiments. Most research neglects differences in bidding behavior due to previous made experiences or the "pre-auction" emotional mindset. I therefore neglect "incidental emotions" (cf. Rick and Loewenstein, 2008), that is, emotions that are not directly related to the decision task and that might arise from completely unrelated stimuli, such as the weather.

The following discussion of a standard repeated static auction by means of the emotional processing scheme depicted in 5.3 illustrates the applicability of a systematic framework. The auction example is the repeated static first-price auction conducted by Isaac and Walker (1985). Bidders experience several stimuli in the course of the auction that might trigger an emotional process: when they are familiarized with the auction design, when the auction starts, and after each auction round when they are informed about the outcome, and when they are informed about the final outcome (last auction round outcome plus outcome across all auction rounds). Not all of these stimuli necessarily have to trigger an emotional process, but certainly they can. For example, if the auction design is not surprising since it fits to the bidder's expectation about the auction design, this stimulus might be too low to elicit an emotional response. On the other hand, if a bidder is confronted with the "dictator game" design for the first time, this stimulus probably triggers strong emotional processes in the organism of the "victim" suffering under the dictator's decision.

The emotional processing scheme depicts the emotions of an exemplary bidder with a solid black line. A purely random decision was made as to which auction rounds he loses and wins, in this case it is assumed that the bidder wins in the first auction round, loses in the second and wins in the last auction round. Emotions, experienced by all $n-1$ remaining bidders, are illustrated as a solid gray line. Furthermore, the emotional processing scheme only depicts the emotions of real bidders, so if a bidder plays against computerized bidders their is no gray line. Prospect and object emotions are experienced regardless of winning or losing and object emotions are only experienced when real goods get auctioned. Further it is assumed that bidders only appraise the attractiveness of the auction good, and do not appraise the attractiveness of other bidders.

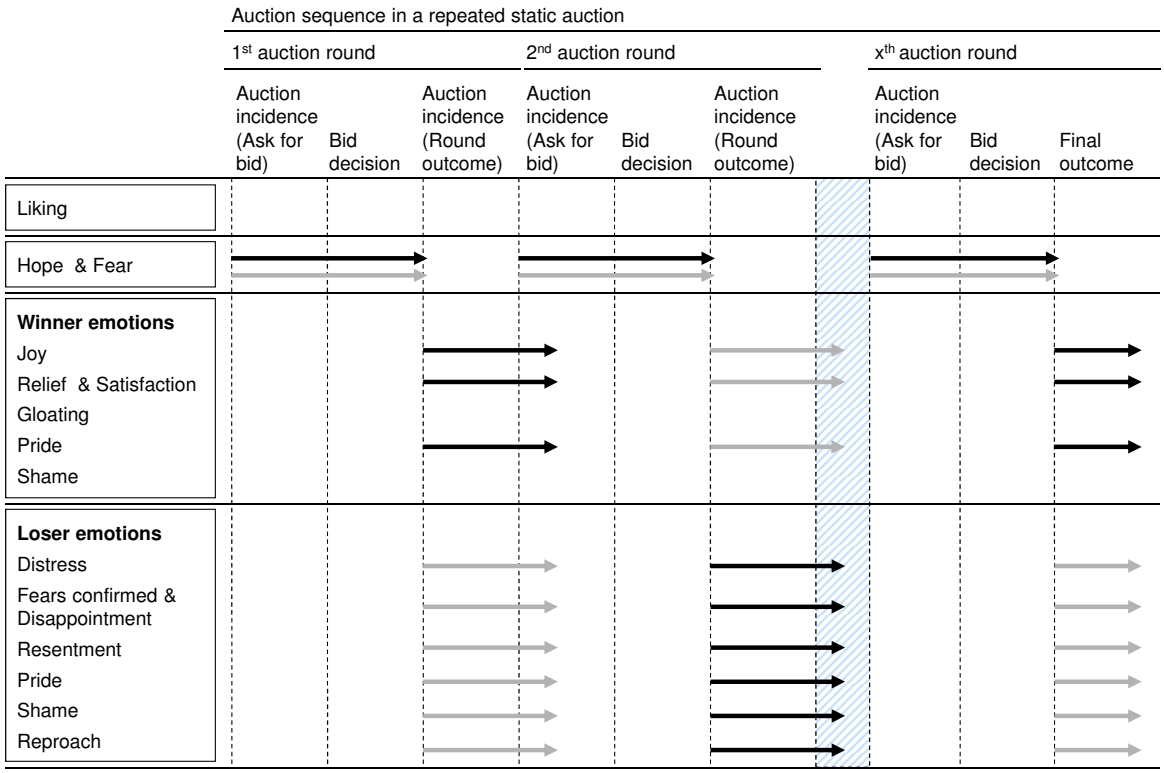

Figure 4.4: Standard emotional processing scheme: Repeated static auction

The concrete possible emotions for a participant of the auction of Isaac and Walker (1985) are illustrated in Figure 5.3. The appearance of relevant emotions in auctions get discussed in Section 3.4. The following paragraphs are based on this discussion.

In case of winning, the winner receives only feedback about his own resale value, bid, and resulting profit. No possibility exists to compare the results with other bidders. The bidder may experience the emotions *Joy*, *Relief*, *Satisfaction* and *Pride*. He is pleased about a desirable event. Depending on his prospects, he is either pleased about the confirmation of a desirable event (*Satisfaction*) or the disconfirmation of an undesirable event (*Relief*). He can also judge his own bidding decision as praiseworthy. Since he is not informed about the other bidders' decisions *Gloating* and *Shame* are not experienced.

In case of losing, the feedback enables a comparison with the winning bidder. Emotions become more complex since bidders also think about the consequences for others and their impact on themselves. Two different situations have to be distinguished. Once,

the winner's bid is above the bidder's value. Then the bidder experiences the emotions *Fears-confirmed*, *Disappointment* and *Distress*. He becomes aware that, given the other's bid, he could have never reached his goal to win the auction at a profitable price. Then he will not evaluate his action as blameworthy and therefore will not experience *Shame*. Still he might start to blame the other person for bidding that high or the lottery for drawing a low resale value. Then *Reproach* is the consequence. And he can be displeased about the event that is obviously desirable for someone else, resulting in *Resentment*. Assuming a small spread with the winning bid below the bidder's own value, I assume that the emotions described above will be more intense. Additionally bidders may experience *Shame*. Loser's regret can appear in this situation due to a missed opportunity to win.

4.3 Conclusion

The chapter reviewed existing bidding frameworks to answer the research question "How can emotional bidding behavior be described and analyzed in a formal bidding framework?" Although Ariely and Simonson (2003) and Adam et al. (2011) include important aspects in their bidding frameworks, the aspect of emotional bidding behavior is not covered systematically and deeply enough. I propose a framework that is characterized by three elements. First, it assumes dynamically evolving bidding behavior. Second, it integrates emotional and cognitive processing into one framework. Third, it establishes a structure of emotions that distinguishes clearly among different emotions and their eliciting factors. This focus on the qualitative aspects of emotions is the most relevant difference especially in comparison to Adam et al. (2011). The chapter concludes with the introduction of the *emotional processing scheme*, a standardized interpretation scheme based on the bidding framework which can be used as basis for discussing emotions in experiments.

Chapter 5

Emotional processing in auctions

Chapter 4 developed a framework for (over-)bidding behavior to answer the research question *How can emotional bidding behavior be described and analyzed in a formal bidding framework?* This chapter shows how the application of the developed framework and the deduced emotional processing scheme can enrich the interpretation of existing auction results introduced in Chapter 2. Several auction settings are discussed along the emotional processing scheme to answer the central research question *What triggers emotions and what emotions are triggered in auctions?* In a next step, possible patterns across the introduced experiments are discussed, shedding light on the second part of the research question *What emotional reactions lead to certain bidding behavior like overbidding?* For example, bidders might be especially prone to overbidding when the role of other bidders stand in the foreground and thus certain emotions play a more significant role. Such a discussion might contribute explanatory approaches for overbidding going beyond the explanations introduced in Chapter 2.

This chapter's emphasis is to identify the relevant emotions and emotion triggering situations in selected auction experiments. The focus is on auction experiments conducted in the lab as introduced in Chapter 2 in the context of the research question: When do bidders overbid? Now they will be discussed from the emotional perspective.

5.1 Emotion triggering auction settings and the resulting emotions

The discussion of the experiment of Isaac and Walker (1985) in Section 4.2 outlined the opportunities of using the *emotional processing scheme* to detect and discuss relevant emotions in auctions. The emotional processing scheme provides a way to structure a discussion of emotions and their eliciting situations by first identifying relevant emotions. When the scheme is applied to experimental settings, differences with respect to emotional consequences become more apparent. Therefore, several experiments are analyzed using the emotional processing scheme to determine the emotional differences evoked by different experimental designs. It is the objective to explain differences in bidding behavior by differences in the evoked emotional reaction. The development of the emotional processing schemes for different auction designs in this chapter is based on the discussions in Section 3.4 and 4.2, which are essential for the understanding of the following discussion. Section 3.4 introduces the relevant emotions in auctions in detail and Section 4.2 introduces the concrete framework and interpretation scheme that enables a structured discussion of emotional bidding behavior.

As discussed in Section 2.2, "Exploring the differences among auction designs is the first step towards a better understanding of bidding behavior and its influencing factors." Differences in auction results are discussed along a structure that focuses on different auction design parameters like auction format, informational feedback or the duration of the auction. The following discusses previously introduced experiments focusing on lab experiments because they are well described and they control for the relevant auction design parameters.

The scope of this thesis only allows me to outline how emotional bidding behavior could be analyzed in a more structured way, since each individual auction involves complex interactions among a range of emotions. Instead of attempting to be exhaustive, this thesis gives a broader perspective across several experiments by introducing the experiment and the relevant emotions along the emotional processing scheme as outlined in Section 3.4, and comparing the results across the different treatments. Since little literature exists on concrete emotions experienced in auctions, the discussion is hypothetical but it is hoped

that this thesis will trigger experimental research work to test the conclusions.

5.1.1 Emotional processing triggered by basic auction format design

Chapter 2 discussed differences in bidding behavior when bidders face different auction formats. While early lab experiments find that bidders bid higher in static auctions than in dynamic auctions, field experiments and also more recent lab experiments support the opposite hypothesis that bidders bid higher in dynamic auctions. Ehrhart et al. (2013) tested whether different auction formats induce players to bid differently, comparing a static (second-price) sealed-bid auction (Treatment $A1$) with a dynamic clock auction (Treatment A2). Both auctions are played only once with three bidders bidding on a hypothetical ship with an induced uncertain private value. Ehrhart et al. (2013) find that prices in the dynamic auction are higher than in the sealed-bid auction, even though the auctions should theoretically yield similar results.

In the static auction, bidders have to submit an upper bidding limit once. Afterward, a bidding mechanism outbid the bids against each other.[1] The bidders in the static auction design only have to decide once. That is, only emotions experienced before the bid submittal can influence the decision process. Figure 5.1 shows that bidders experience the prospect emotions *Hope* and *Fear*.[2] They hope to reach their goal and they fear that they could not reach it. Probably those two emotions are rather intense since bidders face only one single decision. Theoretically, they can also imagine winning or losing the auction and thus experience further emotions. I consider anticipated winning or losing situations and the resulting emotions in all auction settings as possible. But since they trigger rather weak emotional reactions compared to reactions resulting from experienced situations I will not integrate them into the emotional processing scheme.[3]

In the dynamic setting the experienced emotions become more manifold. In the applied

[1] This is a classical second-price sealed-bid auction. However, experience in conducting lab experiments indicates that bidders understand this artificial dynamization better.

[2] The emotional processing scheme depicts the emotions of the winning bidder with a solid black line. Emotions experienced by all $n-1$ remaining bidders are illustrated with a solid gray line.

[3] Please see Subsection 3.4.4. for further details.

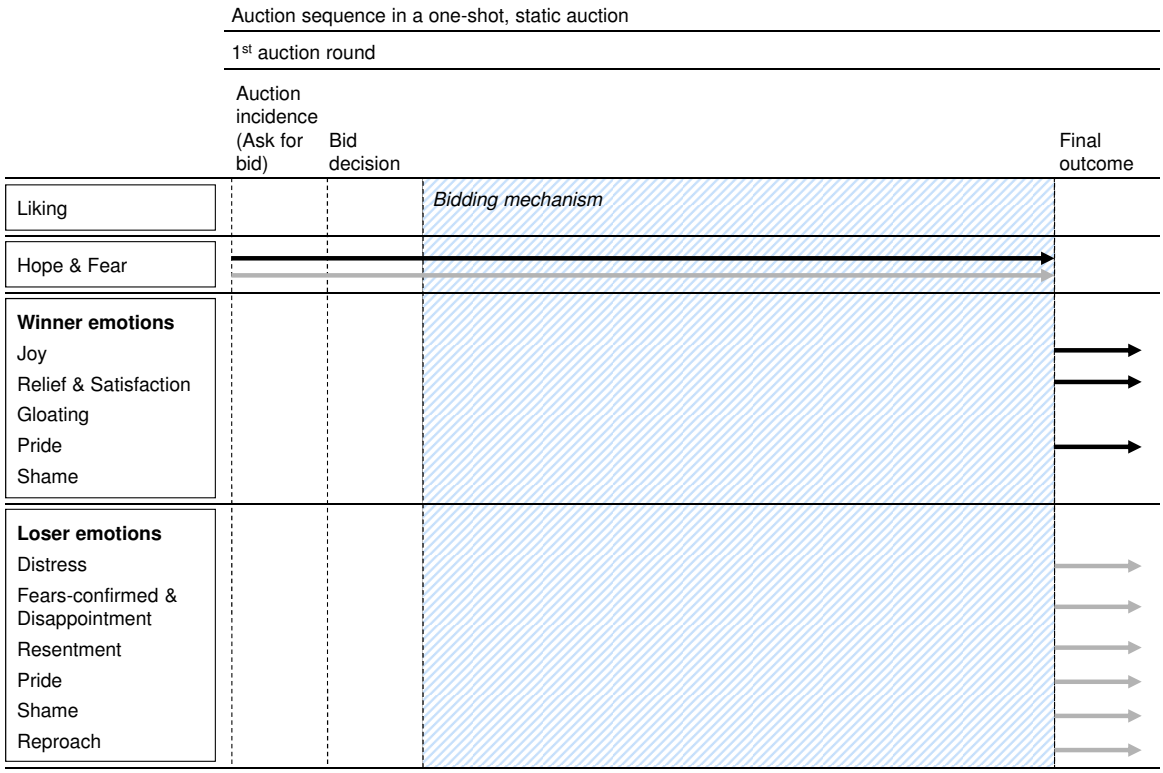

Figure 5.1: Emotional processing scheme, Ehrhart et al. (2013), Static auction

clock auction the price increases incrementally. At every bid round, bidders are asked to accept the current price level. As soon as the bidder does not actively accept the price level, that is, if he does nothing within a time period of 50 seconds, he loses the auction. The last remaining bidder receives the auction good. In such a setting, the information about a next bid round is an indicator that they did not win the auction since there are still several active bidders participating in the auction. Then bidders experience emotions which appear in case of losing like *Distress*, *Fears-confirmed*, and *Disappointment*, although no bidder has lost the auction yet. Figure 5.2 indicates the relevant emotions.[4] I assume that the intensity of *Distress*, *Fears-confirmed*, and *Disappointment* increases when the bidder comes closer to the own private value for the good and he knows that he has to exit the auction in one of the next bid rounds, if he does not want to win

[4]The emotional processing scheme depicts the emotions of the winning bidder with a solid black line. Emotions experienced by all $n-1$ remaining bidders are illustrated as a solid gray line.

