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Master`s Thesis

Supporting Initial Trust in Distributed Idea Generation and Evaluation

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“Creativity comes from trust. Trust your instincts.
And never hope more than you work.”

Rita Mae Brown

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Abstract

Former research has shown that diversity within distributed collaborative teams can lead to innovation, but trust must exist for the open expressiveness of innovative ideas and establishing idea credibility. Initial trust is pivotal for distributed teams if team members have never met face-to-face before and have only a very limited time to accomplish a task. The goal of this thesis is to determine if knowing specific information about other team members could enhance initial trust and improve productivity and satisfaction in idea generation and idea evaluation sessions. It is determined whether trust influences the quality and quantity of ideas, as well as the rating behavior of people and their satisfaction with the rating result. The conducted experiment showed that there is a positive effect between showing specific information and trust. Furthermore it was shown that there are positive effects of trust on the quality and quantity of ideas, as well as one on the satisfaction of the participants with the rating result. The experiment also showed that knowing some information increases the critical rating behavior of the participants. The findings of this thesis can be used for the development of initial trust templates that provide communication support in distributed teams dealing with idea generation and idea evaluation.

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Acronyms

AJAX	Asynchronous JavaScript and XML
CSCW	Computer Supported Cooperative Work
CSS	Cascading Style Sheets
HCI	Human-Computer Interaction
IG	Idea Generation
IE	Idea Evaluation
MANOVA	Multivariate Analysis of Variance
PHP	PHP: Hypertext Preprocessor
TWAN	TrustWorthiness ANtecedents schema
XHTML	The Extensible HyperText Markup Language

1 Introduction

1.1 Trust in Distributed Collaborative Work

Nowadays, globalization and an ever-growing number of new technologies force companies to adapt to new market situations more and more rapidly. As a result the development of innovative products and services is very important to maintain a competitive position. Collaboration helps to combine expertise and knowledge of people with complementary skills in order to obtain synergy effects. It is defined as a group process where participants work together to achieve a shared goal [99]. In modern economy it has become quite common for peers to be spread across different cities or even countries. The literature on innovation indicates that more and more companies use external networks to undertake innovatory activities [31, 37].

Due to this globalization there is an increased need to collaborate with individuals via the Internet, resulting in the growth of the importance of distributed teams using temporal technological support. Those teams provide many advantages over traditional teams, which are bridging time and space and better utilization of distributed human resources without having to physically relocate them [59]. On the one hand distributed teams can offer greater flexibility, responsiveness, and diversity of perspectives than traditional teams can do [49]. On the other hand they encounter numerous challenges due to their distribution and communication limitations. Additionally collaboration processes using technological support are affected by several factors like the characteristics of the individuals, the task, the context, and the technology used [27, 69, 70].

Trust is a major issue in distributed teamwork, especially when team members have never met face-to-face before. In the past studies have shown that in traditional face-to-face teams trust forms and develops over time [34, 56, 81, 87, 105, 107]. This occurs as a result of team members being able to

assess one another based on personal interaction and shared experiences [33]. Distributed team members often do not have enough time to get the needed information about other team members. It is more difficult to determine whether a person is trustworthy or not, especially if the group constellation is only temporary. Thus, trust in distributed teams must be even higher than in traditional teams to achieve a shared goal [38].

1.1.1 Understanding the Concept of Trust

Trust has been studied in social sciences, business, management, and psychology before it became central to computer science research [6]. It is a very complex term and also affects several research areas in computer science. The two considered research areas in this work are Computer Supported Co-operative Work (CSCW) and Human-Computer Interaction (HCI), both of which include trust in distributed teams. Lipnack and Stamps [59] argue that the success of collaboration in distributed teams starts with trust since trust connects distributed teams.

Many definitions of trust have been proposed in different contexts [10, 48, 105]. In general, *trust* can be considered as the “...*belief that the trustee will meet the expectations of the trustor*” [100]. More clearly, trust - sometimes referred to as perceived trustworthiness [69] - can be defined as “*a belief or confidence about another party's integrity - including reliability, predictability, and dependability - and benevolence - including goodwill, motives, intentions, and caring - in order to accept vulnerability*” [62, 68, 86].

According to the multidimensional trust research ideas, two dimensions of trust have been identified as important to organizations [63, 84, 104]: *cognitive trust* and *affective trust*. Cognitive trust refers to the judgment of competence, reliability, and professionalism. The second dimension, affective trust, refers to trust that arises from emotional ties among individuals, and reflects beliefs about interpersonal care and concerns [54, 65, 88]. It is stated that “*cognition-based trust results from deliberate assessment of each other's characteristics and the process of weighting benefits of trusting over risks, whereas affect-based trust involves one's emotional bonds and sincere concern for the well-*

being of the others" [44]. Trust is a very complex term and has overlapping meanings. In this work (initial) *interpersonal trust* [1] is considered, which serves as a mediator between people, for a very limited amount of time. Additionally this interpersonal trust will be distinct in affective and cognitive trust.

Furthermore former research [45, 48] has shown that distributed teams develop trust swiftly at the beginning of the project. Iacono considered initial trust in general, but did not differentiate between cognitive and affective trust. In 2005 Kanawattanachai [54] found that distributed teams developed a higher degree of cognitive trust than affective trust. That result supports the swift trust proposition of Meyerson [65]. He claimed that in a temporary team cognitive trust is more important than affective trust. Meyerson described a temporary group as an analogy to a "*one-night stand*". This so-called *swift trust* develops within "*a finite time span, forming around a shared and relatively clear goal or purpose, and depending on tight and coordinated coupling of activity to achieve success*". So converting the individual skills and efforts of strangers into interdependent work results in a short period of time is a major challenge. In this thesis the work results of the first phase of an innovation process is considered.

1.1.2 Importance of Innovation

Innovation is important for society because it increases the standard of living, health, wealth, and provides new jobs. It is also important for companies, because it preserves competitiveness and enables growth. A company can choose between focusing on *closed innovation* and *open innovation*. In closed innovation, the product development cycle is controlled inside the company exclusively. Open innovation "*...is a paradigm that assumes that firms can and should use external ideas as well as internal ideas, and internal and external paths to market, as the firms look to advance their technology*" [16]. This thesis focuses on open innovation by including students in the innovation processes of companies.

Innovation is basically the creation of a new product or new service. However, two different *degrees of newness* can be distinct. From scratch new ideas

for products or services are called *radical innovation*, and minor adaptations of products or services are called *incremental innovation* [9, 35]. Both kinds of innovation represent opposite ends of the newness spectrum [9, 103]. More precisely, radical innovations are truly novel or unique technological solutions [71], the development or application of new technologies [101], or state-of-the-art breakthroughs in technology or product category [22]. Incremental innovations are new products involving only minor or no changes in technology, also called simple product improvements [22].

In Figure 1 a two-dimensional framework is shown to present the two key factors a company has to consider when dealing with innovation: the *market uncertainty* and *technical uncertainty* of an innovative product or service.

Market Uncertainty	High	Market Innovation	Radical Innovation
	Low	Incremental Innovation	Technical Innovation
		Low	High
		Technology Uncertainty	

Figure 1. Four kinds of innovation (modified) [61]

The four different uncertainties can be combined to *incremental innovation*, *market innovation*, *technical innovation*, and *radical innovation*. In this framework the term radical innovation means that companies need to acquire new marketing and technological skills, because both, market uncertainty and technology uncertainty are high (see upper right quadrant in Figure 1). Technical innovations are especially important for technology-based companies. For those the market uncertainty is low, but the technology uncertainty is high (see lower right quadrant in Figure 1). Incremental innovations can be just as important for companies as radical innovations. They can also lead to competitive advantages. Incremental innovations have a low market uncertainty and a low technology uncertainty (see lower left quadrant in Figure 1). Market innovations - the fourth of the uncertainties - have a high market uncertainty and a

low technology uncertainty (see upper left quadrant in Figure 1). New application fields for existing technologies and the penetration of new markets could increase turnover.

This thesis focuses on *radical innovations* and *incremental innovations*, because they represent the opposite ends of the newness spectrum. Incremental innovations have the lowest uncertainties and are therefore more common and favored by companies than radical innovations. In contrary, the radical innovations might be the more promising ones for companies regarding profit margin and market domination, but they are also more difficult to create and more risky to implement. This work deals with an alternative approach of supporting distributed teams with the goal to create rather radical innovations than incremental innovations.

1.1.3 The Innovation Process

Innovation is a process and several models exist to describe the different phases of that process. In this thesis the first phase of the innovation process according to Herstatt [39] is considered (see Figure 2). This first phase is a sequence of generating and evaluating ideas, so it is divergent thinking followed by convergent thinking.

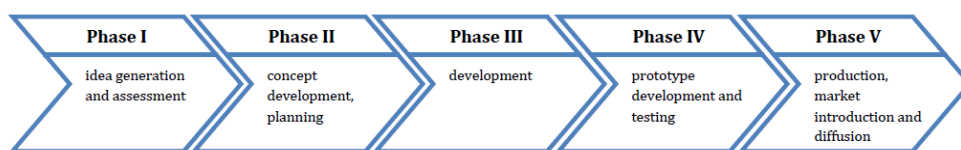


Figure 2. The innovation process (modified) [40]

Only the first phase of the innovation process is considered, because the focus of this thesis is initial trust. *Idea generation* and *idea evaluation* are the phases where initial trust is necessary, because they are part of the first phase

of the innovation process. Idea generation (or ideation) *“is the creative process of generation, developing, and communicating new ideas, where an idea is understood as a basic element of thought that can be either visual, concrete, or abstract”* [52]. The result of idea generation sessions are usually a large amount of ideas. But a good idea does not always appear to be a good idea at the first glance. So a good evaluation process aims a limited number of good ideas for further development [67] and therefore is crucial for identifying good ideas.

1.2 Motivation

A lot of research is going on about defining trust and figuring out how trust develops within face-to-face teams as well as in distributed teams. There is only little research about ways of supporting people in distributed teams to develop trust in relatively short projects, when co-workers never meet face-to-face. In 2009 Al-Ani [5] stated the following:

“This led to the hypothesis that trust was more of a concern when developers were working in relatively uncharted waters (innovative or new products). [...] The issue of trust might arise in teams involved in innovative and new products because there is a greater need to trust others judgment in addition to the possible fear of presenting new ideas...”

The statement leads to the assumption that a lack of trust is a major problem during the development of innovative ideas in distributed teams. As former research has shown, diversity within a team can lead to innovation in collaborations [43, 79, 85, 98], but trust must exist for the open expressiveness of innovative ideas by team members. Trust has a positive characteristic leading to desirable behavior and outcomes, although negative expectations and trust can also occur during collaborations [4]. Therefore trust plays an important role in innovation, efficiency, and effectiveness of teamwork, as team members do not tend to cross-check the work from each other [10, 48, 104]. Moreover, low trust leads to more faulty attributions regarding the source of disagree-

ment in distributed teams [96]. In low trust environments team members are more likely to question others' intentions and thus trust can be fragile and often fractures rapidly [48].

A lack of trust can result in evaluation apprehension [28], since people may be afraid of presenting new ideas during idea generation sessions. The second possible reason for problems can be the lack of trust of other's judgment about an idea, because the expertise of people in a specific field may not be sufficiently transparent during the idea evaluation session. A lack of commitment can increase due to missing trust. Commitment is important to find a consensus about an idea within a team. So it is necessary to support trust and therefore support innovation in collaborative work, especially when the team has never met before and has only a very limited amount of time to accomplish the task.

1.3 Hypotheses and Goals

Since the main research fields of the thesis are trust, human-computer interaction, collaborative work, and innovation, it is analyzed how the presentation of specific information about team members affect initial cognitive and affective trust in distributed idea generation and idea evaluation.

As mentioned in the motivation, people might be afraid of presenting ideas in idea generation sessions due to a lack of trust. Therefore it has to be determined whether knowing of specific information about distributed team members affect trust during the idea generation session. Since evaluation apprehension is dominated by personal emotions, this leads to the following hypothesis:

Hypothesis 1: Knowing personal information of an individual leads to more affective trust during the distributed idea generation session.

If this expectation is satisfied, it furthermore has to be determined whether trust among distributed team members might affect the contributions generated during idea generation sessions. This leads to the second hypothesis:

Hypothesis 2: More affective trust during the distributed idea generation session leads to more radical ideas.

In regards to idea evaluation sessions, people might not trust others' judgment about an idea, because the expertise of people in a specific field may not be sufficiently transparent. Therefore it has to be determined whether knowing of specific information about distributed team members affect trust during idea evaluation sessions. Since expertise is based on skills and experiences, this leads to the following hypothesis:

Hypothesis 3: Knowing the expertise level of an individual leads to more cognitive trust during the distributed idea evaluation session.

If this expectation is satisfied, then it has to be determined how trust among distributed team members might affect the rating behavior and the satisfaction with the result during idea evaluation sessions. This leads to the fourth hypothesis:

Hypothesis 4: More cognitive trust during the distributed idea evaluation session leads to a better consensus within the group.

