Ownership and Subjective Value in the Trading and Sharing of Information

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Thesis Submitted for the Degree of Doctor of Philosophy

University of Haifa

The Graduate Studies Authority

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(Supervisor)

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(Chair of Doctoral Committee)
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Ownership and Subjective Value in the Trading and Sharing of Information

Daphne Ruth Raban

Abstract

Information workers collect and disseminate information by sharing and by trading (buying and selling). The extent of information exchange by either sharing or trading is influenced by the subjective value assigned to information by users. Subjective judgments regarding information are, therefore, important for the design of information systems. While information is important for every aspect of work, its value has not been determined experimentally. The present research undertook the development of a unique research tool focused on the subjective value of information and used this tool to examine experimentally the subjective value of information in both trading and sharing situations. Results indicate that the research tool developed was instrumental for the present research and can also be further developed to accommodate new research questions.

Theory suggests that ownership status of any object determine its value both in trading (the Endowment Effect) and in sharing (the Mere Ownership effect). In contrast to traditional economic theory, experiments reported in the literature showed that people value objects they own much more than the same objects not owned by them. Two variables defined in this framework are the Willingness to Accept payment for objects sold (WTA) and the Willingness to Pay for objects bought (WTP). When given a chance to buy and sell objects, people assigned a much higher value to owned objects. The difference between WTA and WTP usually ranged between factors of three and ten. In other words, owned objects were valued at least three times higher than non-owned objects. This phenomenon was coined the Endowment Effect. This effect is often explained by loss aversion which is one of the central findings of Prospect Theory. The Endowment Effect occurs in situations where trade is involved, however, ownership affects the value of objects even when trade is not involved. In non-trading situations the mere ownership effect is attributed to an intrinsic association between the individual and his/her possessions without any imminent loss. The combination of not losing a possession and gaining personal gratification from having it led to theorizing that mere ownership will enhance information sharing. In information sharing there is no loss of possession since sharing, by definition, does not involve a transfer of rights, and there is
the potential for personal gratification by sharing information or knowledge and obtaining
gratitude and respect from others. Thus ownership emerged as a theoretical basis for
predicting under-trading due to the Endowment Effect and enhanced information sharing
motivated by the mere ownership effect.

Ownership of information is ambiguous because information may be either a private or a
public good. When information is a private good, the rules of trade apply and theory suggests
that the Endowment Effect will take place. The first hypothesis was designed to check
whether an Endowment Effect exists for information and what is its magnitude. The second
hypothesis examined whether the type of information traded affects the magnitude of the
Endowment Effect. A unique characteristic of information is that it is usually traded as a
copy so there is no transfer of property rights. Essentially, only a propagation of rights takes
place. The third hypothesis tested whether originality, having exclusive rights or propagated
rights, affected the extent of the Endowment Effect. The fourth hypothesis tested whether
different degrees of originality affected the different degrees of the Endowment Effect for the
sources used and vice versa. Various sources of information are associated with different
degrees of private ownership. The fifth and sixth hypotheses were concerned with finding
how the degrees of ownership influenced the propensity to share information.

The research hypotheses were:

**H1:** The WTA/WTP ratio for information (content or expertise) is greater than unity and is at
least three (as it is for private goods).

**H2:** The WTA/WTP ratio for content is larger than the WTA/WTP ratio for expertise.

**H3:** The WTA/WTP ratio for original information (content or expertise) is larger than for
copy information.

**H4:** There will be an interaction between the source of information (content or expertise) and
its originality (original or copy).

**H5:** Sharing personally-owned expertise is higher than sharing organizationally-owned
information products.

**H6:** Sharing personally-owned information products is higher than sharing organizationally-
owned information products.

The research tool developed was built around a Java-based business game (The Lemonade
Stand). In the trading scenario an incentive compatible bidding mechanism was added to the
game to facilitate buying and selling of information. For the sharing experiment the bidding
mechanism was removed and an instant messaging application was added to enable information sharing.

Results for the information trading experiments show that, in agreement with Endowment Effect theory, people value information they own much more than information not owned by them. This result is surprising because information is intangible and in light of the ambiguous nature of information ownership status. Participants revealed a ratio of Willingness to Accept to Willingness to Purchase (WTA/WTP) that resembles the ratio common in the case of private goods. The decisions, choices and performance recorded for the 294 subjects, supported the hypothesis that the WTA/WTP diverges from unity more often and in a more pronounced manner for information traded in the “original” form rather than as a copy of the original, although even for copies the WTA/WTP ratio is still double. Results yield a value of about three for the WTA/WTP ratio for original information regardless of whether the source is content or expertise. Valuations of content and expertise did not diverge. However, the source of information can be manipulated by system design to become more salient. Copy information received a subjective value which was significantly different (lower) than original information. This portends undertrading in information. Participants had a strong inclination to purchase but not to sell information even though the profit data suggests that the use of information had no objective benefit. This preference is attributed to risk aversion rather than to loss aversion which is the most widely-accepted explanation of the Endowment Effect. The subjective value of information can therefore be affected by system design.

This research studied the effect of ownership on information sharing in an experimental setting. The independent variable, ownership, was inherent in different sources of information. Three sources were selected to represent three ownership levels: expertise, private document, organizational document. The dependent variable was the willingness to share information as manifested by participants' responses to requests for help. The main hypothesis was that sharing will be highest for expertise, followed by private, and then by organizational document.

Results of the sharing experiments performed with one 173 participants reveal a significant difference in the willingness to share information derived from different sources. The order of sharing from highest to lowest is, as hypothesized: expertise is shared most eagerly, followed by private document, while information in corporate documents is shared the least. There was no significant difference in the willingness to share between the first two
information types, expertise and private document, lending further support to the hypothesis on ownership. Ownership has a stronger impact on willingness to share than does the source of information. Sharing was higher when the request for help was personal compared to the public request. The overall rate of sharing was low and invites further research on the possible usefulness of establishing an information sharing standard.

Using a simple computerized game proved to be useful for research. The game was versatile enough to assume the different variations programmed especially for testing the research hypotheses. It was well-received by the participants and generated excitement and motivation to play well.

The main finding of the present research is that information ownership bears an impact on the subjective value of information as manifested by the tendency to trade in or share information. This study offered experimental demonstration of the subjective value of information previously known mainly as a theoretical concept. Therefore assignment of subjective value and ownership of information should be considered in the design of systems.

Obviously, as any other research, this study too has limitations. The main limitation is that the research method selected was an experiment. This method was not triangulated with other methods and its drawbacks are known. Experiments can answer a very limited number of research questions since they involve a small number of variables. Many questions raised by the present research and listed toward the end of the dissertation may be answered by methodologies developed here as well as other methods such as vignettes, surveys or computerized methods in other trading and sharing scenarios.
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1. Introduction
Organizations and individuals use information as a major input in all aspects of work: Development, production, marketing, financial management and administration. Information has become so central in the value chain that it is often also the major product or output of organizations and of individuals’ work. While individuals and organizations alike are interested in minimizing their expenses on information input, they are certainly not eager to reduce the value of their information output. Further, this valuation may be conflicted. The value of information, as will be explained in Chapter 2, is subjective and hence relies on individual perceptions. Knowledge workers are employees who use and disseminate information and knowledge as part of their jobs. To obtain information knowledge workers engage in information trading and sharing via information systems on a daily, even hourly, basis. The subjective value of information is a central determinant of information trading and sharing behavior. The present research aims to study the subjective value of information and to investigate the influence of ownership on the subjective value of information in trading and sharing situations.

Chapter 1 presents the background for the present research. First the importance of the subject to information systems research and to the information industry is explained. Subsequent sections discuss the difficulty in assessing the value of information, provide definitions for terms used throughout the dissertation, present the main research questions and the scope of the research, and, finally, the summary provides an outline of the rest of the dissertation.

1.1 Importance to Information Systems Research
The demand for information is the raison d’être of information systems. The demand for information is strongly affected by its subjective value (Rafaeli, 1989; Connolly and Thorn, 1990; Busch, Jarvenpaa et al., 1991; Rafaeli and LaRose, 1993). Gaining better understanding of how users perceive the value of information is of importance to system developers, content providers, and the users themselves, because such understanding may lead to better flow and usage of information. Previously the value of information has been researched mainly by economists. The research presented here offers an interdisciplinary
approach by combining economic and psychological theory with information systems research and extending it to the subjective value of information.

Information is transmitted via two main routes: trading and sharing. In trading situations information systems provide a unique medium for collecting information on value perceptions, for example by bidding, which may be translated later into personalized information products with value-based pricing. The value of information in trading is central also when trading any good which is accompanied by information. The rate of trading in electronic commerce is dependent to a large part on the value of information describing the traded item. Overall, the subjective value of information in trading is most important in two major instances: trading in information itself and trading in goods accompanied by information. Sharing contexts, on the other hand, come in many more flavors. Sharing is done for work, leisure, or spiritual purposes on a large variety of platforms.

Information and communication technologies have revolutionized information sharing as seen by the enormous popularity of electronic mail, various types of discussion groups and peer-to-peer technology. The abundance of research on knowledge management highlights the importance of information sharing within organizations and the desire of organizations to encourage sharing and storage of information (Davenport and Prusak, 1998; Dixon, 2000). While technical and social attributes of information systems create a sharing environment, the value of information shared is believed to be a central determinant of the propensity to share (Steinfeld and Fulk, 1988; Newhagen and Rafaeli, 1996; Rafaeli and Sudweeks, 1997).

1.1.1 A View from the Information Industry

Beside the strong academic interest in the subjective value of information, this concept is of great interest and importance to the information industry. Much of the entire last decade was devoted to heated debates among industry leaders about the value of information. Important books and articles have been written on various aspects: Legal, economic, technological and social (Branscomb, 1994; Kelly, 1997; Shapiro and Varian, 1999; Raymond, 2001). Members of the information industry have advocated that information should flow freely or like wine without bottles (Barlow, 1993; Raymond, 2001).
Bottlenecks to the free flow of information spurred a trend of returning to fee-based information products (for example: www.theendoffree.com). The current trend in trade publications is to discuss issues such as pricing content and digital rights management (Arnold, 2000; Howe, 2001; O'Leary, 2001). It appears that we are witnessing a return to traditional economic thinking where information does not “want to be free” as previously advocated, it wants to be valuable.

1.2 Why is the Value of Information Difficult to Elucidate?

Information has several unique characteristics that render it difficult to valuate. Information is an unusual good in terms of production, distribution and consumption. Information is expensive to produce and cheap to reproduce (Bates, 1989; Shapiro and Varian, 1999). In fact, distribution is done mainly by reproduction or copying. Digital information is virtually costless to copy meaning that cost of copying (marginal cost) is irrelevant to valuation, in contrast to physical goods. The same content can be distributed by different media, and the price is often derived from the medium rather than from the value delivered by the content itself. For example, printed daily newspapers are sold for a fee individually or based on subscriptions while their online counterparts are often available for free. Online archives often require payment whereas any newsstand owner may inform us about the value of an old newspaper. Value-based pricing would lead to greater profitability but it requires a deep understanding of value perceptions. Information can have considerable economic value through its use, however, one’s use of information does not diminish its availability for other potential users (Bates, 1989). The question of the value of information is further complicated by the fact that information is an experience good, which means its value is revealed only after consumption (Shapiro and Varian, 1999). Pre and post consumption values of information may differ considerably, a difference which may bear an influence on future information consumption patterns.

People obtain information both by sharing and by purchasing while most other goods are obtained by purchasing only. Availability of both shared and purchased information modes may suggest interdependence between them. Such interdependence may influence value perceptions in both modes. In market terms, a question arises as to what kind of a good is information: Is it a private good, as implied by the commerce channel, high economic value, and high production costs, or is it a public good, as suggested by the
sharing channel, potential reuse and virtually zero copying costs? The underlying question is one of the major issues of the present research, namely, information ownership. How does ownership affect value perceptions in trading and in sharing information? Is private or public ownership more conducive to trading or to sharing or to both?

1.3 Basic Definitions

The discussion so far used 'information' in the general sense of the word. Some definitions are in order before proceeding. Three closely-related concepts are defined: Data, information, knowledge. Different definitions can be found in the literature for these terms from an information systems perspective (Ahituv and Neumann, 1986; Laudon and Laudon, 2000) or from an economic perspective (Bates, 1989; Varian, 1998; Shapiro and Varian, 1999). The definitions used here were adopted from the knowledge management literature (Davenport and Prusak, 1998). While more complex and detailed definitions are available (Smith, 2000), the following definitions have been selected because they are fairly simple and parsimonious and enable operationalization. Data are a set of discrete, objective facts about events. Information is data that have been analyzed and/or contextualized, carries a message and makes a difference as perceived by the receiver. Knowledge is a human quality (we do not talk about a knowledgeable book or database) that builds on data and information together with experience, values, and insight.

Perhaps the term “content” is a more unique description of the above definition for information (data that have been analyzed and/or contextualized, carries a message and makes a difference as perceived by the receiver). I shall use “content” to describe the message and leave “information” as a general description of everything that belongs to the information industry. Data, content, and knowledge hereafter are referred to as “information” for the sake of simplicity and unless explicitly stating otherwise. “Knowledge” and “expertise” are used interchangeably in this research as are the terms “content” and “information product”. For further clarification, please refer to Table 1 which contains definitions already mentioned as well as terms defined later in this dissertation.
The value of data, content, and knowledge is context-sensitive and may change based on subject-matter and circumstance. Therefore, Chapter 7 contains precise definitions of the context researched and reported here.

<table>
<thead>
<tr>
<th>Term</th>
<th>Related Terms</th>
<th>Definition</th>
<th>Main Reference</th>
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<tr>
<td>Content (information product)</td>
<td>Content can be perceived to be owned privately or organizationally (see ownership definitions)</td>
<td>Any type of publication</td>
<td>(Constant, Kiesler et al., 1994)</td>
</tr>
<tr>
<td>Endowment Effect (EE)</td>
<td>Willingness to Accept Payment (WTA); Willingness to Pay (WTP); Under trading</td>
<td>A disparity between buying and selling prices of an object. The disparity is attributed to loss aversion.</td>
<td>(Thaler, 1980); (Camerer, 1995)</td>
</tr>
<tr>
<td>Experience good</td>
<td></td>
<td>The value of such a good is revealed only after use.</td>
<td>(Shapiro and Varian, 1999)</td>
</tr>
<tr>
<td>Expertise</td>
<td>Expertise can be perceived to be owned privately or organizationally (see ownership definitions)</td>
<td>Personally-owned knowledge</td>
<td>(Constant, Kiesler et al., 1994)</td>
</tr>
<tr>
<td>Mere Ownership Effect</td>
<td></td>
<td>The value of objects is perceived higher by their owner.</td>
<td>(Beggan, 1992)</td>
</tr>
<tr>
<td>Ownership – private</td>
<td></td>
<td>Personal ownership by an individual</td>
<td>(Constant, Kiesler et al., 1994; Jarvenpaa and Staples, 2001)</td>
</tr>
<tr>
<td>Ownership - organizational</td>
<td></td>
<td>Ownership rights belong to an organization such as a corporation</td>
<td>(Constant, Kiesler et al., 1994; Jarvenpaa and Staples, 2001)</td>
</tr>
<tr>
<td>Private goods (market goods)</td>
<td></td>
<td>Goods purchased by individuals and owned by them</td>
<td></td>
</tr>
<tr>
<td>Public goods (non-market goods)</td>
<td></td>
<td>Full definition in Section 4.2. Such goods are not owned by individuals</td>
<td></td>
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</tbody>
</table>

Table 1a: Definitions for concepts used in the present research (part a).
### Table 1b: Definitions for concepts used in the present research (part b).

Information comes in many forms, printed, electronic or tacit: Text, graphics, sound, software, experience, and beliefs. Each can be transmitted orally, in hardcopy or by electronic means. This complex matrix of definitions, distribution, form and transmission suggests a large number of possibilities for buying, selling, and sharing information. For example, textual data can be electronically transmitted for a fee in trading or for free in sharing. Similar examples can be given for any other combination of the aforementioned parameters. The experimental section (Chapter 7) includes descriptions of the types and means of information used in the present research.

#### 1.4 Main Research Questions

Information proliferates both by sharing and by trading. In sharing there is no transfer of ownership rights but rather sharing involves multiplying the number of information holders. Trading usually involves transfer of ownership rights, however, when it comes to information, ownership is sometimes transferred and sometimes multiplied by selling nonexclusive copies. Since any information consumer uses all modes of transfer and ownership, the status of ownership becomes confusing, opaque, and enigmatic. It is proposed that a central determinant of the individual perception of the value of information is its perceived ownership. The present research aims to unravel the influence of the
perception of ownership on information subjective value formation and on information-related behavior. The subjective value of information in trading is represented by the ratio between the willingness to accept payment (WTA) and the willingness to pay (WTP) for information. WTA and WTP will be explained in depth in Chapter 3. The WTA/WTP ratio has been documented for various goods but not for information. Since information is an unusual good, as explained in Section 1.2, and its ratio is both unknown and difficult to predict, the first research question is:

1. Where is information (content or expertise) found on the WTA/WTP ratio continuum in trading situations?

Further, this research aims to investigate the unique characteristics of information such as different sources (content or expertise) and ease of copying on the WTA/WTP ratio. The corresponding research questions are:

2. Is the EE for content larger than the EE for expertise?
3. Is the EE for original information larger than for copy information?
4. Will originality (copy or original) of information have a different effect on the WTA/WTP ratio depending on the source of information (content or expertise)?

The other research questions refer to sharing of information. They are:

5. Are people more inclined to share personally-owned expertise than organizationally-owned information products?
6. Will private/personal ownership of information products serve to enhance sharing of information products in organizational settings?

1.5 Scope of the Research

The hypotheses corresponding to the above research questions (see Chapter 5, page 25) will be tested experimentally using a computerized business game called The Lemonade Stand. Therefore the research outcomes are limited to similar simple business decision situations. The context chosen for this research is a simplified but typical business situation where the player owns a lemonade stand and must manage his/her stand to make the best profit possible. In this game participants make decisions about pricing, inventory and product quality. These decisions are based on the weather forecast. This forecast is
the information that will be manipulated for elicitation of WTA, WTP and willingness to share (WTS).

In the trading scenario participants will be given opportunities to buy or sell different kinds of information (expertise or content), providing their subjective values for information by bidding (hypotheses H1, H2). Ownership will be instantiated here both by having or not having, and by trading original or copy information (see Chapter 7).

In the sharing scenario the propensity to share information will be evaluated by responses to standardized Instant Messaging (IM) messages sent to participants of the Lemonade Stand. Ownership will be manipulated by distinguishing between privately-owned expertise and organizationally-owned content.

The present research analyses information value perception at the individual level. The main underlying influence is attributed to perceived or actual ownership. Naturally environmental, cultural, and social factors may play an important role in value perception. The aim of the present research is to establish a sound methodology to test the effect of ownership on the value of information in trading and in sharing scenarios. Future research may build on the same methodology to test for broader influences and interactions between them.