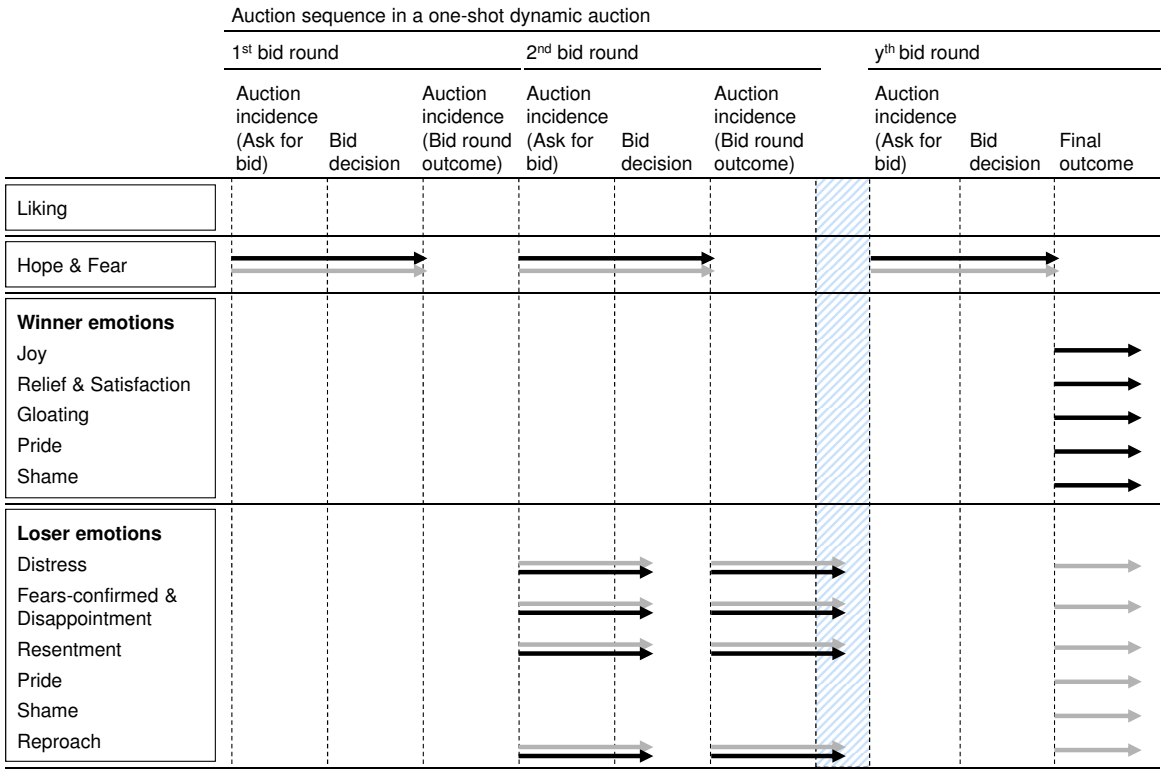

Figure 5.2: Emotional processing scheme, Ehrhart et al. (2013), Dynamic auction

the auction at an unprofitable price. *Resentment* can appear when a bidder decides to withdraw from the auction and knows that other bidders are still in the bidding process. *Reproach* can be experienced after each bid round. Bidders reproach other bidders for still accepting the current price level.

This dynamic clock auction design oppresses the emotions *Shame* and *Pride* during the auction. *Shame* is especially relevant when losers realize that they could have won the auction at a profitable price bidding closer to their own valuation. *Pride* appears when bidders realize that bidding higher to win the auction would have come at a personal loss. Although the result is undesirable, they judge their own action as praiseworthy. With this auction design both emotions can only be experienced when the auction is over and the final result is announced. After the last bid round, the winning bidder gets announced. The winner can experience all emotions that usually appear in case of winning the auction, including *Shame* if he bid too high.

Comparing the static and the dynamic auction of Ehrhart et al. (2013) shows significant differences in the possible emotional reactions. Different auction incidences trigger different emotional experiences. Bidders in the static, sealed bid auction are confronted with one auction incidence. Subsequently they have to decide and their decision is final. In contrast, bidders in the dynamic clock auction are confronted with several auction incidences. Bidders in the static auction may experience *Hope* and *Fear*. Bidders in the dynamic auction, may experience *Hope* and *Fear* before the bid round outcome is announced. They may experience *Distress*, *Fears-confirmed*, and *Disappointment* after each bid round. Thus, they are exposed to a potentially steady vacillation between different emotions. To sum it up, while bidders in a static auction are confronted with one intense situation, in which usually the prospect emotions *Hope* and *Fear* play a role, bidders in a dynamic auction experience a steady change of emotions. *Distress*, *Fears-confirmed*, *Disappointment*, and *Reproach* get replaced by new *Hope* and *Fear*. Looking at the different emotional processing schemes it is less surprising that the different auction formats yield different results.

5.1.2 Emotional processing triggered by information feedback

Informational feedback has an important influence on the bidding behavior: Bids are especially high when the information feedback is restricted to the winning bid. An overview on the influence of informational feedback in auctions is given in Section 2.2. The informational feedback has differed widely across studies (see also Table 2.2).

Isaac and Walker (1985) tested for the "price determination in repeated sealed bid auctions." They tested a limited information setting in which the subjects were only given the winning bid from the previous period, and a full information setting, in which the bidders receive all information. The auction was a repeated first-price auction with 25 rounds. Resale values were drawn from the interval $v \in [0; 10]$ and $n = 4$ players participate.

Neugebauer and Selten (2006) tested the Nash equilibrium prediction in a first-price multi-period auction with three different information feedback treatments. In the first treatment, T0, the bidders were only informed whether they won or lost the auction. In the second treatment, T1, the bidders received the winning bid as information. This

information feedback has been established as standard information feedback in auctions. In the third treatment, T2, the bidders always received the highest competitor's bid as information. In contrast to Isaac and Walker (1985)'s design, the participants bid against computerized bidders with $n = \{3, 4, 5, 6, 9\}$. While the computerized bidders drew their bids from an interval $[0; 100]$, the real bidder had a constant resale value of $v = 100$.[5] Bidders participated in 100 auctions. This leads to an extremely distorted picture regarding the frequency of winning or losing. Bidders bidding the RNNE or close to their resale value have a very small probability of losing and they never come into the situation that they lose while the competitor's bid is greater than their own resale value.

Engelbrecht-Wiggans and Katok (2008) conducted a first-price auction with a thousand repetitions. The bidder played against two computerized players that bid according to RNNE. The real bidder's bid decision was kept constant for ten bid rounds. Thus, bidders had to make 100 bidding decisions and process informational feedbacks from 1000 auction rounds. The authors' objective was to find out whether the information feedback changes the bidding behavior. They therefore introduced four treatments with different information feedback. The experiment of Engelbrecht-Wiggans and Katok (2007) restricted the bidder's value v to $v = 50, 60, 70, 80, 90$ while the computerized bidders receive private valuations in the whole range of $v \in [0, 100]$. Again, the real bidder has a very high probability of winning the auction.

Chapter 2 gives a general overview on the influence of informational feedback. Now, focusing on the emotional influence on bidding behavior, the emotional processing scheme describes the emotional reaction in detail and highlights the differences across different experimental designs introducing three different informational feedback designs.

Information feedback: Winner's information

Isaac and Walker (1985), Neugebauer and Selten (2006) and Engelbrecht-Wiggans and Katok (2008) conducted experiments with a treatment design in which the bidders were only informed about the winning bid: Treatment *Limited information* (Isaac and Walker, 1985), Treatment *T1* (Neugebauer and Selten, 2006) and Treatment *Loser's regret* (Engelbrecht-

[5] At the beginning of each auction round, $n - 1$ numbers between 0 and 100 get drawn randomly and independently. These numbers represent the $n - 1$ competitors' bids.

Wiggans and Katok, 2008). Bidders who lost the auction were told the winning bid while bidders who won the auction did not receive any information regarding the bidding behavior of others. Figure 5.3 illustrates the emotions triggered by an auction design with the described informational feedback.

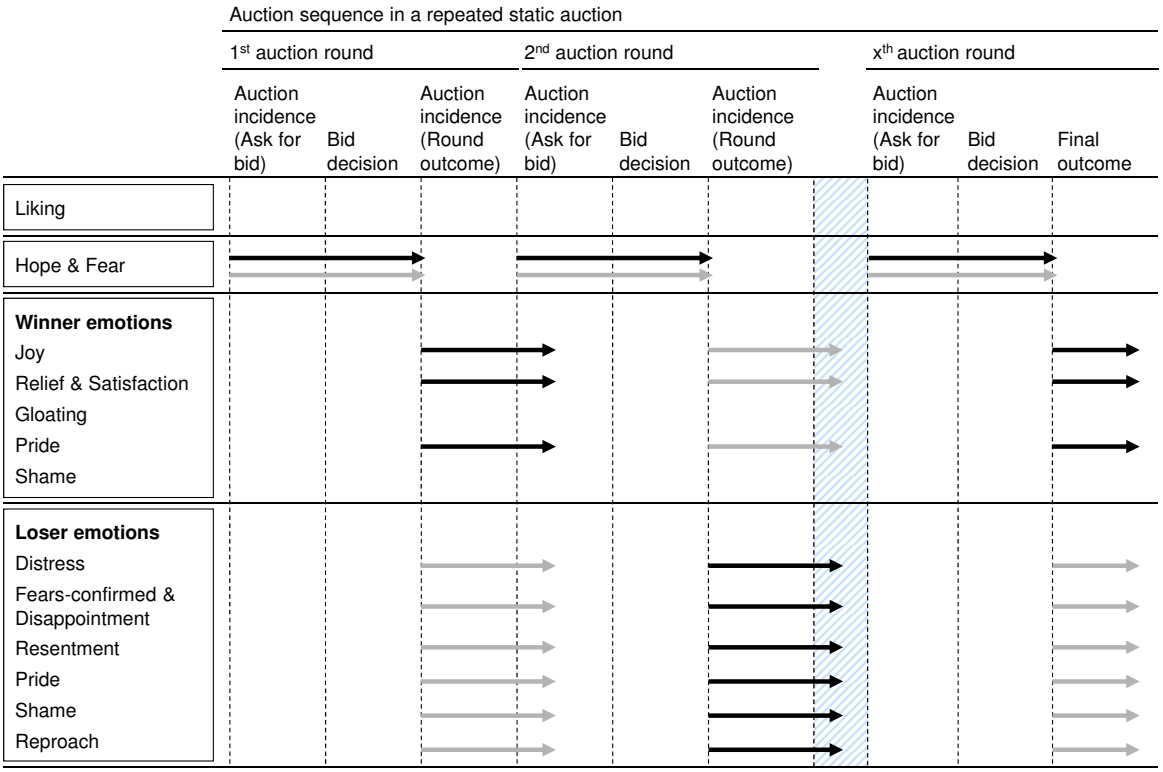

Figure 5.3: Emotional processing scheme for auction designs with winner's information

In case of winning, the winner receives only feedback about his own resale value, bid, and resulting profit. No possibility exists to compare the results with other bidders. The bidder may experience the emotions *Joy*, *Relief*, *Satisfaction*, and *Pride*. The bidder is pleased about a desirable event. Depending on his previous prospects, he is either pleased about the confirmation of a desirable event (*Satisfaction*) or the disconfirmation of an undesirable event (*Relief*). He can also judge his own bidding decision as praiseworthy (*Pride*). *Gloating* and *Shame* are not experienced, since he does not get to know the other bidder's behavior.

In case of losing, the feedback enables a comparison with the winning bidder. Emotions

become more complex since bidders also think about the consequences for others and their impact on themselves. Two cases can be distinguished: In the first case, the spread between the winner's bid and the observed bidder is small and the winning bid is below the value of the observed bidder. In the second case, the spread is high and the winning bid can even be above the value of the observed bidder. Assuming a small spread, the losing bidder may experience *Fears-confirmed*, *Disappointment*, and *Distress*, since he did not reach his goal to win the auction. The emotions will be intense, since the bidder could have won the auction at a profitable price, if he had bid a higher price. The bidder evaluates his action as blameworthy and may experience *Shame* due to the fact that his low bidding lead to a missed opportunity to win. The bidder can also start to blame other persons for bidding high or the lottery for drawing a low resale value, resulting in *Reproach*. And he can be displeased about the event that is obviously desirable for someone else, resulting in *Resentment*. Assuming the spread is big, the bidder may experience *Fears-confirmed*, *Disappointment*, *Distress*, *Reproach*, and *Resentment*. At the same time, he may become aware that, given the significantly higher counter bid, he never could have reached his goal to win the auction. Thus, he will not evaluate his action as blameworthy. In contrast, he might even evaluate his action as praiseworthy and experience *Pride*.

The three different experiments trigger the emotions illustrated in Figure 5.3. The differences among the experiments might lead to differences in the intensity of the emotional experience. The experimental design of Engelbrecht-Wiggans and Katok (2008) allowed for fewer possibilities than the design of Isaac and Walker (1985). Due to the very restricted resale value, bidders are not confronted with big spreads between their own bid and other bids, and bidders never face the situation where the computerized bid exceeds their own value. Thus, in contrast to Isaac and Walker (1985), the bidders only have to face the situation where the spread between the winning bid and the observed bidder's bid is rather small. Neugebauer and Selten (2006) does not even allow for a design in which the competitor's resale value is higher than the observed bidder's resale value. Consequently, in most of the rare cases of losing the auction the spread between the winner's bid and observed bidder's bid is rather small. Then bidders may experience *Distress*, *Fears-confirmed*, *Disappointment*, *Resentment*, *Reproach*, and *Shame*.

Information feedback: Winner's and loser's information

Neugebauer and Selten (2006) and Engelbrecht-Wiggans and Katok (2008) conducted experiments with a treatment design in which the bidders always received the competitors' highest bid: Treatment *T2* (Neugebauer and Selten, 2006) and Treatment *Both* (Engelbrecht-Wiggans and Katok, 2008). In case of winning, the winning bidder also receives the bid of the second highest bidder. In case of losing, the situation is identical to the treatment described above, in which the losing bidder is informed about the winning bid. Figure 5.4 illustrates the emotions triggered by an auction design with the described informational feedback.

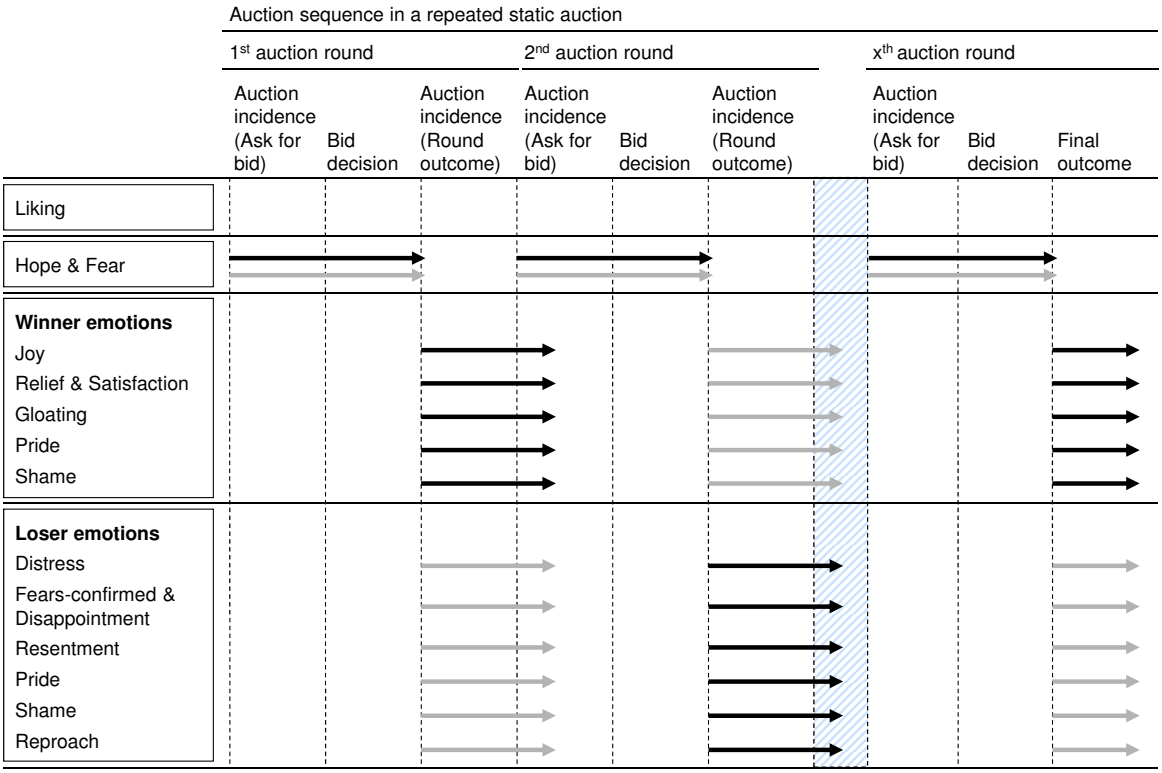

Figure 5.4: Emotional processing scheme for auction designs with winner's and loser's information

In case of winning, the winner receives feedback about his own resale value, bid, and resulting profit. In addition, in contrast to the previously described treatment, the bidder

also receives feedback about the second highest bidder's bid. When facing a small gap between one's own bid and the competitor's bid, the winner is assumed to experience the emotions *Joy*, *Relief*, *Satisfaction*, *Pride*, and *Gloating*. The bidder is pleased about a desirable event. Depending on his previous prospects, he is either pleased about the confirmation of a desirable event (*Satisfaction*) or the disconfirmation of an undesirable event (*Relief*). He can also judge his own bidding decision as praiseworthy resulting in *Pride*. And the bidder can experience *Gloating*, since the desirable event of winning the auction is undesirable for someone else. When the gaps are larger, it becomes more likely that the winner regrets his high bidding and experiences *Shame*. As long as he did not bid above his own value, winning is still a desirable event. The bidder still experiences *Joy*, *Relief*, and *Satisfaction*. However, he might blame himself for bidding high and *Pride* can turn into *Shame*.

As it will be discussed below, there is a high probability of winning the auction. In the rather rare case of losing the auction, there is usually a small spread between the winner's bid and the observed bidder's bid. Bidders experience the same emotions in case of losing as in the Treatment "Winner's information". They experience the emotions *Distress*, *Fears-confirmed*, *Disappointment*, *Resentment*, and *Reproach*. The experience of *Shame* and *Pride* depends on the spread.