To investigate the hypotheses, a theoretical (top-down) research approach has been combined with a practical, design-oriented (bottom-up) research approach. In the first step (the top-down approach), the kind of information, which should be presented in order to produce trust among the individuals participating in the study, were identified. In the second step (the bottom-up approach), a software prototype has been designed and implemented to find out if perceived trustworthiness leads to better results.

The following sections encompass the background knowledge of innovation and trust, the approach, design, and implementation of the experiment, results of the experiment, and a summary and outlook on future research directions.

2 Innovation and Trust

In this chapter necessary background information about idea generation and idea evaluation and the current state of supporting trust in these sessions is presented. Additionally a description of how initial trust can be supported is provided, as well as a trustworthiness schema, which is the basis for this work. The purpose of this thesis is to bridge the gap between trust and innovation. Since this thesis focuses on the first phase of the innovation process, idea generation and idea evaluation are considered separately.

2.1 Creativity and Trust in Idea Generation

To produce both radical and incremental innovation, creativity is necessary. Creativity is the ability to produce work that is both novel (i.e. original, unexpected) and appropriate (i.e. useful, adaptive concerning task constraints) [60, 72, 97]. Originality is the hallmark of creative behavior, and ideas will not be creative if they are not new or unusual. Although ideas must be original in order to be called creative, they will not be implemented if they are not feasible. Hence, the usual definition of a *good* idea is an idea that is both *highly original* (or unusual) and *highly feasible* (or useful).

One way to enhance the creative process is by using formalizing protocols [94], so-called creativity techniques. More than 100 creativity techniques can be found in the literature [41, 102]. This thesis focuses on electronic brainstorming, a computerized version of the brainstorming technique introduced by Osborn [74]. Osborn defined brainstorming as "*a creative conference for producing a list of ideas - ideas which can be subsequently evaluated and further processed*". Electronic brainstorming is used in this thesis, because it is one of the most common idea generation techniques. Knoll et al. [57] stated that most of the idea generation techniques support an associative process with external

stimuli, which are received through the five senses of the individual. Thus brainstorming contains general rules to support a process, which is the basis for many other creativity techniques.

The main goal by supporting trust in *idea generation* is to increase the number of radical ideas. Idea generation sessions are about risking vulnerability by writing down unusual ideas. This social effect is called *evaluation apprehension*. It causes participants to hold back their contributions during the process [28], because they are afraid to be criticized by someone in the group. Postman indicated that anonymity reduces this effect [78]. On the other hand anonymity can easily lead to social loafing. It describes the tendency of participants to expend less effort when they believe that their contributions are not needed for the group success [55]. Therefore anonymity is not the solution.

In order to write down unusual ideas the benevolence of the other team members is needed to avoid that criticism. Dunette [30] mentioned that if lacks of social context cues decrease members' inhibitions, then evaluation apprehension might be reduced, possibly resulting in more novel and diverse ideas. Open exchange of information should be promoted since people are more likely to collaborate with individuals they trust [48]. So supporting affective trust in a distributed team should lead to a better atmosphere where people are not afraid of presenting innovative ideas.

The literature regarding the correlation of trust and creativity in face-to-face teams remains largely inconclusive. On the one hand it was found that trust is beneficial to increase creativity in teams [25, 51, 96], but on the other hand more recent studies showed that there is no positive impact of trust on creativity in teams [15, 26]. Concluding, Bidault [7] found that it is not always true that more trust automatically leads to more creativity. There seems to be a level of trust that maximizes the creative output.

However, no publications could be found regarding the correlation of trust and idea generation in distributed teams.

2.2 Rating Behavior and Trust in Idea Evaluation

In the literature many approaches can be found to evaluate ideas. One well-known technique is the *SWOT analysis* [29]. These approaches are useful for further insights of the advantages and disadvantages of a specific idea. In this thesis a more general approach was chosen to evaluate ideas.

The main goal by supporting trust in *idea evaluation* is to increase the team members' satisfaction with the results and the consensus about an idea within the distributed team. Team members have to trust each other regarding their ability to judge an idea as a *good idea*. To support trust in the idea evaluation phase the basic idea of a recommender system is used. Research has shown that showing predictions when users rate (e.g. movies) changes their ratings [21]. That might also work for the evaluation of ideas and result in more satisfaction with the result, because it is visible to everyone.

A large amount of literature regarding trust and decision-making considers recommender systems, e.g. in e-commerce [17, 21], recommending and evaluating choices in a virtual community of use [42]. Recommender systems are useful when too much information is present. Research on decision-making has focused on trust as a variable that affects decision outcomes. In 2009 Parayitam [75] found that the perceptions of trustworthiness based on the competence of a person enhances decision quality and commitment, whereas the perceptions of trustworthiness based on relationships do not have any effects on outcomes. Rietzschel [83] identified the strong tendency of people to select feasible and desirable ideas at the cost of originality as the main reason for their poor selection performance.

However, no publications could be found containing results about the correlation of trust and idea evaluation in distributed teams.

2.3 Support of Initial Trust

The focus of this work is to find out how initial trust can be supported in

a distributed team when team members only have a very limited amount of time to accomplish a task, and how trust might improve the work results in distributed teams. Therefore the approach of the so-called *first impression* could be used. People make guesses on signs and signals they perceive, which is the seed of trust or distrust and also affect their subsequent behavior [20] [36, 76]. Signs and signals, which appear in face-to-face interaction, might or might not appear differently in computer-mediated interaction. Since team members of distributed teams often do not have a prior working history and never meet again in the future [48], the routes of *word of mouth* [82] and face-to-face interaction are different or blocked. To enable distributed team members to form a first impression, information about their co-workers could be offered. Research has shown that the availability of information can influence trustworthiness assessments positively [92]. However, it is not entirely clear which information elements are most supportive for the assessment of team members, especially regarding teams dealing with innovation.

One way to support distributed team members with the formation of trustworthiness is to provide opportunities for accumulating personal knowledge and task-relevant background information [44, 54]. Feng [32] and Hung [44] claim that, “*developing artifacts to help people to identify others who are similar to themselves or who have similar experiences may be helpful for promoting empathic attitudes that build interpersonal trust*”. Jarvenpaa and Leidner [48] found that high-performing distributed teams exchanged *background and personal information* and were *socializing more* with other members at the very beginning of their project. Rusman [90, 91] introduced an approach to inform trustworthiness assessments in the initial phase of collaboration. It was discovered which information is important for trustworthiness assessments. This knowledge was used for the design of measures to accelerate the formation of interpersonal trust.

The research of Rusman aims at the start of the project just as this work does. More trust in the beginning of the project leads to better collaboration. But in this work it is claimed furthermore that different information is necessary in different kinds of projects. Since this work focuses on the first phase of the innovation process it is especially necessary to know what kind of information should be shown in idea generation and idea evaluation. So this work goes

one step further by showing how this information affects each phase of the innovation process.

2.4 The TrustWorthiness ANtecedents schema

The approach of this thesis is to enhance trust with the so-called *first impression*. Rusman [91] has already taken the first steps in the research regarding first impressions in distributed teamwork and introduced the following TrustWorthiness ANtecedents schema (TWAN) as the footing for trustworthiness decisions (see Figure 3).

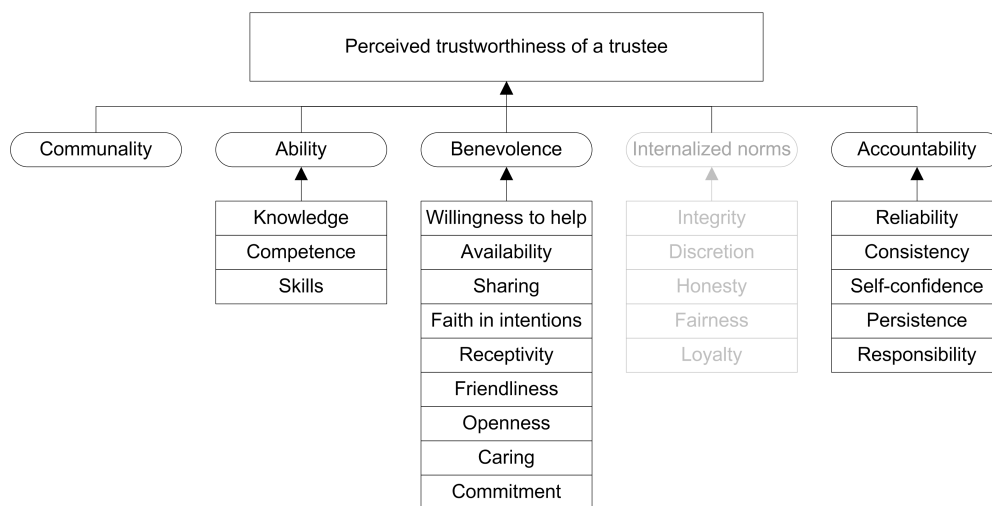


Figure 3. TWAN schema (modified) [91]

For identifying these antecedents, available empirical research on measurement of perceived trustworthiness was reviewed by Rusman. The schema of perceived trustworthiness of a trustee consists of five main categories: *communality*, *ability*, *benevolence*, *internalized norms*, and *accountability*. Each of these main categories can be split up in more detailed antecedents (see Figure 3 and Table 1). Since this work focuses on affective trust and cognitive trust, the different trustworthiness antecedents should be divided into two parts. According to the definition in Chapter 1, *cognitive trust* refers to the main categories *communality*, *ability*, and *accountability* and *affective trust* refers to

communality, benevolence, and internalized norms. Note that *internalized norms* are not considered in this thesis, because they only refer to long-term projects and therefore cannot be integrated in the approach of this thesis. Below is Table 1, which contains a description of each antecedent, considered in this thesis.

Antecedents	Description
Communality	Personal characteristics the trustor has in common with the trustee [2, 32, 46, 58, 73]. This can be any shared characteristic, like a similar goal they want to achieve, shared language use, common identity characteristics or shared values. Even trivial ones, like a shared hobby or the same type of pet they have, can contribute to this category.
Ability	Capability of a trustee, determined by knowledge, skills and competences, which enables someone performing tasks within a specific domain [12] [13] [62]
Knowledge	Able to recall facts, concepts, principles and procedures within certain domains [49, 64]
Competence	Able to act properly and with a good result while solving problems in a complex, real-life environment, using and integrating one's personal characteristics, knowledge, and skills [19]
Skills	To have acquired a proficiency in the execution of operations to achieve a certain goal state [12] [19]
Benevolence	Perceived level of courtesy and positive attitude a trustee displays towards the trustor [62]
Willingness to help	To give support in situations in which it is needed [19, 50, 81, 89, 109]

Availability	Approachable and reachable for another person [89]
Sharing	Not to keep sources Not to keep sources and resources to him/herself but to give access to other people [12, 81, 109]
Faith in intentions	To act in another person's interest and to not exploit this person when vulnerable [19, 24, 53, 81, 89]
Receptivity	Interest in another person's ideas and feelings, and listening to them and taking them into account while acting [12, 19, 53, 109]
Kindness	Friendly and easy to get along with [50, 53, 89]
Openness	To reveal oneself, in terms of personality and thoughts, to another person [12]
Caring	Concerned about other people's interests [73, 95]
Commitment	To show dedication and engagement towards something [49, 54, 108]

Internalized norms

The intrinsic moral norms a trustee guards his actions with. These differ from benevolence in that they are directed towards others in general, rather than toward a specific trustor [18]

Integrity	Sincere and unable to be corrupted [53]
Discretion	To keep sensitive information confidential [12]
Honesty	Not to mislead or lie to others [24]
Fairness	To treat people equally [12, 24, 53]
Loyalty	To be respectful and to be true to another person [12, 53]

Accountability The degree to which a person is liable and accountable for his/her actions and meets expectations of another person

Reliability	To follow up on any appointments and commitments made and to show adequate judgment in encountered situations [12, 53, 81, 109]
Consistency	To display consistent character traits and predictable behavior [12, 81]
Self-confidence	To believe oneself is able to perform a task [14]
Persistence	Stable in the intentions formed to complete a task, irrespective of difficulties encountered [14]
Responsibility	To accept part of the work load and to use his/her ability to accomplish a task [19, 24, 109]

Table 1. *Antecedents* [91]

In order to detect what information elements provide cues for trustworthiness and why these elements matter, the TWAN schema is used in Chapter 3, which follows immediately.

3 Information Elements

Template for Supporting Initial Trust

In this section the requirements for supporting trust via *first impression* in idea generation and idea evaluation are determined. The requirements analysis is divided into three parts. The first part is a general literature review about information elements affecting trust in distributed teamwork. The second part is the result of a set of interviews to approve those findings and to detect further and more detailed factors affecting trust in distributed teamwork, which are necessary and feasible for the approach. In the third and last part the information elements are merged. Furthermore it is described how they were implemented as an online software tool to test the hypotheses in this work.

3.1 General Goals and Constraints

The goal of this approach is to determine one possible way to support initial trust in idea generation and idea evaluation. The basic constraints are the presumptions that the distributed team consists of three people accomplishing an idea generation and idea evaluation task. Furthermore only short-term projects are considered. It is not taken into account how trust might develop over time. The target group consists of students, so it is only considered what kind of information students need to get a good first impression about other team members.