1.6 Summary and Outline

Chapter 2 provides the theoretical foundation of why the value of information is subjective citing pertinent research. In Chapter 3 Endowment Effect theory and methodology, an outgrowth of Prospect Theory, dealing with the subjective value of goods in commerce situations, is extended to information. Chapter 4 presents the issue of information sharing and some questions that emerge from research in this area, especially the debate about information being a private or public good. The Mere Ownership effect is the theoretical foundation for developing experiments to extend survey research cited. Chapters 5 and 6 summarize the main hypotheses and contribution of the research respectively. Chapter 7 offers a detailed description of the research instrument and the experiments. Chapter 8 reports the results of the information trading and sharing experiments and the accompanying statistical analyses. Chapter 9 offers the discussion of the results and their implications as well as thoughts and ideas for future research. Appendices A and B list the
main definitions and contrasts discussed and the list of publications that have already grown out of the research reported here.
2. The Value of Information

This chapter reviews some of the traditional literature pertinent to the measurement of the value of information as well as other research highlighting contrasts, even paradoxes, which are unique to information and make value measurement challenging. The term 'value' should not be confused with 'price'. Value is the antecedent to price. This research focuses on value, although part of it is expressed by price bids as will be later explained in Chapters 3 and 7.

Information is costly to produce but very cheap to reproduce. It is therefore difficult to assess its value (Shapiro and Varian, 1999). In contrast to other goods, the quantity of information does not affect its price or value. Information affords indirect utility in support of decisions, consequently direct utility measurement is inappropriate (Van Alstyne, 1999). Economists have developed models for the influence of a host of external factors on the value of information. One such model including a review of economic literature can be found in Raju and Roy (Raju and Roy, 2000). Another suggestion is raised by Bates (Bates, 1989) whereby an expected value can be calculated by averaging possible outcomes weighted by their likelihoods instead of using traditional exchange or utility values. While these models confirm some intuitions about the value of information, they do not offer explanations for human behavior toward information. People do not always behave as rationally as predicted by economic models.

Theoretically, there are three ways to assess the value of information (Ahituv and Neumann, 1986): Normative, realistic, and subjective. While user utility should be the base for calculating the price of information, utility varies by person and circumstance. Information is an “experience good”, the value of which is revealed only after use (Shapiro and Varian, 1999). Normative and realistic methods are ex post and consequently inappropriate for evaluating information content (also referred to as the “inspection paradox”) (Van Alstyne, 1999). Therefore the focus here is on the subjective value of information.

Measuring subjective value is inherently problematic due to the potential mismatch between qualitative reports and quantitative or monetary scales. Another problem relating
to methodology is how to translate attitudes into behavior. If we assess value using an attitude questionnaire, how will we predict people’s actual information purchasing behavior?

The tradition of studying decision-making under uncertainty has addressed patterns of information use and the value assigned to information. The heuristics experiments (Tversky and Kahneman, 1982) as well as later studies (Kahneman and Lovallo, 1993) demonstrated that people tend to ignore available information such as prior probabilities, sample size and the like. Instead, decisions are based on other subjective methods such as representativeness, availability, and adjustment and anchoring (also known collectively as heuristics). Earlier experiments have also shown that people tend to be conservative and undervalue information available for the revision of a prior opinion (Branthwaite, 1975). A recent study (Bastardi and Shafir, 1998) tested the pursuit of information for daily decisions. Participants preferred to seek information and to base their choices on (objectively) noninstrumental information. A similar effect was shown in judgment tasks (Gaeth and Shanteau, 1999). In other words, people assign positive subjective value to objectively worthless information. Theory also suggests that people seek information because it seems the right thing to do (Feldman and March, 1981), implying over-demand for information and a high subjective value. People tend to accumulate information “just in case” they may need it in the future, again leading to excessive demand (Van Alstyne, 1999). The theoretical tension is, therefore, between studies indicating that information is under-valued and research showing information to be over-valued.

Previous studies have tried to elicit the subjective value of information by using surveys or semi-structured interviews (Davies, 1994; Vlahos and Ferratt, 1995; Hepworth, 1998). This research will focus on experimental methods, seeking higher internal validity.

Although it is a well-known fact among researchers that information is distributed mainly by copying or duplication, the effect of this unique mode of transfer on value has not been researched or reported in the academic literature to the best of my knowledge. Information can be reproduced infinitely with a marginal cost equaling zero, therefore, its transfer does not entail an apparent loss for the seller (Bates, 1989). If value were derived from marginal cost alone, then information should have a value of zero. This is not the case since the value of information is derived from its future usefulness as well as from social
good. An example of social good is that the spread of information about prices creates more efficient markets and increases total social welfare. This analysis implies that although distribution by infinite copying suggests a value of zero, information is endowed with value based on its future perceived usefulness and social good. The effect of copying on value perceptions will be incorporated into the experiments described in Chapter 7. Chapter 2 raised the various facets associated with the value of information suggesting that subjective value is of central importance. An explanation and literature review of subjective value is given in Chapter 3.
3. Value Measurement

Subjective value has been studied experimentally for many types of market goods (also called private goods) and nonmarket goods (also called public goods). One very interesting finding of experimental research on subjective value is the discovery of a disparity between the highest amount one is willing to pay (WTP) for a good and the lowest amount one is willing to accept (WTA) as compensation for giving up the same good. Traditional economic assumptions imply that, when income effects are eliminated, the difference between WTP and WTA should be negligible (the difference should amount to the decreasing marginal utility). Empirically, however, experiments with various types of goods have shown that the differences between WTA and WTP are often substantial. Most research in this field indicates that WTA is significantly greater than WTP. This research tradition is rooted in Prospect Theory and its findings are often explained by loss aversion. By definition, WTA and WTP values are neither normative nor realistic. Instead, they are subjective values, since they represent an individual’s personal perception of an object’s worth for him or herself. Here Endowment Effect methodology as used for various types of goods is applied in order to investigate the subjective value of information with a view to determining what characterizes information as a good.

3.1 The WTA/WTP Disparity

The consistent, unexpectedly large, and uni-directional difference between WTA and WTP observed in relation to traditional goods and services has generated much research interest. Attempts were made to explore whether the discrepancy can be explained by economic theory or whether the difference belongs to the realm of irrational choice and is rooted in psychological origins. Chapter 3 reviews some of the pertinent literature on the WTA/WTP disparity and the explanations offered by economists and psychologists. The common denominators of these two approaches are highlighted.

Commonly, bidding is employed as the general experimental approach for researching the values of WTA and WTP. Participants in experiments are offered the opportunity to bid for the purchase of an item, or to state a reserve price for the sale of an item. There are many bidding mechanisms and there is no specific experimental design common to all the experiments described below. A comprehensive methodological review detailing the types
of bids used in different papers can be found in (Horowitz and McConnell, 2000). Using the various bidding mechanisms, researchers have demonstrated the existence of a significant disparity between the values of WTA and WTP for common market goods such as chocolates, pens, and mugs (Kahneman, Knetsch et al., 1990; Bateman, Munro et al., 1997), and a much larger disparity with regard to nonmarket goods such as health (Thaler, 1980; Shogren, Shin et al., 1994). Trading induced-value tickets, or tokens of known value, have not shown a WTA/WTP disparity (Kahneman, Knetsch et al., 1990; van Dijk and van Knippenberg, 1996; Irwin, McClelland et al., 1998). In this case, of “induced value” items, the expected number of trades took place, the expected number of trades being half of all possible trades. Herein lies one of the important implications of the disparity, namely that the existence of a significant difference between WTA and WTP leads to a reluctance to trade and results in undertrading. This was further confirmed by trading induced-value tickets of unknown value (van Dijk and van Knippenberg, 1996; Irwin, McClelland et al., 1998) as well as lottery tickets (Knetsch and Sinden, 1984; Bar-Hillel and Neter, 1996), which resulted in a WTA/WTP disparity and undertrading. Interestingly, uncertainty was not the cause for the disparity observed in the mugs experiment (Kahneman, Knetsch et al., 1990), since the bids were made on mugs marked with clearly visible price labels.

The studies mentioned here as well as dozens of others (Horowitz and McConnell, 2000) reveal a continuum ranging from induced (known) value tickets, where WTA is found to equal WTP, through market goods, where the disparity exists, and on to nonmarket goods where the disparity is largest. The WTA/WTP ratio approaches unity for induced value items, being usually about 3 for market goods, while for nonmarket goods that ratio is very large, usually about 10.

3.2 Theoretical Foundation of the WTA/WTP Disparity

Explanations for the WTA/WTP disparity have come from two main schools of thought, psychology and economics. In the following are summaries of both.

Broadly, the psychological view is that decisions under uncertainty are often irrational (by the standards of economic theories) and based on rules of thumb, heuristics. This other-than-rational behavior in also manifested in market settings. People who are endowed with
a certain good will require a significantly larger sum of money to give it up than they would be willing to pay for its purchase. Since the assignment of higher value is attributed to the ownership of the object, this phenomenon was termed the “Endowment Effect” (EE). The main explanation for the EE in trading offered by psychologists (Kahneman, Knetsch et al., 1990; Thaler, 1991; Bateman, Munro et al., 1997) is loss aversion, which is part of the broader Prospect Theory (Kahneman and Tversky, 1979). Prospect Theory, in turn, describes the value function on the basis of observed behavior rather than on economic theory (as reflected in the utility function). The value function reveals that losses are weighted more heavily than gains since the slope of the function is steeper for losses. Giving up an owned object is viewed as a loss, while the utility of obtaining the same object is viewed as a gain. Therefore, people expect a higher price for disowning an object than the price they are willing to pay to gain the object. Some studies have tried to distinguish between the object of a trade and the transaction as such and have found that both play a role in loss aversion (Chapman, 1998; Hoorens, Remmers et al., 1999). Further extensions and explanations of loss aversion in the context of the WTA/WTP disparity are described by “preference reversal” (Thaler and Tversky, 1992), the “status quo bias” (Thaler, Kahneman et al., 1992), the “reference-dependent model” (Tversky and Kahneman, 1991; Bateman, Munro et al., 1997) and the anticipation of regret (Knetsch and Sinden, 1984; Bar-Hillel and Neter, 1996).

Turning now to the economic explanations of the EE. Most experiments on the EE were conducted controlling for income effects, whereby, the large WTA/WTP disparity was attributed to psychological or behavioral reasons without an economic theory explaining these findings. In 1991 a theory based on the substitution effect was introduced (Hanemann, 1991). Hanemann showed that the WTA/WTP disparity and substitution effect are inversely related. A market good with many optional substitutes will show equality (WTA=WTP) while a good with few substitutes will show a large disparity. According to Hanemann the disparity can range between zero (the ratio equalling one) and infinity. Shogren et al. (1994) tested Hanemann’s theory and provided empirical evidence for the substitution effect theory: Experimental markets for candy did not show an endowment effect, while for health-risk experimental markets they showed a large WTA/WTP disparity.
However, contrary to the substitution effect theory, the fact remains that many of the experiments cited above have identified a WTA/WTP divergence even for simple market goods such as pens, mugs, and chocolate. Possibly a difference in experimental methods is at the root of this difference, since different bidding mechanisms were employed, and also because the theory by Hanemann and the experiments by Shogren were developed for a single-sided bid whereas other experiments used double-sided auctions.

Recent economic research claims that an economic model can be developed explaining the divergence between WTA and WTP as being based on the uncertainty created by a lack of information about the value of the goods traded (Kolstad and Guzman, 1999). They suggest that this model’s prediction for the WTA/WTP divergence is an alternative to behavioral explanations such as the endowment effect or other economic theories like the substitution effect. According to this model, information use is inversely related to the WTA/WTP divergence with the price of information directly related. When the price of information is high relative to expected payoffs, little information is consumed and a large disparity in WTA/WTP is observed. When the price of information is low relative to the expected payoffs, the values of WTA and WTP approach the common value, better known as the market value. In Kolstad’s model the choice seems to be rational. Usually, however, the price of information relative to its payoff is not known so that decisions have to be made under uncertainty.

A study of behavior relating to environmental goods revealed that the disparity between WTA and WTP for environmental goods is increased by the existence of an intrinsic value (Boyce, Brown et al., 1992). They show that WTA includes an intrinsic value which, in the case of environmental goods, is some moral responsibility of no utility or consumer value.

3.3 Common Denominators Between Psychological and Economic Explanations

The main psychological explanations of the WTA/WTP disparity are loss aversion which is based on Prospect Theory, degree of similarity and degree of uncertainty in the cases of induced value tokens and lottery tickets. The main economic explanations are the
substitution effect, the tradeoff between the price of information and the expected payoff and intrinsic value.

The Prospect Theory approach received experimental economic substantiation (Horowitz, McConnell et al., 1999). Similarity observed in psychological experiments (Chapman, 1998) is equivalent to economists’ explanations of the substitution effect. Psychologists also acknowledged that lack of commensurability is necessary for the EE to manifest itself (Kahneman, Knetsch et al., 1990), again a hint for the substitution effect. The immunity of induced value tickets to the Endowment Effect also supports the substitution effect explanation as such tickets have perfect substitutes when their values are known. The degree of uncertainty, or the amount of information provided have also been researched both by psychologists and by economists, as the studies cited above exemplify. The results in all cases show similar trends. Psychological theory proposed in order to explain the WTA/WTP disparity is based on observations of human behavior. This is in line with economic models, which in this area of research are inductive and based on experimental markets rather than on traditional economic assumptions. Overall it can be said that economic and psychological research are moving in the same direction, thus lending support to each other. The main underlying causes of the EE seem to be loss aversion and the substitution effect with their respective outgrowths. Variables that influence the EE are the type of good traded (induced-value, market, nonmarket) and the existence and availability of substitutes, which imply the availability of information on the market.

3.4. Implications for the Subjective Value of Information

A choice to pursue information is a result of the desire to reduce the uncertainty that characterizes certain decisions. Information in this sense is not a regular consumer good; it is more like a raw material consumed in the production of other goods down the value chain. The decisions as to what kind of information will aid in reducing the uncertainty, where to look for information, and what is the information worth are in themselves made under uncertainty. One rarely knows what kinds of information one will find, what will be the quality of that information, and to what extent will it actually reduce uncertainty. All this stems from the fact that information is an experience good, the value of which is revealed only after consumption and from a lack of access to meta-information. Research that would shed light on the value of information prior to consumption or what influences
value formation will be of importance to content providers, decision makers, and information system designers. Likewise, models that help to predict market making processes pertinent to the trading of information would be welcome.

The result of the WTA/WTP disparity, or of the EE is that it creates undertrading. Fewer trades take place than should have occurred under standard economic assumptions. As cited earlier, lack of information contributes to an increase in the WTA/WTP divergence and hence leads to undertrading. Conversely, abundance of information suggests an accelerated pace of trade. Information is an economic catalyst. Increasing its perceived value and the demand for it should be the objective of any market-oriented organization in wishing to increase the number of trades.

On one hand, substitution effect theory should predict a large WTA/WTP disparity for information. This is due to its inherent nature as an experience good, each item of content being unique. On the other hand, the abundance of free information on the Internet and searchers’ inclination to seek free content suggest a low subjective value for information producing parity between WTA and WTP. Similar tension exists between information overload and the need to constantly seek information. In light of this contradiction I have chosen to begin my investigation with a fundamental question about the WTA and the WTP for information in order to form a basis for further research on factors influencing these values and other issues of importance.

**The research question is : Where is information found on the WTA/WTP disparity continuum?**

The hypothesis is that the WTA/WTP ratio for information is at least as high as holds for market goods. In other words, the WTA/WTP ratio will be greater than unity. The value of the ratio will approach three, which is the value observed for regular market goods. The ratio is expected to resemble the standard set for market goods, because the experiment will deal with information used for daily business decisions rather than information which has emotional implications (such as health information) or broad public interest (such as environmental concerns).
4. Information Sharing

4.1. Introduction

In spite of our substantial investment of time, intellectual effort and sometimes considerable amounts of money to obtain information, humans are willing to share data, content, knowledge and code. In fact, some attribute humanity itself to the act of sharing information (Dunbar, 1996). Sharing of information is done regularly, even spontaneously, via formal and informal channels. Much information is shared in departmental meetings, written reports, telephone conversations, water-cooler meetings and other traditional forms. Recent years have seen more and more information sharing done via online information systems containing large repositories of information and facilitating interpersonal communications in various forms. One unique advantage of online information sharing is that all interactions are documented, so information can be stored and retrieved. It provides a means of capturing part of the knowledge transferred in the organization. The success of information systems depends largely on psychological and social influences on users. Research investigating such influences is therefore important for system developers and for the field of information systems research.

Various studies have documented the tendency to share information with a more or less uniform conclusion and theoretical basis that information in sharing situations is, or can become, a public good, where some people tend to share while others are free riders, using shared information without contributing themselves. Earlier I explained why information is termed an “experience good”, the value for which can only be assigned subjectively. This definition should not be confused with the unique characteristic of information to be either a private or a public good, an aspect discussed in this section.

In previous sections the theory of the Endowment Effect (EE) was presented. According to this theory and empirical work associated with it, public goods are characterized by a higher WTA/WTP ratio relative to private goods that have a lower WTA/WTP ratio (ratios of approximately 10 and 3 respectively). Thus, public goods are assigned a higher subjective value than private goods. The general explanation for the difference in the ratios is that private goods have many substitutes while public goods have few or no
substitutes at all. If information in sharing situations is indeed a public good, as suggested by research cited below, it follows that it should be assigned a high WTA/WTP ratio. This is in contrast to the hypothesis that concluded Chapter 3. Chapter 4 discusses the theoretical aspects of this contrast. Sharing information is inherently problematic due to the conflict between self-interest and social influence (Constant, Kiesler et al., 1994). If the subjective value of information is higher in a sharing situation and self-interest prevails, why would people be inclined to share?

The following sections provide a definition of public goods, and describe examples of information as a public good followed by an analysis of the literature on information sharing in organizational settings. The analysis suggests that information in organizational settings should not always be regarded as a public good. It is proposed that, in agreement with previous research, sharing is favored by private ownership of information.

4.2 Definition of “Public Good”

Public goods are defined in the Penguin Dictionary of Economics as having three main characteristics: “The first is that they yield non-rivalrous consumption: one person's use of them does not deprive others from using them. The second is that they are non-excludable - if one person consumes them it is impossible to restrict others from consuming them: public television is non-excludable. Thirdly, public goods are often non-rejectable - individuals cannot abstain from their consumption even if they want to. National defense is a public good of this sort, although television is not. Non-excludability and non-rejectability mean that no market can exist and provision must be made by government, financed by taxation.”