The experiment of Engelbrecht-Wiggans and Katok (2007) restricted the bidder's value v to $v = 50, 60, 70, 80, 90$ while the computerized bidders received private valuations in the whole range of $v \in [0, 100]$. Thus, the real bidder had a very high probability of winning the auction and usually won the auction with a rather big gap between his own winning bid and the competitor's losing bid. Then, bidders were confronted with a high amount of money left on the table while there was nearly no missed opportunity to win. This systematic winning bias can also be found in the experiment of Neugebauer and Selten (2006). In this case, the design even prohibited the computerized bidders' value from being above the real bidder's value. Consequently in both treatments, winners usually enjoyed a big gap between their own winning bid and the next competitor's bid. Consequently they usually experienced *Joy*, *Relief*, *Satisfaction*, *Gloating*, and *Shame*.

Information feedback: No information

Neugebauer and Selten (2006) and Engelbrecht-Wiggans and Katok (2008) conducted experiments with a treatment design in which the bidders receive no information except whether they won or lost the auction: Treatment *T0* (Neugebauer and Selten, 2006) and Treatment *No* (Engelbrecht-Wiggans and Katok, 2008).

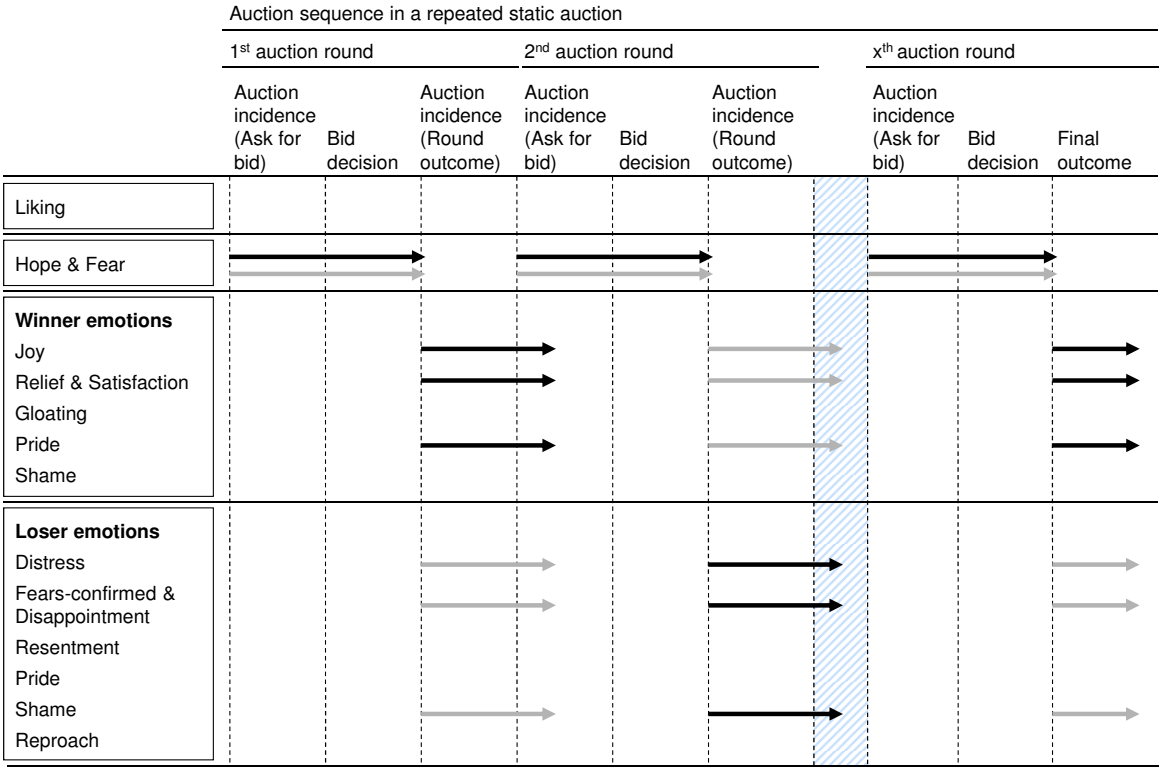

Figure 5.5: Emotional processing scheme for auction designs with no information

In case of winning, the informational feedback was identical to the situation in the winner's information treatment. Bidders experienced *Joy*, *Relief*, *Satisfaction*, and *Pride*.

In case of losing, the bidder received no information. The feedback enables no comparison with other bidders. The bidder experienced *Fears-confirmed*, *Disappointment*, *Distress*, since he failed to reach his goal to win the auction (at a profitable price). *Resentment* and *Reproach* were not get experienced since the losing bidder was not informed about other bidders results. Since the spread toward other bidders was unknown, he could

neither evaluate his bidding action as blame- or praiseworthy.

Comparison of different informational feedback design

Comparing the three different emotional processing schemes resulting from the different informational feedback designs reveals similarities and differences in the emotional reactions as summarized in Figure 5.6.

Winning the auction is perceived as a desirable event and winning bidders always experience the emotions *Joy*, *Relief*, and *Satisfaction*. In the following, these three emotions are denoted the "Basic winner emotions". Losing the auction is perceived as an undesirable event and losing bidders always experience the emotions *Distress*, *Fears-confirmed*, and *Disappointment*. In the following, these three emotions are denoted the "Basic loser emotions". The basic winner and loser emotions are shaded in Figure 5.6.

Further, bidders experience *Gloating*, *Resentment*, and *Reproach*, when bidders do not only focus on the event's desirability for themselves, but also on the consequences for others (*Gloating*, *Resentment*) and the influence of others with respect to the auction result (*Reproach*). It is assumed that the observation or the information about others' bidding behavior can trigger these emotions. The comparison of the different auction designs show that differences in the informational feedback decide whether these emotions get triggered or not.

Bidders evaluate their own action as blame- or praiseworthy. The comparison shows that bidders can experience *Pride*, even though they lost he auction, and they can experience *Shame*, even though they won the auction. This leads to a certain ambivalence. The winning bidder in the "winner's information" design and the "no information" design does not experience ambivalent emotions. Winning is linked with *Pride* and the three basic winner emotions. In the "winner's and loser's information" design winning can be linked to ambivalent emotions. On the one hand, it is perceived as positive, on the other hand, winners think about the missed opportunity to win the item at an even more profitable price.

According to Neugebauer and Selten (2006), 75% of bidders tend to start with underbidding behavior in the first auction round (with no significant differences between the treatments). Later, bidders have a higher tendency to overbid in the Treatment T1.

Basic emotions

3 auction designs with different informational feedback

	Winner's information		Winner's and loser's information		No information	
	Small gap	Big gap	Small gap	Big gap	Small gap	Big gap
IW (1985) NS (2006) EWK (2008)	Limited information T1 Loser's regret		- T2 Both		- T0 No	
Emotions in case of winning	Joy Relief Satisfaction - Pride -	Joy Relief Satisfaction - Pride -	Joy Relief Satisfaction Gloating Pride -	Joy Relief Satisfaction Gloating - Shame	Joy Relief Satisfaction Gloating Pride -	Joy Relief Satisfaction Gloating Pride -
Emotions in case of losing	Distress Fears-confirmed Disappointment Resentment - Shame Reproach	Distress Fears-confirmed Disappointment Resentment (Pride) - Reproach	Distress Fears-confirmed Disappointment Resentment - Shame Reproach	Distress Fears-confirmed Disappointment Resentment (Pride) - Reproach	Distress Fears-confirmed Disappointment - - (Shame) -	Distress Fears-confirmed Disappointment - - (Shame) -

Figure 5.6: Emotional comparison of three auction designs with different feedback

I assume that different emotional reactions, triggered through the different information feedbacks, is one reason for overbidding. In the "winner's information" design, bidders experience unambiguous negative emotions in case of losing, while they get rewarded with unambiguous positive emotions in case of winning. Underbidding behavior result in negative emotions and an impulse is given to increase the bid in the next round. If the bidder succeeds, he then experiences positive winner emotions. In contrast to the "winner's and loser's information" design, the winning bidder does not experience *Shame*. Hence, no impulse is given towards a downward correction so the lacking correction impulse might be the reason that "winner's information" design favors overbidding. There is such an impulse in the "winner's and loser's information" design. In the (very likely) case of winning the auction with a big gap, the winner experiences *Shame*. That is, more balanced feedback leads to more balanced emotional reactions and thus to more balanced bidding behavior. The "no information" design keeps this balance of emotional reactions by giving

no information feedback at all.

5.1.3 Emotional processing triggered by number of bidders and bids

Chapter 2 introduces experimental literature confirming the theoretical prediction that final prices and the number of bidders correlates positively. Usually, in lab experiments the number of bidders is determined exogenously, while in field experiments the number of bidders, bids, and rebids, develop endogenously. Heyman et al. (2004) manipulated the number of bids and rebids in an auction conducted in the lab, telling experiment subjects they they were playing in a group of six bidders. In fact, one real bidder played against five computerized bidders. Bidders were either confronted with very passive computerized bidders, bidding 5 times in 9 bid rounds, or with rather active computerized bidders, bidding 30 times in 9 bid rounds. According to Heyman et al. (2004) the treatment with comparatively passive computerized bidders is perceived as an auction with low competition. And the treatment with very active computerized bidders is perceived as an auction with high competition. They find that bidders bid higher in an environment perceived as highly competitive. Subjects are allowed to submit a bid in each bid round. They can either stay with their previous bid or raise the bid as they please. Bidders are informed about the cumulative bidding history throughout the auction including bid amounts of each participating bidder (both, real and computerized).

When the real bidder wins a bid round, he usually experiences *Joy*, *Relief*, *Satisfaction*, *Gloating*, and *Pride*. Since bidders are always informed about the cumulative bidding history, the emotions experienced are the same as in the "winner's and loser's information" design. It is assumed that the emotions are perceived less intensely since the bidders are only informed about intermediary results in a dynamic one-shot auction. If a bidder wins the final round, he can also experience *Shame*, if he regrets having bid too much. When the real bidder loses a bid round, he usually experiences *Distress*, *Fears-confirmed*, *Disappointment*, *Resentment* and *Reproach*. Due to the intermediary character of the information, *Pride* and *Shame* are only experienced in the last round, when the final outcome is announced.

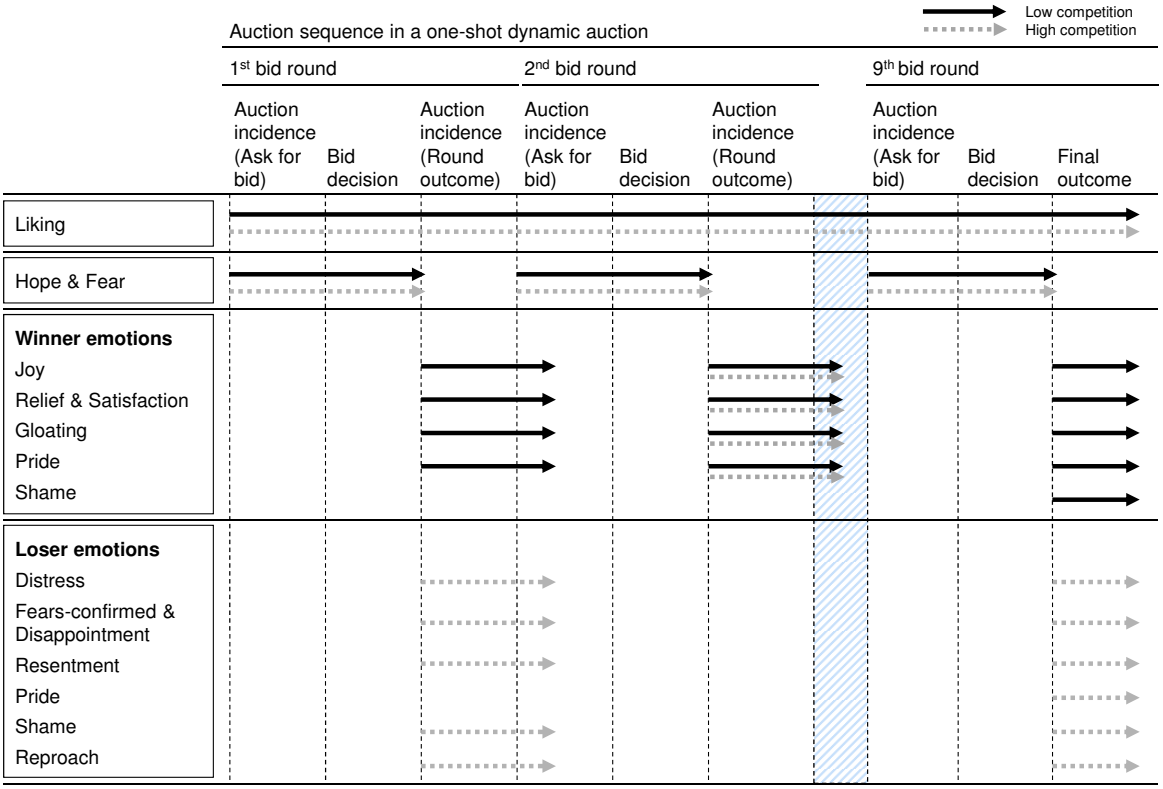

Figure 5.7: Emotional processing scheme, Heyman et al. (2004), low vs. high competition

The bidder in an auction setting with high competition experiences frequent changes in emotions. Due to the high bidding activity of others, he should experience a more frequent change between winning and losing. While in the exemplary emotional processing scheme in case of low competition, a more stable situation is assumed. With five computerized bids in nine rounds it is possible to keep the winning status for several rounds. It is also assumed that the intensity of emotions like *Gloating*, *Resentment*, and *Reproach* is greater in a highly competition environment. Bidders are just more aware of each other due to the high bidding activity. This awareness leads to a stronger focus on others and their emotions in particular. Similar to the comparison of a static and a dynamic auction, the emotional changes might be one reason for more overbidding in the high competition treatment. Additionally the more intense emotions *Gloating*, *Resentment*, and *Reproach* in case of losing a highly competitive auction might also trigger overbidding. Bidders try to avoid this strong negative emotions by bidding higher. A first conclusion is that bidders

in a highly competitive environment are more likely to overbid, since their experienced emotions are more intense and they experience more frequent changes between loser and winner emotions.

5.1.4 Emotional processing triggered by the auction duration

The second chapter also discusses the length of an auction as influencing auction design parameter for overbidding. It concludes that bidders bid higher when they participate in an auction for a longer time. Heyman et al. (2004) find that bidders bid higher when they are allowed to participate in nine rounds instead of one round.

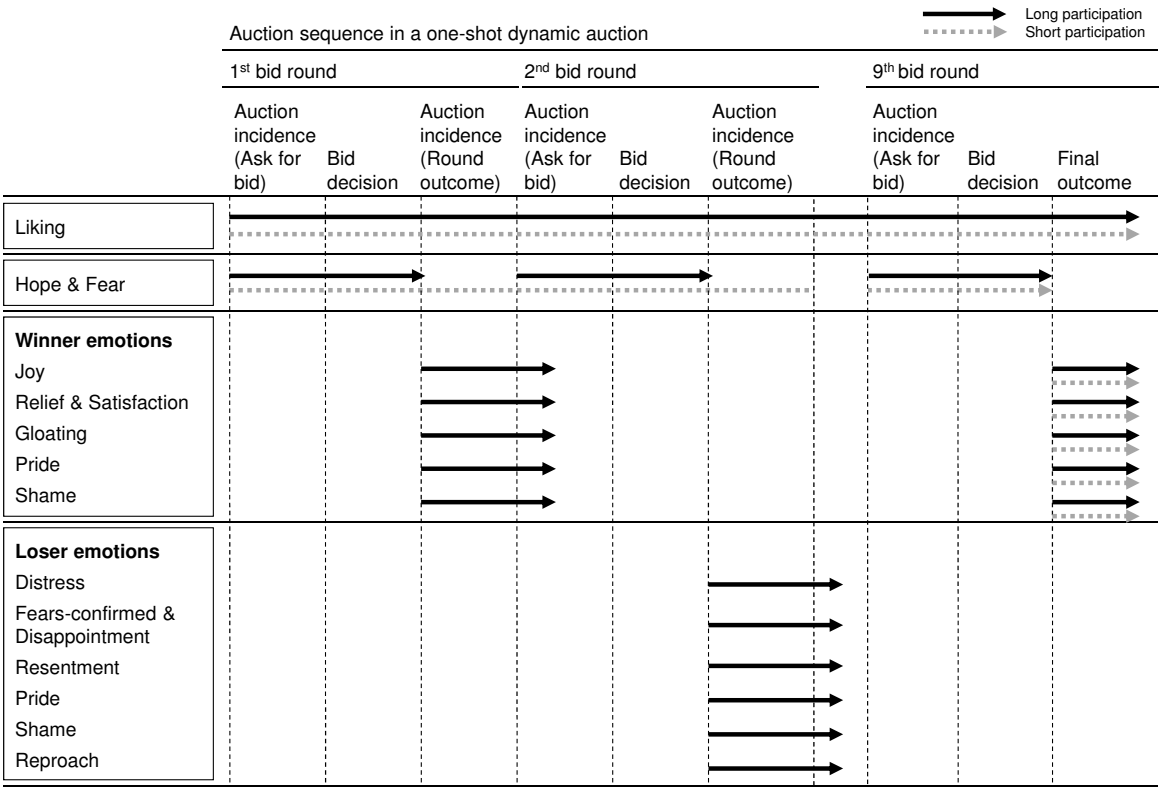

Figure 5.8: Emotional processing scheme, Heyman et al. (2004), long vs. short participation

Regarding the illustration of the emotional processing scheme in Figure 5.8 the situation is similar to comparing a static with a dynamic auction. In the dynamic auction

as well es in Heyman et al. (2004)'s long duration setting, bidders participate in several bid rounds in an auction. In a static auction as well es in Heyman et al. (2004)'s short duration setting, bidders just jump into the auction in the last bid round. Despite the similarities, there are relevant differences: First, in Heyman et al. (2004)'s design, unlike the static auction, bidders are presented with a bid history before submitting their bid. Since information feedback influences bidding, the bid history can have an additional influence on bidding behavior. Second, Ehrhart et al. (2013) conducted an auction with induced values, whereas Heyman et al. (2004) auctioned university store mugs. Experiments with induced values do not enable attraction emotions, that is *Liking* or *Disliking* of an object, since induced values are seen as abstract concepts rather than concrete objects. Despite these differences I consider it possible to evaluate Heyman et al. (2004)'s design and its results in the context of differences between static and dynamic auctions, as discussed in the first subsection of this chapter. I assume that the change in emotions in the long participation setting favors overbidding, just as was the case in the comparison between static and dynamic auctions.