3.2 Information Elements

Rusman [93] determined what information elements trustors have in common to decide whether a person is trustworthy or not. An overview of the 15 most selected information elements are shown in Table 2.

Information elements	Frequency
Personality traits/character	124
Work experience	118
Personal motivation for project	117
Education/studies/training/diplomas	94
Age/date of birth	87
Availability during project/agenda	82
Recommendations/references/reviews by third parties	74
Project work experience	67
Language/language proficiency/language skills	66
Photo (formal/informal)	65
Interests/hobbies	60
Family situation/marital status	54
Ideas in relation to project	49
Occupation/function/role/job	49
Nationality	47

Table 2. Frequency of information elements [93]

The table shows that each person prefers different information elements to assess trustworthiness, but there is also quite some overlap. For the purpose of this thesis, some information elements are not considered. The personal moti-

vation of a participant cannot be taken into account, because the only motivation probably is the offered money for participating in the experiment (see Chapter 4). Also the language skills are not considered, because the conducted experiment is completely in English. So it is expected that participants are fluent in English and other language skills are not important in this case. Furthermore a photo will not be offered to participants, because the anonymity of the participants has to be protected. The family status will not be considered as well, because it is not important regarding the constraints of the approach.

To refine the findings of Rusman, a set of interviews was accomplished to discover important information elements adapted for the approach in this thesis.

3.3 Refining Information Elements

Overall 15 students were asked what personal and professional information they would like to know about team members they have to work with, but never met and never will meet face-to-face. In Table 3 the summary of the results of the interviews is shown. The table lists criteria (personal information and expertise level) that the students listed as important, and their frequency (#).

Personal information	#	Expertise level	#
Hobbies	14	Experience (projects)	15
Gender	13	Specific skills	15
Honorary activities	12	Specialization/interests	14
Age	11	References (awards)	14
Nationality	8	Degree (years in the program)	12
Taste of music	7	Companies	8
TV shows	6	Department	7

Motivation	2	Ability to work in a team	4
Family status	1	Time management	2

Table 3. Results of interviews

The **personal information elements** the students mentioned are hobbies, gender, honorary activities, age, nationality, taste of music, TV shows, motivation, and family status. Hobbies were very important and mentioned 14 times, because they stand for a balance to people's work life and also personal interests which they can share with other team members to increase a personal bond. Gender was also important for 13 people. In mixed teams the team members can complement each other. People mentioned honorary activities twelve times. Those can give a hint regarding the general motivation or intention of people as well as commitment and leadership qualities. Age was mentioned eleven times. It is also important in regards to mixed teams. Nationality was an issue for eight students because of differences in language and cultural background. On the one hand people work better together if they share the same language or cultural background, but on the other hand a diverse team has probably a wider range of knowledge to share. The taste of music was mentioned seven times, because this can give a hint about the mood of people or similarity between the students. TV shows also give hints about similarity and were mentioned by six students. Two of the students also mentioned motivation directly as an important criterion to work with somebody, because it is always useful to know the personal intention of a future teammate. As mentioned before, motivation is not considered in this thesis, because the major motivation of students participating in the experiment probably is the offered money. Another person added the family status to the list of requirements, because this could tell how much time someone could bring up for the shared project. This one is also not considered in this work, for the same reason mentioned in the previous section.

The **expertise level information elements** the students mentioned were experiences regarding project work, specific skills, specialization/interests, references or awards, degree or years in the program, companies, department, the ability to work in a team, and time management. Fifteen students men-

tioned experience with working in projects. The more work experience someone has the bigger the success of the project might be. All 15 students also mentioned specific skills within and outside of their professional background. This knowledge is important to assess what a team member can contribute to the project. Furthermore 14 students were interested in the specialization or specific interests of other students they would work with for the same reason as mentioned before. References and awards are also important for 14 students, since they work as recommendations of a person. The degree or the number of years in the program, mentioned by 12 students, is another hint for experience in a specific field. Eight students were interested in the companies that other students worked for, as that gives hints about interests, reliability, and general work experience. Department was mentioned by seven people, since that gives a general overview about possible knowledge background of an individual. The ability to work in a team was stated by four people and the ability to manage time was stated by two people. The last two are not considered in this work, because they were not mentioned very often. Time management is also not really necessary regarding the experiment in this thesis.

3.4 Information Elements and Their Relation to Trust

In Table 4 and 5 the relationship of those information elements and TWAN according to Rusman (introduced in Chapter 2) is shown. Since not all information elements detected by Rusman are used, the overview of the relationship between the information elements and TWAN was adapted and modified for the needs of this specific study. It is differentiated between information elements available before the actual collaboration happens (Table 4) and information elements derived from behavior during the collaboration (Table 5). The information elements *updated list of professional/private interests* were refined by the results of the interview in the previous section.

Information Element	Relation with TWAN
Age	Communality, Availability, Sharing

Gender	Communality, Availability, Sharing
Nationality	Communality, Availability, Sharing
Hobbies	Communality, Availability, Sharing
Honorary activities	Communality, Availability, Willingness to help, Faith in intentions, Caring, Friendliness, Commitment, Openness, Sharing
TV shows	Communality, Availability, Openness, Sharing, Receptivity
Taste of music	Communality, Availability, Openness, Sharing, Receptivity
Companies / Experience (projects)/ References (Awards)	Communality, Self-confidence, Knowledge, Reliability
Department	Communality, Skills, Knowledge
Degree (years in the program)	Communality, Reliability, Consistency, Responsibility, Persistence, Competence
Specialization/Interests	Communality, Consistency, Persistence, Competence, Knowledge
Specific skills	Communality, Knowledge, Competence, Skills

Table 4. Information initially available before collaboration

All of the original information elements from Table 5 according to Rusman are used, but they are not actively part of the template itself. They can be perceived by the participants passively.

Information element	Relation with TWAN
Message read by addressed person	Availability, Reliability, Responsibility
Suggestion/idea	Competence, Willingness to help, Sharing, Openness, Commitment, Self-confidence,

	Persistence, Responsibility
Task-status overview (task, accepted by, deadline, status)	Competence, Reliability, Responsibility
Average response	Availability, Receptivity, Commitment, Consistency, Responsibility

Table 5. Information derived from behavior during collaboration

Different information elements affect trust in different ways, so the TWAN schema was divided into affective and cognitive trust. The personal information elements should support affective trust and the expertise level information elements should support cognitive trust.

3.5 Design and Implementation of the Prototype

Since distributed teams usually collaborate via the Internet, a web-based software tool is one possible way to implement an initial trust template for idea generation and idea evaluation sessions. A *horizontal prototype* [66] was designed by focusing at first on the user interaction and later on the low-level system functionality like the data transfer.

Six different versions of the web pages of both the idea generation and the idea evaluation session were created, because two different tasks were used as well as three different conditions – the control group with no information, the participants who only perceive personal information, and the participants who only perceive expertise level information.

The interface for the idea generation session and idea evaluation session is an application based on XHTML [106], CSS [23], PHP [77], and Ajax [3]. The prototype consists of a client (web browser) and a server (web server with database). XHTML and Ajax were used to create the user interface of the prototype and the different functionalities. Furthermore PHP connects the client with the server. It serves the purpose to save the input of the user on the

server. The input is the ideas in the idea generation session and the ratings in the idea evaluation session. CSS was used to complete the visual design of the prototype.

3.5.1 Initial Trust Template for Idea Generation

The idea generation session consists of two different web pages. The first web page is shown in Figure 4 and the second web page is shown in Figure 5.

The start page of the idea generation session consists of four main parts. Part number one is an overview about the different steps of the session to provide an overview for the participants, while part number two shows the task for the session so that the participants know what to do in the next step. Next part number three provides further information about the technology used in the task in case the participants are not familiar with it, and part number four shows the profiles of two other participants, depending on the condition the participant was randomly assigned to.

Start Idea Generation Session

Thank you for participating in this study. In the first step you will generate ideas with two other participants. The idea generation session contains three steps:

- (1) Read the task and think about it (5 minutes)
- (2) Generate ideas (15 minutes)
- (3) Fill out questionnaire (5 minutes)

Now you have 5 minutes to read the idea generation task and think about it.

You have been retained by Facebook Inc. to identify new software concepts for their website. Facebook Inc. is interested in software concepts likely to be appealing to students. These software concepts might be solutions to unmet needs or improved solutions to existing needs of a student Facebook user.

The goal is to get a list of ideas, which have a title, a short description and the advantage of the idea regarding the following question: "How could we make Facebook more useful for students?"

Be specific, complete and concise – yet you need to provide enough information so that someone else can fully understand your idea without requiring further explanation.

While writing please consider the following rules:

- (1) Criticism is ruled out.
- (2) Freewheeling is welcome.
- (3) Quantity is wanted.
- (4) Combinations and improvement are sought.

You have 4:57 minutes left.

You will work together with two other participants. You can find information about them on the right side of the screen during the entire session. Your information will be shown to them as well.

In case you don't know Facebook, we provided additional information about it below.

Description of Facebook Features

Features

Each user can have a profile page with personal information and upload photos or videos. On the whiteboard of the profile, visitors can leave messages. As an alternative to public news, users can send personal or chat messages to other users. Friends can be invited to groups and events. Facebook also has a marketplace where users can place and view classified ads. Furthermore users can be informed about news, such as new wall posts on the profile pages of friends by a watch list.

You are logged in as: Participant 1
Your profile is shown to the other participants.

Participant 2:

- Companies/References: Google Inc., Apple Inc.
- Awards: No awards
- Degree: M.Sc.
- Department: Computer Science
- Current year in the program: 3rd
- Specialization/Interests: Visualization, Software Engineering
- Skills: Java, C++, PHP, JSP, Javascript, Ajax

Participant 3:

- Companies/References: Microsoft Research
- Awards: Outstanding Research Award
- Degree: Ph.D.
- Department: Social Sciences
- Current year in the program: 5th
- Specialization/Interests: Social Networks, Education
- Skills: Experienced in quantitative and qualitative analyses

Figure 4. Start screen for the idea generation session

The second web page of the idea generation session also consists of four main parts. Part number one shows the specific task and the brainstorming rules so that the participants remember what they are supposed to do and how they are supposed to do it, while part number two is the chat window that displays the contributions of the participants. Next part number three is a pre-defined input mask for the entry of the participant's contributions and part number four shows the profiles of the two other participants as on the start page.

Idea Generation Session

Now you have 15 minutes to generate ideas for the task: 'How could we make Facebook more useful for students?'

While writing please consider the following rules:

- (1) Criticism is ruled out.
- (2) Free-wheeling is welcome.
- (3) Quantity is wanted.
- (4) Combinations and improvement are sought.

You are logged in as: Participant 1
Your profile is shown to the other participants.

Participant 2:

- Companies/References: Google Inc., Apple Inc.
- Awards: No awards
- Degree: M.Sc.
- Department: Computer Science
- Current year in the program: 3rd
- Specialization/Interests: Visualization, Software Engineering
- Skills: Java, C++, PHP, JSP, Javascript, Ajax

Participant 3:

- Companies/References: Microsoft Research
- Awards: Outstanding Research Award
- Degree: Ph.D.
- Department: Social Sciences
- Current year in the program: 5th
- Specialization/Interests: Social Networks, Education
- Skills: Experienced in quantitative and qualitative analyses

Participant 2:
Title: Electronic bulletin board
Description: A bulletin board integrated into Facebook
Advantage: Can look up cheap stuff and does not need another website

Participant 3:
Title: Calendar
Description: Important dates (e.g. exam date) are in a calendar in Facebook
Advantage: Student is up-to-date

Idea title: _____

Idea description: _____

Advantage of idea for the student: _____

You have 13:54 left.

Figure 5. Idea generation session

3.5.2 Initial Trust Template for Idea Evaluation

The idea evaluation session also consists of two different web pages. The first page is shown in Figure 6 and the second page is shown in Figure 7.

The start page of the idea evaluation session consists of four main parts. Part number one is an overview about the different steps of the session to pro-

vide an overview for the participants, while part number two is the task for the session so that the participants know what to do in the next step. Next part number three provides further information about the technology used in the task in case the participants are not familiar with it and part number four shows the profiles of two other participants as in the idea evaluation session.

Start Idea Evaluation Session

In the next step you will evaluate ideas with the group for a **different task**. These ideas are generated by other people. The final ratings of the ideas will be determined by the average of ratings provided by you and the other participants in your group. The idea evaluation session contains four steps:

- (1) Read the task and think about it (5 minutes)
- (2) Evaluate ideas (10 minutes)
- (3) See final result (5 minutes)
- (4) Fill out questionnaire (5 minutes)

Now you have 5 minutes to read the idea evaluation task and think about it.

You have been retained by **Apple Inc.** to identify new software concepts for their iPad2. Apple Inc. is interested in software concepts likely to be appealing to **senior citizens**. These software concepts might be **solutions to unmet needs** or **improved solutions to existing needs** of senior citizens using the iPad2.

The goal is to get a ranked list of ideas, which are original and feasible regarding the following question: 'How could we make the iPad2 more useful for senior citizens?'