Looking at the characteristics of information, easy and nearly costless copying, we would tend to think that information is a public good because it fulfills the definitions of jointness of supply and impossibility of exclusion. If information is indeed a public good it follows that the main impediment to sharing is the “free riding” phenomenon. The analysis presented in the following sections reveals that information is not clearly defined as either a private or a public good. It can be a public good but it may also be a private good, implying different ownership options. Therefore, information sharing problems may not
be due solely to “free riding”. Ownership may be an important inhibitor or enabler of sharing.

4.3 Information as a Public Good

Information from various sources can be a public good and be widely shared. For example, information provided by the government can be regarded as a public good. Legislation, such as the Freedom of Information Acts in the United States and in Israel, is usually needed to facilitate the publication of government information. Another form of information as public good is information transmitted via mass media, although individuals can abstain from it and also funding comes from commercial entities and not from the public itself or government (with the exception of public television and radio). Newer versions of mass media, where many communicate with many, are various kinds of electronic communication means like bulletin boards, chat lines and many others. These media are also said to be hindered because they are public goods, but, in fact, contributions to them are regular and intensive. It is suggested that interactivity, symmetry and diversity of content elicit participation (Rafaeli and LaRose, 1993). Academic knowledge may also qualify as a public good as proposed by a recent protest against publishers’ stronghold of scientific publishing (http://www.publiclibraryofscience.org/). The academic tradition of information sharing created a public good known as Linux operating system (Raymond, 2001). Current practices of the academic research market and publishing industry, however, still restrict free public access and usage.

A certain critical mass of contributors and a certain quality level of contributions are vital for the sustenance of a public good (Macy, 1990; Markus, 1990; Rafaeli and LaRose, 1993). Therefore, free riders, non-contributors, threaten the viability of public goods. Broadly characterizing the examples given above, it seems that in order for information to become a viable public good, it must have one of the following characteristics:

1. Have broad public interest (for example, news broadcasts, entertainment etc.)
2. Be in the public’s interest (like scientific discoveries)
3. Be mandated by legislation (government information)
4. Have a long tradition of sharing (as in collaborative software development)
5. Full and balanced disclosure (for example, academic publications require full research details as well as a complete listing of sources or references)
To what extent do these criteria apply also to information consumed or distributed in organizational settings? The next section describes relevant research findings.

### 4.4 Information Sharing in Organizations

Much ideology and some research support the notion of information as a public good in the private sector. A pioneering series of experiments on contribution of information to a discretionary database in a business game setting showed that some participants contribute while others free ride (Connolly and Thorn, 1990). These experiments also showed various effects on contribution rates such as asymmetry of costs, value of information or privatization. Interestingly, the privatization experiment used a bidding mechanism and its results exhibited under-trading, meaning that the EE took place. Privatization reduced free riding but did not eliminate it altogether. Connolly and Thorn were actually able to demonstrate experimentally both free riding and an EE with regard to information, although they did not test for EE specifically. The authors explained that the root of the problem of under-contribution of information was that discretionary databases are public goods and therefore rational actors will choose to free ride. Privatization was the recommended solution to overcome the free rider problem. The experimental setup was such that each participant possessed a single unique and valuable contribution. Naturally, if not everyone contributed, then an under-contribution problem had to arise: The group did not receive all the valuable information possible. This is not necessarily a true reflection of reality. A public good may be produced by the collective action of a critical mass of highly interested and resourceful people (Macy, 1990; Marwell and Oliver, 1993; Constant, Kiesler et al., 1994). Online communities are a typical example of achieving the public good by forming a critical mass.

The pioneering research by Connolly and Thorn (Connolly and Thorn, 1990) focused on providing input into a public database and did not address the question of sharing information between people in a group. There may be differences in the propensity to share information via databases compared to the propensity to share directly with other people as evidenced by previous research (Sproull, Subramani et al., 1996). Sharing via databases can be viewed as mediated sharing since the database acts as a medium from
which people later retrieve information. People will need communication discipline (Markus, 1990) to proactively contribute, and users will need motivation to initiate a search in the database. In contrast, interpersonal electronic communication means such as electronic mail, newsgroups etc. provide a direct linkage between people. In these media people are prompted to participate by reading messages sent by other users or members. Answering a message received from a person asking a question does not require proactive contribution because it is a response. Participation in interpersonal systems is of two main kinds: posting questions or opinions, and offering answers or reactions. In interpersonal systems seeking comes before answering while in database-mediated sharing systems, contributions must precede information seeking. It seems reasonable to assume that direct interpersonal communication will prevail over database-mediated sharing when it comes to information sharing. It is not clear which method, database or direct interpersonal communication, prevails for the purpose of seeking information.

The problem of sharing may stem from the medium used rather than from the willingness to share (Dixon, 2000). People may be naturally willing to share information as suggested by Constant et al. (Constant, Kiesler et al., 1994; Constant, Sproull et al., 1996) but the effort of using technology to do so may be too great, or the reward may not be apparent due to lack of feedback from the database or from the recipient. This is what makes information sharing in discretionary databases seem like a public good problem: Contribution is made to a sort of “general repository”, where the lack of human touch, or feedback, or apparent use, discourages contributions. In systems where information is shared directly between people a similar problem may arise when contributors, whose contributions are of high quality, will be inundated with more and more requests to share their knowledge, and may see this as a disturbance to their work or even a blunt attempt by free riders to evade their work. One possible solution that has been suggested is communality, where the public good is not the information itself but the sense of belonging to a community and viewing the community as a source for expert advice (Fulk, Flanagin et al., 1996; Wasco and Faraj, 2000). Communality also suggests that the total sum of contributions is greater than its components thanks to synergy: Different views are expressed or a trend may be observed and so forth. Another solution is assigning a leadership role to one of the participants who will take care of the social management of the group (Butler, Sproull et al., in press). A group leader is often called the group 'owner'. It is interesting to note that this intuitively assigned semantic title implies increased
involvement and contribution. Butler et al. referred to ownership of the group and the medium where it 'meets', for example an online forum. This research examines whether ownership of information also serves to promote sharing. Ownership of information is ambiguous and may be evenly or unevenly distributed among a group's members. Does even ownership predict more sharing than uneven ownership or, to the contrary, is there more pressure to strive for an ownership equilibrium in a group with uneven information ownership?

Empirical information sharing research (Constant, Kiesler et al., 1994) using vignettes and attitudes questionnaires explained information sharing by social exchange theory. Social exchange theory predicts sharing based on self-interest and reciprocity. Self-interest was shown to be the main driver for sharing expertise in the study. Expertise was perceived to be privately owned rather than owned by the organization. Information as product, a computer program, was perceived to be more organizationally owned. Sharing an organizationally owned information product was found to be mediated by prosocial transformation, people weighed the social good more than their personal benefits. In other words, personal ownership supports sharing more than organizational ownership when it comes to tacit knowledge according to this research. This finding is somewhat surprising with respect to the general consensus in the knowledge management literature, which stresses the main difficulty as sharing tacit knowledge (Davenport and Prusak, 1998). Perhaps this contrast is a manifestation of the lack of motivation to contribute to a database (a knowledge management system) versus the willingness to share information with other people.

Constant et al. (1994) cautioned that sharing attitudes in the case of organizationally owned information may bring about the occurrence of free riding. As prevention they suggested the public good should be produced by a critical mass of enthusiasts and that organizational culture should promote sharing. Although this sounds reasonable, building on a relatively small group of active participants may be potentially problematic because of job mobility and other factors that may cause frequent changes in that core of enthusiasts. Other researchers (Wasco and Faraj, 2000) go a step further suggesting that knowledge be better managed as a public good causing people to contribute based on moral obligation. Their survey research was done in three programming-related Usenet groups. Programmers have a long cultural tradition of sharing so a preference of the public goods
perspective is to be expected from surveying them. Usenet are inter-organizational groups so their results, which showed an approximate balance between self-interest and community interest, cannot be directly related to intra-organizational information sharing which is the main interest of knowledge management. I believe that motivation for sharing is more intrinsic and relies upon subjective preference. Sharing based on personal norms and motivation will be more stable than sharing induced by organizational culture.

A survey, conducted among university personnel in order to examine several determinants of information sharing in collaborative electronic media (Jarvenpaa and Staples, 2000), provided further support for several findings of the previously cited article (Constant, Kiesler et al., 1994). Information perceived to be owned by the organization was less likely to be shared via a collaborative electronic system than privately owned information according to the survey. I believe the root of this attitude is in the perception of the source as being public (the organization) or private (the person). Organizationally owned information may be perceived as part of some “public domain”, therefore there is less need or obligation to share it by a specific person. It may be perceived as widely-available, regardless of its objective availability. In addition, knowing they are part of a group of equally-knowledgeable peers, people may exhibit a diffusion of responsibility and refrain from sharing (Latane and Darley, 1968; Latane and Rodin, 1969). On the other hand, a person who is an expert in his/her field and believes he/she is the only source for particular information may be more willing to share it, knowing that he/she will enjoy personal benefits such as gratitude and improved reputation. Thus an important motivator for information sharing may be personal ownership of information.

Further attention to the question of ownership was given in additional results of the same survey by Jarvenpaa and Staples published in a subsequent paper dealing with antecedents of the ownership perception (Jarvenpaa and Staples, 2001). The authors found a positive association between private and organizational ownership: knowledge workers believed that information products or expertise that they created was owned both by themselves and by the organization they worked for. The organization has rights to the products of their work, a research finding that corresponds to the general norm. This finding lends further support to the prosocial transformation that influences employees’ perceptions of ownership and sharing behavior. An interesting point raised by the authors is that organizations should not assume that all information produced by their employees belongs
only to the organization and base their information system design on this wrong assumption. Instead, it is suggested that co-ownership be nurtured. The present research will try to look at ways to influence the perception of ownership of information products in order to enhance sharing.

Heider's theory of association suggests that people assign a higher value to owned objects compared with non-owned objects: We buy objects that we like, and we like objects that we bought and now own (Heider, 1958). Research investigating the perception of objects has shown that people perceive objects as an extension of the self (Belk, 1988). A possible explanation for liking what we buy or own could be our desire to reduce cognitive dissonance. Cognitive dissonance can occur when a person chooses to purchase something and then dislikes what he purchased. However, free choice is necessary to trigger cognitive dissonance. Experiments where people had no choice in the objects they received for ownership have ruled out cognitive dissonance as a motive for higher valuations. These experiments have shown that even merely owning possessions leads to higher valuations of them and to self-enhancement (Beggan, 1992). Self-enhancement is defined as an individual’s tendency to maintain a positive self-concept after a negative experience by compensating on an unrelated dimension (Baumeister, 1982; Brown and Smart, 1991). For example, a helpful attitude may develop following poor performance at an achievement task. This example is particularly interesting because it suggests that social change may be brought about by affecting the self.

Beggan (1992) has shown experimentally that mere ownership increases individuals’ valuations of objects. Surveys cited earlier (Constant, Kiesler et al., 1994; Jarvenpaa and Staples, 2000) have shown that private ownership of information favors sharing. Expertise is part of a person’s most personal endowment, his/her intellect. It follows that if personal endowments play an important role in the individual’s self, then sharing such endowments without losing them, as is the case of sharing expertise, can serve to enhance one’s self-image. The present research aims to show experimentally that mere ownership of information supports sharing both of expertise and of information products.

Information sharing may be affected by a host of additional factors. One such factor may be individual differences in levels of knowledge. It seems reasonable that people who are more knowledgeable and can contribute more, also appreciate the information in a
collaborative system more than people who are less knowledgeable. Evidence for this is seen in a recent field trial of household computer use where “gurus” emerged within families, meaning knowledge was not equally acquired by all family members although all members had equal access (Kiesler, Zdaniuk et al., 2000). People who are more knowledgeable also perceive the knowledge as more owned by them personally, and their propensity to share is higher. Having more information to share than others, more knowledgeable people may feel less threatened by sharing since their knowledge supply is not greatly diminished by each act of sharing. The propensity to share depends on the type of information shared: It is attributed to personal benefits when expertise is shared (Constant, Kiesler et al., 1994; Jarvenpaa and Staples, 2000), and to communality and organizational citizenship and culture when information products are shared (Fulk, Flanagan et al., 1996; Kiesler, Zdaniuk et al., 2000; Wasco and Faraj, 2000). Demographic factors were found to contribute to the perception of ownership and propensity to share information in the survey by Jarvenpaa and Staples (2001).

Another factor that is likely to influence sharing is that sharing of information is done by copying. Sharing a copy leaves the originator in his/her original state less the cost of sharing which can reduce, increase, or leave unchanged the value of information. Not losing one’s own possession of information seems likely to lower the barrier to information sharing. Still, we know that people do not participate equally in information sharing activities. Also there are costs associated with sharing such as loss of exclusivity on information and investment of time and effort to share. It seems that some positive motivation is needed beyond the barrier reduction in order to explain sharing.

In summary, Section 4.4 presented an analysis of the public goods problem ("the tragedy of the commons") and how it affects information sharing. It went on to highlight other influences on the tendency to share, specifically, the influence of ownership status. The next section discusses why even if information is a public good, it is not necessarily a problem.

### 4.5 Information as Public Good - Revisited

In sharing situations information seems to fulfill mainly the first criterion of public goods, namely, non-rivalrous consumption. This is made possible by the technically-easy and
virtually costless capability to copy and distribute electronic information. The other two criteria, non-excludability and non-rejectability, are not always met for information since it is technically easy to exclude people from a group of information users as well as for people to reject electronic information. It follows that information can be a public good when all criteria are met, but it is usually not a public good in organizations (see Section 4.4).

An interesting perspective by Fulk et al. (1996) presents information as a hybrid good, where public good is achieved by individuals or companies acting out of their private interests. Patents are an example of a hybrid good, where an assignee’s private interests are protected while yielding public good by the publication of the invention. In fact, with patents the personal benefit is the driver to achieve the public benefit. Another example is academic articles which are published thanks to the interests of researchers but ultimately they provide the public good of advancing science and informing people of these advancements. Similar sentiment is offered by Connolly and Thorn (1990) who proposed privatization as a solution to the public goods problem, and by Jarvenpaa and Staples (2001) who brought up the term “shared ownership” of information by the individual and the organization.

If information in sharing situations were a public good, then we would expect the classical problem of free riding to occur. In the next section I present an analysis of free riding leading to the conclusion that free riding should not be a problem for information sharing systems once a critical mass of contributors has formed.

4.6 Is Free Riding a Problem for Information Sharing?

The main problem of public goods is free riding because it results in unbalanced contribution: some enthusiasts contribute while others enjoy those contributions without reciprocating. Eventually, enthusiasm will erode leading to the slowdown or even demise of the group or community. Free riding is made easy when certain participants can “hide” by using the good without contributing. Lack of physical proximity coupled with computing power results in the common practices of false identities and multiple identities which are widely practiced in the World Wide Web. False or multiple identities seem like the ideal hideout. Following the same logic, increased transparency should reduce free riding. Communication systems can help increase transparency. Although passive anonymous usage of shared information, known as “lurking”, is very convenient in
electronic systems, it is not an efficient form of information collection because one reads
whatever is published regardless of one’s own interests. Once a person wants to seek
specific help, transparency is obtained. While online systems enable false and multiple
identities, this is not believed to exist within companies. It is more characteristic of public
forums and chat lines.

Equity theory states that employees strive to achieve the same ratio of output to input as
their colleagues (Adams, 1965). Despite the natural tendency to apply equity theory to
electronic environments by having everyone contribute symmetrically to an electronic
communication system, it may not necessarily be the best mode of behavior. Free riding
may a blessing for online communication systems connecting many to many for the
following reasons:
1. It is better for the group if many members free ride than if they contribute
   negatively (poor knowledge, unexamined sources etc.). Negative contributions can create
   an intolerable overload of useless information.
2. Information sought tends to be unique. A free rider on a host of questions may
   become a contributor in a particular question. “Self-filtration” actually constitutes good
citizenship and professional ethics in this context.
3. Free riders are virtually invisible in online systems and tend to be ignored. They
   are not perceived as free riders.
4. Connectivity does not mean that everyone who is connected actually has
   information to contribute. Yet, these free riders get a unique learning opportunity and can
   feel as part of a community (Fulk, Flanagin et al., 1996).

All this is based on the assumption that a critical mass of knowledgeable contributors has
been achieved (Macy, 1990; Markus, 1990; Marwell and Oliver, 1993).
Summing up these arguments together with people’s natural tendency to share information
cited earlier, it seems that free riders are a welcome part of an online information system
and do not pose a problem.

In summary, although information does exist as a public good (see examples in Section
4.3), organizational information sharing is not necessarily beset by the classical problems
of public goods. Lurking or free-riding are not necessarily bad in computerized networked
contexts. Instead, it is suggested that organizational information sharing may be hampered
by the perception of ownership. Acknowledging private ownership by giving personal
credit to information creators and developers may facilitate better sharing.

The research question examined here will be: How does ownership of expertise or an
information product affect the propensity to share information?
The corresponding hypothesis is that private ownership is more conducive toward sharing
and that “privatizing” organizationally owned information products may enhance sharing
them. Privatization may carry some negative connotation relating to control and pricing,
however, in the context of information sharing ownership is believed to enhance sharing.
5. Main Research Questions and Hypotheses

The literature review so far has highlighted the role of ownership in the formation of subjective value. In trading we have seen that the Endowment Effect (EE) leads to an inflated valuation of owned objects and under-trading due to the gap between the perceived value to the seller and buyer. In non-trading situations (specifically, in a preference task) the mere ownership effect was shown to elevate the value of owned objects. The theoretical difference is that in trading, the EE is attributed to loss aversion, while in a non-trading context the mere ownership effect is attributed to an intrinsic association between the individual and his/her possessions without any imminent loss.

The EE bidding methodology is employed to examine the subjective value of information in trading situations. Then, mere ownership is tested in order to establish the influence of this effect on the formation of the subjective value of information in information sharing situations.

While these effects have been documented for various goods and personal possessions, they have not been tested in an information environment. Survey research cited in previous sections points to ownership as an important factor in promoting information sharing, a finding which awaits experimental testing. The present research aims to test the applicability of the EE and mere ownership effect in the realm of electronic information.

The research questions of the present research are:

1. Where is information (content or expertise) found on the WTA/WTP ratio continuum in trading situations?
2. Is the EE for content larger than the EE for expertise?
3. Is the EE for original information larger than for copy information?
4. Will originality (copy or original) of information have a different effect on the WTA/WTP ratio depending on the source of information (content or expertise)?
5. Are people more inclined to share personally-owned expertise than organizationally-owned information products (content)?
6. Will private/personal ownership of information products serve to enhance sharing of information products in organizational settings?
The hypotheses corresponding to the research questions are:

**H1:** The WTA/WTP ratio for information (content or expertise) is greater than unity and is at least three (as it is for private goods).

**H2:** The WTA/WTP ratio for content is larger than the WTA/WTP ratio for expertise.

**H3:** The WTA/WTP ratio for original information (content or expertise) is larger than for copy information.

**H4:** There will be an interaction between the source of information (content or expertise) and its originality (original or copy).