5.1.5 Emotional processing triggered by the type of good

Most lab experiments conduct auctions with induced private values. Only Heyman et al. (2004) and Wolf et al. (2008) auctioned real goods in a lab experiment where the attraction emotion *Liking* is relevant and the experienced intensity might influence bidding behavior.

Wolf et al. (2008) tested how the length of exposure to an item before the auction starts influences bidding behavior. They hypothesized that increased feelings of ownership, triggered trough a longer exposure to the item, would increase the valuation of the item and thus the bid level. The time that participants were given to examine the auctioned item, a coffee mug, varied between 10 seconds (short duration) and 30 seconds (long duration). In an English open bid auction as well as in the first price sealed bid auction, bidders bid significantly higher in the long-duration exposure design.

The variation of the exposure length only has an influence on the object-based emotion *Liking*. Consequently, the emotional processing scheme looks identical for both treatments, but I assume that the intensity of the *Liking* emotion is different. Bidders in the long exposure design experience a more intense *Liking* emotion. And this intense emotion

might result in greater (over-) bidding behavior.

5.2 First conclusions based on emotional processing schemes

The previous section identifies relevant emotions in selected lab experiments, indicating that the differences between the emotional processing schemes can provide some explanations for different bidding behavior. The focus of this section is to find differences and commonalities with respect to the triggering of emotions through certain auction designs by looking for consistent emotional reactions across different experiments with similar auction designs.

5.2.1 What triggers emotions in auctions and what emotions get triggered?

According to the bidding framework developed in Section 4.2, emotions in auctions get triggered by auction incidences, which are heavily determined by the auction design. For example, the auction format determines how often bidders are asked to submit a bid and how often they receive feedback on the bid or auction round outcome. Furthermore, the design of the informational feedback determines which kind of feedback the bidders receive. Sometimes they get only informed about the basic result of the auction, that is, whether they won or lost the auction and sometimes they are informed about all bidders' whole bidding history. The manipulation of the number of participating bids and the activity of individual bidders also influences the auction incidences. Consequently the experimental design of an auction offers the possibility to trigger certain emotions and, hence, to isolate some emotions for research purposes.

The discussion of the emotional processing schemes make evident which emotions get triggered. First, basic winner and loser emotions get triggered in all introduced auctions. Second, certain emotions get triggered, when there is a certain focus on the presence of other bidders. Third, the emotions *Pride* and *Shame* play a relevant role, when the bidder's own actions get appraised.

Basic emotions

Some emotions appear in every auction. I call them "basic emotions". But their intensity might differ depending on the auction design and the individual bidder, even though the eliciting situation for the specific emotion type is given in every auction.

In case of winning, the "basic winner emotions" *Joy*, *Relief*, and *Satisfaction* are commonly experienced by the bidder assuming, as discussed in Subsection 3.4.1, that the primary goal of participating in an auction is to win the auction. If so, winning the auction is a desirable event and *Joy* is the resulting emotion type. During the bidding process, bidders are uncertain about the final result, therefore they experience *Fear* (to lose the auction) and *Hope* (to win the auction). When the final outcome gets announced, both prospect emotions get resolved and bidders experience *Relief* and *Satisfaction*.

Astor et al. (2013, p. 3) states that "the emotion triggered by the event of winning an auction and receiving a positive monetary payoff has been referred to as the joy of winning. The established concept joy of winning is either too narrow or has to be re-defined. Since bidders do not only experience one emotion in case of winning as suggested by the notion joy of winning. Bidders experience several emotions and at least the three basic winner emotions *Joy*, *Relief* and *Satisfaction*.

In case of losing, it is assumed that the bidder experiences the "basic loser emotions" *Distress*, *Fears-confirmed*, and *Disappointment* because the primary goal, to win the item, has not been achieved. Consequently, losing is perceived as undesirable event and bidders experience *Distress*. Again, during the course of the bidders experience *Fear* (of losing the auction) and *Hope* (to win the auction). When the final outcome is announced, both prospect emotions get resolved and bidders experience *Fears-confirmed*, and *Disappointment*.

Emotions focusing on others

Some emotions are assumed to appear only in auctions in which the bidder is especially aware of the presence and the results of other bidders. When bidders are not only concerned with auction incidences effecting their own results, they can experience emotions like *Gloating*, *Resentment* or *Reproach*. This thesis summarizes the three emotions as

"Emotions focusing on others".

Winning the auction is a desirable event, and since winning implicates losing for all other bidders participating in a standard one-good auction, the auction outcome is perceived as undesirable event for all other bidders. In this case, the eliciting situation for the emotion type *Gloating* is given. The previous discussion lead to the assumption that *Gloating* is only experienced if a winning bidder also focuses on the consequences for the losing bidders. This is triggered when further information regarding the other bidders is given, or when the outcomes of the other bidders is announced. I conclude that *Gloating* is experienced when winning bidders also focus on other bidders and their results. In this thesis, it is assumed that information about the other bidders' bidding behavior is necessary to trigger *Gloating*. Further research should investigate when exactly *Gloating* appears. The mere physical presence of other bidders in the room might for example be a sufficient trigger.

Losing the auction is an undesirable event. In parallel to the discussion above, the losing bidders can focus on the winner and his experience of a desirable event, resulting in the eliciting situation for the emotion type *Resentment*. Additionally, losing bidders can blame other more successful bidders for their actions, resulting in the emotion type *Reproach*. Here again, it is assumed that information about the other bidders' bidding behavior is necessary to trigger *Resentment* and *Reproach*.

Pride and Shame

The emotions *Pride* and *Shame* are experienced when bidders evaluate their own action as praiseworthy or blameworthy. The discussion of the influences of the informational feedback on emotional reactions indicates that the degree to which an action is evaluated as praiseworthy can be influenced by the information bidders receive about other bidders' bidding behavior.

If bidders receive no information about other bidders' behavior, as discussed in Subsection 3.4.1, bidders experience *Pride* when they win the auction. They perceive winning as socially valuable and the bid decision leading to this result as praiseworthy action. In case of losing the auction, they do not necessarily experience *Shame*. It is possible that they make their own action responsible for losing and evaluate it as blameworthy, but it

is also possible that they make others and their high bidding or the low valuation responsible for the loss. In this case, they do not evaluate their own action as blameworthy and thus do not experience *Shame*. Further research is needed to determine to what degree and when *Shame* appears in this situation.

If, however bidders receive feedback about other bidders bidding behavior, I build on Engelbrecht-Wiggans and Katok (2008)'s analysis of bidders evaluating their actions as blameworthy when losing the auction or as blameworthy although they won the auction.

I conclude that bidders experience *Shame* when they win the auction with a high gap between their own bid and the next competitor's bid. Then they regret that they bid so high, although they did not overbid in the sense that they bid above their own valuation. They experience *Shame* since they know that they could have won the auction at a more profitable price. When bidders win the auction with a small gap between their own bid and the next competitor's bid, they evaluate their action as praiseworthy. Further research should focus on the size of the gap to the next competitor's bid that turns *Pride* into *Shame*.

In case of losing the auction bidders experience *Shame* when they could have bidden above the winner's bid while still bidding below their own valuation. Engelbrecht-Wiggans and Katok (2008) calls this loser's regret. Again it is assumed that bidders evaluate their action as praiseworthy, when they are faced with a high gap between their own bid and the winner's bid (and the winner's bid is above the own valuation). Then bidders still perceive losing as an undesirable event but they do not judge their action as blameworthy. From my point of view it is not certain whether they judge their action as praiseworthy and experience *Pride*. Perhaps bidders in this situation do not evaluate their action at all. Again, this is a question for further research.

Summary

Table 5.1 summarizes the findings regarding the central research question "What triggers emotions and what emotions get triggered in auctions?" All relevant emotions except for *Hope*, *Fear*, and *Liking* get triggered through the announcement of bidding results. Independent of the concrete informational feedback, bidders experience the basic winner emotions *Joy*, *Relief* and *Satisfaction* in case of winning. And they experience *Distress*,

What triggers emotions?	Which emotions get triggered
Announcement of winning or losing	Winning: *Joy*, *Relief*, *Satisfaction* Losing: *Distress*, *Fears-Confirmed*, *Disappointment*
Announcement of winning	*Pride*
Announcement of losing	(*Shame*)
Announcement of winning or losing emphasizing the presence of other bidders	Winning: *Gloating* Losing: *Resentment*, *Reproach*
Announcement of winning or losing triggering the direct comparison between own bidding and others' bidding behavior	Winning: *Pride*/*Shame* Losing: *Shame*/*Pride*

Table 5.1: Summary of the central research question: What triggers emotions in auctions and what emotions get triggered?

Fears-confirmed, and *Disappointment* in case of losing. When the presence of other bidders is emphasized, they can experience *Gloating* in case of winning, and *Resentment*, and *Reproach* in case of losing. The experience of *Pride* and *Shame* strongly depends on the design of the informational feedback. Bidders usually experience *Pride* in case of winning, but *Pride* can turn into *Shame* if the comparison with other bidders' bidding behavior make bidders feel that they bid too high. Vice versa, bidders' possible *Shame* in case of losing the auction can turn into *Pride*, when they realize that they could not win the auction at a profitable price given the bidding behavior of other bidders.

5.2.2 What emotional reactions lead to certain behavior like overbidding?

The previous subsection identifies the emotions that get triggered in auctions and what auction designs trigger which kind of emotions, as summarized in Table 5.1. The lack of research on concrete emotions in auctions make it impossible to deduct resilient results on the specific pattern of emotions that fosters overbidding. However, based on the discussed experiments in this chapter and the identified triggers of emotions in the previous

subsection, three general statements regarding overbidding can be deduced and two more concrete assumptions can be proposed.

Hypothesis 1: The presence of certain emotion types lead to overbidding

One emotion-centered explanation for overbidding is the presence of certain emotion types. Chapter 2 discusses joy of winning, fear of losing, spiteful bidding, and loser's regret as possible emotions fostering overbidding. This explanation views the basic winner and loser emotions (*Joy*, *Relief*, *Satisfaction*, and *Distress*, *Fears-confirmed*, *Disappointment*) as less crucial emotions for overbidding since they appear in every auction. Thus, their presence alone cannot foster overbidding in selected auctions. Consequently, only *Gloating*, *Reproach*, *Resentment*, *Pride*, and *Shame* are possible overbidding triggering emotion types.

The discussion of the experiments in Section 5.1 suggests that the experience of *Pride* despite losing an auction and, especially, the experience of *Shame* despite winning an auction, can serve as a very important emotional corrective to prevent bidders from overbidding because bidders like to experience positive winner emotions and like to avoid negative loser emotions. That is, if the informational feedback that triggers *Pride* in case of losing the auction and *Shame* in case of winning the auction are not given, the likelihood for overbidding becomes higher. This is why bidders tend to overbid especially when they are only informed about the winning bid in case of losing and this winning bid is rather close to one's own bid. This idea is described as loser's regret by Engelbrecht-Wiggans and Katok (2008). I criticize the experimental implementation and the emotional foundation of their analysis in Subsection 5.1.2, however, I agree with the general thought and consider loser's regret as a central emotion influencing overbidding.

Hypothesis 2: The intensity of certain emotion types leads to overbidding

Another emotional explanation for overbidding is the more or less intensive experience of certain emotions. That is, bidders who experience more intense *Joy* might overbid more than bidders who experience less intense *Joy*. This relates back Ortony et al. (1988)'s ideas on global, central, and local variables increasing the intensity of a certain emotion. Subsection 3.3.2 discusses the global variables and Table 3.4 and Table 3.5 summarize

the central and local variables relevant for the emotions appearing in auctions. Ku et al. (2005) discuss the influence of arousal. According to Ortony et al. (1988), arousal is a global variable influencing the emotion's intensity independent of a certain emotion type. They assume "that changes in one's level of arousal may be roughly proportional to the subjective importance of an emotional situation" (Ortony et al., 1988, p. 65). Based on the discussion of the experiments in Section 5.1, I see no conclusive evidence regarding the influence of the emotional intensity on overbidding.

Hypothesis 3: The dynamic development of certain emotion types leads to overbidding

The third emotional explanation for overbidding is the pattern of emotions experienced throughout a dynamic or repeated auction. E.g., bidders who loses eight rounds in a row experiencing loser emotions bid differently in the ninth round than a bidder who wins eight rounds in a row experiencing winner emotions.

The discussion of the experiments in Section 5.1 suggests that frequent changes between losing and winning leads to volatile emotional experiences in auctions and triggers overbidding. However, this is only a first vague indication since the individual bidding histories were not analyzed.

5.3 Outlook

I conclude that the interpretation of experimental results can benefit significantly by applying the emotional processing scheme. The systematic application is a promising way to identify relevant emotions in certain auction designs. This thesis focuses only on emotional aspects, but for a deeper interpretation it should be supplemented by all considerations regarding cognitive processes when overbidding, as introduced in Chapter 2. So far, the discussion about the concrete emotions experienced in a certain design are very hypothetical. Some ideas are based on existing literature introduced in Chapter 3, but overall, little relevant literature exists. Consequently, experimental work is necessary to verify the chapter's discussions and illustrations. I suggest using questionnaires in experiments to identify which of the 14 emotions bidders experience and how intensely. I

further suggest using experiments which control for one specific emotion. The experiments on informational feedback indicate the potential significance of such experiments.

Chapter 6

Method for auctioning real goods in the lab

In the previous chapter emotion triggering auction designs, the resulting emotions, and their possible influence on certain bidding behavior were discussed based on existing lab experiments. *Liking* is the object-based emotion experienced throughout the auction when a real good is auctioned.[1] It is obvious that online auctions in the field use real goods or certificates for real goods. But so far, only two lab experiments, Heyman et al. (2004) and Wolf et al. (2008), conducted lab experiments with real goods allowing for this emotion type. The predominant procedure in the lab is to use induced values as auction goods. A monetary value is assumed to be neutral in terms of appealingness—an explicitly desirable effect in many experimental settings. But in the context of emotional bidding behavior, the use of real goods is essential for insightful research. Because otherwise the emotional consequences triggered by the most central part of the auction, the auction good, would be neglected. Furthermore, I propose that object emotions cause important interferences with other emotions intensifying them or even resulting in new effects.

The first part of this chapter reviews the existing literature on experiments with real goods to gain an overview of the possible types of products auctioned and to learn from previous experiments with respect to selecting suitable goods. This will include the iden-

[1]Besides the auction good participating bidders can trigger *Liking*. Since standard online and lab auctions take place between bidders, that do not know each other personally and are seated separately from each other, the emotion *Liking* triggered by other participants is considered as negligible.

tification of relevant criteria for the selection process in lab experiments. I argue that research using real goods must move beyond field experiments and has to go into the lab. The second part of this chapter critically discusses the findings from the literature review and the third part develops the selection process for real goods.

6.1 Literature overview

While experimental economists conduct nearly all auction experiments with induced values, newer behavioral auction research focuses on field experiments with real goods. The following introduces lab and also field experiments in order to learn from field experiments about auctioning real goods. I demonstrate why auction experiments with real goods should not only be conducted in the field, but in the lab as well, introducing also some field studies that can trigger ideas for lab or field experiments.

Lab experiments are conducted in a controlled environment with exogenously determined and variable influencing parameters (e.g., number of bidders, type of information). Emotion triggering auction incidences can be induced and the experiments can be repeated under the same conditions. These traits allow lab experiments to offer almost unlimited possibilities to test design parameters by altering the basic design or changing parameters to test specific sensitivities. Experimental researchers can build very realistic designs, e.g., replicate the eBay auction design, or they can use artificial designs to examine specific mechanisms.