Please rate every idea by **originality** and **feasibility** (1 star = lowest rating, 5 stars = highest rating). The best three ideas will be implemented. Be aware of that two other people rated the same ideas and the result of all three ratings will be merged.

You have 4:57 minutes left.

You will work together with two other participants. You can find information about them on the right side of the screen during the entire session. Your information will be shown to them as well.

In case you don't know the iPad2, we provided additional information about it below.

Description of iPad2 Features

Two cameras.

You'll see two cameras on iPad — one on the front and one on the back. They may be tiny, but they're a big deal. They're designed for FaceTime video calling, and they work together so you can talk to your favorite people and see them smile and laugh back at you. The front camera puts you and your friend face-to-face. Switch to the back camera during your video call to share where you are, who you're with, or what's going on around you. When you're not using FaceTime, let the back camera roll if you see something movie-worthy.

LED-backlit display.

iPad is one big, beautiful display — 9.7 inches of high-resolution photos, movies, web pages, books, and more. LED backlighting makes everything you see remarkably crisp, vivid, and bright. Even in places with low light, like an airplane. And there's no wrong way to hold iPad. It's

You are logged in as: Participant 1
Your profile is shown to the other participants.

Participant 2:

- Companies/References: Google Inc., Apple Inc.
- Awards: No awards
- Degree: M.Sc.
- Department: Computer Science
- Current year in the program: 3rd
- Specialization/Interests: Visualization, Software Engineering
- Skills: Java, C++, PHP, JSP, Javascript, Ajax

Participant 3:

- Companies/References: Microsoft Research
- Awards: Outstanding Research Award
- Degree: Ph.D.
- Department: Social Sciences
- Current year in the program: 5th
- Specialization/Interests: Social Networks, Education
- Skills: Experienced in quantitative and qualitative analyses

Figure 6. Start screen for the idea evaluation session

The second web page of the idea evaluation session also consists of four main parts. Part number one shows the specific task so that the participants remember what they are supposed to do and how they are supposed to do it, while part number two is the rating area the participant can manipulate by clicking on the stars. Next part number three shows the previously rated ideas by two other participants and the final result of the idea evaluation session and part number four shows the profiles of the two other participants as on the start page.

Idea Evaluation Session

Please take your time to read the ideas and think about their originality and feasibility to the task: 'How could we make the iPad2 more useful for senior citizens?'
Choose your rating carefully, because you can rate an idea only once.

1

You are logged in as: Participant 1
Your profile is shown to the other participants.

Participant 2:

- Companies/References: Google Inc., Apple Inc.
- Awards: No awards
- Degree: M.Sc.
- Department: Computer Science
- Current year in the program: 3rd
- Specialization/Interests: Visualization, Software Engineering
- Skills: Java, C++, PHP, JSP, Javascript, Ajax

Participant 3:

- Companies/References: Microsoft Research
- Awards: Outstanding Research Award
- Degree: Ph.D.
- Department: Social Sciences
- Current year in the program: 5th
- Specialization/Interests: Social Networks, Education
- Skills: Experienced in quantitative and qualitative analyses

List of Ideas	Participant 1 (You) <small>Please rate here by clicking on the stars.</small>	Participant 2 <small>...rated as follows:</small>	Participant 3 <small>...rated as follows:</small>	Result
Idea 1 Idea Title: Analysis of illness symptoms Short Description: App for analyzing illness of senior citizen Advantage For The Senior Citizen: For senior citizens who get sick often	Originality: ★★★★★ Feasibility: ★★★★★	Originality: ★★★★★ Feasibility: ★★★★★	Originality: ★★★★★ Feasibility: ★★★★★	Result: 0.0/5 (0 votes cast)
Idea 2 Idea Title: Grow-Up-Scrapbook-App for grandchildren Short Description: App which documents the grow up of the grandchildren Advantage For The Senior Citizen: For senior citizens with grandchildren	Originality: ★★★★★ Feasibility: ★★★★★	Originality: ★★★★★ Feasibility: ★★★★★	Originality: ★★★★★ Feasibility: ★★★★★	Result: 0.0/5 (0 votes cast)
Idea 3	Originality: ★★★★★	Originality: ★★★★★	Originality: ★★★★★	

Figure 7. Idea evaluation session

3.6 Validation of the Prototype

To deploy the prototype for the experiment it has to be validated beforehand. The validation makes sure that the prototype functions correctly and therefore minimizes errors during the experimental session. To validate the prototype a test run was conducted with two dummy participants. Both participants had the task to access the website and go once through the entire process once. Additionally they were supposed to produce errors on purpose. The participants found some inconsistencies.

Therefore all requirements were tested during the validation and the results showed that the prototype is a solid basis for the experiment described in Chapter 4.

4 Experiment

In this chapter the conducted experiment is examined. At first the goals and expectations for the experiment are presented. Afterwards the experimental setup is described in detail, including the description of the participants, scenario, and tasks. The chapter concludes with the measures used in the experiment.

4.1 Goals and Expectations

The goal of this experiment is to examine if knowing specific information might support trust in a distributed idea generation and idea evaluation sessions. Moreover, it is determined if higher trust affects the output of both sessions in a positive or negative way.

If the results show that there is a positive correlation between personal information or expertise and affective trust in the idea generation phase, a statement is possible on how that influences the kind of ideas created. The thesis claims that more affective trust might lead to more radical ideas. On the contrary more cognitive trust might lead to more incremental ideas.

Furthermore if the results show that there is a positive correlation between the expertise level and cognitive trust in the idea evaluation phase, a statement is possible on how that influences the rating behavior of the participants and their satisfaction with the result. More cognitive trust is hypothesized to lead to more satisfaction regarding the evaluation result. It also could lead to a more similar rating, because the participants agree more with experts.

In Chapter 1 four hypotheses were introduced which are considered in the experiment and summarize the main expectations of the experiment:

Hypothesis 1: Knowing personal information of an individual leads to more affective trust during the distributed idea generation session.

Hypothesis 2: More affective trust during the distributed idea generation session leads to more radical ideas.

Hypothesis 3: Knowing the expertise level of an individual leads to more cognitive trust during the distributed idea evaluation session.

Hypothesis 4: More cognitive trust in the distributed idea evaluation session leads to a better consensus within the group.

In regards to these hypotheses the following questions have to be answered in order to measure the achievement of the goals and expectations of this thesis:

1. Does knowing of personal information have an effect on affective trust in the idea generation session?
2. Does knowing of the expertise level have an effect on affective trust in the idea generation session?
3. Does more affective trust during the idea generation session lead to more radical ideas?
4. Does knowing of the expertise level have an effect on cognitive trust in the idea evaluation session?
5. Does knowing of personal information have an effect on cognitive trust in the idea evaluation session?
6. Does more cognitive trust during the idea evaluation session affect the rating behavior of the participants?
7. Does more cognitive trust during the idea evaluation phase lead to more consensus about an idea?

In the following sections it is described how these questions can be answered with the help of the experiment.

4.2 Experimental Setup

This section contains the experimental design, including the description of the participating subjects, the tasks, and the study design.

4.2.1 Study Design

The study follows a 3x2x2 counterbalanced within-subjects design (see Table 6). All participants accomplish both the idea generation and idea evaluation session. The participants are divided into male and female. Furthermore the tasks are counterbalanced (setup A¹ and setup B²). Each participant was randomly assigned to one of three different conditions. In *condition N* the participants did not get any information about their team members. In *condition P* the participants did get personal information about their team members, and in *condition E* the participants got the expertise level of their team members.

Idea Generation (IG) & Idea Evaluation (IE)											
Male						Female					
Setup A			Setup B			Setup A			Setup B		
N	P	E	N	P	E	N	P	E	N	P	E

Table 6. Study design

Before the study began each participant had to complete a demographics survey (see Appendix A.1). When the study began the subjects were scheduled to show up alone. The procedure took place in a behavioral research lab. At first each participant had the study explained by the research staff. They were asked to provide verbal consent before they were allowed to participate in the

¹ Setup A = Facebook task in IG and iPad2 task in IE

² Setup B = iPad2 task in IG and Facebook task in IE

study. They did receive training on the usage of the prototype. The subjects were assigned to one of the three possible conditions (N, P, and E) and were given one of the two tasks described in Section 4.2.4. The subjects then got a one page long description of the major functionalities of Facebook (see Appendix A.2) or the iPad2 (see Appendix A.3) depending on the task they were randomly assigned to.

Each subject then logged into the system and generated ideas (which were logged) for 15 minutes with two confederates (described in Section 4.2.3). After a short break the participants were asked to fill out a follow up questionnaire about their personal trust level during the idea generation activity (see Appendix A.9), as well as their satisfaction with the result of the idea generation session.

Next they were asked to evaluate six ideas provided by the researchers. The six ideas depended on the task the participants got (see Appendix A.10 and A.11). Each participant stayed in the same condition, but the task was counter-balanced to the task in the idea generation session. All of them rated six ideas for originality and feasibility on a 5-point scale. After a short break the participants had to fill out a follow-up questionnaire about their personal trust level during the idea evaluation (see Appendix A.12) as well as their satisfaction with the result of the idea evaluation session.

The entire study lasted approximately 60 minutes and did not include any photographs, audio or video recordings. The subject's privacy was protected.

4.2.2 Subjects

Altogether 36 participants from a major US university campus took part in the experiment. 18 of them were male and 18 were female. They were between the ages of 20 and 33 years. The age distribution is shown in Figure 8.

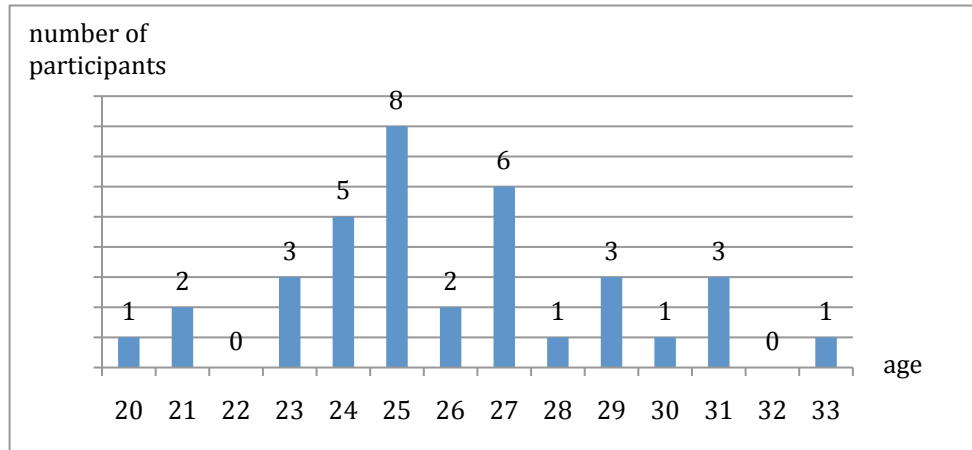


Figure 8. Age distribution of the participants

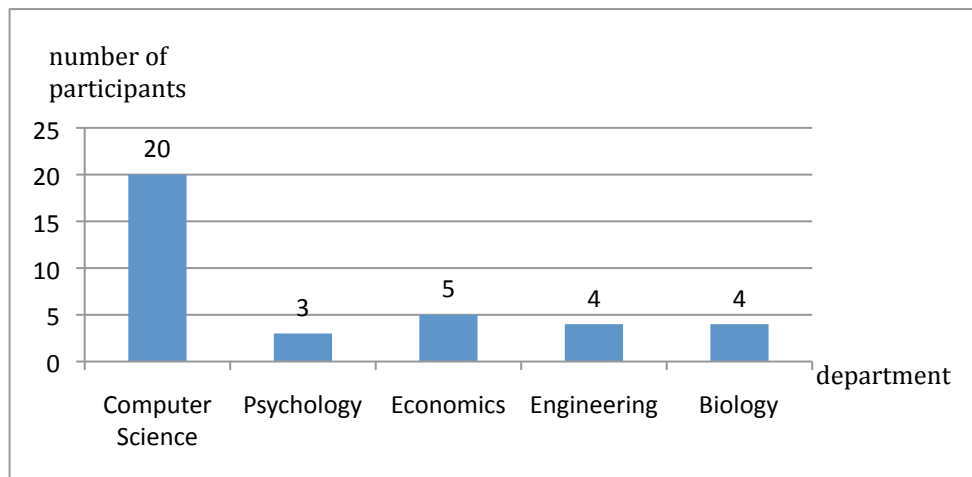


Figure 9. Department distribution of the participants

The nationality distribution of the participants contains 21 Americans, three Asians, and 11 Europeans from different departments (see Figure 9). Furthermore there were three Bachelor students, 14 Master students, 12 PhD students, and four Post-Docs. Most of the participating students were from the computer science department and the others are almost equally distributed to psychology, economics, engineering, and biology. Figure 10 shows the distribution of the participant's experience with idea generation (IG) and idea evaluation (IE). Almost all participants were familiar with the processes on at least occasional basis.