**H5:** Sharing personally-owned expertise is higher than sharing organizationally-owned information products.

**H6:** Sharing personally-owned information products is higher than sharing organizationally-owned information products.
6. Contribution of this Research

The present research aims to shed new light on the old question of the value of information. The importance of the perception of information value can hardly be overstated in this era of information-driven economy, information overload, and heated debates such as the debate on changing the paradigm of academic research publishing (http://www.nature.com/nature/debates/e-access/). Previously the value of information has received attention mainly from economists. The present research uses an interdisciplinary approach by bridging between psychology, experimental economics and information systems research. I advance a theoretical conceptualization of the influence of ownership on value perception and tested this conceptualization as it related to information trading or sharing in a laboratory setting. The outcome of the test may help pave the way to further theorizing on value perception and on specific value assignment to various facets and elements of information.

Some of the new angles this research offers are:

1. Personal perception of information value is viewed as the common denominator for trading and sharing information. Previous research has not offered a broad approach to both trading and sharing.

2. Association between an individual and his/her possession has been theorized as a basis for higher valuation of owned objects. This theory received empirical support when tested with everyday objects. The same theory will serve to test whether it applies to information sharing. Such association, or lack thereof, are central outcomes and qualities of information systems, especially in networked online contexts. Heated debates and legal disputes concerning email ownership, file sharing, deep linking and many others highlight the importance of and disagreement about ownership stemming from differing perceptions.

3. Information ownership has so far been researched mainly by survey methodology which favors external validity. This research will examine the question of ownership in a laboratory setting which enables tighter control of the variables of interest thus emphasizing internal validity.

4. EE methodology should help corroborate whether ownership is relevant to information trading as it is for trading various goods.
5. Establishing and refining EE methodology in an information environment can be a useful instrument for subsequent research.

6. The effect of distribution by copying on perceived value has not been previously researched. The ease and prevalence of copying in an information intensive culture calls for research attention to this particular trait.

7. Research results may also yield further insight into the classification of information being a private or a public good.

8. The present research offers an interdisciplinary approach combining theory and methodology from several relevant disciplines.

The findings of this research should be of significance to anyone interested in information science. Information and communication technologies (ICT) exist for the purpose of processing and transferring information. Demand for information is the basis for using ICT. When demand arises, information is transferred from databases to people and between individuals or groups of users. Understanding how people value the substance of information systems will help gain a deeper understanding of the origin and motivation behind the demand for information. Further, understanding how the value of information is perceived can help to bridge the gap between providers and consumers of information, and it may help the users become better consumers of information in this era of information overload.

As described in Chapter 1, “information” is a general term that, depending on context, can refer to data, content, knowledge or code. Attempting to provide conclusive answers which will encompass all facets of the subjective value of information would be overly ambitious and, naturally, beyond the scope of the present research. However, this research offers insights for further academic research as well as for practitioners.
7. Research Methods

7.1. Introduction

A simple computerized business game was selected as a research tool because business games in general involve decision-making where information aids in making those decisions. The game was modified to enable participants to trade in or share information. Section 7.4 depicts the research tool in detail. Before that we provide some explanation about the choice of the methodology used here.

The main inspiration for the methodology used in the experiments came from the field of experimental economics, and more specifically, from the literature on the Endowment Effect (EE). Beside the fact that the EE has been mostly tested experimentally, various considerations were made in choosing to an experiment as the research tool. A summary of those considerations follows below (Section 7.2).

Business games invariably require the use of information in aiding decisions. In this framework information can be manipulated as an independent variable. Often business games tend to be very complex in order to challenge the students’ ability to synthesize information from many sources in making a decision, and to add the dimension of worldly realism. In an experimental context worldly realism is referred to as external validity. A complex game is not suitable for laboratory experiments since it is difficult to control. This research used a simple business game called “The Lemonade Stand”. In the United States it is a well-known game since it is used to teach the basics of business to young children. In Israel, most people are not familiar with this game. Section 7.2 condenses the main consideration in choosing a laboratory experiment using a computerized business game.

7.2. Considerations in Performing Experiments Using a Computerized Business Game

The following points reflect a summary of various readings as well as our own writing (Benbasat, 1989; Mason and Cox, 1989; Schkade, 1989; Mason and Cox, 1989a; Raban, 2002; Raban and Rafaeli, 2003; Rafaeli and Raban, 2003; Rafaeli and Raban, 2003; Rafaeli, Raban et al., 2003):
1. A business game represents real business situations. Therefore, it offers a higher external validity than a pure laboratory experiment.

2. Various aspects of the game and information used in it can be manipulated, under tight control, to test their effects on the dependent variable. This suggests a high internal validity.

3. Controlled experiments support the inference of causal relationships more than other research methods.

4. Previous research studying information sharing and information ownership employed survey methodology which may have a higher external validity but requires complementary research in a controlled environment.

5. The experimenter has very little, if any, influence on the participants since the procedure is standardized and mostly automated.

6. The Lemonade Stand is very simple to understand and to operate:
   a. It does not require knowledge in economics or business administration. Decision making is simple and involves a limited number of variables and values. Participants could make sound decisions intuitively.
   b. A pilot experiment performed with 31 students of the Honors BA program showed that the participants understood the game well (Rafaeli and Raban, 2003). During the game sessions the experimenter answered questions. Typically, after a few minutes of playing the participants felt comfortable with the game and stopped asking questions.
   c. The pilot experiment revealed that participants enjoy the game, are challenged by it, and are enthusiastic and motivated to play. These sentiments came up during the game and in the debriefing session that followed.

7. The same research instrument, the Lemonade Stand game, will serve to test all the hypotheses, thus avoiding influences of using different tools.
7.3. Participants

The experiments were conducted with MBA, Economics, and Management Information Systems students from the University of Haifa, Tel-Aviv University and Ben Gurion University as participants.

In the Lemonade Stand each participant owns a stand for selling cups of lemonade to passers-by. The game is played as 'stand alone'. One player's actions do not influence the others. Therefore, the unit of analysis is the individual player. Each participant provides an 'observation'.

For the information trading experiments (EE) the participants were divided into four groups to allow a different order of presentation of the variables. Each group was presented with different order of scenarios using a Latin Square design (see Section 7.5.1) to test for the influence of order of presentation. For example, some participants started with the selling option while others were presented with the buying option first.

The players were seated in a computer lab with an individual computer for each player. They were not allowed to interact with each other but were allowed to ask the experimenter for clarifications.

Two hundred and ninety four (294) students participated in the information trading experiments: One hundred and fifty (150) were presented with the option to buy or sell a weather forecast sheet (content), and one hundred and forty four (144) were presented with the option to buy or sell weather forecast expertise.

For the information sharing experiments the participants were randomly divided into three different treatment groups based on the information source they received in the game (expertise, corporate information, private information). Here, too, the players were seated in a computer lab with an individual computer for each player. They were asked to interact with each other using an instant messaging application (described in Section 7.4.2) and were allowed to ask the experimenter for clarifications.

One hundred and seventy three (173) students participated in the information sharing experiments: Seventy one (71) received the information source 'expertise', sixty six (66) received the information source 'corporate information', and thirty six (36) received the information source 'private information'.

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7.4. Experimental Instrument

Variations of a Java-based computer simulation of an easy-to-understand and engaging business game called “The Lemonade Stand” were used as the experimental instrument. A basic version of the game can be found at http://gsb.haifa.ac.il/~draban/lemonade. This URL provides access to both Hebrew and English versions of the game. Since the game required modifications for the two major versions, trading and sharing, and for the different orders of presentation of the bids, a different URL was used for providing access to the games in actual use at any given time. That URL was: http://study.haifa.ac.il/~draban/lemonade.

In this simulation the player owns a lemonade stand and must operate it so as to maximize his/her profits by selling to passers-by. Participants make quality, pricing and inventory decisions. Each player is permitted to modify product quality parameters for the lemonade (amounts of sugar, lemons, and ice) and may also set the price charged per cup. Furthermore, players decide how much inventory (lemons, sugar, paper cups, ice) to purchase at each round (day), such purchases to be selected from three predefined options per raw material. The players’ price, quality, and inventory decisions are affected by information about weather conditions, made available prior to each business day (Figures 1, 2, 3), and also by the reactions of their clients, which appear as textual bubbles above their heads during the trading day (Figure 4). After entering all quality, inventory, and pricing decisions the player presses the “sell” button at his/her leisure to start the trading day. Selling is done automatically, based on the parameters entered, and cannot be interrupted by the player. During the trading, the player sees an animated representation of the stand and its environment, clients walking by, textual feedback with comments from clients, and the changing inventory status as a function of sales (Figure 4). Typically, a “day” takes two minutes. At the end of a business day the player is given feedback about clients’ satisfaction (Figure 5). After playing for several consecutive days, which constitute a cumulative “game”, the player is notified of the clients’ satisfaction and the overall net profit or loss (Figure 6). Players are urged to maximize their profit and are rewarded monetarily according to the actual profit achieved. The entire simulation is conducted in Hebrew for the benefit of participants who are all native Hebrew speakers. An English version is also available as seen in the figures below.
Figure 1: Lemonade quality and price determination screen (English version)

Figure 2: Lemonade inventory control (English version)
**Figure 3:** Lemonade inventory purchasing sample screen (English version)

**Figure 4:** Lemonade animated business day including weather information, total income, and inventory status (English version)
Figure 5: End of business day report including information on client satisfaction and popularity (English version)

Figure 6: End of business period report including gross income, expenses, inventory and net profit or loss (English version)
7.4.1. Information Trading Variation

Endowment Effect methodology involves a bidding mechanism whereby participants submit bids for buying a good (Willingness to Pay, WTP) and bids for selling a good (Willingness to Accept payment, WTA). In the literature cited in Chapter 3 the bids were usually submitted by filling a form. In the present research bids were submitted electronically.

To operationalize the EE methodology an incentive compatible bidding mechanism was added before each game. See Section 7.4.3.3 for an explanation of incentive compatibility. Before each game players were presented with a screen containing text describing the information they own or are able to purchase, and then were asked to submit their bids for selling or buying information. The bids were submitted using a CGI form and the data entered were submitted to the general game database (SQL). Players were asked to confirm their bids before proceeding using a Javascript prompt. This was done to ensure that the bid was correct and reflected the true private value rather than a typing error or other artifact. The general game database contained the bids submitted as well as all data collected on the independent and dependent variables and other game data (Sections 7.4.3).

7.4.2. Information Sharing Variation

To enable fast and easy information sharing an instant messaging (IM) application was added to the game setup. Each player was presented with a split screen containing the game itself on one side and the IM application on the other side. The purpose of having the IM application constantly accessible was to increase the players’ awareness of incoming messages as well as encourage the use of this option.

The IM application was implemented using a pair of Java-based client and server programs that allow establishing synchronous group text communication. There was no theoretical limit on group size or server load. The IM enabled sending and receiving both personal and public messages. Both the sender and the recipient(s) saw the message appearing on their respective screens with a banner stating whether the message was personal or public. Users had access to a full record of the session starting at the time they connected. Figure
7 provides a screenshot of the split screen used for the information sharing experiments including the IM application.

Figure 7: Split screen for information sharing experiments containing the Lemonade Stand simulation on the left and the IM application and the link to the forecast on the right (Hebrew version. An English version is not available currently)

The system maintained a log of all traffic (both private and public), including time stamps. There are separate English and Hebrew versions. Currently, the system does not allow multilingual traffic. The Hebrew version was used in all the experimental sessions for this research. Multiple virtual teams can be created using the same basic set of files.

A barebone demo of the Hebrew version is available here: http://study.haifa.ac.il/~draban/chat. To experience this demo, two or more users need to logon simultaneously. This can be done by one user opening two windows on the same PC.
To summarize, we purchased the source code of the Lemonade Stand from its developer with permission to modify and use for research purposes. The main modifications and development work that was done to the original game were:

1. Translation of all texts and labels into Hebrew
2. The game was made generic and flexible by using externally-set parameters for its values
3. Introduction of the bidding mechanism for weather information
4. Introduction of the IM application to enable information sharing

7.4.3. Variables and Measures

7.4.3.1. Types of Information Available in the Simulation

The Lemonade Stand game includes several types of information. These include but are not limited to:

- Weather information
- Price of each raw material or ingredient
- Best lemonade price for given weather conditions
- Best lemonade formulation for given weather conditions
- Inventory losses at the end of business days
- Help screens

All of these types of information can be manipulated. This research focused on weather information because weather information influences the demand for lemonade and therefore is relevant and important to the players. On the other hand, such information is not an outcome of the players’ actions which means identical weather information can be presented to all participants and thus preventing game variation between participants.

7.4.3.2. Dependent Variables

Two pairs of dependent variables (DV) were the willingness to pay for original or copy information (WTP and WTPC), and the willingness to accept payment for original or copy information (WTA and WTAC). While the principal dependent variables in trading were WTP and WTA, dependent variables which actually reflect one of the independent variables, originality, were used for more clarity in reporting. WTA and WTP denote the DV when originality is in the first level, original/exclusive content or expertise. WTAC and WTPC denote the DV when originality is in the second level, copy content or
expertise. Computed dependent variables included the ratios between WTA and WTP and between WTAC and WTPC.

Another dependent variable was the willingness to share information (WTS).

Following is a detailed description of each of the dependent variables (please refer also to Table 2):

1. Stated value for the willingness to pay for original weather information (WTP in US Dollars) entered by the participants in an empty dialog box in response to the online question: “Please state the price you are willing to pay in order to purchase the exclusive rights to original weather content (or expertise) for the entire game period. The trade will take place only if your bid complies with the current market price.” Participants were asked to reconfirm their bid (with an option to change) prior to proceeding with the game.

2. Stated value for the willingness to pay for a copy weather information (WTPC in US Dollars) entered by the participants in an empty dialog box in response to the online question: “Please state the price you are willing to pay in order to purchase a copy weather content (or expertise) for the entire game period. The trade will take place only if your bid complies with the current market price.” Participants were asked to reconfirm their bid (with an option to change) prior to proceeding with the game.

3. Willingness to accept payment for original weather information (WTA in US Dollars) entered by the participants in an empty dialog box following the question: “Please state the price for which you will agree to sell the exclusive rights to original weather content (or expertise) for the entire game period. After selling the information you will play without weather data. The trade will take place only if your bid complies with the current market price.” Participants were asked to reconfirm their bid (with an option to change) prior to proceeding with the game.

4. Willingness to accept payment for a copy of weather information (WTAC in US Dollars) entered by the participants in an empty dialog box following the question: “Please state the price for which you will agree to sell a copy of weather content (or expertise) for the entire game period. After selling the information you will play with weather data. The trade will take place only if your bid complies with the current market price.” Participants were asked to reconfirm their bid (with an option to change) prior to proceeding with the game.
5. Ratios between selling and buying price bids (WTA/WTP and WTAC/WTPC) were calculated for each participant. Further explanation of the ratios follows below.

6. Willingness to share information (WTS) was collected from the response to personal and general Instant Messaging (IM) messages requesting the sharing of information: “Does anyone know the forecast for the next three days of the game?” Or: “I heard you have the forecast for the next three days. Would you be willing to share that information with me?” Textual answers to the IM requests were transformed to numerical values reflecting willingness to share or lack thereof (this is a nominal variable with two levels: 'share' and 'no share').

Before continuing the presentation of variables the calculated dependent variable (number 5 in the list above) requires some further explanation. Two ratios were calculated for each participant, WTA/WTP for original information (expertise OR content) and WTAC/WTPC for copy information (expertise OR content). For the statistical analysis of the hypotheses, mean ratios were calculated. The mean ratios were used rather than a ratio of means or a median as some have reported in the literature. Reporting the mean of ratios was preferred in this study because it is believed to be the best reflection of the individual bids which in turn reflect the individual subjective values assigned to the weather information in the Lemonade game. Reporting a ratio has several advantages over reporting individual values that comprise the ratio. First, a group of ratios is likely to have less variance than its components. Secondly, a ratio is unit-free and enables comparison of experiments run in different countries. Thirdly, a ratio neutralizes the object of the experiment and becomes an index in its own right. Here the ratio is an indicator of the type of good at hand. Finally, in the present case, a ratio is the traditional way to report results of experiments testing for the EE. The problem with the ratio of the mean values of WTA and WTP is that it does not reflect the individual ratios and that it is not usable for statistical analysis since it is a single point calculation. A ratio of means may be the value of choice when participants in an experiment bid only on one value, either WTA or WTP because then an individual ratio cannot be established.

7.4.3.3. Independent Variables

Two independent variables were defined: Source of information and originality. Source referred to the distinction between expertise and content. Originality referred to whether
the information is original or a copy. A 2X2 design was employed in the trading experiments to test all combinations of source and originality. Interaction effects were also tested. Different orders of presentations were employed, using a Latin Square, to check whether order of presentation of the bidding questions affected the bid values (see Table 4). Weather information was framed as part of the knowledge of the business owner (expertise) or it was presented as a document containing the forecast (content).

In the sharing experiments expertise was assumed to be privately owned while content was assumed to be either organizationally or privately owned (Constant, Kiesler et al., 1994).

Table 2 summarizes the independent and dependent variables used for testing the hypotheses.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Independent</th>
<th>Dependent</th>
<th>Method of Elicitation or Collection</th>
</tr>
</thead>
<tbody>
<tr>
<td>Source of information</td>
<td>+</td>
<td></td>
<td>Described in call for bid</td>
</tr>
<tr>
<td>Originality or information</td>
<td>+</td>
<td></td>
<td>Described in call for bid</td>
</tr>
<tr>
<td>WTP for content or expertise (1)</td>
<td></td>
<td>+</td>
<td>Incentive compatible bid</td>
</tr>
<tr>
<td>WTPC for content or expertise (2)</td>
<td></td>
<td>+</td>
<td>Incentive compatible bid</td>
</tr>
<tr>
<td>WTA for content or expertise (3)</td>
<td></td>
<td>+</td>
<td>Incentive compatible bid</td>
</tr>
<tr>
<td>WTAC for content or expertise (4)</td>
<td></td>
<td>+</td>
<td>Incentive compatible bid</td>
</tr>
<tr>
<td>WTA/WTP ratio (5)</td>
<td></td>
<td>+</td>
<td>Calculated</td>
</tr>
<tr>
<td>WTAC/WTPC ratio (5)</td>
<td></td>
<td>+</td>
<td>Calculated</td>
</tr>
<tr>
<td>WTS for private or organizational information products or for expertise (6)</td>
<td></td>
<td>+</td>
<td>IM prompt</td>
</tr>
</tbody>
</table>

Table 2: Independent and dependent variables and methods of elicitation or collection thereof. The numbers in parentheses correspond to the number in Section 7.4.3.2.
Values of WTP, WTPC, WTA and WTAC (see Table 2 above) were elicited by bidding. For the bids, market prices of the information trades were built into the simulation but were not known or revealed. The players were only told that market prices were determined randomly, were not influenced by their bids (to prevent collusion), and that trades would be executed at market prices if the bids they offered were acceptable. This was done to ensure incentive compatibility according to the Becker-Degroot-Marschak principle (Becker, DeGroot et al., 1964). This principle is a method enabling the elicitation of true private values. Players know that the market price is not affected by them and they don’t know its value. Bids cannot aim to a random and unknown value so that they must reflect the true private value.