In contrast, field experiments test real life behavior with real auction goods in the field, that is, in a largely non-controlled environment. Most parameters, such as the number of bidders or the number of competitive auctions, develop endogenously. While subjects in the lab participate in one auction and different behaviors can be attributed explicitly to different auction formats, bidders in field experiments can select from a range of different auctions.

Field studies intend to identify empirical patterns like correlations or other data interdependencies and are based on large samples.

In order to determine how an auction with real goods in a controlled environment can be realized, thus inducing object emotions in lab experiments, I review the auction of real

goods in terms of experimental methods, lab and field experiments.

6.1.1 Real goods in lab experiments

As outlined above, one advantage of lab experiments is that they offer almost unlimited possibilities in testing different auction designs, varying certain auction parameters, and inducing emotion triggering incidences. They are also replicable and relatively easy to conduct using students recruited as participants. Lab experiments are often used to test existing theories, such as game theoretical concepts, but they also reveal new phenomena, triggering the need for new theories. Overbidding is a good example. Although the first researchers' intention was to test game theoretic predictions, they instead created the new phenomenon of "overbidding". Lab experiments are an important part of empirical economic research, but with two caveats for auctioning real goods. First, since lab experiments are artificial they might yield false results because they are not perceived as real life auctions. Second, the selection of auction goods and the compensation mechanisms in the conducted auction experiments are unconvincing. The following critically examines the two existing experiments.

First, lab experiments are artificial and might lead to other results since they do not get perceived as real life auctions. Second, the existing auction experiments conducted with real goods neither convinces regarding the selection of auction goods, nor with respect to the compensation mechanism. That is, so far no completely convincing idea exists how lab experiments can be conducted with real goods. I present the existing two experiments and work out the critical points.

Literature	**Good**	**Compensation**
Heyman et al. (2004)	Godovia chocolate	Class credit
	T-shirt, gift certificates	\$10 show-up fee
Wolf et al. (2008)	Coffee mug	Class credit

Table 6.1: Auction goods and compensation in laboratory experiments with real goods

Heyman et al. (2004) auctioned an Amazon.com gift certificate, a local music store gift certificate, a university T-shirt, and a box of Godovia chocolate. 140 students from a marketing class participated, who, in return for participating, received partial class

credit. They had to pay for the goods with their own money, but were not obliged to submit a bid. Only 10 out of 140 participants did not place a bid. Subjects were told that they were divided into six-person auction groups across a classroom computer network but in reality were individually bidding against five computerized scripted competitors that varied according to the experimental conditions. Heyman et al. (2004) tested a low and a high competition treatment. Subjects in the low competition treatment received 3-5 additional bids, while subjects in the high competition treatment received 20-35 additional bids. The researchers also manipulated the duration of ownership, allowing bidders to take part in nine bidding rounds or only in the last bidding round. Heyman et al. (2004, p. 16) found that the "average bid for the subjects in the long duration of ownership condition is \$6.39 as opposed to \$4.04 for those people who came in just prior to the last round (short duration of ownership)."

While Heyman et al. (2004) show that real goods can be auctioned in the lab, their study still has weaknesses. Offering class credit as an incentive to participate leads to less resilient results. It is possible that some bidders participated only to get credit and not because they wanted to win the auctioned goods. In the best case they did not participate in the auction and thus did not disturb the course of the auction (like ten out of 140 participants did). In the worst case they did not take the bidding seriously and negatively influenced the results. The fact that bidders did not participate is not a problem in this case, since bidders bid against computerized bidders and this observation can be eliminated. Observations can also be eliminated when bidding is obviously not being taken seriously, such as when bidders only bid a few cents for a \$10 gift certificate. However, these shortcomings are disruptive when a group of six real bidders is imagined, once with seriously interested bidders and once with only three out of six interested bidders. Unserious behavior is likely to yield different results than in a real auction in which all bidders have a serious interest winning the auction. Moreover, strict experimental guidelines do not allow participants to be deceived, such as when Heyman et al. (2004) led bidders to believe that they were bidding against other real bidders. Further, to avoid budget constraints, bidders bid for all four auctions but only one auction counted selected at random. Bidders might take each auction less seriously since the probability of this auction to be the relevant one was only 25%.

Wolf et al. (2008) auction mugs from the university store, located directly across the building in which the experiments took place. The mugs have a retail price of $4.49 in the English open bid auction and a price of $3.95 in the first-price sealed bid auction. In both auction types the mugs have their price tag still affixed and participants know that they can buy the mugs at this price at the university store. 144 students from an introductory information systems course participated and received a $10 participation fee. In the English auction the winner keeps the mug and his bid gets subtracted from his participation fee. In the sealed bid auction the winner can choose between keeping the mug and getting the price subtracted from the participation fee or selling the mug back for $3.95, receiving $10 minus their bid plus $3.95. Seven out of ten auction winners chose the second option. All participants bid in groups of six bidders, fourteen groups in the English auction and ten groups in the sealed bid auction. Participant groups were assigned randomly to either a short or long duration treatment. Before the auction started, participants examine the good for ten seconds in the short duration treatment and for 30 seconds in the long duration treatment. Wolf et al. (2008, p. 479) summarizes that "the average winning bid was $3.70 for short duration groups, with the winning bid exceeding the mugs retail price only once ($7.50). The average winning bid was $5.80 for the longer duration groups, with winning bids exceeding the mugs retail price four out of seven times." They tested the same effect in a static auction and found the same effect of short versus long exposure, albeit on a lower level ($2.24 vs. $3.07).

Here again, I argue that participation incentives such as a participation fee might lead to the same distortion as in Heyman et al. (2004)'s experiment. Some bidders just participate to receive the high participation fee. A further caveat exists which already becomes evident in the bidding results. Bidders might use the $10 as an anchor point or as game money, increasing the likelihood that they submit this amount as a bid or bid significantly higher than they would normally without this compensation. Two winners submitted a $10 bid and four more bidders who decided to keep their mugs paid more than the price tag.

Both experiments pioneered the auction of real goods in lab experiments. All other experimentalists used induced values following established standards or, in some cases, hypothetical goods (e.g., Ku et al., 2005, 2006)). The last method does not fulfill the

requirements of good experimental practice because participants are required to imagine they are in a certain situation, instead of participating in a replicated situation. Moreover, their actions are not linked with a payoff-function and they receive a fixed amount of money regardless of the action they take. Sometimes this kind of experiment is indispensable, such as when the situation cannot be rebuilt.

6.1.2 Real goods in field experiments

A field experiment examines an intervention in the real world rather than in the laboratory. Like lab experiments they "study a controlled setting in order to evaluate treatment effects" (Card et al., 2011, p. 18). The common procedure is to set up a certain number of auctions with certain characteristics on eBay or other large commercial online auction sites. Bidders are not informed that they are participating in a field experiment. Harrison and List (2004) classify this kind of field experiment as a "natural field experiment". For example, Ariely and Simonson (2003) auctioned several goods on eBay, differing in terms of comparable offers (low/high comparability) and in terms of starting prices (low/high starting price). Lucking-Reiley (1999) programmed his own website to control for factors like the auction format, which is given on most other websites. The advantages of field experiments are evident: Research can evaluate treatment effects with real world data and bidders bid for real auction goods. However, compared to a controlled laboratory experiment field experiments are still very uncontrolled and subject to numerous endogenous factors. Auctions in the field can not be controlled for auctions taking place in parallel or also fixed price offers being offered on the same platform. And researchers usually have limited possibilities with respect to the auction design without programming their own auction website. And even if this were the case, it would be cumbersome to recruit enough participants, since few online platforms dominate the auction market.

There have been several important field experiments investigating overbidding behavior in auctions and working with a controlled environment.

Lucking-Reiley (1999) tested the RET in a field experiment auctioning off collectible trading cards. He observed a very active market dealing with cards from the game "Magic: the gathering", which was launched in 1993. The over 1000 cards, each with a slightly different meaning for the game, could be bought in random assortments, leading to a

Literature	Good	Field
Lucking-Reiley (1999)	Magic game cards	Own auction platform
Ariely and Simonson (2003)	DVD, VHS, web cam keyboard, trackballs	Commercial online platform
Katkar and Reiley (2005)	Pokemon cards	eBay
Kamins et al. (2004)	Coins	eBay

Table 6.2: Overview of controlled field experiments

very active exchange market on the Internet, selling unwanted cards and buying missing cards through auctioneers using different auction mechanisms. Lucking-Reiley (1999, p. 1063) saw the "unique possibility to perform tests on the revenue equivalence theorem in auctions for real goods" and began to run his own auctions using a special Internet platform allowing for own programming of auction designs. Thus, Dutch and first-price auctions, as well as English and second-price auctions could be compared in a controlled setting. He found that Dutch auctions earn significantly more revenue than first-price auctions, while English and second-price auctions differ only insignificantly. Testing the RET, Lucking-Reiley (1999) conducted 85 to 100 simultaneous auctions with different Magic cards advertising the auctions to a wide number of people, either by sending e-mails to individuals or by sending an advertisement to a newsgroup. He was not able to influence how many bidders participated. Lucking-Reiley (1999) established a very convincing method of conducting field experiments in a more controlled environment. However, today the method is difficult to replicate due to the predominance of few auction platforms and the challenge of setting up a new competing Internet auction platform.

Ariely and Simonson (2003) auctioned off several goods on a large commercial auction platform differing in terms of comparable offers and starting price. They find that high starting prices serve as an anchor in a low comparability treatment. Low comparability means that no second controlled and therefore completely identical auction is available. With the inability to compare in the immediate context, high starting prices lead to higher winning bids. Ariely and Simonson (2003) conducted 48 auctions lasting a week each with every product offered by a different person so that an increasing seller's reputation would not influence prices. The 48 items auctioned included 8 DVDs, 8 VHS tapes, 16 web

cameras, 8 computer keyboards, and 8 trackballs. Half of each product was offered at a low starting price of $1 and the other half of each product at a high starting price of approximately half the retail price ($5 for DVD and VHS tape and $30 for computer equipment). While products in the high comparability treatment were auctioned off in parallel, products in the low comparability treatment were auctioned off sequentially in one week each, so that no price comparison was possible. Ariely and Simonson (2003, p. 120) comments that it is "a relatively subtle manipulation because there were (concurrently or in the past) many more items of the same type at the same online auction site that people could have searched."

Katkar and Reiley (2005) conducted a field experiment on eBay with 50 matched pairs of Pokemon cards. Within each pair, one card was auctioned with a publicly known starting price (set at 30% of the card's book value) and the other card with a hidden reserve price (set at 30% of the card's book value)[2]. A hidden reserve price lowers the expected auction price, reduces the probability of selling the good, and deters serious bidders from participating. Similar to Lucking-Reiley (1999), the authors used game cards. Pokemon cards entered the market in 1999 and since some of the cards are rare, a secondary exchange market developed.

Kamins et al. (2004) conducted a field experiment on eBay with coins. Like Katkar and Reiley (2005), they manipulated the presence or absence of either a reserve price or a starting price. The reserve price was set at 65% of the final price gained in a pretest study. The starting price was set at 57% of the reserve price level. In 192 auctions, half US coins and half foreign coins were auctioned off. The authors also varied the product type, describing it either in terms of weight (e.g., one pound of foreign coins) or count (e.g., 144 wheat pennies). They also doubled the count or the weight in some auctions.

6.1.3 Real goods in field studies

Field studies do not evaluate treatment effects like field or lab experiments do. Their objective is to find certain empirical pattern like correlations or other data interdependencies. Usually they use large samples and define very general correlations. They work

[2]The auction with a hidden reserve price had a starting price of $0.05 since eBay does not allow for a starting price of $0.00

out findings like "final price correlates with bidding activity and with starting price", and they often give ideas or impulses for more detailed experimental work. For example, Bajari and Hortaçsu (2004) conducted a field study and identified general auction patterns like strategic late bidding (sniping). Since sniping is as a common pattern, it is of interest why bidders snipe. To find this out, the bidding process has to be understood in more detail, which might be possible through certain experiments.

Sometimes data from field studies are of such good quality that they seem to be suitable for a treatment classification and goes beyond pure finding of empirical pattern. For example, Lee and Malmendier (2011) conducted a field study comparing prices for a certain board game in auctions with prices in a fixed price setting offered on the same platform. However, Katkar and Reiley (2005) consider data generated by other sellers difficult to study because they do not ensure ceteris paribus conditions. Two auctions might not only differ in terms of the observed parameter, but also in terms of how the good is presented, in the seller's reputation, the shipping costs, or other. There are parameters which can only be controlled by the seller, such as the reserve price, which is not commonly known.

6.2 Critical discussion of the literature

The above literature review aimed to identify relevant criteria for the selection of suitable products in lab experiments and indicates that a systematic selection of suitable products has not been conducted. The review identifies problematic approaches in the existing two lab experiments with real goods when compensating participants for their participation. The review of selected field experiments makes evident that concentrating exclusively on field experiments is not a viable alternative to conducting lab experiments.

My main objective is to find a procedure for how real goods can get auctioned in the lab and selecting suitable auction goods is a key success factor. I conclude that no systematic selection of certain product types has been conducted. Instead a variety of goods has been selected in the existing experiments. In lab experiments, mugs and t-shirts from the university store, certificates and chocolate were auctioned. In field experiments game cards, movies, coins, and computer equipment were auctioned. In field studies the

selection was even wider and more diverse. Often products with an appropriate data set were chosen.

Wolf et al. (2008)'s lab experiment follows the tradition of one of the most famous endowment experiments auctioning mugs like Kahneman et al. (1990) did. Heyman et al. (2004, p. 15) selected a set of goods according to the following criteria: "The different items were selected to represent a wide variety of product types. The gift certificates were selected because their value is perfectly defined, the chocolates because of their high hedonic nature, and the t-shirts because the university store's standard retail price for the t-shirt was reasonably well known to the students." However, their selection criteria is only partially evident. In selecting goods based on the certainty of their values, they excluded goods with an uncertain or unknown values. Furthermore, they provide no explanation of the value of choosing a good with a high hedonic value. Finally, Heyman et al. (2004) do not find significant differences across the four products. My conclusion is that we can learn little from the existing literature with respect to developing criteria for product selection. I therefore see a research need, which I will address in the next section.

Second, I conclude that motivating participation in lab experiments with real goods through compensation has disadvantages and might distort results. The participants in Heyman et al. (2004)'s experiment were undergraduates from a marketing class who received credit points for participating. To accommodate budget constraints, one out of the four auctions was selected to receive compensation. The subject with the highest bid in the selected auction paid for the good with his or her own money. Although participants did not have to bid to receive class credits, most of them did, even if they may not have wanted to auction the good. Such bids from uninterested participants can distort the overall results. In Wolf et al. (2008)'s experiment all participants receive a participation fee of \$10. In one treatment, the high bidder had to buy the good at the winning price. In the other treatment, the high bidder was given the option to sell the auctioned item back, then receive \$10 minus the bid plus the \$3.95 price of the mug. If they kept the mug, they received \$10 minus the bid. In both cases, the compensation is problematic since bidders receive a relatively high participation fee. This can serve as an anchor or lead bidders to treat the fee as "game money", potentially leading them to bid higher than they normally would. Despite the visible price tag of \$3.95, bidders bid

up to $6.00. In the first treatment, where the mug was priced at $4.49, two out of seven bidders bid $10.00. In the auction where the high bidder is permitted to give the mug back, the bidders de facto do not participate in an auction with real goods, since there is an alternative option based purely on monetary values. It is nonetheless informative that in the second experiment, none of the bidders of the short duration group chose to keep the mug, while 3 out of 5 winners in the long duration group chose to keep the mug.

Third, I conclude that despite the disadvantages of auctioning real goods in the lab, there is no viable alternative. On the one hand, restricting lab experiments to induced values will not trigger the full spectrum of emotions experienced in real auctions. On the other hand, focusing only on field experiments, will restrict our experimental possibilities enormously since we do not have the full spectrum of experimental methods like changing the auction design or varying certain parameters. Thus, given the wish and necessity to trigger attraction emotions in an almost fully controlled lab experiment, a way has to be found to auction real goods without the existing caveats.

6.3 Method to select suitable products for lab experiments

Therefore, the leading question is: Which goods should be auctioned in a lab experiment? Criteria which have to be considered when selecting an auction good are discussed. A good selection is also the precondition for eliminating problematic compensation mechanism like credit points or participation fees.

The previous section introduced goods which have been used in previous auction experiments, revealing that experimentalists consider product choice but often lack a systematic selection procedure or criteria set. In this section I therefore sketch a selection process based on basic principles. Since my research focuses on how real products can be auctioned in the lab, my focus is on the selection process for lab experiments. However, a similar process can be used to select suitable goods in field experiments.

In developing a procedure, the following requirements and restrictions apply:

- Replication: In order for an experiment to be replicable, the good should be available

for a significant length of time. Thus, goods associated with special occasions and goods with rapid price decrease should be avoided.

- Comparability: To ensure comparability of different experiment designs with respect to the chosen product, it is helpful to establish a stable set of products. New experiments should check whether the existing set of products are suitable for their experimental setup and use them. Additionally, the product should also be available on eBay or other relevant Internet auction platforms, since pre-studies in the field are sometimes recommended.