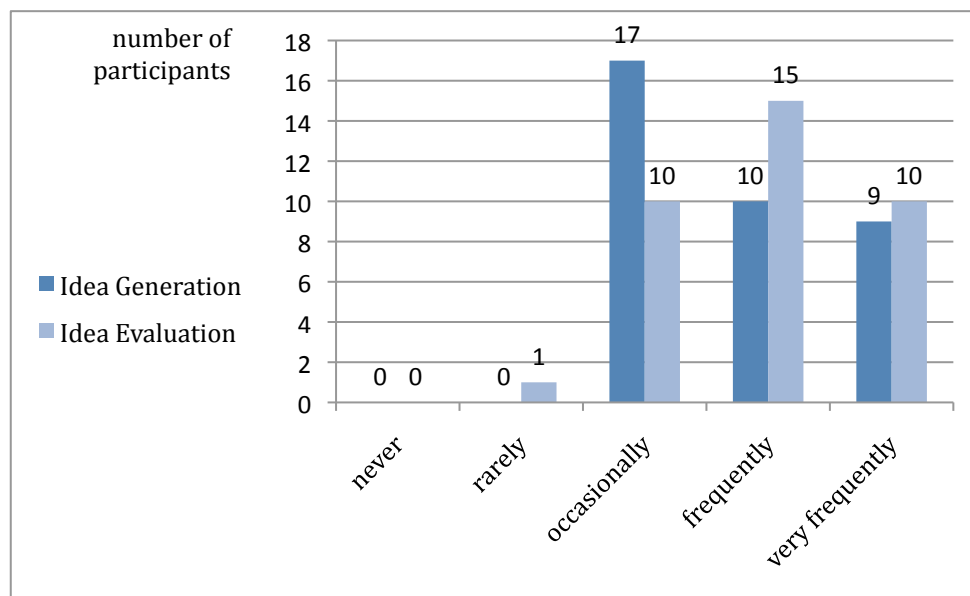


Figure 10. Experience distribution regarding IG and IE

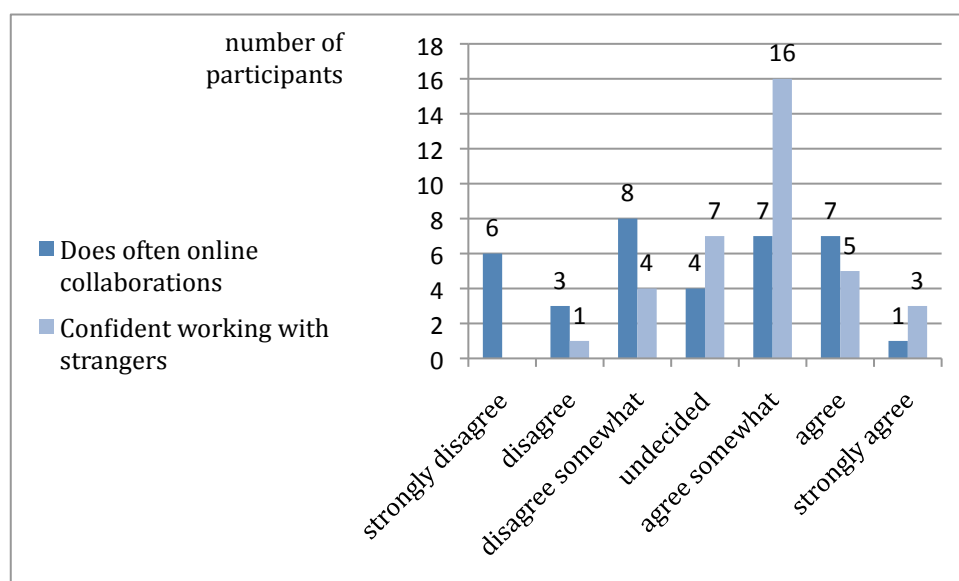


Figure 11. Online collaborations and working with strangers

Figure 11 displayed how often the participants do online collaborations and how confident they are working with strangers. Most of the participants are fine working with strangers and the experience range of doing online collaborations is wider in comparison to their confidence in working with strangers.

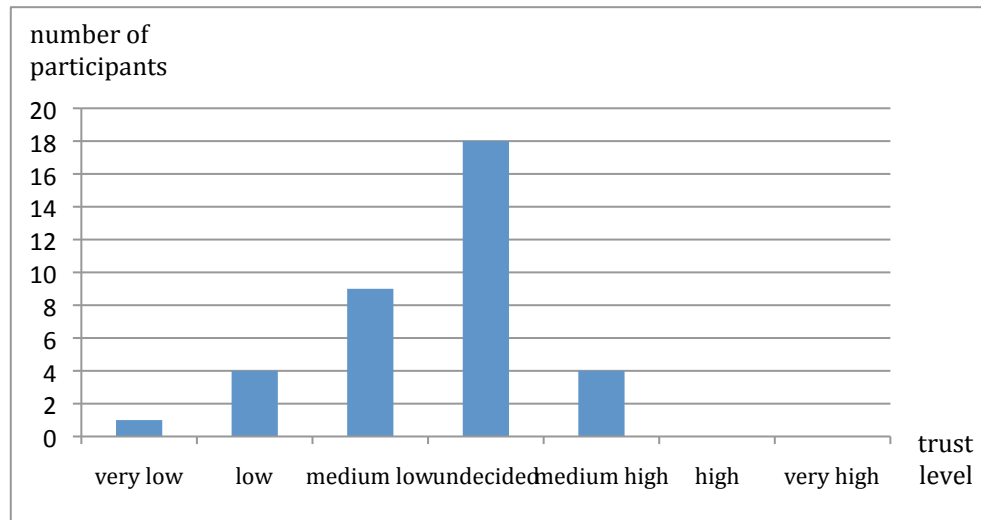


Figure 12. Overall trust level distribution of participants

Figure 12 shows the distribution of the overall trust level of the participants. Most students were undecided about their trust level regarding other people. This could mean that they start every meeting with a new person on a neutral basis. On the other hand the trend of the overall trust level tends to the lower end of the trust spectrum.

4.2.3 Confederates

Two confederates (bots) are used to simulate idea generation and idea evaluation processes in a group of three people. In the idea generation session the confederates entered an applicable list of ideas into the chat window at specific times (see Appendix A.5 and A.6), which means every participant saw the same ideas. Each confederate had an applicable list of ten ideas, which contains the name of the idea, a short description of the idea, and an advantage for the target group, depending on the task. Depending on the condition (described in Section 4.2.1), different profile information of the confederates was shown to the participants (see Table 7). This information was chosen, because it represents two typical fictive participants of this study. In the idea evaluation session the ideas displayed to the participants were previously rated by two experts (see Appendix A.10 and A.11).

Condition	Confederate 1	Confederate 2
N	Participant 2 ...is logged in	Participant 3 ...is logged in
P	Age: 27 Gender: Male Nationality: American Hobbies: Playing basketball and guitar Honorary Activities: Deans List, Athletic Department Honor Roll TV shows: How I Met Your Mother, Chuck, Seinfeld Taste of Music: Rock, Indie	Age: 25 Gender: Female Nationality: American Hobbies: Music, photography, swimming Honorary Activities: Co-founder of a non-profit association TV shows: Sex and the City, The Big Bang Theory, The Simpsons Taste of Music: Electronic
E	Companies/References: Google Inc., Apple Inc. Awards: No awards Degree: M.Sc. Department: Computer Science Current year in the program: 3rd Specialization/Interests: Visualization, Software Engineering Skills: Java, C++, PHP, JSP, Javascript, Ajax	Companies/References: Microsoft Research Awards: Outstanding Research Award Degree: Ph.D. Department: Social Sciences Current year in the program: 5th Specialization/Interests: Social Networks, Education Skills: Experienced in quantitative and qualitative analysis

Table 7. Profiles of confederates

4.2.4 Tasks

In the past several standard tasks were created for idea generation problems [104]. A classical brainstorming task, such as the thumb and people problem [11] was not chosen, because it is already very imaginary. Instead, a software topic for a well-known application was chosen, because all participants are able to put themselves into that position. It does not matter if the participant has a major in computer science or something similar, because the main focus is on the plain idea. One of the idea generation problems on the website [104] was adapted to two software-related problems. The first problem considers Facebook Inc. and the second problem considers Apple Inc.. So the participants will be given one of the following two tasks for the idea generation session:

Task 1:

“You have been retained by Facebook Inc. to identify new software concepts for their website. Facebook Inc. is interested in software concepts likely to be appealing to students. These software concepts might be solutions to unmet needs or improved solutions to existing needs of a student Facebook user.

The goal is to get a list of ideas, which have a title, a short description and the advantage of the idea regarding the following question: ‘How could we make Facebook more useful for students?’

Be specific, complete and concise – yet you need to provide enough information so that someone else can fully understand your idea without requiring further explanation.”

Task 2:

“You have been retained by Apple Inc. to identify new software concepts for their iPad2. Apple Inc. is interested in software concepts likely to be appealing to senior citizens. These software concepts might be solutions to unmet needs or improved solutions to existing needs of senior citizens using the iPad2.

The goal is to get a list of ideas, which have a title, a short description, and the advantage of the idea regarding the following question: ‘How could we make the iPad2 more useful for senior citizens?’

Be specific, complete and concise – yet you need to provide enough information so that someone else can fully understand your idea without requiring further explanation.”

For the idea evaluation session the participants got one of the following two tasks:

Task 1:

“You have been retained by Facebook Inc. to evaluate new software concepts for their website. Facebook Inc. is interested in software concepts likely to be appealing to students. These software concepts might be solutions to unmet needs or improved solutions to existing needs of a student Facebook user.

The goal is to get a ranked list of ideas, which are original and feasible regarding the following question: ‘How could we make Facebook more useful for students?’

Please rate every idea by originality and feasibility (scale 1 = lowest to 5 = highest). Be aware of that two other people will rate the same ideas and the result of all three ratings will be merged.”

Task 2:

“You have been retained by Apple Inc. to evaluate new software concepts for their iPad2. Apple Inc. is interested in software concepts likely to be appealing to senior citizens. These software concepts might be solutions to unmet needs or improved solutions to existing needs of senior citizens using the iPad2.

The goal is to get a ranked list of ideas, which are original and feasible regarding the following question: ‘How could we make the iPad2 more useful for senior citizens?’

Please rate every idea by originality and feasibility (scale 1 = lowest to 5 = highest). Be aware of that two other people will rate the same ideas and the result of all three ratings will be merged.”

4.3 Metrics

The goal of this experiment is to examine if knowing of specific information might support trust in distributed idea generation and idea evaluation sessions. Furthermore it is determined if higher trust affects the output of both phases in a positive or negative way. Thus, different kinds of metrics are needed: trust metrics for both the idea generation and idea evaluation session as well as idea quality metrics for the idea generation session and satisfaction metrics for the idea evaluation session.

4.3.1 Trust Metrics

Two major groups of trust metrics do exist: formal metrics and empirical metrics. Formal metrics are formalizations leading to the ease of manipulation, processing, and reasoning about trust. On the contrary empirical metrics support the capture of values of trust in a reliable and standardized way. In this experiment the questions fitting to TWAN (see Chapter 2) were used. In Table 8 the TWAN variables and the associated question(s), combined as a construct to measure affective trust in the idea generation and idea evaluation session are shown.

Variable	Questions
Communality	I trust because ___ shares the same interests.
Benevolence	
Willingness to help	I feel that I can count on ___ to help me with a crucial problem.
Availability (given)	___ was available during the session.
Sharing	I felt I could freely share my ideas in this group.
Faith in intentions	___ has good intentions.

Caring	___ cares about the well-being of others.
Commitment	I was very committed to the task. I think ___ was very committed to the task.
Friendliness	___ is friendly and approachable.
Openness	___ is secretive.

Table 8. Metrics for affective trust

In Table 9 the TWAN variables and the associated question(s), combined as a construct to measure cognitive trust in the idea generation and idea evaluation session are shown.

Variable	Questions
Communality	I trust because ___ shares the same background.
Ability	
Knowledge	I trust ___ to contribute relevant expertise to this project.
Skills	I have confidence in the skills of ___.
Competence	___ does things competently.
Accountability	
Reliability	I feel that ___ will not keep his / her word.
Consistency	___ behaves in a very consistent manner.
Self-confidence	I think that ___ is very self-confident.
Persistence	Even in hard working circumstances I can count on ___ to follow through on work commitments.
Responsibility	I can rely on ___ not to make my work more difficult by careless work.

Table 9. Metrics for cognitive trust

After accomplishing the experiment, Cronbach's alpha [8] was calculated and resulted in an alpha reliability for the 'affective trust' part of the questionnaire of 0.87. As a result this construct of affective trust is valid. The items correlate and reveal the same underlying trend. The alpha reliability for the 'cognitive trust' part of the questionnaire is 0.93. As a result this construct of cognitive trust is also valid. The items correlate and reveal the same underlying trend.

4.3.2 Satisfaction Metrics

Additionally general questions about the satisfaction of the participant with the process were asked, as shown in Table 10.