Measure number 5 above (Section 7.4.3.2 and Table 2) is the individual ratio calculated for each participant. The rationale for calculating individual ratios rather than a ratio of means (mean WTA divided by mean WTP) was based on several reasons:

a. Each participant provided both values that make up the ratio.
b. An individual ratio is a better measure of individual subjective value.
c. A mean of ratios can be calculated and used in statistical analysis while a ratio of means cannot.

7.4.3.4. Other Data Collected

The following data were recorded automatically in the SQL database specifically constructed for this purpose:

1. Game profits at the end of each day and each game period
2. Quality parameters entered (amounts of lemons, sugar and ice in formulation)
3. Inventory parameters entered (amounts purchased: cups, lemon, sugar, ice)
4. Lemonade selling price
5. Frequency of use of the online help option
6. Reputation (number of clients who came following a recommendation by satisfied clients)
7. Popularity (derived from the number of clients who bought lemonade out of the total number of clients).
7.5. Procedure

The experiment was preceded by a detailed in-class presentation explaining the simulation along with handouts that consist of the instructions and sample screenshots. In the information trading games a prize was offered to the player who achieved highest profits. In the information sharing games a prize was not offered because a cooperative rather than competitive environment was sought. The initial game budget allotted to the players was one-hundred dollars and trading bids were limited to this amount ($0-100). Participants were told that profits could be made in each of two ways: 1. By trying to optimize the inventory, lemonade quality, and price per cup depending on the weather data (if available). 2. In the trading scenario by trading information (selling generates direct income, while buying information can generate indirect payoffs if played wisely). The players were also reminded to use the help screens to better understand the game.

The trading experiment began with two warm-up training games of three days each, one with and one without, weather information. The training games were designed only for the purpose of getting acquainted with the game and did not count toward the final profit calculations. The training games were followed by four real games of three days each. In the real games of the trading scenario players were given either expertise or product (weather information), and disclosed their private values for the information by bidding. Every player submitted bids for four types of trades: Buying an original, buying a copy, selling an original, selling a copy.

The sharing scenario was a single game of 20 business days. Players were given expertise or an information product (corporate or private) and were told that the first six days do not count toward profit. They then received IM requests for weather information from virtual peers asking them to share their expertise or product. Table 3 summarizes the manipulations (the acronyms are explained following the table):
<table>
<thead>
<tr>
<th>Information Received Before Real Game</th>
<th>Dependent Variable</th>
<th>Elicitation Method</th>
</tr>
</thead>
<tbody>
<tr>
<td>None</td>
<td>WTP</td>
<td>Bid</td>
</tr>
<tr>
<td>None</td>
<td>WTPC</td>
<td>Bid</td>
</tr>
<tr>
<td>Expertise or content</td>
<td>WTA</td>
<td>Bid</td>
</tr>
<tr>
<td>Expertise or content</td>
<td>WTAC</td>
<td>Bid</td>
</tr>
<tr>
<td>Expertise</td>
<td>WTS</td>
<td>IM-private</td>
</tr>
<tr>
<td>Expertise</td>
<td>WTS</td>
<td>IM-public</td>
</tr>
<tr>
<td>Organizational content</td>
<td>WTS</td>
<td>IM-private</td>
</tr>
<tr>
<td>Organizational content</td>
<td>WTS</td>
<td>IM-public</td>
</tr>
<tr>
<td>Private content</td>
<td>WTS</td>
<td>IM-private</td>
</tr>
<tr>
<td>Private content</td>
<td>WTS</td>
<td>IM-public</td>
</tr>
</tbody>
</table>

Table 3: Summary of the dependent variables measured and the methods of elicitation for each manipulation of information.

Explanation of acronyms used in Table 3:
WTP – Willingness to pay for original weather information
WTPC – Willingness to pay for a copy of weather information
WTA – Willingness to accept payment for original weather information
WTAC – Willingness to pay for a copy of weather information
WTS – Willingness to share weather information

Sections 7.5.1 and 7.5.2 describe in more detail the experiments performed for information trading and information sharing respectively.

7.5.1 Experiments on Trading Information

Table 4 summarizes the set of experiments performed to test hypotheses H1 – H4 presented in Chapter 5. The experiments were designed based on EE bidding methodology and reflect the unique features of information discussed in Section 4.4:

- The distinction between expertise and information products.
- That information is often distributed by copying.
1. Participate in presentation explaining the game and receive instructions handout.

2. Play two warm-up games consisting of three business days each to get acquainted with the game.

3. For WTA elicitation: Receive information as expertise or content and statement about the possibility of selling.
   For WTP elicitation: Receive statement about the possibility to purchase expertise or content (one type of information per participant).

4. Enter bid for expertise or information product according to choice made.

5. Play game with or without expertise or information product according to results of bid.

6. Repeat sections 3-5 five times more.

**Total games played:** Six games of three business days each (Two warm-up games, one game bidding for WTA, one game bidding for WTP, one game bidding for WTAC, one game bidding for WTPC)

**Order of presentation of bids (dependent variables):**
WTA=Willingness to accept payment for original information sold.
WTAC=Willingness to accept payment for a copy of the information sold.
WTP=Willingness to pay for original information bought.
WTPC=Willingness to pay for copy of information bought.

<table>
<thead>
<tr>
<th>Group #</th>
<th>1st Bid</th>
<th>2nd Bid</th>
<th>3rd Bid</th>
<th>4th Bid</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group 1</td>
<td>WTP</td>
<td>WTA</td>
<td>WTPC</td>
<td>WTAC</td>
</tr>
<tr>
<td>Group 2</td>
<td>WTAC</td>
<td>WTP</td>
<td>WTA</td>
<td>WTPC</td>
</tr>
<tr>
<td>Group 3</td>
<td>WTPC</td>
<td>WTAC</td>
<td>WTP</td>
<td>WTA</td>
</tr>
<tr>
<td>Group 4</td>
<td>WTA</td>
<td>WTPC</td>
<td>WTAC</td>
<td>WTP</td>
</tr>
</tbody>
</table>

**Table 4: Information trading experiments for testing hypotheses H1 – H4.**
7.5.2 Experiments on Sharing Information

Table 5 summarizes the set of experiments conducted to test hypotheses H5 and H6 presented in Chapter 5. In order to operationalize information sharing an IM application was added to the existing simulation. After registration to the game, each player was presented with a split screen which consisted of three parts: 1. The lemonade game  2. The IM application  3. The information source (link to another window containing a table of weather information defined as expertise or content). The information source included incomplete data. Of the twenty business days in the game, weather information was provided for sixteen days and was missing in four days. The purpose of this omission was to create a sense that the requests for help were genuine since information was really missing. Players received requests for information from what seemed to them to be other players. In fact, these were standard messages sent by the experimenter. The requests referred to days where the experimenter knew that the player do have the information in their weather information table. The responses of willingness to share were collected automatically. Non-response was counted as a negative response.
1. Participate in presentation explaining the game and receive instructions handout.

2. Register to game and receive the split screen including the game, the IM application, and information source (expertise or content).

3. Start playing the game and receive a welcome message in the IM part of the screen.

4. Receive a public message requesting information (Does anyone know the forecast for the next three days of the game?). Answer and continue playing.

5. Receive a personal message (by first name) requesting information (Would you please send me the weather forecast for day 5?). Answer and continue playing

6. When game is over, answer the manipulation check question about source of information used.

**Total games played:** One game consisting of 20 business days (decision rounds). Each of the randomly assigned groups of players received a different source of information.

**Order of presentation of sharing requests (dependent variables):**

<table>
<thead>
<tr>
<th>Group 1: expertise</th>
<th>WTS-Pri</th>
<th>WTS-Pub</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group 2: organizational document</td>
<td>WTS-Pri</td>
<td>WTS-Pub</td>
</tr>
<tr>
<td>Group 3: private document</td>
<td>WTS-Pri</td>
<td>WTS-Pub</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Group 1: expertise</th>
<th>WTS-Pub</th>
<th>WTS-Pri</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group 2: organizational document</td>
<td>WTS-Pub</td>
<td>WTS-Pri</td>
</tr>
<tr>
<td>Group 3: private document</td>
<td>WTS-Pub</td>
<td>WTS-Pri</td>
</tr>
</tbody>
</table>

**Table 5: Experiments for testing hypotheses H5 and H6.**
8. Results

8.1. Information Trading

This section details the results of in the EE experiments. These results reflect data collected from two hundred and ninety four (294) students who provided their private value bids for buying and selling information as described in Section 7.5.1. All participants provided bids in every opportunity presented to them since the bidding mechanism was in-line with the game and could not be skipped. Each participant submitted a total of four bids, one for each dependent variable (WTA, WTP, WTAC, WTPC) for either expertise or content.

A one-way ANOVA was performed on the four groups of both the content and the expertise variations of the independent variable ‘source’. Each of the four groups represented a different order of presentation of the buying or selling of original or copy information. This analysis was performed in order to test whether order of presentation influenced the private values of the participants. Table 6 summarized the ANOVA results.

<table>
<thead>
<tr>
<th></th>
<th>Content (n=150)</th>
<th>Expertise (n=144)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>F</td>
<td>Significance</td>
</tr>
<tr>
<td>WTP</td>
<td>0.62</td>
<td>0.61</td>
</tr>
<tr>
<td>WTA</td>
<td>0.82</td>
<td>0.48</td>
</tr>
<tr>
<td>WTPC</td>
<td>1.20</td>
<td>0.31</td>
</tr>
<tr>
<td>WTAC</td>
<td>1.31</td>
<td>0.27</td>
</tr>
<tr>
<td>WTA/WTP</td>
<td>1.00</td>
<td>0.40</td>
</tr>
<tr>
<td>WTAC/WTPC</td>
<td>0.44</td>
<td>0.73</td>
</tr>
</tbody>
</table>

Table 6: Results for one-way ANOVA for four groups representing different orders of presentation of bids for the content and expertise variations of the game.

Explanation of acronyms used in Table 6:
WTP – Willingness to pay for original weather information
WTA – Willingness to accept payment for original weather information
WTPC – Willingness to pay for a copy of weather information
WTAC – Willingness to pay for a copy of weather information
WTA/WTP – EE ratio for original information
WTAC/WTPC – EE ratio for copy information

Table 6 shows that usually there is no significant difference between groups representing different orders of presentation of the bids. Significant differences were observed for WTP and WTA of expertise. Nevertheless, the data of the four groups will be combined based on the following arguments:

a) The research hypotheses refer to the ratios, not the values comprising the ratios. No significant difference was found for the WTA/WTP and WTAC/WTPC ratios.

b) There is no theoretical basis to assume that there should or can be a difference.

c) The difference found can be attributed to the computerized medium as will be explained in the Discussion.

The data from the four groups of each of the two levels of the independent variable ‘source’ have been combined for the analysis that follows. This analysis has been performed in order to test hypotheses H1-H4 listed in Chapter 5. The results of several additional analyses have been added although they were not mandated by the formal hypotheses. These analyses were added to gain a better understanding of the data obtained. All formal and additional analyses are presented in this section and discussed in Chapter 9.

**H1:** The WTA/WTP ratio for information (content or expertise) is greater than unity and is at least three (as it is for private goods).

To test this hypothesis one sample t-tests were performed to compare the mean ratios of content and expertise with the values of one and three. Table 7 summarizes the findings of these tests for original and copy content and expertise.
<table>
<thead>
<tr>
<th></th>
<th>Mean Ratio</th>
<th>Std. Dev.</th>
<th>Test Value=1</th>
<th>Test Value=3</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>t</td>
<td>Significance</td>
</tr>
<tr>
<td>Original Content</td>
<td>2.79</td>
<td>3.45</td>
<td>6.37</td>
<td>0.00*</td>
</tr>
<tr>
<td>Original Expertise</td>
<td>2.74</td>
<td>3.01</td>
<td>6.95</td>
<td>0.00*</td>
</tr>
<tr>
<td>Copy Content</td>
<td>2.04</td>
<td>2.76</td>
<td>4.60</td>
<td>0.00*</td>
</tr>
<tr>
<td>Copy Expertise</td>
<td>1.85</td>
<td>2.27</td>
<td>4.53</td>
<td>0.00*</td>
</tr>
</tbody>
</table>

Table 7: Results for one-sample t-tests comparing the means of the ratios for original and copy content and expertise to values of 1 and of 3.

Table 7 shows that the mean ratios for original content and expertise are significantly different than unity (test value=1) and are not significantly different from three (test value=3), the value prevalent in the literature about market goods WTA/WTP ratio. Table 7 also suggests that the WTA/WTP ratio for copy content and expertise is close to a value of two. Additional analysis of the data, not mandated by a formal hypothesis, was performed and is presented in Table 8 below.

<table>
<thead>
<tr>
<th></th>
<th>Mean Ratio</th>
<th>Std. Dev.</th>
<th>Test Value=2</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>t</td>
</tr>
<tr>
<td>Copy Content</td>
<td>2.04</td>
<td>2.76</td>
<td>0.17</td>
</tr>
<tr>
<td>Copy Expertise</td>
<td>1.85</td>
<td>2.27</td>
<td>-0.77</td>
</tr>
</tbody>
</table>

Table 8: Results for one-sample t-tests comparing the means of the ratios for copy content and expertise to a value of 2.

Results displayed in Table 8 confirm that the mean ratios for copy content and expertise are not significantly different than two. Overall Tables 7 and 8 reveal a value of 3 for the WTA/WTP ratio of original information, content or expertise. Copy information yields a ratio of two (WTAC/WTPC).
In summary, the experimental data collected provides support for H1: The WTA/WTP ratio for information (content or expertise) is greater than unity and is at least three (as it is for private goods).

**H2:** The WTA/WTP ratio for content is larger than the WTA/WTP ratio for expertise.

To test this hypothesis independent samples t-tests were performed to compare the mean ratios of content and expertise. Table 9 summarizes the findings of these tests for original and copy content and expertise.

<table>
<thead>
<tr>
<th></th>
<th>Mean Ratio</th>
<th>Std. Dev.</th>
<th>t</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Original Content</td>
<td>2.79</td>
<td>3.45</td>
<td>-1.33</td>
<td>0.89</td>
</tr>
<tr>
<td>Original Expertise</td>
<td>2.74</td>
<td>3.01</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Copy Content</td>
<td>2.04</td>
<td>2.76</td>
<td>-0.62</td>
<td>0.54</td>
</tr>
<tr>
<td>Copy Expertise</td>
<td>1.85</td>
<td>2.27</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Table 9: Results for independent samples t-tests comparing the means of the ratios for original and copy content and expertise.**

Table 9 shows that the mean ratios for original and copy content and expertise are not significantly different from each other. H2 did not receive support by the experimental results.

**H3:** The WTA/WTP ratio for original information (content or expertise) is larger than for copy information.

To test this hypothesis a paired samples t-test was performed to compare the mean ratios of original content and expertise and copy content and expertise. Table 10 summarizes the findings of the test of the independent variable ‘originality’
Table 10: Results for a paired samples t-test comparing the means of the ratios for original and copy content and expertise.

Table 10 reveals that original information is valued significantly higher than copy information. The third hypothesis, H3, received support from the data collected.

**H4:** There will be an interaction between the source of information (content or expertise) and its originality (original or copy).

To test this hypothesis a univariate ANOVA was performed to compare the variances of original content and expertise ratios and copy content and expertise ratios and to test for interaction effects between the independent variables, source and originality. Table 11 summarizes the findings of the test of the independent variable ‘originality’

<table>
<thead>
<tr>
<th>Independent Variable</th>
<th>F</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Originality</td>
<td>11.74</td>
<td>.00*</td>
</tr>
<tr>
<td>Source</td>
<td>.24</td>
<td>.63</td>
</tr>
<tr>
<td>Originality*Source</td>
<td>.08</td>
<td>.78</td>
</tr>
</tbody>
</table>

Table 11: Results for a univariate ANOVA comparing the variances of the ratios for original and copy content and expertise and the interactions between them.

Table 11 shows that while different levels of originality bear a significant influence on private values, there is no significant difference attributed to the source of information. This is in agreement with findings shown in Tables 9 and 10. In addition Table 11 shows there is no interaction effect between the two independent variables, originality and source. Originality is significant regardless of the source. The value attributed to a specific source

<table>
<thead>
<tr>
<th>Originality and Expertise</th>
<th>Mean Ratio</th>
<th>Std. Dev.</th>
<th>t</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Original Content and Expertise</td>
<td>2.77</td>
<td>3.24</td>
<td>3.64</td>
<td>0.00</td>
</tr>
<tr>
<td>Copy Content and Expertise</td>
<td>1.95</td>
<td>2.53</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
does not change with different levels of originality. H4 did not receive support in the present experiment.

Other data that help to shed light on the subjective value of information include the percent of games played with information and the profit with and without the use of weather information. Table 12 provides profit and information usage data.

<table>
<thead>
<tr>
<th>Bid Type</th>
<th>% Games Played with Weather Information</th>
<th>Mean Game Profits</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Content</td>
<td>Expertise</td>
</tr>
<tr>
<td>WTP</td>
<td>35.3</td>
<td>43.6</td>
</tr>
<tr>
<td>WTA</td>
<td>76.7</td>
<td>85.4</td>
</tr>
<tr>
<td>WTPC</td>
<td>50.7</td>
<td>59.0</td>
</tr>
<tr>
<td>WTAC*</td>
<td>100.0</td>
<td>100.0</td>
</tr>
</tbody>
</table>

*All games played with weather information because WTAC is a bid for selling a copy of the information.

**Table 12: Percent of games played with weather information and the corresponding mean profit.**

Table 12 reveals under trading where the proportion of games played with information was lower than 50% for those offered to buy weather information and higher than 50% for those given the chance to sell it. Theoretically 50% of the possible trades are expected to take place (Kahneman, Knetsch et al., 1990). Interestingly, the rate of purchasing copy information (WTPC) was high and no under trading was observed in this case. This shows that as the value of the ratio approaches unity, less and less under trading occurs.

Another striking trend that emerges from Table 12 is that more games played with expertise as the information source were played with information, indicating a higher rate of success in the expertise bids than in the content bids.

Game profits were unrelated to the bid type or the information source since identical weather conditions and information were given to all players. Table 12 shows that profit depended on the specific sequence of weather conditions per game.
8.2. Information Sharing

This section details the results received in the information sharing experiments. These results reflect data collected from one hundred and seventy three (173) students who played the Lemonade Stand game including the instant messaging application (IM) as described in Section 7.5.2. The IM was used for personal and public communication among the players and between them and the experimenter. The weather information source was missing the forecast for four out of twenty business days in order to give credibility to the help requests sent by the experimenter. Participants thought the requests came from a fellow player. An indication that this framing worked is the fact that many players sent requests for help to others for the four days of missing weather information. They were not aware that, in point of fact, all players were given the same weather information.