- Budget constraints: Experimentalists have to consider possible their own and participants' budget constraints. Since auction revenues might not cover the cost of the auctioned good, auctioning expensive goods in high volume can incur significant costs. Likewise, the budget constraints of typical lab experiment participants, students, make spontaneous expenditures exceeding $20 unlikely. At the same time, choosing goods with a certain value will help to ensure that the lab experiments are taken seriously. We therefore should also establish a lower limit.

In addition, special criteria may apply to the specific experimental design. For example, experiments testing for the winner's curse need different products than auctions in an independent private values context. In certain contexts, products with a hedonic or luxury nature might be appropriate, while another context may require quotidian goods.

Lastly, goods must be chosen which are desirable among bidders to guarantee that they bid realistically and to avoid problematic compensation mechanism like class credits or participation fees. Bidders' desire for the good provides incentive enough without additional incentives for participating. By not awarding compensation, we avoid distorted results caused by bidders, who participate only to earn the compensation, as well as anchoring effects leading to bids influenced by the value of the participation fee.

Since this criterion is critical to the success of the lab experiments in terms of good results and participation levels, we recommend testing the attractiveness of goods among likely participants before the experiment. Once goods are identified which meets the basic requirements and the experiment-specific criteria, the goods can be presented in an market research questionnaire among likely participants to identify the most attractive

goods. I will discuss this method in more detail in the next chapter presenting an auction lab experiment with real goods.

Chapter 7

First auction experiment with real goods

Chapter 5 identified relevant emotions in auctions and discussed first ideas about how emotions lead to overbidding. In Chapter 6 an approach of auctioning real goods in the lab while avoiding common pitfalls was developed. It would seem logical to continue with an experiment testing the appearance of certain emotions and the application of the bidding framework in an auction with real goods in the lab. However, the developing process of this experiment was different. The experiment was conducted based on the explanations for bidding behavior presented in Chapter 2 and the method for auctioning real goods in the lab presented in Chapter 6. While I intended to test the pseudo-endowment effect in a well-designed auction setting auctioning real goods, the results indicated that the pseudo-endowment effect was weak and the explanatory power of other existing indicators was small. I therefore shifted the focus of my study beyond just stating the importance of emotional bidding behavior applying insights from emotional psychology to the economic situation of an auction to better understand the notion of emotion and identify the emotions present in auctions. Ultimately, a structured framework was developed which can used to re-interpret the results focusing on emotional bidding behavior.

This chapter introduces the experiment's auction design and the hypotheses regarding the established explanation, the pseudo-endowment effect. It then provides an interpretation of the results and an evaluation of the original hypotheses. Finally, an alternative

interpretation is introduced and the results are discussed considering the explanatory power of emotions for this interpretation.[1]

7.1 Auction design

Thaler (1980) finds that the willingness to pay (WTP) is smaller than the willingness to accept (WTA), that is, decision makers value a good more when it is part of their own endowment. This discrepancy can be explained by prospect theory and its idea of loss aversion (cf. Kahneman and Tversky, 1979). The subject's current endowment serves as a reference point leading subjects to demand a higher compensation for losing an item than the subject would be willing to pay to gain the item. This phenomenon is called the endowment effect. According to Ariely and Simonson (2003), the so-called pseudo-endowment effect can appear in auctions. As long as the auction is ongoing, no one owns the item, but during the auction process psychological ownership can develop and increases the willingness to increase the bids in order to reclaim the endowment. Probably due to the fact that the endowment effect and its explanation of loss aversion is widely discussed in behavioral economics, it has also attracted significant attention in auction theory and experiments. For example, in their auction experiments, Heyman et al. (2004), Ehrhart et al. (2013), and Wolf et al. (2008) induce a higher perceived degree of ownership. Due to loss aversion, this higher perceived degree of ownership leads to a higher valuation of the good and thus to higher final bids or revenues. Subsection 2.3.2 provides a more detailed description of their experiments.

When designing experiments to find evidence for the pseudo-endowment effect, there are three major pitfalls: First, treatment variables have to be found which induce a higher perceived degree of ownership. It sounds logical that declaring the high bidder induces a higher perceived degree of ownership, but no one has measured the effect. Second, it should be shown that designs that increase the perceived degree of ownership actually influences the bidding decision. For example, a bidder who is declared the high bidder

[1]Since this experiment was a collaboration between Prof. Karl-Martin Ehrhart, Laura Goebes, and Stephanie Lotz, the author of this dissertation, I will refer to the team using the plural "we" in the following sections.

in every round is very likely to have a high perceived degree of ownership. But does this higher perceived degree of ownership instantaneously result in higher valuations? And is the higher valuation expressed by higher bids? For example, it can be assumed that the bidder's valuation increases when the perceived degree of ownership increases, but this mechanism can proceed unconsciously. The experience of losing the item in one round is required in order to subsequently express this higher valuation in the bidding behavior. Third, even when the chosen variables are suitable to increase the perceived degree of ownership and are proven to have induced this effect, it still cannot be taken for granted that the induced high perceived degree of ownership is the sole cause of higher bids. For example, certain variables might also induce a higher level of arousal and thus trigger higher bids (according to the competitive arousal theory introduced in Subsection 2.3.3). Or bidders who have invested time and energy in the auction feel the need to justify their previous actions and escalate their commitments, which also leads to higher bids.

The challenge is to find an auction design which influences only the perceived degree of ownership without influencing other emotional or cognitive processes. Varying the length of exposure in an auction like Heyman et al. (2004) did, does not fulfill this criteria since varying the exposure length also has a massive impact on commitment. Bidders who have already bidden eight rounds have invested time and energy and may overbid due to their escalating commitment. The same mechanism might be in place in the experiment of Wolf et al. (2008), even though 20 seconds more of observing is not that much invested time compared to eight active bidding rounds.

The design of Ehrhart et al. (2013) is also not the most suitable. When comparing a ticker auction with no high bidder declared during the course of the auction versus an auction in which a high bidder is randomly declared after each round, decision makers are confronted with two different competitive surroundings. It can be supposed that the first treatment feels significantly less competitive than the second, since bidders in the first treatment do not consciously perceive other bidders as competitors. But since bidders also overbid due to competitive arousal, pseudo-endowment is not the only possible explanation for their findings.

These experiments underscore the importance of understanding the pseudo-endowment effect in auctions in more detail. Our goal is to develop an experiment that avoids the

described pitfalls to a greater degree. While in the Treatment "Endowment" the pseudo-endowment effect is induced, in the Treatment "No-Endowment" only the same informational feedback is given without inducing the pseudo-endowment effect.

Treatment Endowment: The bidders bid in a two-step auction design. In the first round two separate one-shot auctions with two bidders each take place. The bidders submit their bids and afterward the bidders receive the information whether they were the high or the low bidder. During a short waiting time the results of the two separate auctions are brought together and the four bidders receive the information about the consolidation. The bidder with the lowest bid is not allowed to participate in the second bid round. This sanction mechanism ensures that the bidders have an incentive to take the first round seriously. The three remaining bidders can raise the bid of their first round in a second bid round. If they do nothing, their bid of the first round stays valid. The bidder with the highest bid wins the auction and pays a price equal to his bid.

This design induces the pseudo-endowment effect. The bidder who was declared high bidder in the first round, but "lost" the good after the consolidation, the outbidden bidder O_{Con}, stands in the focus. The outbidden bidder O_{Con} changes his reference point toward owning the item when he receives the feedback of being high bidder. After the consolidation he is confronted with a new situation: Now he has to decide whether he wants to "defend" the item, i.e. at which price he is willing to sell the item (although he has not owned it yet). This situation is very similar to the situation in the real endowment effect, where the owner of an item has to decide whether he will sell and at which price.

Treatment No-Endowment: This treatment also applies a two step procedure. In contrast to the Treatment *Endowment*, in the first step all four bidders directly participate in a single one-shot auction. Afterward they are informed about the bidding result and after 60 seconds waiting time the three highest bidders can enter the second bid round. Again the bidder with the highest bid wins the auction, receives the auction good and has to pay his bid.

The procedure and the informational feedback of both experimental treatments is summarized in Table 7.1.

This design addresses all possible pitfalls: First, different levels of a perceived degree of ownership are induced by declaring winning and losing bidders after the first round.

Treatment *Endowment*		**Treatment *No-Endowment***	
Action	**Information**	**Action**	**Information**
1st bid round	High bidder $H_1^{1/2}$	1st bid round	High bidder $H^{'}$
with bidders B1,B2	Low bidder $L_1^{1/2}$	with bidders	Second bidder $S^{'}$
and B3,B4	High bidder $H_1^{3/4}$	$B1^{'}$,$B2^{'}$, $B3^{'}$, $B4^{'}$	Third bidder $T^{'}$
	Low bidder $L_1^{3/4}$		
60 seconds of enjoying the new ownership status			
Consolidation	High bidder H_{Con}	not applicable	
	Outbidden bidder O_{Con}		
	Low bidder L_{Con}		
	Excluded bidder $Excl_{Con}$		
2nd bid round	High bidder H_2	2nd bid round	High bidder $H_2^{'}$
with bidders	2 low bidders L_2	with bidders	2 low bidders $L_2^{'}$
H_{Con},O_{Con}, L_{Con}		$H^{'}$, $S^{'}$, $L^{'}$	

Table 7.1: Overview on Treatment *Endowment* and Control Treatment *No-Endowment*

Second, the process enables a realization of the higher valuation due to the higher degree of perceived ownership. The bidders experience a cut through the consolidation of the results. That is, when the formerly high bidder becomes an outbidden bidder, the outbidden bidder has the possibility to realize that his valuation has changed and to adapt his bid. This process probably occurs unconsciously. Third, by introducing Treatment *No-Endowment* as a control treatment which does not induce the pseudo-endowment effect, but does provide almost equal informational feedback and equal commitment levels, the pseudo-endowment effect is isolated.

7.2 Hypotheses and theoretical predictions

To allow for comparability of the treatments it has to be assured that from a theoretical point of view rational bidders behave the same way in both treatments. Subsequently, the change in the individual's behavior in the Treatment *Endowment*, assuming the pseudo-endowment effect, is discussed.

In both treatments, bidders are predicted to bid as they would in a first-price auction, choosing how high to bid and submitting a bid without knowing the others' bid decisions. And no bidder gets to learn anything about the other bidder's valuation before he submits his own bid. If the bidder wins the auction, the price is equal to his bid. To guarantee some surplus, bidders in both auctions will bid strictly less than their valuations (only a completely risk averse bidder would exactly bid his valuation). When a bidder decides on his bid, he has to keep the balance between the gains of winning the good, which depends negatively on his own bid, and the probability of obtaining the good, which depends positively on his own bid.

Assuming expected utility maximizing bidders, bidders should increase their bids in the second round: The outbidden bidder O_{Con} and the low bidder L_{Con} (the second bidder S' and the third bidder T') have room to increase their bids at a profitable price and would lose with certainty if they leave their bid constant. The high bidders in both treatments realize that the other bidders have an incentive to raise their bids above the Risk Neutral Nash Equilibrium (RNNE). Thus they cannot longer assume that the others bid according to RNNE and have to raise their bids, too.

As discussed in the literature, bidders usually do not bid the RNNE (cf. Kagel, 1995) and it is doubtful whether the average bidder can derive this solution. But usually bidders understand the general mechanism that underlie a first-price auction, that is, bidders understand that they have to keep a balance between increasing gains when winning the good and a decreasing probability to obtain the good. When choosing between a certain zero profit (which means doing nothing) and a positive probability of profitable gains (which means increasing the bid), the latter is a straightforward choice. Even in a less rigorous theoretical model it can be expected that the outbidden and the low bidder will increase their bids. The only situation in which this should not be the case is when extremely risk averse bidders bid their absolute maximum, their valuation, in the first round. Following hypothesis results from the theoretical discussion:

Hypothesis 1 *All bidders increase their bids in the second round. Bidders O_{Con}, L_{Con} (Treatment Endowment) and S', T' (Treatment No-Endowment) do so to increase their chance of winning at a profitable price. Both high bidders do so because they expect the other bidders to increase their bids and adapt their bidding strategy accordingly.*

If the pseudo-endowment effect holds, the outbidden bidder O_{Con} (unconsciously) realizes a valuation increase and increases his bid more than the low bidder and bidders in Treatment *No-Endowment* do, who only raise their bids to increase the chance of a profitable gain. The outbidden bidder's reference point shifts, when he is declared the winner after the first bid round. Being outbidden he realizes his changed reference point and, due to loss aversion, his resulting increased valuation. Given a higher valuation v_i^* this bidder raises his bid in the second bid round more than the low bidder L_{Con} and more than the second bidder S' and the third bidder T'.

Hypothesis 2 *The outbidden bidder's subjective reference position moves toward the status of owning the good. The outbidden bidder O_{Con} increases his bid in the second round in Treatment Endowment on average more than the low bidder L_{Con} and the second and third highest bidder S' and T' in Treatment No-Endowment do.*

7.3 Implementation

As described in the previous chapter, it is very difficult to conduct experiments with real goods because of the lack of systematic research on suitable goods for real good auctions and because participation incentives like credit points or relatively high participation fees can distort the results. Therefore the selection of a suitable good is critical when implementing a real good lab experiment. As described above, the good should fit the experimental requirements and attract bidders enough to participate without incentives.

We chose a two-step procedure in selecting a suitable good. First 98 students were asked on the campus to fill in a questionnaire ranking products worth approximately 10 Euros on a scale from one (no interest in buying the good) and five (very high interest in buying the good). Table 7.2 summarizes the average, standard deviation, and standard error regarding the attractiveness, that is, the interest in buying the good. With an average interest of 3.54 points the memory stick is the most suitable good to use in the auction. 58 persons out of 98 rank the memory stick with 4.0 or 5.0 points, that is almost 60% have a high or even very high interest in having this good. The rather homogenous attractiveness is reflected by a standard deviation of 1.33.

Additionally the participants were asked to name a maximal willingness to pay (WTP)

Product	Average	Standard deviation	Standard error
Memory stick	3.54	1.33	0.18
International beer set	3.51	1.39	0.19
Italian food specialties	3.10	1.05	0.11
Chocolate specialties	3.07	1.15	0.13
USB travel adapter	2.65	1.46	0.21
Coffee specialties	2.56	1.29	0.17
World travel adapter	2.36	1.25	0.16
Reflective bike strips	2.04	1.27	0.16
Paper stool	2.01	1.17	0.14

Table 7.2: Attractiveness of different potential auction goods

for each good. The selected goods and the corresponding WTP are summarized in Table 7.3. The memory stick is considered highly attractive and is also linked to a high average willingness to pay (9.69 Euro).

Product	Average	Standard deviation	Standard error
Memory stick	9.69	6.02	3.66
International beer set	5.70	3.59	1.30
Italian food specialties	7.10	5.43	2.98
Chocolate specialties	4.67	3.42	1.18
USB travel adapter	5.48	4.83	2.35
Coffee specialties	4.13	3.38	1.15
World travel adapter	5.18	4.37	1.03
Reflecting bike stripes	1.94	2.00	0.40
Paper stool	3.80	4.87	2.40

Table 7.3: Willingness to pay for different potential auction goods

In the second step, two different ways to recruit students for a lab experiment with real goods were implemented. Both experiments were run at the Karlsruhe Institute of Technology, Germany. Every subject participated in one auction with three other bidders. The sessions were conducted with a maximum of four groups (16 participants). In total

88 subjects participated.

"Class room recruited experiment": The auction good was introduced in a class with approx. 250 participants. Afterward all interested students had the possibility to participate in four different nearby lab rooms. To avoid long waiting times a high capacity of 32 lab places were provided at the same time. The participants were informed that they would not miss any important lecture contents if they participated and that they had to pay for the auctioned good with their own money—either cash or electronic cash. They did not receive any money or credit points for participating to avoid anchoring effects and misguided participation incentives. After the auction, every participant received a chocolate bar. Ten valid independent observations with 40 subjects in Treatment *Endowment*[2] and five valid independent observations with 20 subjects in Treatment *No-Endowment* were obtained.

"Database recruited lab experiment": 250 students registered in a database of students interested in lab experiments were invited by email to participate in a real good auction with the possibility to auction an 8 GB memory stick. The memory stick was introduced with a picture and a short description and students were informed that the winner had to pay with real money. After the auction every participant received a chocolate bar. In all, 30 students registered for the experiment and 28 students participated in the lab experiment. Two valid independent observations with eight subjects in Treatment *Endowment* and five valid independent observations with 20 subjects in Treatment *No-Endowment* were obtained.

The experiments were computerized. Each subject was seated at a computer terminal separated from the others subjects' terminals. The subjects received written instructions which were also read out loud by an experiment assistant. Before the experiment started, each subject had to answer several questions about the instructions at her/his computer terminal. After all subjects had given the right answers to the five questions in the Treatment *Endowment* / three questions in the Treatment *No-Endowment*, the auction started. No communication was permitted and subjects could not identify which members of the session they interacted with. The experimental sessions lasted approximately 20

[2]We had to exclude one group since a visually handicapped participant unintentionally submitted a high bid of 59,59 Euro. The computer accepted bids up to 100 Euro.