Variable	Questions
General	<p>I am satisfied with my own performance.</p> <p>I am satisfied with the performance of ____.</p> <p>I am satisfied with the overall result.</p> <p>I enjoyed working on this particular problem.</p> <p>I ignored the contributions of the other group members.</p> <p>The people I worked with are trustworthy.</p>

Table 10. Metrics for satisfaction

The alpha reliability for this part of the questionnaire is 0.72. As a result this construct of satisfaction is also valid. The items correlate and reveal the same underlying trend.

4.3.3 Idea Quality Metrics

In the literature of creative idea generation ideas are usually measured by their *quantity* and *quality* [28]. The quantity of an idea is defined as the number of unique ideas produced in the idea generation phase. The quality of an idea is defined as a combination of *originality* and *feasibility*. In this thesis the idea quality measure in Rietzschel et al. [83] was adapted. People were asked to rate ideas by their originality and feasibility on a 5-point scale. This measure is an extension of the classic approach of Diehl and Stroebe [28].

Researchers typically use the sum-of-cores approach, the average-quality-score, or the count-of-good-ideas approach by Diehl and Stroebe [28]. Reinig et al. recommended to “...use the count-of-good ideas approach for assessing ideation quality because it is not biased by the presence of bad ideas and assumes an ordinal rather than interval scale for the idea quality score” [80]. Thus, in this thesis the *count-of-good-ideas* approach was used. To count the ideas, they were rated first by two experts for originality and feasibility on a 5-point scale independently. The scale points are accompanied by descriptions for a better understanding of their meaning (see Table 11 and Table 12). All ideas are rated in random order for originality, and after that in a newly randomized order for feasibility.

Scale Point	Description
1	<ul style="list-style-type: none">• Highly unoriginal• Very common• Often concerns only issues that already exist
2	<ul style="list-style-type: none">• Unoriginal• Common
3	<ul style="list-style-type: none">• Not really original
4	<ul style="list-style-type: none">• Innovative• Introduce radically new applications of existing things

5	<ul style="list-style-type: none"> • Highly original • Very innovative • Often introduce radically new applications of things that are completely new
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Table 11. Originality Scale

Scale Point	Description
1	<ul style="list-style-type: none"> • Highly unfeasible • Cannot be implemented • Means are nonexistent
2	<ul style="list-style-type: none"> • Unfeasible • Might be implemented under certain circumstances • Means are unavailable
3	<ul style="list-style-type: none"> • Not really feasible • Can be implemented • Means are available
4	<ul style="list-style-type: none"> • Feasible • Easy to implement • Does not require large investments (either in money or in time)
5	<ul style="list-style-type: none"> • Highly feasible • Very easy to implement • Does not require large investments (either in money or in time)

Table 12. Feasibility scale

In Table 13 all ideas sorted into the green cells (R) are counted as radical ideas and all ideas sorted into the orange cells (I) are counted as incremental ideas. All ideas having a feasibility of one or an originality of one (in the red

cells) were not considered (D).

		Originality				
		1	2	3	4	5
Feasibility	1	D	D	D	D	D
	2	D	I	I	I	I
	3	D	I	R	R	R
	4	D	I	R	R	R
	5	D	I	R	R	R

Table 13. Originality/feasibility matrix

In this chapter the experimental design and the execution of the experiment were described. Furthermore the presented metrics were used to calculate the results, which can be found in Chapter 5.

5 Results and Discussion

In this chapter the results of the experiment are analyzed and discussed. The results of the idea generation session and the idea evaluation session are split up into two different sections.

5.1 Results of the Idea Generation Session

Looking back on Chapter 1 the following two hypotheses were considered regarding idea generation:

Hypothesis 1: Knowing of personal information of an individual leads to more affective trust during the distributed idea generation session.

Hypothesis 2: More affective trust during the distributed idea generation session leads to more radical ideas.

To test these hypotheses, *MANOVA* (Multivariate Analysis of Variance) and *t-tests* were performed with the data obtained from the idea generation session. The data includes the answers to the questionnaire the participants got along after the session, along with the ideas generated, which were rated by two experts.

5.1.1 Knowing of Information and its Effect on Trust in IG

To test Hypothesis 1 and Hypothesis 2 *MANOVA* was performed first to evaluate the effect of *condition* (knowing no information = “condition N”, ver-

sus knowing personal information = “condition P”, versus knowing the expertise level = “condition E”), *gender* (male versus female), and *task* (Facebook task versus Ipad2 task) on the trust level of the participants in the idea generation session. The test showed that there is no effect of gender and task on the trust level of the participants. The F-test did show however that there is a significant effect regarding the different conditions and the trust level of participants in the idea generation session ($F(14,48) = 3.52, p < 0.0006$)).

To get further insight in how the different conditions affect the trust level of the participants, t-tests were conducted with the answers to the questionnaire the participants had to fill out after the idea generation session. The first 18 questions of the questionnaire were related to the affective trust categories of the TWAN schema (see Table 8). The t-tests showed that the participants in *condition P* developed significantly more affective trust in the idea generation session than the control group *condition N* ($t(22) = 3.96, p < 0.0003$). A similar effect could be observed for *condition E* in which participants also developed significantly more affective trust than in the control group ($t(22) = 3.46, p < 0.001$).

The next 16 questions of the questionnaire were related to the cognitive trust categories of the TWAN schema (see Table 9). The tests showed similar results. The participants in *condition P* developed significantly more cognitive trust in the idea generation session than the participants in the control group *condition N* ($t(22) = 3.06, p < 0.0028$). A similar effect can be seen in *condition E* in which the participants also developed significantly more cognitive trust than in the control group ($t(22) = 2.73, p < 0.006$).

In the third and last section of the questionnaire the participants were asked about their general satisfaction and the personal trust level they felt regarding the other participants. The t-test supports what the other two parts of the questionnaire already showed. In *condition P* the participants felt significantly more overall trust than the participants in *condition N* ($t(22) = 2.55, p < 0.009$). Additionally, the participants from *condition P* felt more overall trust than the participants from *condition E* ($t(22) = 1.85, p < 0.03$). In Table 14 a summary of the results in the idea generation sessions is shown.

	Affective Trust	Cognitive Trust	Satisfaction
Condition P vs. N	$t(22) = 3.96,$ $p < 0.0003$	$t(22) = 3.06,$ $p < 0.0028$	$t(22) = 2.55,$ $p < 0.009$
Condition E vs. N	$t(22) = 3.46,$ $p < 0.001$	$t(22) = 2.73,$ $p < 0.006$	No significance
Condition P vs. E	No significance	No significance	$t(22) = 1.85,$ $p < 0.03$

Table 14. Summary of results in the idea generation session

With regard to affective trust, it was shown that knowing of personal information leads to more affective trust during the distributed idea generation session. It was surprising to observe that the knowing of the expertise level also leads to more affective trust when its primary goal is to support cognitive trust. Apparently it is not possible to clearly distinguish affective trust and cognitive trust, because the participants not only perceive the profile information, they also perceive information derived from behavior during the collaboration, like the different ideas of the confederates and their average response. Note though that the impact of affective trust is much stronger by knowing personal information than by knowing the expertise level.

With regard to cognitive trust the statistical analysis showed that knowing of the expertise level leads to more cognitive trust during the distributed idea generation session. It again was surprising to observe that the knowing of personal information also leads to more cognitive trust when its primary goal is to support more affective trust. It is interesting to observe that a clear cut between cognitive and affective trust is not possible. Knowing both personal information and expertise level enhance affective and cognitive trust in the idea generation session. Thus knowing any personal information or expertise level enhances trust in general.

Another thing that has to be noticed in the data is that there is a difference between the trust level calculated from the TWAN schema questions and the personal trust level felt by the participants. According to TWAN both groups - *condition P* and *condition E* - had a similar high trust level in comparison to the

control group. The data for knowing personal information and affective trust had by far the best results though. Moreover the felt personal trust level of the participants showed that *condition P* outperforms *condition E*.

As a result it can be said that the data supports *Hypothesis 1*. Showing personal information has a strong effect on the affective trust of the participants.

5.1.2 Quantity of Ideas

The 36 participants created a total amount of 177 ideas. The total amount of ideas created in the control group *condition N* is 48, 77 in *condition P*, and 52 in *condition E*. Different t-tests were performed to determine the effect of trust on the total amount of ideas for the three different conditions. By looking at the pure numbers a strong trend is already visible. The t-tests approved that there is no significant difference between the total amount of ideas created in *condition N* and *condition E* as they are almost equal. The test did approve that participants in *condition P* created significantly more ideas than in the control group *condition N* ($t(22) = 3.29$, $p < 0.05$) and in *condition E* ($t(22) = 2.68$, $p < 0.06$).

Condition N	Condition P	Condition E
48	77	52

Table 15. Number of ideas

In the previous section it was shown that the participants in *condition P* outperform the other two conditions regarding affective trust. Table 15 shows that the participants in *condition P* also created by far the most ideas. That leads to the assumption that more affective trust makes the participants open up more regarding the other participants and create more ideas, because they are not afraid of being judged for contributing all kinds of ideas. This fact supports *Hypothesis 2* partially. In the next section it is determined what kinds of ideas were created in the different conditions in hopes to make a statement

whether *condition P* also created more radical ideas than the other two groups or not.

5.1.3 Quality of Ideas

In order to determine if more affective trust during the idea generation session has any influence on the kind of ideas produced by the participants, two experts clustered and rated the ideas (see Appendix A.4). The inter-rater agreement coefficient was calculated as shown in the work of Diehl and Stroebe [28]. The ideas were rated for originality and feasibility on two 5-point scales (see Table 11 and 12). The ratings were in agreement when both ratings fell within one point of each other. The two experts agreed on 89.3% of the originality ratings and on 90.4% of the feasibility ratings. According to the definition of radical and incremental ideas in this thesis the total amount of radical ideas is 36 (20.3%), and the total number of incremental ideas is 53 (29.9%). The rest of the ideas were not considered, because they were neither incremental nor radical.

	Condition N	Condition P	Condition E
Radical ideas	11	19	5
Incremental ideas	14	27	13

Table 16. Number of radical and incremental ideas

The total amount of **radical ideas** in *condition N*, *P*, and *E* are 11, 19, and 5 respectively (see Table 16). The t-tests showed that there is a strong trend that the participants in *condition P* produced more radical ideas than in *condition N* ($t(22) = 1.54$, $p < 0.06$) and that the participants in *condition N* produced more radical ideas than in *condition E* ($t(22) = 1.54$, $p < 0.06$). The results are very close to being significant at the 5% level. The only real significance could be found in the fact that participants in *condition P* created more radical ideas than participants in *condition E* ($t(22) = 5.54$, $p < 0.0001$). There is weak signifi-

cance in two out of three cases. The experiment showed that the condition with the highest trust level created more radical ideas. That clearly supports *Hypothesis 2*. Furthermore it can be claimed that knowing the expertise level of the other participants has a negative influence on producing radical ideas. The enhanced affective trust in *condition P* seems to give participants enough confidence to write down more interesting or unusual ideas. It is very surprising that participants in *condition E* created lesser ideas even though their trust level according to TWAN is pretty much the same as in *condition P*. As mentioned earlier there is a big difference between the trust level calculated by TWAN and the personal trust level felt by the participants. Note that the personal feeling seems to have a very strong influence on the decision if someone is trustworthy or not, thus making it hard to decouple the properties of the very complex term *trust* into single questions to calculate it.

Moving on, the total amount of **incremental ideas** in *condition N* is 14, 27 in *condition P*, and 13 in *condition E*. A similar trend to the distribution of the radical ideas is visible (see Table 16). The conducted t-tests showed that participants in *condition P* created significantly more incremental ideas than the participants in *condition N* ($t(22) = 2.07, p < 0.02$) and *condition E* ($t(22) = 2.26, p < 0.01$). The number of ideas in *condition N* and *condition E* is almost equal.

In regard to pure originality and feasibility a significant effect of gender was found ($F(2,147) = 3.02, p < 0.04$). T-tests showed that female participants on average created more feasible ideas and male participants on average created more original ideas (see Table 17).

	Female participants		Male participants	
	Originality	Feasibility	Originality	Feasibility
Mean value	3.01	3.97	3.25	3.69
Standard dev	0.78	0.77	0.87	0.87

Table 17. Effect of gender on originality and feasibility of ideas

Since the ideas are clustered, a statement about the number of different ideas within the conditions can be made. The t-test showed that participants in

condition P created more different kinds of ideas than participants in *condition N*, ($t(22) = 3.56, p < 0.0009$) and in *condition E* ($t(22) = 3.06, p < 0.0028$).

As a result it can be stated that participants in *condition P*, the condition with the most affective trust, created significantly more ideas in general, as well as more radical and more incremental ideas, and more different kinds of ideas than the control group and the group which saw the expertise level of the other participants. That supports *Hypothesis 1* and *Hypothesis 2*.

5.2 Results of the Idea Evaluation Session

In retrospection to Chapter 1 the following two hypotheses are considered in the idea evaluation session:

Hypothesis 3: Knowing of the expertise level of an individual leads to more cognitive trust during the distributed idea evaluation session.

Hypothesis 4: More cognitive trust during the distributed idea evaluation session leads to a better consensus within the group.