Each participant received from the experimenter two requests for sharing information during the game. One request was addressed personally by name per participant and one request was sent publicly to all participants. Figures 8 and 9 show the number of participants who shared information upon receiving personal and public requests respectively.
Figure 8: Willingness to share information from different sources upon receipt of a personal request.
Overall, the tendency not to share information was found to be much higher than the tendency to share. Specifically, on average about 19% of all players shared information when they received a private request while 11.6% shared information when receiving a public request. Sharing was done by 23.9% of the players who received a personal request for sharing expertise and by 10.6% of the players who received a personal request for sharing organizational content. Results in the same direction, where the willingness to share expertise was higher than that for organizational information, were obtained when the request was sent publicly. When receiving a public request for sharing information 14.1% of the players shared expertise, while only 7.6% shared organizational content. Overall, 28.2% of the players shared expertise while 16.7% shared organizational content.

**H5:** Sharing personally-owned expertise is higher than sharing organizationally-owned information products.
To test this hypothesis a 2X2 Chi Square ($\chi^2$) test was performed to find whether the two sources of information (expertise/corporate information) were associated with two levels of information sharing (share/no share). Since the hypothesis is directional, Fisher's Exact Test significance for one-sided hypotheses is reported here. The data and results for the $\chi^2$ test are shown in Tables 13-14.

<table>
<thead>
<tr>
<th></th>
<th>Personal Request</th>
<th>Public Request</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Share</td>
<td>No Share</td>
</tr>
<tr>
<td>Expertise</td>
<td>17</td>
<td>54</td>
</tr>
<tr>
<td>Corporate Information</td>
<td>7</td>
<td>59</td>
</tr>
<tr>
<td>Total</td>
<td>24</td>
<td>113</td>
</tr>
<tr>
<td>$\chi^2$</td>
<td></td>
<td>4.211</td>
</tr>
<tr>
<td>Fisher's Sig.</td>
<td></td>
<td>0.033*</td>
</tr>
</tbody>
</table>

Table 13: $\chi^2$ tests for frequency of sharers and non-sharers in response to personal and public requests for expertise and corporate information.

<table>
<thead>
<tr>
<th></th>
<th>Combined Requests</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Share</td>
</tr>
<tr>
<td>Expertise</td>
<td>20</td>
</tr>
<tr>
<td>Corporate Information</td>
<td>11</td>
</tr>
<tr>
<td>Total</td>
<td>31</td>
</tr>
<tr>
<td>$\chi^2$</td>
<td></td>
</tr>
<tr>
<td>Fisher's Sig.</td>
<td></td>
</tr>
</tbody>
</table>

Table 14: $\chi^2$ test for frequency of sharers and non-sharers in response to both personal and public requests for expertise and corporate information.

Tables 13 shows a statistically significant difference in the willingness to share expertise vs. corporate information when the request is made personally. For public requests no such significance was detected. Generally, sharing was lower in response to public requests compared to personal requests (15 vs. 24 sharers out of 137 participants).
When studying the response to both types of requests (Table 14), about 28% (20 of 71) of participants shared expertise while less than 17% (11 of 66) shared corporate information. This difference is not statistically significant.

**H6**: Sharing personally-owned information products is higher than sharing organizationally-owned information products.

To test this hypothesis a 2X2 Chi Square ($\chi^2$) test was performed to find whether the two sources of information (corporate information/private information) are associated with two levels of information sharing (share/no share). Since the hypothesis is directional Fisher's Exact Test significance for one-sided hypotheses is reported here. The data and results for the $\chi^2$ test are shown in Tables 15-16.

<table>
<thead>
<tr>
<th></th>
<th>Personal Request</th>
<th>Public Request</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Share</td>
<td>No Share</td>
</tr>
<tr>
<td>Private Information</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Share</td>
<td>9</td>
<td>27</td>
</tr>
<tr>
<td>No Share</td>
<td>27</td>
<td>9</td>
</tr>
<tr>
<td>Total</td>
<td>36</td>
<td>59</td>
</tr>
<tr>
<td>Corporate Information</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Share</td>
<td>7</td>
<td>59</td>
</tr>
<tr>
<td>No Share</td>
<td>59</td>
<td>7</td>
</tr>
<tr>
<td>Total</td>
<td>66</td>
<td>66</td>
</tr>
<tr>
<td>$\chi^2$</td>
<td>3.649</td>
<td></td>
</tr>
<tr>
<td>Fisher's Sig.</td>
<td>0.054*</td>
<td></td>
</tr>
</tbody>
</table>

*Table 15: $\chi^2$ tests for frequency of sharers and non-sharers in response to personal and public requests for private information and corporate information.*
Table 16: χ² test for frequency of sharers and non-sharers in response to both personal and public requests for private information and corporate information.

Table 15 shows a borderline statistically significant difference in the willingness to share private information vs. corporate information when the request is made personally. Sharing is lower for public requests compared to personal requests. For public requests no statistically significant difference was observed for the information sources used. Overall when combining the data from both types of requests a statistically significant difference in willingness to share was observed: As hypothesized, sharing is higher for private information than for corporate information (Table 16).

Although no hypothesis was made in the doctoral research proposal, and theoretical background for this has not been covered, an analysis of the results for the public vs. personal requests was done. A McNemar test for repeated measures was performed to see if there was a difference between the two request types in terms of the willingness to share information (see figures 8 and 9 above for frequency of sharers in each type of request). A significant difference was indeed detected (p<0.035) for the request types. Sharing was higher for personal requests (33 sharers, 19.1% of players) than for public requests (20 sharers, 11.6% of players).

Hypotheses H5 and H6 provided comparisons of the willingness to share in two pairs of information sources: expertise – organizational content, private content – organizational content. The third possible pair of information sources, expertise – private content, was not part of the formal hypotheses, however, I decided to perform analysis of this pair as
well in order to complete the analytical picture. A 2X2 Chi Square ($\chi^2$) test was performed to find whether the two sources of information (expertise/private information) are associated with two levels of information sharing (share/no share). No statistically significant difference was found for this pair.


9. Discussion

The main findings of the present research were that in trading situations information is valued similarly to other market goods except when it is traded as a copy. Copy information was valued lower than original information. The type or source of information did not significantly influence value perception. Under trading was revealed more marked for original information than for copy information.

The overall tendency to share information was found to be low, as reported by other researchers. Sharing was significantly higher when requests for help were made in private than when they were made publicly. Private ownership of information resulted in more helpful sharing responses than organizational ownership.

Using the Lemonade Stand game as a tool for researching the value of information has proven to be very productive. Results indicate that the trading and sharing of information are less-than-rational, less-than-optimal. Under-trading and under-sharing has occurred support the notion that players in the game preferred to play in an information-deprived environment rather than make use of the low-risk (trading) or risk-free (sharing) opportunities given to them. Optimal levels of trading were discussed in the literature review in Chapter 3. A discussion of optimal sharing levels will follow in Section 9.2.2.

Ownership emerges as a central element in the subjective value of information. In trading, ownership elevates the overall value of information, regardless of its source. Degrees of ownership, exclusivity versus non-exclusivity, change the perceived value. In sharing, too, levels of ownership create a value differential. While in trading high value assigned by owning information impedes the free flow of information, in sharing ownership emerges as a catalyst to the flow of information. This may seem contradictory but it is not, because trading and sharing are motivated differently as will be discussed below.

9.1. Information Trading

Participants revealed a ratio of Willingness to Accept to Willingness to Purchase (WTA/WTP) that resembles the ratio common in the case of private goods. Theoretical analysis predicts that this ratio should approach unity. However, the empirically-revealed preference here places this ratio elsewhere. Support was found for the hypothesis that the WTA/WTP diverges from unity more often and in a more pronounced manner for
information traded in the “original” form rather than as a copy of the original, although even for copies the WTA/WTP ratio is still double. In other words, exclusive information ownership attenuates the Endowment Effect (EE). Or, looked at from the other side, easy-to-copy, digital information in networked contexts is a more likely subject to Endowment Effect perturbations than non-digital, traditionally packaged information. In fact, the digital medium can be used to influence the EE and thus the perceived value of information. These findings lend further support to previously-reported findings (Rafaeli and Raban, 2003) because the number of participants reported here is considerably larger, and contained these additional significant independent variables in the model.

The main implication of a WTA/WTP ratio that is larger than unity is that it leads to under-trading. In other words, people will purchase less information than expected. Perhaps this plays a role in over-investment in IT and perhaps even in the IT Paradox (Lee and Menon, 2000). Employees don’t value or use all IS/IT available to them. Adjusting IT investments to users’ needs and perceptions may lead to cost saving. In this research I have developed a method to assess private values for information.

Another way to examine the same result is to state that exclusive access to information, that is enforceable by information systems (such as information security, encoding, etc.), might strengthen the Endowment Effect on subjective valuation of information. A stronger Endowment Effect may result in greater digital divides. Recent years have seen a trend toward commercialization and/or encryption of previously-free information on the web. The EE predicts under utilization of such information.

The high variance of the WTA/WTP ratios for copy information occurred in part as a result of a large number of people submitting bids which resulted in ratios smaller than one. The WTA/WTP ratio is smaller than one when people are willing to pay more than the amount they are willing to accept for the same information, a situation typical for selling copy information. This is an interesting observation because it means that participants realized that they could make a quick profit from selling information which they could later still use for themselves. This indicates a very good understanding of the game rules. There are scant examples of market goods that have a WTA/WTP ratio that is smaller than unity.
This, of course, is a unique feature of information that is suspected to result from the ambiguity in ownership. Further statistical analysis of the initial data confirmed these findings. When comparing the ratio components, WTA for expertise with WTA for content, as well as WTP for expertise and for content no significant differences were observed although values for expertise were always higher than for content. WTAC for expertise and content have been found to have a statistically significant difference (t=2.68; p<.01) and so have WTPC for expertise and content (t=2.38; p<.02). This confirms the previous finding relating to the higher value assigned to original than to copy information. Interestingly, the mean WTAC/WTPC ratios for copy content and expertise are significantly different from both one and three (Table 7). Therefore, another one-sample t-test was performed with a test value of two. Results are shown in Table 8.

The main psychological explanations of the WTA/WTP disparity are loss aversion which is based on Prospect Theory, degree of similarity and degree of uncertainty in the cases of induced value tokens and lottery tickets. Table 8 shows that the mean ratios for copy content and expertise are not significantly different from a ratio of two. The lowest payment there is willingness to accept for copy information is still double than the highest sum there is willingness to pay for such information, although this is the experimental case which has the most resemblance to the case of induced value tickets (Kahneman, Knetsch et al., 1990).

The main economic explanations are the substitution effect, the tradeoff between the price of information and the expected payoff and intrinsic value. The substitution effect should not have played a role in this case because the players were assured that the same information would be available to them after even selling it, which translates into a perfect substitute. The ratio for copy information demonstrates that although players did grasp a difference compared to original information, they did not maximize this difference to their benefit. Maximization would have resulted in a ratio of one (perfect substitute), or, as explained earlier, even less than one. A ratio lower than one would imply that players are willing to make a relatively significant bid to buy information, while they would sell it for almost any price greater than zero. Any selling price would constitute a profit so why take risks trying to sell at a high price? The decision in this case was riskless, nevertheless,
high selling bids were given indicating, perhaps, loss aversion in this case (Tversky and Kahneman, 1991). Although a number of players did have a ratio of less than unity, the mean of ratios was, as shown in Table 8, approximately two. Since some players did produce a very low ratio, it is possible that there is a learning effect in this case. Some players may have learned fast and applied their knowledge in their bidding behavior or strategy, while other players did not.

The bidding learning curve should be subject to further research. It would be particularly interesting to learn whether a bidding learning curve exists for information because there is conflicting evidence regarding learning in EE experiments for market goods. Some studies did not find a learning effect (Morrison, 2000) while others found that learning did occur (List, 2003; Loomes, Starmer et al., 2003; List, 2004). Although the issue of learning was not a main focus of the present research it was covered in the pilot experiments conducted in preparation for the main experiments. The results have been published and they indicate no significant learning (Rafaeli and Raban, 2003). While those results provide a preliminary indication, further investigation of the learning effect is definitely needed.

The percent of games played with expertise (Table 12) and the trend toward higher value for expertise (Table 9) without statistical significance suggests a flattening effect. The computer medium seems to impact the perception of sources of information. A typical decision maker has to imagine an expert or a document based on a screen display (Daft and Lengel, 1986). In addition, the large bidding scale in this experimental setup induced variance. Participants could place bids between 0 and 100 dollars for either buying or selling. The scale is even larger considering that decimals were allowed. Research in social science usually involves using a smaller scale such as seven-point Likert scales. The scale was not defined by any anchors to provide meaning for specific choices. Scales used in social sciences often have anchors such as “agree” and “disagree”. In the scale used here there was no ‘right’ or ‘correct’ answer. This scale in effect is a one item measure, in contrast to psychological measures where several items are used to quantify specific traits or constructs.
Interestingly, mean profit values with and without the use of weather information in the warm-up games were virtually identical (Rafaeli and Raban, 2003). No significant difference was found for the profits of players playing with information versus without information. It is worth noting that high subjective values were assigned to information despite the lack of objective value for the information presented. This is, of course, in line with traditional MIS findings and the general notion of information overload (Chervany and Dickson, 1974) as well as with theoretical analyses of the tendency to over-value information (Feldman and March, 1981). The players were shown their profit data at the end of each game so they were free to decide not to purchase information if it did not prove instrumental. Each participant played two practice games and four 'real' games. However, the data show that even in the face of objective uselessness of the information, participants valued information and wanted to buy it. They exhibited a bias in favor of buying more than selling, although buying and not selling had an effect on subsequent profits (buying meant paying from one’s budget while selling meant earning and enlarging one’s budget). Further confirmation was received from the participants during the debriefing session at the end of the game when many expressed their strong preference toward playing with weather information, wanting to buy it and preferring not to sell it. This is in agreement with the observations of (Bastardi and Shafir, 1998) and with (Grant, Kajii et al., 1998) who found that preference for information does not imply expected utility. It could be argued that participants may act as “information dealers” wanting to maximize profits by buying and selling information in every opportunity given. To exhibit such behavior means to execute all three WTA deals and all three WTP deals. The bias in favor of buying information is further highlighted by the exceptionally low inclination to use free information available by clicking on the Help button. The Help button was selected twenty one times by all participants combined (out of a possible 1,240 times) although the availability of Help regarding improving performance was stressed during the presentation and in the handout. Help screens contained tips on how to improve game performance. Does the reluctance to use online help mean that for-fee information is valued higher and is more desirable than free information? Would attaching a price to the help item serve to encourage usage? These questions await further research.

The overall EE ratio for information is relatively low and resembles that of market goods (Horowitz and McConnell, 2002). Does this mean that information is a regular market
good? If we look carefully at Table 12 we see that up to about 43% of the purchasing trades were made (WTP) while only up to about 23% of the selling trades took place. This observation has two implications. The first is that this is yet another manifestation of the high value assigned to the information available for purchasing or selling, the strong desire to buy or not sell the information. The second implication is that the EE ratio is relatively low because both the numerator and denominator are relatively high. This phenomenon is believed to be unique to information and warrants further research. For example, one research question that arises from these data is whether the explanation for high values of both WTA and WTP may be risk aversion while the traditional explanation for EE is loss aversion. Risk aversion explains value assignment because risk averse people will be willing to pay for information to reduce their risk while risk neutral people will not. The relationship between information and risk aversion has been addressed by a theoretical model establishing that intrinsically information-loving people are also risk-averse (Grant, Kajii et al., 1998; Eeckhoudt and Godfroid, 2000). Risk aversion has also been linked empirically to lack of information (Kahneman and Lovallo, 1993). Another explanation for the high bids is that bidders had no information about the market price and received only indirect feedback whether they succeeded in purchasing or selling information from the new game settings presented to them after the bid. Lack of information tends to produce higher bids (Kagel, 1995). This corresponds well to the theory put forth by (Kolstad and Guzman, 1999) who showed there is an inverse relationship between the amount of available information and value of goods traded.

An alternative explanation for the EE is that people focus on maintaining their existing state rather than changing it (Lieberman, Idson Chen et al., 1999). Lieberman et al. suggested that the EE stems from a prevention focus and they showed that EE diminishes when a promotion focus is introduced. Their experiments highlight the basic premise of this research, namely, that value assignment is subjective and influenced by various factors. Further support to this premise can be found in recent studies which discussed the role of affect in creating the EE disparity (Peters, Slovic et al., 2003) as well as the role of motivation (Mandel, 2002). Moreover, Lieberman et al. explained that EE is a result of a concrete and detailed description of the traded object. A more generic description would reduce the substitution effect, they argued, and thus would lower the EE. Again, detailed descriptions are part of normal trading practices and should be accounted for by experiments. Detailed descriptions may increase the EE but they represent true situations.
The value of experience goods is not known a priori and there is usually no indication for it. Indeed in a study which collected *ex-post* valuations of the usefulness of shared information, seekers of information assigned a value of $11.30 while providers assigned a value of $13.20 (Constant, Sproull et al., 1996). Beside being ex-post values, another reason for the small difference in valuations may stem from the smaller scale used for that study compared to the present research. The ratio of these reported values approaches unity which highlights that the main obstacle to valuing information is that it is an experience good, that the EE stems from lack of prior 'information on information'. The high variance is in accord with the high uncertainty associated with buying and selling experience goods. The value of experience goods is not known a priori and there is no indication for it. Perhaps smaller variance will be achieved if a ‘preview’ is made available for the weather forecast in our game. Examples of ‘previews’ for other information experience goods include abstracts of articles and film previews. Viewed from a different angle, bidding in electronic commerce is always a one item measure. This characteristic can be manipulated. For example, a wide scale without anchors may induce higher bids which are in the interest of auction sites.

The value assigned to specific information by a certain person can vary according to external circumstances. This implies that subjective value is inherently unstable. Social science usually aims to identify stable or generalizable phenomena. Here instability is inherent. External circumstances include parameters such as timeliness, form, and content (Ahituv, 1989). These parameters change per person and between people and are perceived differently especially when there is uncertainty about information.

While the first and third hypotheses were held up by the data (Tables 7 and 10), no support was found for the hypothesis regarding differences in valuation due to the source of information (Table 9), H2. Attributing the information to expertise or to a document had no significant impact on the WTA/WTP ratio. In other words, the subjective value of information is not variously affected in these results by the nature of the source of information. This result is surprising as intuitively a difference is assumed and because previous research has identified a difference (Constant, Kiesler et al., 1994). The
difference originally reported in the literature was attributed to ownership. Expertise was perceived to be privately owned rather than owned by the organization. Information as product, a computer program, was perceived to be more organizationally owned. While that study identified a difference in sharing two types of information, the present research did not identify such a difference with statistical significance. This lack of difference stresses the distinction between sharing and trading and information-related behaviors associated with each setting. Value judgments in these different scenarios are most likely attenuated by additional motivations beyond ownership status. The second factor is likely to be the flattening effect discussed earlier. Since there was a difference but it was not statistically significant, it is reasonable to assume that increasing the salience of the information source would yield a significant difference in the WTA/WTP ratio for different sources of information. This teaches an important lesson in the setup of computerized experiments. The difference seen in Table 9 suggests that content is valued higher than expertise as proposed in hypothesis H2.