		Treatment *Endowment*	**Treatment *No-Endowment***
Class room recruiting	Observations	10	5
	Participants	40[3]	20
Traditional database recruiting	Observations	2	5
	Participants	8	20
Total	Observations	12	10
	Participants	48	40

Table 7.4: Number of observations and participants in the Treatments *Endowment* and *No-Endowment*

minutes. At the end of an experimental session, the winner of the auction had to pay his bid and received the memory stick. The average winning bid was 10.73 Euro.

7.4 Results and interpretation

	Number of bidders increasing their bid	
	Absolute	**Relative**
H_{Con}	5	42%
O_{Con}	12	100%
L_{Con}	11	92%
$H^{'}$	2	20%
$S^{'}$	10	100%
$T^{'}$	8	80%

Table 7.5: Frequency in bid increases (Treatment *Endowment* and *No-Endowment*)

Due to the very special auction setting, it is remarkable that selling prices were close to the purchase price of 12.90 Euro and sufficiently high participation rates were reached, considering that participants had to pay with their own money and did not receive a show-up fee. The average selling prices were 11.14 Euro in Treatment *Endowment* and 10.24 Euro in Treatment *No-Endowment* . Approximately 20% of the informed subjects

decided to participate in the class room recruited experiments and around 10% decided to participate in the database recruited experiments.

	Absolute bid increase	Relative bid increase	Frequency highest absolute increase	Frequency highest relative increase	Frequency highest absolute and relative increase
H_{Con}	0.64	8%	1	0	0
O_{Con}	1.52	25%	6	7	6
L_{Con}	1.41	27%	5	5	4
$H^{'}$	0.25	4%	0	0	0
$S^{'}$	1.96	42%	8	7	7
$T^{'}$	0.90	26%	2	3	2

Table 7.6: Overview bid increase

The first hypothesis holds: Bidders raise their bids in the second round. Table 7.5 shows that the high bidder does this relatively seldom, while the overwhelming majority of losing bidders (between 80% and 100%) raise their bids in the second round. That suggests that bidders understand the mechanism of a first-price auction very well. They do not bid up to their maximum in the first round and use this room in the second round. Especially the information of being outbidden or being second highest bidder triggers an increase in the bid. Both bidder types always use the chance to increase their bid.

Table 7.6 indicates that the high bidders increase their bids only slightly, while the other bidder types increase their bids on average between 25% (O_{Con}) and 42% ($S^{'}$). The hypothesis that the outbidden bidder has the highest tendency to increase his bid due to the pseudo-endowment effect does not hold. The outbidden bidder and the low bidder have an almost equal tendency to increase their bids in the second round.

According to Table 7.6 and Figure 7.1 the outbidden bidder O_{Con} does not increase his bid more than the second bidder $S^{'}$ in the control treatment. In fact, the average relative bid increase of O_{Con} (25%) and $S^{'}$ (42%) indicate the reverse result. However, no significant difference exists in the bidding increase, neither in absolute terms (Mann-Whitney-U-Test, two-sided, p=0.418) nor in relative terms (Mann-Whitney-U-Test, two-sided, p=0.210). Thus, the hypothesis that bidders bid higher due to the induced pseudo-

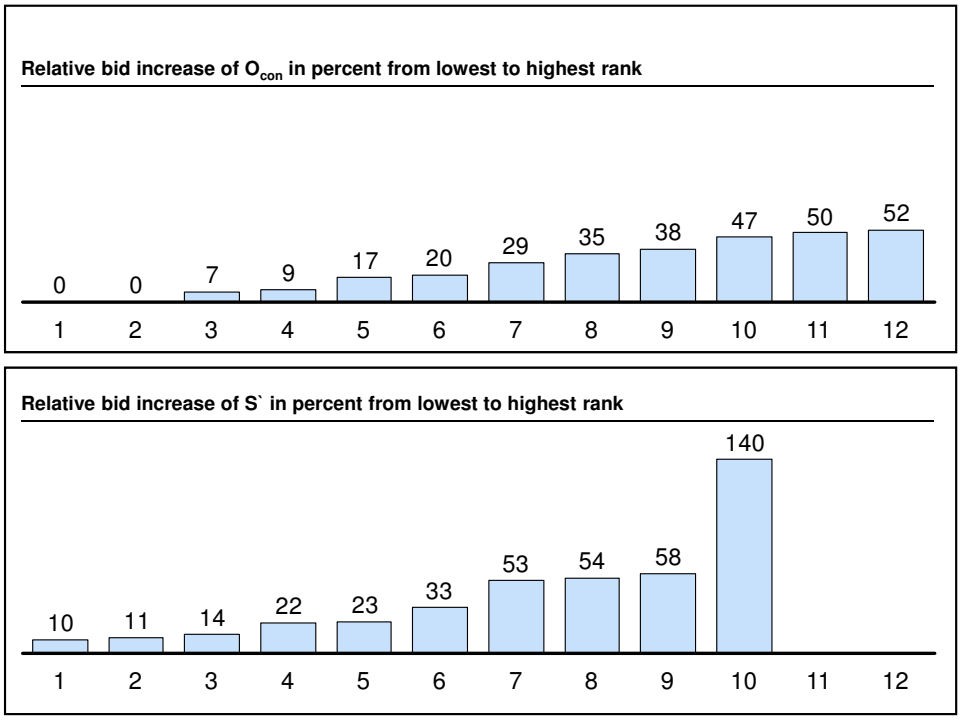

Figure 7.1: Relative bid increase of O_{Con} and S'

endowment effect cannot be confirmed.

7.5 Emotional re-interpretation

The interpretation in the previous section makes the restriction of the existing explanatory approaches evident. The puzzling result triggered us to examine emotional processes in more detail. In the following, the experiment will be re-discussed, applying the findings outlined in the Chapters 3, 4, and 5. Specifically, it will be tested whether the emotional processing scheme developed in Chapter 4 enables a structured and meaningful interpretation of the design and helps in building the right hypotheses. To sum it up, this section intends to show that including emotional processes into a bidding framework better explains human decision behavior.

7.5.1 Application of the emotional processing scheme

Since both treatment have already been discussed, the focus will be on the discussion of the treatments' emotional processing schemes. As in Section 5.1, the discussion of the emotional processing schemes is based on the findings from Chapter 3 and Chapter 4. The subsequent discussion further refers to the conclusions in Section 5.2.

Both treatments induce three bidder types with different emotional histories or emotional combinations. The comparison of their bidding behavior might give hints regarding the influence of emotional experiences on bidding behavior. The three bidder types in Treatment *Endowment* include the high bidder H_{Con}, who was declared high bidder in the first round and kept this high bidder status after the consolidation, the outbidden bidder O_{Con}, who was declared high bidder in the first round but "lost" the good after the consolidation, and the low bidder L_{Con}, who was declared low bidder in the first round and was not excluded after the consolidation. Figure 7.2 illustrates their individual emotional history (H_{Con}: dotted line, O_{Con}: continuous line, L_{Con}: dashed line)

First, the high bidder H_{Con} experiences *Hope* and *Fear* in the first bid round. Then, the basic winner emotions *Joy*, *Relief*, and *Satisfaction* are experienced when receiving the feedback that he is the high bidder after the first outcome information. As discussed in earlier chapters, the announcement of being high bidder is perceived as goal-conform. Then the event is desirable and bidders experience *Joy*. The *Hope* to win the auction is partly confirmed. And the *Hope* to lose the auction is partly disconfirmed. Still the degree of realization is low, which is why the emotions *Relief* and *Satisfaction* are experienced with lower intensity. According to Subsection 3.4.1 the degree of realization is one variable that influences the intensity of an emotion. The bidder can also experience *Pride*. A bid decision leading to a socially valuable result, that is, winning the auction, is considered praiseworthy. When consolidating the bids he experiences these basic winner emotions again, since he is again declared high bidder. Announcing the consolidated outcome confirm the existing emotions. During the waiting time and in the second bid round *Hope* is probably predominant since he expects to win the auction due to the positive intermediary outcome. This predominance of *Hope* also implicates that *Satisfaction* is experienced more intense then *Relief*. According to the discussion in Chapter 5, *Gloating* and *Shame* are not experienced since bidders are not informed about other bidders' bidding behavior.

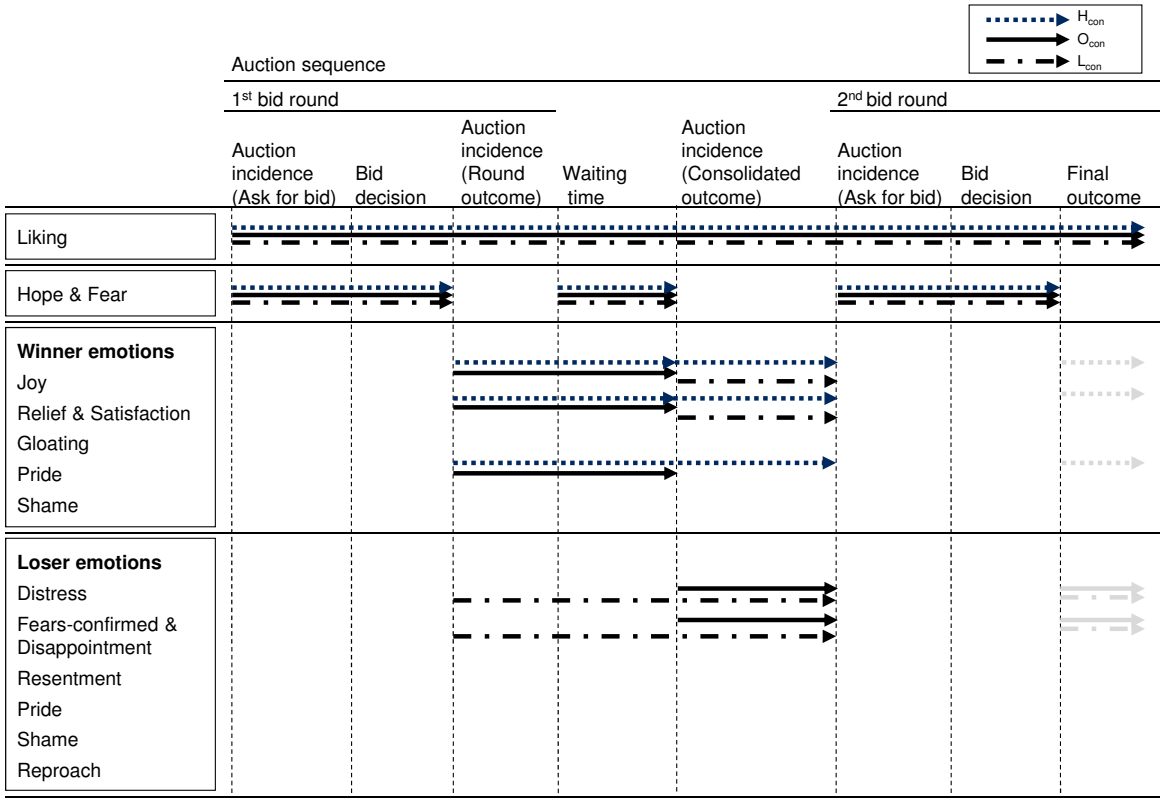

Figure 7.2: Emotional processing scheme for Treatment *Endowment*

Analogical to the high bidder H_{Con}, the outbidden bidder O_{Con} experiences the basic winner emotions and *Pride* when receiving the feedback that he is high bidder after the first bid round. After the consolidation he loses the winner status. The disconfirmation of the winning status can be seen as undesirable event and the basic loser emotions *Distress*, *Fears-confirmed*, and *Disappointment* result. Thus, the bidder experiences a surprising turn in his emotional experience. After the consolidation, with respect to prospect emotions, the bidder faces both *Hope* and *Fear*.

The low bidder L_{Con} experiences basic loser emotions when receiving the feedback that he is the low bidder after the first outcome information. When consolidating the bids his emotional experience becomes ambivalent. On the one hand there are still loser emotions, triggered by the declaration of the first round outcome. Whereas the new auction incidence make the bidder to experience *Joy*, *Relief*, and *Satisfaction*. The participant's *Fear* of being excluded from the auction did not materialize. The *Hope* to stay in the auction did

materialize. The feedback is thus a desirable event.

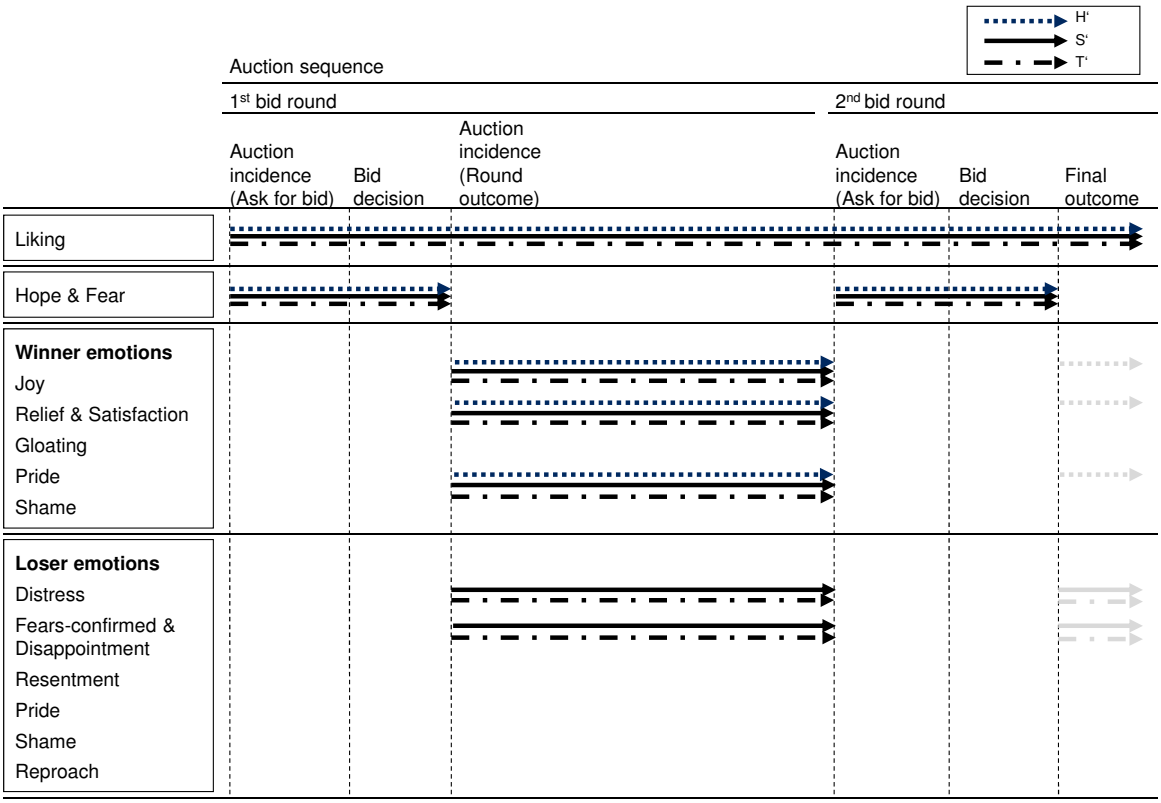

Figure 7.3: Emotional processing scheme for Treatment *No-Endowment*

Treatment *No-Endowment* also induces three different bidder types with individual emotional combination: The high bidder $H^{'}$, who is declared high bidder in the first round, the bidder $S^{'}$, who is declared second-highest bidder in the first round, and the bidder $T^{'}$, who is declared third-highest bidder in the first round. In contrast to Treatment *Endowment*, these bidders do not face changing emotions induced through an additional emotional trigger, but the information about the bid rank induces mixed emotional experiences. Figure 7.3 illustrates their individual emotional history ($H^{'}$: dotted line, $S^{'}$: continuous line, $T^{'}$: dashed line).

The high bidder $H^{'}$ experiences basic winner emotions and *Pride* like the high bidder H_{Con} in the first treatment. The second and third bidder $S^{'}$ and $T^{'}$ experience basic loser emotions since they did not win the auction. And they also experience the basic winner emotions since their *Fear* to get excluded from the auction did not materialize. Both

bidders can judge their action as praiseworthy and experience *Pride*, since the second bidder did better than the third bidder, and the third bidder better than the excluded bidder. It is assumed that the second bidder $S^{'}$ experiences stronger winner emotions than the third bidder $T^{'}$, since he considers it more likely to reach his goal to win the auction. Additionally, it is assumed that the second and third bidder experience *Resentment* and *Reproach*, since the ranking information emphasizes the presence of other bidders and thus triggers emotions focusing on others as discussed in Section 5.2.

7.5.2 Comparison of bidding behavior in both treatments

The high bidder $H^{'}$ experiences the same emotions like the high bidder H_{Con} in the first treatment. There is no significant difference in the bidding behavior between both treatments. In both treatments the high bidders tend to rebid rather seldom compared to the other bidders.