To test these hypotheses *MANOVA* and *t-tests* were performed with the data produced in the idea evaluation session. The data includes the answers to the questionnaire the participants got after the idea evaluation session as well as their ratings of the provided ideas.

5.2.1 Knowing of Information and its Effect on Trust in IE

For testing Hypothesis 3 and Hypothesis 4 *MANOVA* was performed to evaluate the effect of *condition* (no information versus personal information versus expert level), *gender* (male versus female), and *task* (Facebook task versus Ipad2 task) on trust in the idea evaluation session. The test showed that

there is no effect of gender and task on the trust level of the participants in the idea evaluation session. However, there is significance regarding the different conditions and the trust level of participants in the idea evaluation session ($F(10,52) = 3.55, p < 0.0013$).

To get further insight in how the different conditions affect the trust level of the participants, t-tests were conducted with the answers to the questionnaire the participants had to fill out after the idea generation session. The first 18 questions of the questionnaire were related to the affective trust categories of the TWAN schema (see Table 8). The tests showed that only the participants in *condition P* developed significantly more affective trust in the idea evaluation session than the participants in *condition N* ($t(21) = 2.07, p < 0.02$). As a result it can be stated that knowing personal information leads to more affective trust in the idea evaluation session.

The next 16 questions of the questionnaire were related to the cognitive trust categories of the TWAN schema (see Table 9). The tests showed very different results. The participants in *condition P* developed significantly more cognitive trust than participants in the control group *condition N* ($t(22) = 2.32, p < 0.01$). A much stronger effect on cognitive trust can be observed in *condition E* ($t(22) = 4.82, p < 0.0000$). Furthermore there is also a significant difference between condition P and condition E ($t(22) = 3.03, p < 0.003$). That just means that showing the expertise level affects cognitive trust of participants much stronger than showing them personal information.

In Table 18 a summary of all results in the idea evaluation session is shown.

	Affective Trust	Cognitive Trust	Satisfaction
Condition P vs. N	$t(21) = 2.07, p < 0.02$	$t(22) = 2.32, p < 0.01$	$t(22) = 2.67, p < 0.006$
Condition E vs. N	No significance	$t(22) = 4.82, p < 0.0000$	$t(22) = 1.97, p < 0.03$
Condition P vs. E	No significance	$t(22) = 3.03, p < 0.003$	No significance

Table 18. Summary of results in the idea evaluation session

As a result the statistical analysis showed that knowing of the expertise level leads to higher cognitive trust during the distributed idea evaluation session. There was another surprising effect: the knowing of personal information also leads to more cognitive trust. Since the effect of knowing expertise level on cognitive trust is extremely strong, this is evidence that supports *Hypothesis 3*. It can again be broadly stated that knowing any personal information or expertise level about another person enhances trust in general.

5.2.2 Rating Behavior

In the third and last section of the questionnaire the participants were asked about their general satisfaction and the trust level they felt regarding the other participants. The participants in *condition P* felt significantly more trust than participants in *condition N* ($t(22) = 2.67, p < 0.006$). Furthermore the participants from *condition E* had also more overall trust than participants from *condition N* ($t(22) = 1.97, p < 0.03$). This also supports *Hypothesis 3* in that the general knowledge of some information enhances trust.

In order to determine if there is any correlation between the ratings of the participants and the provided expert ratings, a couple of t-tests were conducted, but there was no significance in all three of the different conditions. Therefore the participants did not tend to rate the same values as one of the two expert raters. However, by comparing the average originality ratings of all participants in the three conditions no significant effect could be found. All three conditions showed a similar rating behavior. Interestingly by comparing the average feasibility ratings of all participants in the three conditions an effect between *condition N* and *condition E* was found ($t(22) = 1.68, p < 0.05$). This means the participants in *condition E* tended to be more critical on the feasibility ratings. Table 19 shows an overview of the average ratings in the different conditions. Although there is no significance regarding the average originality rating of *condition P* in comparison to the other two conditions, there is still a strong trend, that participants in *condition P* on average also rated lower for originality. So their critical behavior is supported.

	Average Originality	Average Feasibility
Condition N	3.01	3.83
Condition E	3.18	3.87
Condition P	2.87	3.47

Table 19. Summary of rating average in the idea evaluation session

As a result participants were not significantly influenced by knowing personal information of other raters. It is important to note that knowing the expertise level clearly influenced the rating behavior of the participants. By knowing the expertise level they rated more critically, which is a surprising result. More cognitive trust did not lead to a better consensus, but to better satisfaction regarding the result. People do not tend to rate in the same way as so-called experts. Thus, the data does not support *Hypothesis 4*.

5.3 Summary of Results

The results of the experiment showed that trust does not differ depending on the task effect and that gender has little effect on trust. There is however a significant effect of condition on the trust level of participants and their output.

It was shown that the knowing of personal information leads to more affective trust in the distributed idea generation session. That supports *Hypothesis 1* and therefore satisfies the expectation of the approach. It was also shown that knowing the expertise level has a positive effect on affective trust. That is an unexpected result, but it can be explained by the fact that participants also perceive information in a passive way, e.g. by reading ideas of others. So there is always a mix between affective and cognitive trust, which cannot be separated in distributed idea generation. It could also be shown that participants knowing personal information created the most radical ideas. That supports *Hypothesis 2* and therefore satisfies the expectations of the approach. Additionally

female participants created more feasible ideas and male participants created more creative ideas in the experiment.

Regarding distributed idea evaluation the experiment showed that knowing the expertise level leads to more cognitive trust. The result supports *Hypothesis 3* and satisfies the expectations of the approach. It was also shown that knowing personal information has a positive effect on cognitive trust. This again is an unexpected result, but it can be explained by the fact that knowing any information enhances trust in general over than knowing nothing about another team member.

The experiment also showed that the participants knowing the expertise level of other team members were the most critical raters in comparison to the other participants. Hence more cognitive trust has an effect on the rating behavior of the participants, but in an unexpected way. It did not lead to a better consensus about an idea, but to more satisfaction regarding the result. Furthermore the participants rated the ideas more critically than participants in the other two conditions. Therefore *Hypothesis 4* is not supported and the expectation of the approach was not satisfied. This is interesting, as it can be a useful effect to make participants more critical regarding their own ratings. In this way participants really reflect on their own ratings and the ratings of other participants.

The overall results support the approach and show that providing personal information in distributed idea generation sessions and providing expertise level information in distributed idea evaluation sessions improve the output depending on the goal of those sessions. In Chapter 6 the limitations, benefits, and possible future work of this thesis are described.

6 Conclusions and Future Work

This chapter summarizes the thesis and offers a conclusion by describing the limitations, benefits, and possible future work for this thesis.

6.1 Summary of Thesis

At the beginning of this thesis the terms distributed collaborative work, trust, and innovation were described and related to each other. Then the TWAN schema was introduced as the basis for the approach in this thesis. Interviews were conducted to refine the ongoing research of the information elements for initial trust in distributed teams. With the help of a prototype, an experiment was accomplished with overall 36 participants and with an equal number of males and females, as well as and three conditions (control group with no information, personal information, and expertise level) and two different tasks (Facebook task and iPad2 task). The participants had to accomplish an idea generation task and an idea evaluation task within 60 minutes. The results of the experiment are supporting the hypotheses and therefore the goals of this thesis were achieved.

6.2 Limitations

The first limitation is the total number of participants. In the future it would be useful to do a bigger experiment with a larger number of participants than 36. Also it has to be taken into consideration that the population of participants consisted mainly of student and therefore the information elements were adapted to students as well. So for another population the information elements have to be extended or replaced by other information elements. Fur-

thermore it has to be emphasized that this work is based on the TWAN schema, so other researchers might interpret the data differently.

There are also several different methods for generating ideas. The focus of this thesis is on one of the most common idea generation technique, brainstorming. Note though that the approach is probably assignable to other idea generation techniques as well. The same applies to idea evaluation techniques.

6.3 Benefits

The results in this thesis support former trust research by confirming that trust influences the behavior of people in a positive manner. It also supports the two-dimensional trust research, but it has to be noted that it is very difficult to clearly distinguish between cognitive trust and affective trust. Basic research about the correlation of trust and distributed idea generation as well as idea evaluation is provided. It can be used as a first step for further exploration. It was shown that trust is an important factor regarding distributed idea generation and idea evaluation. Furthermore this research has benefits for gender research, since it was shown that women create more feasible ideas and men more creative ideas. Although the reason for that is not quite clear yet. Further research is necessary to explain this effect.

The research in this thesis can be used to support the development of templates that provide communication support to distributed teams. Since it was shown that knowing personal information has the biggest influence on affective trust in the idea generation session developers should keep in mind to provide this kind of information while designing an interface or a group process including an idea generation session. Participants should be able to develop initial trust to enhance their group performance regarding the quality and quantity of their ideas. More affective trust seems to make it possible to overcome evaluation apprehension, which is one problem in distributed idea generation.

Moreover, interface and group process designers should keep in mind to offer expertise level information to enhance cognitive trust in distributed idea

evaluation sessions. Higher cognitive trust does not lead to a better consensus within the group. It makes people more critical about their own ratings, but also more satisfied with the process, because of more transparency. As an overall result, interface and group process designers should be aware of always integrating information of the group process participants. Providing some information is always better than providing no information. Offering information increases trust in the participants, which is a key factor to success in innovation processes.

6.4 Future Work

There are plenty of possibilities to extend the study as other participants than students could be used. With other participants other information elements will be more important. A next step could be to create a taxonomy on information elements important to different kinds of participants. This knowledge could be used for supporting collaboration, giving group process designers the possibility to better integrate the trust factor in their processes in a structured and predictable way. In regard to cross-organizational collaboration other knowledge is needed, like experience with projects.

Also the confederates could be replaced by real participants. It would be interesting to see if the results change at all. If a long-term project would be analyzed the fifth category from the TWAN schema - internalized norms - could be included. Observing a bigger group than three is another possibility to extend the study. Instead of only using text more or different communication channels could be used.

It would also be interesting to apply that approach in this thesis to other distributed group work besides idea generation and idea evaluation sessions. Also other ways of doing an idea generation or idea evaluation session could be implemented. For example instead of using brainstorming a more structured technique for creating ideas could be applied.

Bibliography

- [1] Abdul-Rahman, A. and Hailes, S. "Supporting Trust in Virtual Communities." *Proceedings of the 33rd Hawaii International Conference of System Sciences*. IEEE CS Press, 2000. 1-9.
- [2] Abrams, L.C., Cross, R., Lesser, E., and Levin, D. "Nurturing interpersonal trust in knowledge sharing networks." *Academy of Management Executive* 17, no. 4 (2003): 64-77.
- [3] Ajax. <http://www.w3schools.com/ajax/default.asp> (accessed 05-07-2011).
- [4] Al-Ani, B. and Redmiles, D. "Supporting Trust in Distributed Teams through Continuous Coordination." *IEEE Software* 99, no. 1 (August 2009): 35-40.
- [5] Al-Ani, B. and Redmiles, D. "In Strangers We Trust? Findings of an Empirical Study of Distributed Development." *IEEE International Conference on Global Software Engineering*. Limerick, Ireland, 2009. 121-130.
- [6] Artz, D. and Gil, Y. "A survey of trust in computer science and the Semantic Web." *Web Semant.* 5, no. 2 (June 2007): 58-71.
- [7] Bidault, F. and Castello, A. "Trust and Creativity: Understanding the Role of Trust in Creativity-Oriented Joint Developments." *R&D Management* 39 (2009): 259-270.
- [8] Bland, L.M. and Altman, D.G. "Cronbach's alpha." *British Media Journal* 314, no. 7080 (February 1997): 572.
- [9] Booz, Allen. *New Product Management for the 80s*. New York: Booz, Allen, Hamilton Inc, 1982.
- [10] Bos, N., Olson, J., Gergle, D., Olson, G., and Wright, Z. "Effects of four computer-mediated communications channels on trust development." *Human Factors in Computing Systems: Changing Our World, Changing Ourselves*, April 2002: 135-140.
- [11] Bouchard, T.J. "Personality, problem-solving procedure, and performance in small groups." *Journal of Applied Psychology* 53 (1969): 1-28.
- [12] Butler, J.K. "Towards understanding and measuring conditions of trust: Evolution of a condition of trust inventory." *Journal of Management* 17, no. 3 (1991): 643-663.