To summarize, people are sensitive to originality when trading information, which implies exclusive or non-exclusive ownership, but not to the nature of the source, and the ownership status implied by it. When access to some information is limited to a privileged few set of eyeballs, that information is accorded or assigned a high value. When the information, content or expertise, becomes commonplace, its value decreases. Is it possible that the well-known economic concept of ‘scarcity’ governs our trading behavior as it does for other market goods? Is scarce information valued higher than widely-available information? This would mean that either behaviorally or cognitively people have not yet absorbed the concept of ‘network economy’ (Kelly, 1997; Noam, 2001), that information is distributed mostly by copying and its value does not necessarily decrease because of that. On the contrary, in a network economy value sometimes increases with wider distribution. The value of software is one such example – end-user software is often more valuable as more people use it and become dependent on it for communicating with other users. The descriptives in Table 12 suggest the same trend. The theoretically expected rate of trading was reached only for copy information (WTPC values) suggesting that popularity is more conducive to trading in a network economy than exclusivity.
Although the findings in the information trading experiment do not support the distinction between content and expertise and the ownership status implied by these forms of information cited in previous studies, I did find an ownership effect that resonates with the studies on information sharing and studies on EE in other market goods. First, an EE was observed and was statistically significant. EE is attributed to ownership status in the literature (Kahneman, Knetsch et al., 1990; Beggan, 1992). Secondly, the fact that originality played a significant effect in the results shows that ownership matters. If everyone has access then value does drop, but if only one person has exclusive access/ownership value increases. Of course, ownership itself and perceptions of it can be affected and manipulated via system design. The tension between value and rate of trading remains. We must make a choice whether to create high value, low trade information products, or aim for a large market with lower value products. Some have claimed the latter is the recommended, even the inevitable, route for information products. This may be true for gaining wide recognition but economic realities in the new millennium render this approach questionable. The continued, if somewhat limited, success of sites who were aimed for a small market of paying customers versus the failure of other content providers who were not able to make the change from free to fee also favors the 'high value, low trade' market approach. Perhaps this is yet another manifestation of personalization suggesting that privatizing/personalizing content can indeed be a sustainable business model. This closes the loop back to ownership: Catering to the individual user in the 'high value, low trade' market rendering him/her the almost sole proprietor of the information he/she purchases.

A possible explanation for our failure to find significant effects of the source nature (expertise vs. content) variable may stem from the experimental manipulation. Sources were introduced to the participants in writing. This uniformity of presentation provided experimental control. However, it may be argued that a computer can be used to present different forms of information differently. Perhaps our 'bare bones' controlled design created a flattening effect where any kind of information looks and feels the same. Graphics, sounds, and more elaborate texts could have contributed to stronger differentiation between both forms of information. This would be difficult to operationalize while keeping experimental control. On the other hand, it may be argued that both contrasts were presented in the same manner: Expertise versus content, and copy
versus original. If a statistically significant difference was found for the second contrast, this lends support and validation to the true, not just apparent, lack of such difference for the first contrast.

Another way to examine perceptions of types of information is to experiment with stronger contrasts. Information in this experiment was important for estimating market demand for lemonade but perhaps it was not perceived as critical information. Experimenting with more critical information may elicit a difference between sources. For example, if a life-or-death situation is described as expertise, say a doctor's advice, it would be valued more than content, say an article taken from an encyclopedia or the internet. Another topic which is not a life-death question but could carry strong implications is investment information. Is analyst advice valued more than an information flier distributed by a bank? Another example may be related to professional decisions. Would we value an article we read in a work situation more than seeking an expert's advice? Clearly, cultures vary in the respect they accord the written document. It would be interesting to see if a larger gap between EE ratios is revealed with further research, running a simulation game while varying the criticality of the information. Of course the most obvious path for further research is to expand work on sharing information. What are the equivalent dimensions to WTA/WTP when sharing rather than trading is at stake?

This research shows a value of about three for the WTA/WTP ratio for original information regardless of whether the source is content or expertise. The similarity between content and expertise may be attributed to some extent to the trading scenario and to some extent to the flattening effect. However, some of the results indicate that the source’s nature may become significant depending on the degree of criticality, or, in other words, source can be manipulated by system design to become more salient. Copy information received a subjective value which was significantly different (lower) than original information. This observation invites further research into information system users’ perceptions of the information economy. Information systems can be used to enhance understanding of network economy and they can be used to manipulate prevailing perceptions.
In summary, studying the subjective value of information in trading by using a computerized simulation of a simple business game as an experimental setting where EE methodology was applied proved to be a very productive research line which should be further elaborated by future work. The nature of information transferred by sharing, not just by trading, also invites research which would use a similar platform to assess the interplay or interdependence between trading and sharing content and expertise.

Some of results of this research were reported in conferences and published in the academic literature. Please see Appendix B for a description of the research progress and a list of publications.
9.2. Information Sharing

One major development in Internet culture that occurred during the time this research was conducted has been the meteoric rise of blogs. A blog, short for web log, is a personal journal published on the web. The huge popularity of blogs emphasizes how important it is for individual ‘publishers’ to be known in person in the mass medium, the web, take center stage, and get full credit for their writing. In fact, blogs eclipsed previous sharing loci such as Usenet, forums, listservs etc.. While the blog technology enables readers' responses, ownership of blogs is the most salient trait of such sites. This is exactly what this research has found: People will be more inclined to share information when that information is identified with them personally.

This section will refer to the findings obtained in the information sharing experiments and highlight the analysis and implications of those findings. The discussion will continue with a proposal for an information sharing standard, a comparison of the present study with previous research, and implications for system design.

9.2.1. Information Sharing in the Lemonade Stand Simulation

Results of the information sharing experiments indicate that ownership plays an important role in the willingness to share. Sharing was higher for privately owned expertise than it was for an organizationally owned information product (Tables 13-14). The difference in willingness to share was statistically significant when the sharing request was made personally lending further support to the notion of ownership. Not only is expertise a private source of information by definition, but also sharing activity was stronger when the request was made in private. In fact, sharing was done by 23.9% of the players who received a personal request for sharing expertise and by 10.6% of the players who received a personal request for sharing organizational content. Results in the same direction, where the willingness to share expertise was higher than that for organizational information, were obtained when the request was sent publicly. This effect, however, was not statistically significant probably due to the generally low sharing rate. When receiving a public request for sharing information 14.1% of the players shared expertise, while only 7.6% shared organizational content. The overall willingness to share (responses to personal and public requests combined) was also in the same direction (sharing expertise was higher than
sharing organizational content) but lacked statistical significance, probably because of the lack of significance in the public request. Overall, 28.2% of the players shared expertise while 16.7% shared organizational content. Ownership affected the willingness to share consistently and in the expected direction as shown by descriptive statistics as well as by statistical analysis.

Sharing was also higher for a privately owned information product than it was for an organizationally owned information product (Tables 15-16). The difference in willingness to share was statistically significant when the sharing request was made personally, again, lending further support to the notion of ownership. A quarter (25.0%) of the players shared private information when asked personally compared with only 10.6% who shared information labeled as organizational content upon a personal request. Results in the same direction, where the willingness to share a private information product was higher than that for organizational information, were obtained when the request was sent in public. 13.9% shared private information following a public request and 7.6% shared organizational information. This effect was not statistically significant possibly because of the relatively low response rate. The overall willingness to share (responses to personal and public requests combined) was also in the same direction (sharing private information was higher than sharing organizational content) and was statistically significant. One third (33.3%) of the game participants shared private information while 16.7% shared organizationally-owned information.

The overall propensity to share was as hypothesized in H5 and H6: highest willingness to share was displayed by players who received a private document (12 of 36) or expertise (20 of 71) as their information source in the Lemonade Stand simulation compared with an organizational information product (11 of 66). The difference in sharing expertise and a private document was not statistically significant strengthening the claim that ownership is the underlying cause for sharing behavior and not the information source per se. Private ownership augments the willingness to share.

9.2.2. A Benchmark or Standard for Information Sharing

This research shows that ownership promotes sharing. However, it also seems that the extent of willingness to share is modest. Sharing activity was exhibited by a range of
about a tenth to one third of the participants in different experimental conditions. A generally-accepted standard or benchmark for sharing is not available so it can't be said whether this magnitude of sharing activity was "low" or "medium" or "high" compared to such a standard/benchmark. However, since a fairly wide range of willingness to share was displayed, it can be safely assumed that in reality a wider range of propensities to share exists as well. Some systems and situations will result in under-sharing while other instances may serve to promote information sharing. What constitutes "under sharing" and how can sharing be promoted? Section 4.6 explained why non-sharing is not necessarily a problem. However, it is generally agreed that sharing can and should be enhanced. What is satisfactory sharing? What should the standard for sharing be? These questions are open for future research and will be repeated in Section 9.5.

At one extreme, 100% sharing can serve as the goal, implying that sharing should be mandatory. This can be applied by designing a system that excludes members who do not contribute to their community or one that enforces total transparency. Obviously, this is neither practical (see Section 4.6) nor desirable. Experiments using discretionary databases (Thorn and Connolly, 1987; Connolly and Thorn, 1990) have shown that the cost of sharing is high and that full cooperation in sharing cannot be expected (Thorn and Connolly, 1987; Connolly and Thorn, 1990).

At the other extreme, a laissez-fair approach may be adopted assuming that people will speak-up whenever they wish and volition is given top standing. Laissez-fair, too, is not a good standard because it is not a standard by definition. It is self-defeating, inefficient, and definitely inappropriate for work settings. Somewhere between these two extremes lies the point of the critical mass where just enough people are willing to share thus sustaining their communities. Critical mass is vulnerable to the “Tragedy of the Commons”. Leaning on a small number of active participants is particularly vulnerable to free riding. Worse yet, what would happen to the critical mass if a number of those active participants go on vacation at the same time? The aim of setting a standard or benchmark is to construct a more stable environment for information sharing and to inform information systems construction and feedback.

All three reference points (mandatory sharing, laissez-fair, critical mass) described here are not satisfactory when it comes to organizational settings, where sharing information can
lead to cost saving and even profit. Information sharing is considered critical to team work (Stasser, 1999; Rafaeli and Ravid, 2003). Previous research pointed to the fact that most organizational sharing of information involves sharing of common knowledge (Eeckhoudt and Godfroid, 2000; Bonito, 2003). Sharing unique rather than common knowledge should become an organizational norm. If workers would perceive information and knowledge sharing as a norm, they will realize the social benefits of sharing which will serve as an incentive to practice sharing regularly (Cialdini, Bator et al., 1999). It may be argued that a standard is not needed in the first place, because "the more sharing, the better". Why confine the discussion to an artificially set point? It can be claimed that any extent of sharing is better than a lower level of sharing. While such claims are true, setting a standard will assist in:

- Building stable communities
- Increasing the likelihood or probability that a request will find an answer
- Creating an acceptable research measure for community success (Rafaeli and LaRose, 1993).
- Benchmarking available research and conducting future research
- Reducing free-riding by those who can contribute (Adar and Huberman, 2000)

A standard is not sacred or always true. A standard can be fluid and change per sharing environment (business, leisure) and organizational goals. Time, external circumstances, technologies, organizational culture and values can all influence standards and will require periodic evaluation.

I propose that the standard for sharing in organizational contexts be equal to the conventional economic prediction assumed for trading (Kahneman, Knetsch et al., 1990): 50% of a community's members should contribute their ideas or feedback to the community on a regular basis. This sharing level implies that within a given time span half of a community's members will actively share information while the other half will be on the reading/receiving end. Ideally, every information seeker should find an information sharer, or, alternatively, every information request should receive a response. Sharing is dyadic at minimum. The time span may be defined per community, medium, subject matter, and urgency. Some communities, such as programmers, tend to be more active than others. The time span will differ in various technologies: instant messaging, forums, blogs, usenet groups and so on. Controversial or emotional topics will create faster sharing
than neutral ones. Lastly, the urgency of the issue itself will call for differing timeframes. Discussing stock value is different than exchanging views about a recent best-seller. Reverting to the standard, some requests for information can be satisfied by a single response while more complex information needs may require multiple answers and even interactivity, a thread of discussion. Some requests are never replied to. The set standard will reflect the average or median response rate. In summary, establishing an information sharing standard framework calls for further and deeper analysis and research.

9.2.3. The Extent of Sharing

Compared to the proposed 50% standard, the extent of sharing observed in the current experiment (10-33% of participants shared) was low. This is surprising in light of the encouragement for sharing the players received from the experimenter during the game and given the intensive instant messaging activity that took place. Players sent 262 personal messages and 484 public messages in total. Thirty three (33) personal messages were the responses to the sharing request. Only 20 public messages were responses to sharing requests. The extent of sharing based on total message volume is much lower than the fraction of participants quoted earlier who replied to the requests for sharing. Information overload represented by the total message volume may be suspected to have hindered the experimentally-controlled sharing. The business atmosphere of the game may have played a role in the low tendency to share although before and during the game the experimenter reminded players that each owns a franchise of the Lemonade Stand and is not in competition with other franchisees. Further research on sharing patterns in different environments, such as for-profit vs. non-profit, may shed light on this explanation.

It is interesting to note that despite the lower general use of the personal IM channel, sharing was much higher in the personal channel. Sharing appears to need personal induction while broadcasting in the public channel seems to come more naturally. Some support for this notion may be inferred from a recent survey by the Pew Research Center who discovered that 44% of Americans have contributed content online (Lenhart, Horrigan et al., 2004). Previous academic research attributed this pattern of sharing more in private than in public to a diffusion of responsibility in the public domain (Barron and Yechiam, 2002). The tension between sharing and broadcasting deserves further research attention. Future research may also look into the correlation between general participation and helpful sharing.
Another reason for less-than-expected sharing in the present research may be that no incentives were used in the sharing variation of the game. Incentives would probably enhance sharing. However, the interest here was to study how the traits of information itself and the system that conveys it influence sharing. Providing incentives would make it harder to discern the effects of the variables of interest. Information sharing based on prosocial transformation has been reported previously (Constant, Kiesler et al., 1994). Positive regard for an organization can substitute for direct incentives (Constant, Sproull et al., 1996). To summarize this issue, while incentives would promote sharing they are not relevant to the present research.

The frequent use of the instant messaging (IM) application demonstrated that:

- IM use was well-understood
- There was no technological impediment to sharing
- Enough attention was paid to the IM – there seemed to be no problem of dividing attention between the game and the IM.

Why, then, was the level of sharing relatively low? In the next section I shall discuss some of the experimental observations I collected and cite literature dealing with this problem.

9.2.4. Information Sharing Literature

Research literature and semi-popular writings on information sharing and knowledge management discuss the problem of sharing, or lack thereof, stating that non-sharing or manipulative/strategic sharing practices harm organizations by causing a duplication of efforts, loss of productivity, accidents and may even lead to legal action against the firm (Davenport and Prusak, 1998; Messick, 1999). Information sharing levels reported in the literature range between 10 and 50 percent (Rafaeli, Ravid et al., 2004). These values shed a new light on the experimental results received here. The sharing level found here is compatible with the percent sharing reported previously. Also, considering that the request was for factual data, the weather forecast, a minimal sharing level can be acceptable as long as at least one reply containing the facts was given. This point may contribute to the lower response rate in the public request. Since the reply is factual and undisputed, once participants noticed that a public reply appeared on screen, they knew they didn't have to send another reply. On one hand, good communication behavior was thus demonstrated by
not sending redundant replies. On the other hand the 'common knowledge effect' says that repeating an idea will increase the likelihood that it will be subsequently used in decision-making (Stasser, 1999) so, more sharing is better. Repetition, or crossing of information, may be advantageous also for the purpose of verifying information: receiving similar information from different sources increases its reliability and is a common practice in intelligence and business intelligence work. In other cases where answers are not as simple as mere facts, a larger extent of sharing is to be expected and is desirable. All replies collected were truthful indicating a serious attitude toward the game and toward other participants. As players saw replies which matched the data they had, they may have felt it unnecessary to echo the same reply.

The effect of ownership on information sharing is discussed in a very limited manner in the academic literature. One article discussed implied ownership: people with higher education levels tend to become list owners more than less educated people. Community owners are known to be more active in online communities (Butler, Sproull et al., in press). One way to look at this association is to say that people who own more information (in this case by having graduate education) tend to be more active in online communities. However, the survey conducted by Butler et al. showed that community owners did not contribute more content than other active members. This outcome is probably a result of more investment in and focus on community building and maintenance rather than on particular content issues. The mere fact that more educated people tend to be community owners is in agreement with the observation of this study where people who own expertise tend to be more active contributors than people with access to organizational content.

More specific research on information ownership has highlighted the ambiguous perception of ownership inherent in information (Jarvenpaa and Staples, 2001). That study found that employees who have a higher propensity to share will tend to assign their organization ownership rights for the information they created in the course of work. Such ‘pro-organizational’ attitude may reflect organizational citizenship but may also suggest that social desirability motivated some of the responses to the survey. The present study found that private ownership promotes sharing but did not investigate perceptions of ownership. Comparing these two different research methodologies, survey and experiment, is difficult. The theme common to both studies is that there is a strong relationship between ownership and sharing behavior.
An interesting explanation for the modest sharing may lie in the topology of networks. Research on virtual social networks has identified a scale-free small world structure for online forums (Ravid and Rafaeli, working paper). Small world is a concept introduced by Stanley Milgram who discovered that conveying a letter requires an average of 6 links (Milgram, 1967). The recipient is separated from the sender by an average of 6 people who know each other. The meaning of small world in the context of online forums is that members tend to communicate more because they are known to each other. Recent research lends further support to the notion of recognition as promoter of sharing (Chan, Bhandar et al., 2004). In the present research, experimental sessions were conducted as part of class meetings in various courses. There was only limited prior acquaintance between participants. If groups had formed naturally according to the small world principle, more sharing may have been observed. A preference for sharing information with known people rather than with strangers opens the discussion on social cognition online which is not the main focus of this research (Rafaeli, Raban et al., 2004 forthcoming). Moreover, the small world phenomenon identifies 'hubs' which in the case of social networks (online communities, peer-to-peer networks etc.) mean that there are opinion leaders who promote the spread of information considerably more than other members. The present data was not formally analyzed for the small world structure, however, the descriptive data of the general chat traffic show that few people chat a lot while others are silent. The mere fact that sharing does occur among strangers in computerized networks means that sharing in this medium is natural and is to be expected (Constant, Sproull et al., 1996). The expectation for naturally-occurring sharing should be upgraded. The standard suggested earlier should be used as a goal for improving the level of corporate information sharing.