First, outbidden bidder O_{Con} experiences the basic winner emotions and *Pride*. After the consolidation, he loses the winner status and the basis loser emotions *Distress*, *Fears-confirmed*, and *Disappointment* become predominant. The second bidder $S^{'}$ experiences basic loser emotions since he did not win the auction. The ranking information also triggers the emotions *Resentment* and *Reproach*. Additionally he also experiences the basic winner emotions since the *Fear* to get excluded from the auction did not materialize. That is, while outbidden bidder O_{Con} experiences first positive winner emotions and then negative loser emotions, the second bidder $S^{'}$ experiences both in parallel and additionally the emotions *Resentment* and *Reproach*.

Low bidder L_{Con} experiences basic loser emotions when receiving the feedback that he is the low bidder after the first outcome information. $T^{'}$ experiences basic loser emotions since he did not win the auction. And he also experiences the basic winner emotions since his *Fear* to get excluded from the auction did not materialize. That is the bidder with the third highest bid experiences ambivalent emotions throughout the first bid round, while the bidder L_{Con} experiences ambivalent emotions after the consolidation of the bids.

The comparison shows that high bidders $H^{'}$ and H_{Con} enter with a similar emotional experience into the second bid round. Equally do low bidder L_{Con} and third bidder $T^{'}$, although their emotional experience developed in a slightly different way and the third

bidder T' additionally faces *Resentment* and *Reproach*. Only the emotional experience of the outbidden bidder O_{Con} and the second bidder S' differ more significantly. While the outbidden bidder O_{Con} experiences first winner emotions and then loser emotions, the second bidder S' experiences both in parallel and *Resentment* and *Reproach* in addition.

In this experiment the differences in the emotional experiences does no lead to significantly different behavior. The original hypothesis has to be refused, average increases even indicates a slight reverse effect, even though this difference is not significant. Chapter 5 concludes that the appearance of certain emotion types, the intensity and the differences in the dynamic development can trigger overbidding. A far better understanding of emotions is necessary to understand to what degree the two additional emotions *Resentment* and *Reproach* and the difference in the time sequence (first winner then loser emotions) can be responsible for overbidding in this auction design. The limitations of this experiment becomes very clear since the experimental design was developed to test another hypothesis and without the deeper understanding of emotional psychology.

7.6 Summary and outlook

This experiment served as the trigger for systematic experimental research into the qualitative characteristics of emotions in auctions. Having done only the very first steps in this research area, it is impossible to focus on all important aspects, so we focused on two aspects. First, we conducted a non-repeated auction with real goods. Second, we applied the emotional processing scheme showing the complexity of emotional reactions triggered by the selected auction design. As already mentioned, this experiment was not the result but the trigger of Chapters 3-5. For this reason, no self-report questionnaire on the important emotions during auctions, as discussed in Chapter 5, was attached to the experiment. We recommend attaching a self-report questionnaire in further experiments on emotions in auctions.

Regarding the first focus, this experiment showed that is possible to auction real goods in the lab without the usual caveats. Enough bidders could be recruited and they bid significant high amounts. Although they bid with their own money and did not receive money or other incentives for participating, they spent on average 10.73 Euro. We

conclude that when auctioning real goods, it is essential to make the effort to identify a suitable good that meets the requirements for the experiments and is attractive enough that participants participate without any additional incentive mechanism.

Regarding the second focus, all relevant emotions appearing in the selected auction design have been identified and discussed. It becomes evident that especially the emotional experience of the outbidden bidder O_{Con} and the second bidder $S^{'}$ differ from each other. While the outbidden bidder O_{Con} experiences first winner emotions and then loser emotions, the second bidder $S^{'}$ experiences both in parallel and *Resentment* and *Reproach* in addition. The limitations of this experiment in finding out the reasons for different respectively equal bidding behavior due to differences in the emotional experiences mainly stem from the fact that the experimental design was developed without the deeper understanding of emotional psychology.

Going forward, experimental designs should become more sophisticated in terms of identifying the emotions bidders experience during the auction. Bosman and Riedl (2004) already conducted an experiment in which bidders indicated how intensely they experienced 17 different emotions. Such a procedure should be established in emotional auction research. Physiological measurements could provide additional insights, but measuring methods are currently too unspecific to differentiate among specific emotion types. Finally, explanations building on insights from emotion psychology should be combined with explanations from cognitive psychology and behavioral economics. The framework allows for such an interdisciplinary approach.

Chapter 8

Conclusion

The central objective of this thesis is to understand when and why bidders overbid in auctions, with a focus on emotional aspects. A literature review indicates that existing approaches do not have sufficient explanatory power. Therefore, recent research has focused on emotions as key to understanding bidding behavior in greater depth. However, there is no common understanding of the notion of emotion and there are few frameworks that integrate the emotional aspect into their bidding behavior concepts. This thesis therefore establishes a foundation on which further emotional auction research can be based. The central result, the emotional processing scheme, enables experimentalists to discuss the emotional bidding process using a standardized concept. First application of this standardized concept sheds light on the influences of certain emotion types, their intensity and their dynamic development throughout auctions. It illustrates the importance of incorporating the emotional component into the experimental design.

Chapter 2 reviews existing literature and concludes that there is little consensus about when bidders overbid, identifying some consistency in terms of the influence of informational feedback and number of bis and bidders on overbidding behavior. However, existing explanatory approaches still have shortcomings when answering the question why bidders overbid. Expected utility theory has proven to be too unilateral to describe human behavior, whereas approaches allowing for a human agent with certain cognitive restrictions but a wider set of tools to find solutions have proven more insightful because they consider the human decision-making process, the role of heuristics, and cognitive biases. Approaches which include emotional decision-making further enrich the possibilities to understand

overbidding in auctions. However, such approaches are still in their infancy. While recent literature often mentions emotions, a clear concept for how to integrate emotional aspects has been lacking.

Chapter 3 introduces the main developments in emotional psychology and discusses their transferability to auction theory, answering the first central research question: "What are emotions, what types of emotions exist and which emotions influence bidding behavior in auctions?" Cognitive psychologists' basic segmentation of emotion into immediate and experienced emotions serves as a basis for the current emotional research in economics, but this thesis concludes that the best approach for explaining emotional decision behavior in economics has been developed by emotional psychologists, favoring the direction of appraisal theory. They emphasize emotions' cognitive component and define emotions as organized patterns of psychological and physiological components. According to Scherer (1984), cognitive appraisal, physiological arousal, motor expression, action tendencies, and subjective feelings are the most characteristic features of emotion. Despite different emotion theories, there is a consensus among emotional psychologists on these basic characteristics of emotions. While Scherer (1984)'s insight into the detail mechanism of emotions and the interaction of different components is useful, it is first necessary to achieve a holistic understanding of all relevant emotions before investigating them on a more detailed level. According to Ortony et al. (1988)'s appraisal theory, a structured categorization of 22 different emotion types, the notion of a particular emotion type is determined by how the eliciting situation is construed. Understanding these construction principles leads to a global structure, covering all important emotion types. 14 out of the 22 emotion types play a relevant role in auctions. Seven emotions (*Joy*, *Relief*, *Satisfaction*, *Gloating*, *Pride*, *Shame*, *Liking*) are identified as relevant when a bidder wins the auction. Eight emotions (*Distress*, *Fears-confirmed*, *Disappointment*, *Resentment*, *Pride*, *Shame*, *Reproach*, *Liking*) are relevant when a bidder loses the auction. During the course of the auction, *Hope*, *Fear*, and *Liking* play an important role. This deeper understanding of relevant emotion types for auctions, their eliciting situations and their intensifying factors, provides a basis for developing a bidding behavior framework that includes emotional processing as central component.

As discussed in Chapter 2 and Chapter 3, a static bidding model does not accurately

reflect human bidding behavior because emotions contribute to a dynamic bidding behavior. Chapter 4 develops a standardized framework that reflects the human decision making process adequately and that enables the interpretation of emotional aspects in bidding behavior. This framework should give researchers a deeper understanding of the complex interactions involved in decision behaviors in auctions and help us describe bidding behavior in an easy to understand but suitable manner. The chapter proposes a framework addressing the central research question: "How can emotional bidding behavior be described and analyzed in a formal bidding framework?" The proposed formal bidding framework is characterized by three elements. First, it assumes dynamically evolving bidding behavior. Second, it integrates emotional and cognitive processing into one framework. Third, it establishes a structure of emotions that clearly distinguishes among different emotions and their eliciting factors. The framework acknowledges the dynamically adaptive nature of the decision process. The focus on qualitative aspects of emotions distinguishes this framework most clearly from Adam et al. (2011). The chapter concludes with the introduction of the *emotional processing scheme*, a standardized interpretation scheme which is based on the bidding framework and can be used as a basis for discussing emotions in auction experiments.

Based on the foundations developed in the previous chapters, existing experiments can now be discussed from the emotional perspective. Combining and comparing the results across several experiments leads to new insights. Chapter 5 first identifies the appearance and dynamic development of all relevant emotion types in selected lab experiments, applying the emotional processing scheme as a standardized procedure to answer the central research question "What situations trigger emotions and what emotions are triggered in auctions?" All relevant emotions, besides *Hope*, *Fear*, and *Liking*, are triggered through the announcement of bidding results. Independent of the concrete informational feedback, bidders experience the basic winner emotions *Joy*, *Relief* and *Satisfaction* when they win and *Distress*, *Fears-confirmed*, and *Disappointment* when they lose. When the presence of other bidders is emphasized, they can experience *Gloating*, *Resentment*, and *Reproach*. The experience of *Pride* and *Shame* strongly depends on the concrete design of the informational feedback. Bidders usually experience *Pride* in case of winning, but *Pride* can turn into *Shame* if the comparison with other bidders' bidding behavior makes bidders feel

that they bid too high. Vice versa, bidders' possible *Shame* in case of losing the auction can turn into *Pride*, when they realize that they could not win the auction at a profitable price given the bidding behavior of other bidders. Based on the discussed experiments and the identified emotional triggers, three general statements regarding overbidding can be deduced, addressing the central research question "What emotional reactions lead to bidding behaviors such as overbidding?" First, differences in the appearance of certain emotion types lead to overbidding. Second, differences in the intensity of certain emotion types lead to overbidding. Third, differences in the dynamic development of certain emotion types lead to overbidding. With respect to appearance, the experience of *Pride* and *Shame* can serve as an important emotional corrective preventing bidders from overbidding. With respect to the dynamic development it is suggested that the frequent change between losing and winning triggers overbidding.

This research provides a structured method to think about possible emotions in auctions and a methodology for conducting lab experiments focusing on emotions. It enables lab experimentalists to test for emotions and their implications in a very systematic way. While designing the experiment, the application of the emotional processing scheme enables researchers to think through all steps of the auction and the emotion triggering incidences. It further allows for the (hypothetical) illustration of emotions and the formulation of hypotheses with respect to bidding behavior. Additionally, applying the global structure of emotions developed by Ortony et al. (1988) ensures that all relevant emotion types are considered. Chapter 3 identifies 14 out of 22 emotion types as relevant in auctions. Clustering these into emotions experienced by auction winners and losers and those experienced throughout the auction make the emotional processing scheme clearer and future discussion more productive. Hence, this structured way to trigger, identify, and discuss emotions in auctions will benefit emotional economic research in general.

The discussion of existing experiments shows that the method can lead to new insights into emotional reactions resulting in overbidding behavior. However, it is also evident that much research is needed in this field to address several relevant issues.

First, the appearance of certain emotion types triggered through certain designs has to be empirically tested. So far, the whole discussion is rather hypothetical albeit with solid foundations from emotional psychology. In addition, the dynamic development of

emotions with respect to their appearance and their intensity should be investigated. And the emotion type itself should be discussed in greater depth.

Second, a standard experimental method of measuring emotions during the auction is needed. Measurements measuring physiological reactions like the heart rate or skin conductance rate are too vague to be attributed to a certain emotion type. It is expected that self reporting, the well-established method used in psychological experiments could yield better results once critical questions are addressed, such as how to prevent self-reporting from influencing bidding behavior.

Third, methods are needed for controlling for emotional experiences in experimental designs, especially emotional sequences in dynamic or repeated auctions. This is essential since the "emotional history" influences current bidding behavior. Bidders facing the same decision situation might react differently depending on the emotional experiences they have had in the past. Granted, this is also important in experimental designs without an emotional focus.

Forth, even though emotions triggered through the object, that is the auction good, play an important role few existing lab experiments auction real goods. And the few existing experiments show significant caveats when incentivizing students to participate. Therefore, methods for auctioning real goods in the lab without caveats need to be refined further.

To address these four points new experimental studies focusing on emotional aspects in auctions are necessary. Analyzing existing experiments is a first helpful step but cannot replace more specific experiments when dealing with emotions in auctions. Chapter 6 and Chapter 7 take first steps toward addressing some of these points. Chapter 6 presents a new approach to auctioning real goods in the lab without the usual caveats, focusing on identifying a suitable auction good that is desirable enough to alleviate the need to incentivize participation. Chapter 7 experimentally implements a procedure for auctioning real goods in the lab and shows that auctions with real goods can achieve price levels close to the value of the good. This chapter illustrates how the emotional processing scheme can be applied to analyze the emotional consequences of a certain experimental design.

In summary, this thesis provides a substantial basis for future research into emotions in economics. It identifies key weaknesses in auction research and reviews the literature

on emotional psychology to transfer the main findings on auction research and economic research in general. The thesis introduces a new framework for decision making in auctions based on a dynamic decision process, that incorporates emotionally motivated bidding behavior.

It further shows how this framework can be used to discuss experimental research focusing on emotion, resulting in the identification of certain emotional patterns. This provides a springboard for testing emotions in experimental research. Finally, the thesis introduces a methodology for auctioning real goods in lab experiments, an aspect that is gaining relevance in the context of emotional bidding, and concludes with an experimental auction of real goods illustrating the new possibilities of interpreting results including emotional aspects. In answering the question "When and why bidders overbid in auctions?", this thesis contributes important methods for identifying and interpreting emotions in auctions and their role in overbidding.

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Appendix A

Participant instructions

A.1 Participant instructions for treatment 1

You participate in an auction, in which a memory stick gets auctioned off. You will make your decisions isolated from other participants at a computer terminal. If you purchase the memory stick and at which price level you do, depends on your bid and the other bidders' bids. The auction is conducted according to the following rules:

The memory stick get auctioned off among you and three other bidders. The four bidders are divided up into two groups with two bidders each. The bidders get placed in two different rooms. You do not know, who the other bidders are.

You and the other bidder in your group are asked to place a bid for the memory stick. The minimum bid is 1,00 Euro and any bid, you like to place, is to be specified in Euro and Cent. While you place your bid, the other bidder does not know your bid, and you, vice versa, do not know the other bidder's bid.

Subsequently you get informed whether you are the high bidder in your group of two or not. The other group of two proceeds in the same manner. Subsequently the four bids get consolidated and you get informed whether you are the high bidder of all four bidders or not.

If your bid is among the highest three, you are allowed to submit a second bid. Again this is without knowing the other bidders' decisions. If your bid is the lowest, your are not allowed to submit a second bid and get excluded from the auction.

Now the winner of the auction get declared. The bidder with the highest bid wins the auction and receives the memory stick, paying the price he bid in the second round.

Please consider:

Each submitted bid is binding. Submitted bids can neither be withdrawed nor reduced.

If you auction the memory stick, you have to pay the bid. You can either pay cash or via debit advice procedure.

If two or more bidders submitted the same bid, it gets randomly selected, which bid is to be considered the highest bid.

In each group of four one memory stick gets auctioned off. The memory stick looks like this:

Before tha auction starts, you have to answer some questions, since we want to be sure that everyone has understood the auction rules.

A.2 Participant instructions for treatment 2

You participate in an auction, in which a memory stick gets auctioned off. You will make your decisions isolated from other participants at a computer terminal. If you purchase the memory stick and at which price level you do, depends on your bid and the other bidders' bids. The auction is conducted according to the following rules:

The memory stick get auctioned off among you and three other bidders. The four bidders get placed in two different rooms. You do not know, who the other bidders are.

You and the other three bidders are asked to place a bid for the memory stick. The minimum bid is 1,00 Euro and any bid, you like to place, is to be specified in Euro and Cent. While you place your bid, the other bidders do not know your bid, and you, vice versa, do not know the other bidders' bids.

After the bid submittal you get informed about the sequence of the four bids. That is you get to know whether you submitted the highest, second-highest, third-highest, or lowest bid.

If your bid is among the highest three, you are allowed to submit a second bid. Again this is without knowing the other bidders' decisions. If your bid is the lowest, your are not allowed to submit a second bid and get excluded from the auction.

Now the winner of the auction get declared. The bidder with the highest bid wins the auction and receives the memory stick, paying the price he bid in the second round.

Please consider:

Each submitted bid is binding. Submitted bids can neither be withdrawed nor reduced.

If you auction the memory stick, you have to pay the bid. You can either pay cash or via debit advice procedure.

If two or more bidders submitted the same bid, it gets randomly selected, which bid is to be considered the highest bid.

In each group of four one memory stick gets auctioned off. The memory stick looks like this:

Before tha auction starts, you have to answer some questions, since we want to be sure that everyone has understood the auction rules.