In conclusion, the overall sharing level was fair but not good enough in view of the standard proposed in the previous section. There is a tension between personal sharing which invites more intensive helpful sharing activity and public sharing which is more parsimonious in terms of sharing but more productive in broadcasting information and general chatting. Tables 17 and 18 summarize a list of factors that serve to promote or hinder information sharing and were discussed in this dissertation. Some of those factors listed here are based on research literature while others are speculative and await further research. Obviously, each factor can be discussed as promoting or hindering sharing.
depending on the circumstances. These tables attempt to show the common effects of the various factors.

<table>
<thead>
<tr>
<th>Factors that Promote Information Sharing Online</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ownership</td>
</tr>
<tr>
<td>Personal benefits: self identity/respect/esteem</td>
</tr>
<tr>
<td>Prior acquaintance and similarity</td>
</tr>
<tr>
<td>Prosocial transformation</td>
</tr>
<tr>
<td>Social facilitation</td>
</tr>
<tr>
<td>Reciprocity</td>
</tr>
<tr>
<td>Organizational citizenship and norms</td>
</tr>
<tr>
<td>Designating a community leader</td>
</tr>
<tr>
<td>Having a common goal</td>
</tr>
<tr>
<td>“Small World” community structure</td>
</tr>
<tr>
<td>Technology usability</td>
</tr>
<tr>
<td>Information system design</td>
</tr>
<tr>
<td>Incentives</td>
</tr>
<tr>
<td>Trust</td>
</tr>
</tbody>
</table>

*Table 17: Factors that promote information sharing online.*

<table>
<thead>
<tr>
<th>Factors that Hinder Information Sharing Online</th>
</tr>
</thead>
<tbody>
<tr>
<td>Public goods – free riding</td>
</tr>
<tr>
<td>Diffusion of responsibility</td>
</tr>
<tr>
<td>Organizational culture and politics</td>
</tr>
<tr>
<td>Hierarchical organizational structure</td>
</tr>
<tr>
<td>Competition</td>
</tr>
<tr>
<td>Selfishness</td>
</tr>
<tr>
<td>Alienation</td>
</tr>
<tr>
<td>Self-inefficacy in the subject matter</td>
</tr>
</tbody>
</table>

*Table 18: Factors that hinder information sharing online.*
9.2.5. Implications for System Design

The information sharing experiments reported here show that the mere labeling of information displayed on the screen created a strong enough manipulation to bring about the main effect hypothesized. The graphic design variations here were minimal in order to maintain experimental control. The direction and strength of the effect obtained suggest that the presentation of ownership (by labeling) can and should be manipulated by information systems when enhanced information sharing activity is sought. There has been significant interest in personalization of information as a way to increase its profitability in electronic commerce. The economic reasoning is that a personalized product is not a commodity and will be assigned higher value and pricing (Shapiro and Varian, 1999). Personalization of products, and especially of information products, generates a higher profit margin. The novel claim of the present research is that personalization, creating a sense of ownership, will also serve to enhance information supply by sharing. Creating a sense of personal ownership by users must be a design goal for designers of knowledge management and other information sharing platforms. System users should be viewed as suppliers by system designers.

9.3. Discussion of the Research Tool

The tool developed for the present research is novel and deserves some special attention and deliberation. Throughout the data collection stage it was evident that the Lemonade Stand simulation was very well received by participants. They were highly motivated during the game sessions, expressed interest and played seriously with an ambition to obtain good business results from selling lemonade. In the debriefing after each game the participants repeatedly commented that the game is entertaining and is a fun way to learn about doing business. Despite the plurality of information sources available, the players invariably suggested the use of additional information sources during the debriefing. Some of the suggestions included:

- Data on the player's past performance, tabular and graphical display.
- Data on performance of other players or past players.
- A built-in calculator for optimization of the lemonade formulation and purchasing decisions.
- Real-time profitability data.
• Conversions calculator.
• Sensitivity calculator: be able to try out various options before making decisions.
• Ability to advertise and promote the product.
• Data on the shelf-life of the ingredients.

The prominent thirst for additional information expressed in this list of ideas is fascinating. Participants wanted to receive information much more than they wanted to give or share information. Hasn’t it occurred to them that sharing activity may compensate for some of the missing information? Are people ‘programmed’ to working on their own, seeking more information, rather than being a part of a social environment, seeking and providing help or advice? The contrast between seeking information and seeking advice may be subject to further research.

During the debriefing period I often asked the participants how they perceived the instant messaging (IM) option and why they chose to use or not use it. Some of the responses were:

• Several people said that they would make more use of the IM if they thought they were part of a team.
• Some commented that the text was difficult to follow: some said it was small, others said that it moved scrolled off the screen quickly (quick movement indicates intensive use).
• Few said they feared disinformation.
• Some commented on lack of reciprocity.
• Information overload: some people said they couldn’t absorb and react to all information.

The large number of private and public messages that were sent using the IM indicates that using this tool was not difficult. With no technological barrier to speak of, a new question emerges: is information provided by IM valued less than information delivered by other technologies (for example, the weather forecast which was presented as a web page)? Is ‘hardcopy’ (for example, a web page) valued more than ‘soft’ conversation? This question and many others are presented as directions for future research in Section 9.5. The research tool developed for the present research makes it possible to study such questions.
9.4. Limitations of the Present Research

First and most important, the present research employed experiments only and there was no attempt to triangulate this method by other research methods. Many of the limitations of the present research are related to the method chosen, namely, the experiment using a computerized simulation. Experiments tend to have a weaker external validity than, say, field studies. The trade-off of good experimental and variable control is that experiments may be somewhat artificial compared to reality. Control also implies a relatively small number of variables that can be tested in a given experiment. The experiments conducted in this research suffer from these limitations.

Another limitation is that the design was a 'blackbox': independent variables were controlled, dependent variables were collected, and there was no attempt to investigate the specific motivations or thoughts that brought about the observed behavior. Possibly the use of questionnaires may have shed light on additional reasons for the preferences exhibited. To preserve experimental control the population of participants was limited to a fairly homogenous group as described in Section 7.3. Obviously, it would be beneficial to run the same experiment in other settings and with other populations. Further, the present experiment related to three types of information. Additional types of information should be covered in this experimental paradigm in order to get a broader view of the value enigma.

The high variance observed in the trading experiments was already discussed in Section 9.1. The experimental set-up may have been improved graphically and also by taking into account some of the suggestions made by the players in the debriefings.

9.5. Directions for Future Research

This research suggests that trading and sharing of information in the context of a computerized business game are influenced by the perception of ownership of information. This new finding led to and opened up questions for subsequent research. Since the number of future research questions is quite large I will present them in a list as follows:

1. Is the EE for information attributable to loss aversion, the traditional explanation, or to risk aversion?
2. Does the criticality of information affect the EE?
3. Is there a learning process related to information EE?
4. Do people prefer to broadcast information rather than to share it? Are frequent broadcasters also helpful sharers?
5. Would having a common goal serve to increase sharing?
6. Would more explicit ownership rights assignment augment the results of the present study?
7. Would people prefer to practice sharing in different media or technologies: using the phone or using voice over IP?
8. Can sharing be enhanced using a confederate in the study design?
9. Will the same results for trading and sharing be obtained in a field study in organizations?
10. Will privatization of knowledge within corporations serve to enhance sharing and collaboration?
11. Is sharing perceived more as a solution to information overload or to information deficiency?
12. How do the values of information seeking and advice seeking compare?
13. Is the tendency to seek information related to the willingness to share?
14. How does technology affect the value of information?
15. Will information sharing be increased when fee-based information is available simultaneously? When sharing and trading information are available simultaneously, which will prevail?
16. Is there a theoretical basis for the 50% sharing benchmark offered by the present research and what research setting can be employed to validate this level of sharing as a benchmark?

All the questions listed above may be divided into four major categories of influences on the perceived value of information. These categories are: Personal/behavioral, intrinsic/informational, environmental, and technological. Table 19 presents the variables suggested for research under each category.
Several variables appear both in the trading and in the sharing columns. These variables are of prime interest when it comes to researching the possibility of interdependence between the two modes of information transfer.

### 9.6. Summary and Conclusion

The value of information is enigmatic and controversial. Often, it is discussed in the macro level relating to issues such as intellectual property, equity, social good, policy making or the tendency for formation of monopolies in the information industry (Levitan, 1982; Gandy, 2002; Lievrouw and Farb, 2003). The ambiguous ownership structure inherent in information together with the economies of scale required for market penetration and success are antecedents of the mixed information market which exists today offering private and public goods concurrently. This research has undertaken to
investigate the micro level, the perception of value by individuals and how it affects their information choices and behavior. Despite its ambiguity information ownership makes a difference. Ownership serves to increase value both in trading and sharing situations. Increased value leads to under-trading in market environments, but enhances sharing. Ownership can and should be framed by system design according to the particular circumstances.

Information co-exists as both a privately-owned traded or shared good and a publicly-owned traded or shared good. Corporations sell information as a major source of income. Non-profit organizations sell information because it is their mission. They also disseminate free information for the same reason. Has the Web brought about an era of selling information by individuals? The Web has certainly been used for information sharing by individuals. Why do people share information that they could otherwise trade? Is there a market for small bits of information currently shared? What is the value of traded and shared information? Is information over or under-traded? Is it over or under-shared? The present research presented a novel methodology to put a magnifying glass on the link between trading and sharing information.

The value of information is in the eye of the beholder. This work demonstrated experimentally what was already known theoretically, namely that the value of information is subjective. Further, a driving vector for the subjectivity of information value was identified: ownership. Ownership affects the value of information both in trading and in sharing. In trading, high value perceptions bring about under-trading because people don't want to part from information even if they know it's a copy. Conversely, in sharing, high value predicts increased sharing activity probably because people expect personal, non-monetary, benefits. While in trading people still behave according to rules of scarcity, in sharing they behave according to social and psychological rules. The difference between economic exchange and social exchange was experimentally demonstrated in a computerized network environment.
## Appendix A: Contrasts Mentioned in the Research

<table>
<thead>
<tr>
<th>Contrast</th>
<th>Definitional</th>
<th>Empirical</th>
<th>Main Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Endowment Effect – Mere Ownership</td>
<td></td>
<td>✓</td>
<td>(Thaler, 1980; Beggan, 1992)</td>
</tr>
<tr>
<td>Experience good – tangible good</td>
<td>✓</td>
<td></td>
<td>(Shapiro and Varian, 1999)</td>
</tr>
<tr>
<td>Expertise - Content</td>
<td>✓</td>
<td></td>
<td>(Constant, Kiesler et al., 1994)</td>
</tr>
<tr>
<td>Original - copy</td>
<td>✓</td>
<td></td>
<td>(Bates, 1989)</td>
</tr>
<tr>
<td>Private good – public good</td>
<td>✓</td>
<td></td>
<td>(Ledyard, 1995)</td>
</tr>
<tr>
<td>Private ownership – organizational ownership</td>
<td></td>
<td>✓</td>
<td>(Constant, Kiesler et al., 1994; Jarvenpaa and Staples, 2001)</td>
</tr>
<tr>
<td>Trading - sharing</td>
<td>✓</td>
<td></td>
<td>(Thaler, 1980; Constant, Kiesler et al., 1994)</td>
</tr>
<tr>
<td>WTA - WTP</td>
<td></td>
<td>✓</td>
<td>(Thaler, 1980)</td>
</tr>
</tbody>
</table>
Appendix B: Publications Based on the Present Research

Progression of the present research was reported in conferences and in academic and trade literature. The following description refers to the numbered references listed below. Since the references are listed from recent to earliest, the numbers in the text are mostly in descending order.

Research work started in October 2000 and continued through October 2001 when the research proposal was submitted. That year was devoted to surveying the scientific literature and preparing the theoretical basis of the research and later that year, the development of the research tool (the Lemonade Stand business game simulation). A light version of part of the theoretical background was published in Hebrew (#15) and was used later as a reference for further reading by students who participated in the game sessions. Initial results collected during the research tool development were first reported in the AoIR conference in Maastricht (#13) and later formally published in the Journal of the Association for Information Systems, JAIS (#9). An overview of the research tool appeared in a book chapter written with colleagues on the topic of simulations as a tool for management training (#11).

Experimental work on the trading aspect started upon approval of the research proposal in the beginning of 2002. Results of the first doctoral experiments on information trading were reported in the IADIS conference in Portugal (#10). Full results of the information trading experiments were presented in the ICEB conference in Singapore (#7) and then in a conference organized by the Center for the Study of the Information Society here, in the University of Haifa.

A paper describing the results of the sharing experiments was recently sent for review in JASIST (#4). A brief version of that paper was accepted for presentation in the September 2004 AoIR conference (#3). Another version reporting the sharing results was submitted to the upcoming ICIS conference, December 2004 (#1).
During the course of the research I felt that some of the theoretical aspects are important for practitioners in the information industry. I shared these thoughts via several conference presentations given in non-academic conferences and published in print and online (#14, #12, #6).

Other articles and a book chapter written alone or in collaboration with others are not directly related to the present research but have grown out of various academic activities. These are: a chapter on social cognition (#5), an article about competitive intelligence (#2) and another one on teaching information retrieval (#8).

An additional planned article based on this doctoral research will cover the relationship between sharing and trading of information. Possibly, another paper will attempt to offer a theoretical analysis of information sharing and the issue of setting a standard for this concept.

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בעלונות ועקר סובייקטיביים במסחר ובשירותים מודע

דפנה רן

חיבור לשם קבלת התואר דוקטור לפילוסופיה

אוניברסיטת חיפה

הרשויותлежаיזדים מתכדמים

הועדה הכללית אוניברסיטה לתלמידי מחקר

מאי 2004
בעלות זכויות סובייקטיביות בסוחר ובשיטות מיידות

מאת: דפנה רגב

ב الأمير: פרופסור שי צ'רל

תיוור לשימ קבלת התואר דוקטור לפילוסופיה

אוניברסיטת חיפה

הרשויות וلزمודים מתקדים

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מאי 2004
תקציר

ענבר, יד שטיבווה ומפיצים, "ענבר" ו"יד שטיבווה ומפיצים" מסתור, מידה העברת המידה באת المباشر ומקסום. מספר המنحن ומשתמשים עם ערך המשמעות של המ_damage של המنحن העד משוער זה שヷ של ענבר, עכן לא מדריך בכוחו. המ닫ה הנפה עם פיתוח, כי פיטון היא המחודד בוחר

הערך בהרבה חפצים של סובייקטיביים שיתוף בציבור. הפונקציה של ענבר ושמשון כי הוא לבניה המסינה של ענבר והסובייקטיבית של ענבר וה

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Endowment effects, or the difference in the value people place on an asset when they own it compared to when they do not, can influence economic decisions. One approach to study this phenomenon is through the experimental method, which involves manipulating factors such as the availability of information or the context in which decisions are made. In this study, we examine the effects of Endowment on players' WTA/WTP values.

The study was conducted with a sample of 250 participants who were randomly assigned to one of the following four conditions:

1. **Control Group (WTA/WTP)**: Participants were asked to state their WTA/WTP values without any additional information.
2. **Endowment Group (WTA/WTP)**: Participants were told that the asset was theirs and asked to state their WTA/WTP values.
3. **WTA/WTP + Information**: Participants were provided with additional information about the asset before stating their WTA/WTP values.
4. **Endowment + Information**: Participants were told that the asset was theirs and provided with additional information before stating their WTA/WTP values.

The results showed that participants in the Endowment + Information condition had significantly higher WTA/WTP values compared to the Control Group, indicating that the ownership status of the asset influenced their valuation. This finding supports the Endowment effect, suggesting that people place a higher value on items simply because they own them.
הרוח שלמה במשקף לא י埼ו על תועלת המקביל ושל השיוויות במידה. ה gratuiteת החוזקה לשחק
שquoi מיתושך או למשתתף בוו וד אדוק למשתתף הפוס, שני ההסרב המוקדש של חור.

הערה:란 שרっと המודעה יכי להווסת מועץ משכון ממיד.

המחكانةוכח, ב אוגדה ובעקב Warp Đầuית של הɩיים
מ professionnelות של מיפוי מודיעין. פיתוח חברה לשני קושיאה.

שלי בעלות: משכון, מסמר אירוג, יישום התחלתי היא הנחנה לשחק כפי שיא
ילדי ביטוי בשווק לבושות עזרה. השערור המחכים ייחיו כי שתיות מידי לירית קפי

הדים הבא: משכון, מסמר אירוג.

הנוצץ גיסי, הש TFT וע ע 173 מнстיסיסים מרואת הבצל מבọc הבכון לשתיית בין מוקורת
המידה השניהו. סדר השתוות בן הברה לממד התאתי לחישת המחקה: משכון, מסמר
פרטי, מסמר אירוגי. לא ממאת הבצל מבולק בן שני המידות של ההסמנה והמחקה בת.

השעוזה הסならない לגבו יבלוע. הבצלות משועיפה על התטענות השתיות ייחו מארת סון המידה.
בפנס, צפה יишיט ובר יאני כשר בקושית הדרור הוא יאישוב החשאה לשחק שמלת טוב
ציבור. ביס conosc ישתית המידה ייחיו מחכ לשני מחכים המשçiler על התעשות
שבחגרוד תקן לשתית מידי.

השתויות בשכון הנסכים והמוחשב יTwig במחקה משך עצותם, יעביים לעב ימיד.
ולשתיתים איזו יאני ע"ב, י祛斑 ייקנה. המשקת התכלבי באופי חותי, יעי, המשחתיפה יזר

משטיבה לשכון ולוצלו.

המטרה היעירה, של המחקה הגיקה, היא שלבלועה היא השפעה על העור הסובייקטיבי של מיתוד
כפי שנראה ע"ב, הנטיה למחר במידוי או לשתית מידי. מחקה זה את כל הדמות בסיום של עור
הפובייטיבי של מידה של伸びה עד הכמוס תיאורות בצעכר.梅אן שרקר על"ב קיטים הציגו בבלועה על

מידוי מצומצם כיסודות בטעים במיתוד מידי.

לבדה המחקרה באירוס, וב המחקה הגיקה, יושב מצלבה. המגבול האחרונים מתועカテゴיה פינית.
המחקה שבחזרה, נוכרי. לא תועشاهد טריאנגולציה עם טוטום מחקרה. יניסו מתבע
יכלי ליעום על משך民办 של שלאות מחקרה משומש שייניק לובן במפרים הזומצמים של

משתתפים. שלאות רובוmouseup מחקרה עבור יחידה ולהשיט ע"ב, מתושיט חולוגיה יאני שmony הברויס קקיריס
(})vignettes( תועשות של תיאורות בשתיות בברואיס קקיריס.

בכרים או בשתיות מוחשבות בסיוטיאיציон שנות של מסחר ושיתוק.