- [13] Butler, J.K. and Cantrell, R.S. "A behavioural decision theory approach to modelling dyadic trust in superiors and subordinates." *Psychological Reports* 55, no. 1 (1984): 19-28.
- [14] Castelfranchi, C. and Falcone, R. "Trust is more than subjective probability: mental components and sources of trust." *Institute of Cognitive Sciences and Technologies (ISTC) Trust, Theories and Technologies (T3)*. 1999.
- [15] Chen, M.H., Chang, Y.C., and Hung, S.C. "Social capital and creativity in R&D project teams." *R&D Management* 38, no. 1 (2008): 21-34.
- [16] Chesbrough, H.W. *Open Innovation: The new imperative for creating and profiting from technology*. Boston: Harvard Business School Press, 2003.
- [17] Chircu, A.M., G.B. Davis, and R.J. and Kauffman. "Trust, expertise and e-commerce intermediary adoption." *Proceedings of the Sixth Americas Conference on Information Systems*, August 2000: 710-716.
- [18] Chopra, K., and Wallace, W.A. "Trust in electronic environments." *International Conference on System Sciences*. Hawaii: IEEE, 2002.
- [19] Cook, I., and Wall, T. "New work attitude measures of trust, organizational commitment, and personal need non fulfillment." *Journal of Occupational Psychology* 53 (1980): 39-52.
- [20] Cooper, A., and Bott, M.W.J. "Influence of Expectancies and Experience on Impression Formation." *JPI* 4 (1999): 21-24.
- [21] Cosley, D., Lam, S. K., Albert, I., Konstan, J. A., and Riedl, J. "Is seeing believing? How recommender interfaces affect users' opinions." *CHI Lett.* 2003.
- [22] Crawford, M.E. *New Products Management*. 4th Edition. Boston, Massachusetts: Irwin, Inc., 1994.
- [23] CSS. <http://www.w3.org/Style/CSS/> (accessed 05-07-2011)
- [24] Cummings, L.L., Bromiley, P., Kramer, R.M., and Tyler, T.R. *The Organizational Trust Inventory (OTI): Development and validation*. Thousand Oaks, CA: Sage Publications, Inc., 1996.
- [25] Dakhli, M. and De Clercq, D. "Human capital, social capital and innovation: a multi-country study." *Entrepreneurship and Regional Development* 16 (2004): 107-128.
- [26] De Clercq, D., Thongpapanl, N.T., and Dimov, D. "The role of conflict and social capital in cross-functional collaboration." *4th Workshop on Trust Within and Between Organizations*. Amsterdam, 2007.
- [27] Dennis, A.R., George, J.F., Jessup, L.M., Nunamaker Jr., J.F., and Vogel, D.R. "Information technology to support electronic meetings." *MIS*

- Quarterly* 12, no. 4 (1988): 591–624.
- [28] Diehl, M. and Stroebe, W. "Productivity loss in brainstorming groups: Toward the solution of a riddle." *Journal of Personality and Social Psychology* 53 (1987): 497-509.
 - [29] Doshier, M., Benepe, O., Humphrey, A., Stewart, R., and Lie, B. *The SWOT analysis method*. Mento Park, CA: Stanford Research Institute, 1960-1970.
 - [30] Dunette, M.D., Campbell, J., and Jaastad, K. "The effect of group participation on brainstorming effectiveness in two industrial samples." *Journal of Applied Psychology* 47 (1963): 30-37.
 - [31] Duysters, G., Kok, G., and Vaandrager, M. "Crafting successful strategic partnerships." *R&D Management* 29 (1999): 343-351.
 - [32] Feng, J., Lazar, J., and Preece, J. "Empathy and online interpersonal trust: a fragile relationship." *Behaviour and information technology*, 2004.
 - [33] Gabarro, J.J. "The development of trust, influence, and expectations." In (Eds.) *Interpersonal Behavior: Communication and Understanding in relationships*, by A.G., and Gabarro, J.J. Athos. New Jersey: Englewood Cliffs, NJ: Prentice-Hall, 1978.
 - [34] Gabarro, J.J. "The Development of Working Relationships." In *Intellectual Teamwork*, by J., Kraut, R. E., and Egido, C. Galegher, 79-110. Hillsdale, NY: Erlbaum, 1990.
 - [35] Giffin, A. "PDMA Research on New Product Development Practices: Updating Trends and Benchmarking Best Practices." *Journal of Product Innovation Management* 14 (1997): 429-58.
 - [36] Good, D. "Individuals, Interpersonal Relations, and Trust." In *Trust: Making and breaking cooperative relations*, by D. (ed.) Gambetta, 31-48. Oxford: Blackwell, 2000.
 - [37] Hagedoorn, J. "Trend and patterns in strategic technology partnering since the early seventies." *Review of Industrial Organizations* 11 (1996): 601-616.
 - [38] Hartman, F. "eams and team building." In *The Technology Management Handbook*, by R.C. Dorf, 8-12. Boca Raton: CRC Press/IEEE Press, 1999.
 - [39] Herstatt, C. "Theorie und Praxis der fruehen Phasen des Innovationsprozesses." *Management* 68, no. 10 (1999): 72-81.
 - [40] Herstatt, C. and Verworn, B. "The Fuzzy Front End of Innovation." In *EITIM (ed.) Bringing Technology and Innovation into the Boardroom*, by C., and Verworn, B. Herstatt, 347-373. Houndmills and New York: Palgrave MacMillan, 2004.

- [41] Higgins, J.M. *101 Creative Problem Solving Techniques: The Handbook of New Ideas for Business*. New Management Publishing Company, 1994.
- [42] Hill, W., Stead, L., Rosenstein, M., and Furnas, G. "Recommending and evaluating choices in a virtual community of use." *Conference on Human Factors in Computing Systems—CHI '95*. Denver, 1995.
- [43] Holton, J.A. "Building Trust and Collaboration in a Virtual Team." *Team Performance Management* (Emerald Group Publishing Ltd.) 7, no. 3-4 (2001): 36-47.
- [44] Hung, Y.C., Dennis, A.R., and Robert, L. "Trust in Virtual Teams: Towards an Integrative Model of Trust Formation." *37th Hawaii International Conference on System Sciences*. Hawaii, 2004.
- [45] Iacono, C. and Weisband, S. "Developing Trust in Virtual Teams." *Hawaii International Conference on System Sciences*. Wailea, HI, USA, 1997. 412-420.
- [46] Illes, K. *Trust Questionnaire*. 2006. [http://btc-server.btc\(anglia.ac.uk\)/phpsurveyor/?sid=3S](http://btc-server.btc(anglia.ac.uk)/phpsurveyor/?sid=3S) (accessed 05-10-2011).
- [47] iPad2. Apple. <http://www.apple.com/ipad/features/> (accessed 05-19-2011).
- [48] Jarvenpaa, S.L. and Leidner, D.E. "Communication and Trust in Global Virtual Teams." *Organization Science* 10, no. 6 (June 1999): 791-815.
- [49] Jarvenpaa, S.L., Knoll, K., and Leidner, D.E. "Is anybody out there? Antecedents of trust in global virtual teams." *Journal of Management Information Systems* 14, no. 4 (March 1998): 29-64.
- [50] Jeanquart-Barone, S. "Trust differences between supervisors and subordinates: examining the role of race and gender." *Sex roles* 29, no. 1-2 (1993): 1-11.
- [51] Jehn, K. A. "A Multimethod examination of the benefits and detriments of intragroup conflict." *Administrative Science Quarterly* 40 (1995): 256-282.
- [52] Johnson, B. "Design Ideation: the conceptual sketch in the digital age." *Design Studies* 26, no. 6 (2005): 613-624.
- [53] Johnson-George, C.E. and Swap, W.C. "Measurement of specific interpersonal trust: Construction and validation of a scale to assess trust in a specific other." *Journal of Personality and Social Psychology* 43, no. 6 (1982): 1306-1317.
- [54] Kanawattanachai, P. and Yoo, Y. "Dynamic nature of trust in virtual teams." *Sprouts: Working papers on Information Environments, systems and organizations* 2, no. 2 (2005): 41-58.

-
- [55] Karau, S.J. and Williams, J.W. "Social loafing: A meta-analytic review and theoretical integration." *Journal of Personality and Social Psychology* 65, no. 4 (1993): 681-706.
 - [56] Kim, P.H., Ferrin, D.L., Cooper, C.D., and Dirks, K.T. "Removing the shadow of suspicion: The effects of apology versus denial for repairing competence- versus integrity- based trust violations." *Journal of Applied Psychology* 89 (2004): 104-118.
 - [57] Knoll, S.W. and Horton, G. "Changing the Perspective: Improving Generate thinkLets for Ideation." *Proceedings of the 43rd HICSS*. Los Alamitos: IEEE Computer Society Press, 2010.
 - [58] Levin, D.Z., Cross, R., Abrams, L.C., and Lesser, E.L. *Trust and knowledge Sharing: a Critical Combination*. Somers, NY: IBM Institute for Knowledge-based organizations, 2002.
 - [59] Lipnack, J. and Stamps, J. *Virtual Teams: People Working Across Boundaries with Technology*. 2nd Edition. New York: Wiley, 2000.
 - [60] Lubart, T.I. "Creativity." In *Thinking and problem solving*, by Sternberg (Ed.), R.J. , 289-332. New York: Academic Press, 1994.
 - [61] Lynn, G.S. and Akgun, A.E. "Innovation strategies under uncertainty: a contingency approach for new product development." *Engineering Management Journal* 10, no. 3 (1998): 11-17.
 - [62] Mayer, R.C., Davis, J.H., and Schoorman, F.D. "An integrative model of organizational trust." *Academy of Management Review* 20, no. 3 (1995): 709-734.
 - [63] McAllister, D.J. "Affect- and cognition-based trust as foundations for interpersonal cooperation in organizations." *Academy of Management Journal* 38 (1995): 24-59.
 - [64] McKnight, D.H., Choudhury, V., and Kacmar, C. "Developing and Validating Trust Measures for e- Commerce: An Integrative Typology." *Information Systems Research* 13, no. 3 (2002): 334-359.
 - [65] Meyerson, D. Weick, K.E., and Kramer, R.M. "Swift Trust and Temporary Groups." In *Trust in Organizations: Frontiers of Theory and Research*, by Kramer (Eds.), R.M., and Tyler, T.R., 166-195. Thousand Oaks, CA: Sage Publications, 1996.
 - [66] Nielsen, J. *Usability Engineering*. San Diego, California: Academic Press, 1994.
 - [67] Nijstad, B.A., and De Dreu, C.K.W. "Creativity and group innovation." *Applied Psychology: An International Review* 51 (2002): 400-406.
 - [68] Nooteboom, B., Berger, H., and Noorderhaven, N. G. "Effects of trust and governance on relational risk." *Academy of Management Journal* 40 (1997): 308-338.
-

- [69] Nunamaker Jr., J.F., Dennis, A.R., Valacich, J.S., Vogel, D., and George, J.F. "Electronic meeting systems to support group work." *Communications of the ACM* 34, no. 7 (1991): 40-61.
- [70] Nunamaker, Jr., J.F., Reinig, B.A., and Briggs, R.O. "Principles for Effective Virtual Teamwork." *Communications of the ACM* 52, no. 4 (2009): 113-117.
- [71] Nystrom, H. "Product Development Strategy: An Integration of Technology and Marketing." *Journal of Product Innovation Management* 2 (1985): 25-33.
- [72] Ochse, R. *Before the Gates of Excellence: The Determinants of Creative Genius*. New York: Cambridge University Press, 1990.
- [73] Olson, J.S. and Olson, G.M. "I2i trust in e-commerce." *Communications of the ACM* 43, no. 12 (2000): 41-44.
- [74] Osborn, A. F. *Applied imagination: Principles and procedures of creative problem solving*. 3rd Revised Edition. New York: Charles Scribner's Sons, 1963.
- [75] Parayitam, S. and Dooley, R.S. "The interplay between cognitive- and affective conflict and cognition- and affect-based trust in influencing decision outcomes." *Journal of Business Research* 62, no. 7 (2009): 89-96.
- [76] Petty, R.E., and Cacioppo, J.T. *Communication and Persuasion: Central and Peripheral Routes to Attitude Change*. New York: Springer, 1986.
- [77] PHP. <http://www.php.net/> (assessed 05-07-2011)
- [78] Postmes, T. and Lea, M. "Social processes and group decision making: anonymity in group decision support systems." *Ergonomics* 43, no. 8 (August 2000): 1252-1274.
- [79] Pyysiäinen, J. "Building Trust in Global Inter-Organizational Software Development Projects: Problems and Practices." *International Workshop on Global Software Engineering*, May 2003: 69-74.
- [80] Reinig, B.A. and Briggs, R.O. "Measuring the Quality of Ideation Technology and Techniques." *Proceedings of the 39th Hawaii International Conference on System Sciences*, 2006.
- [81] Rempel, J.K., Holmes, J.G., and Zanna, M.P. "Trust in close relationships." *Journal of Personality and Social Psychology* 49, no. 1 (1985): 95-112.
- [82] Riegelsberger, J. *Trust in mediated interactions*. London: University College London, 2005.
- [83] Rietzschel, E.F., Nijstad, B.A., and Stroebe, W. "The selection of creative ideas after individual idea generation: Choosing between

- creativity and impact." *British Journal of Psychology* 101 (2010): 47–68.
- [84] Rocco, E., Finholt, T., Hofer, E., and Herbsleb, J. "Out of sight, short of trust." *Founding Conference of the European Academy of Management*, 2001.
- [85] Rosen, B., Furst, S., and Blackburn, R. "Training for Virtual Teams: An Investigation of Current Practices and Future Needs." *Human Resources Management* 45, no. 2 (2006): 229-247.
- [86] Ross, W. and LaCroix, J. "Multiple meanings of trust in negotiation theory and research: A literature review and integrative model." *The International Journal of Conflict Management* 7 (1996): 314-360.
- [87] Rotter, J.B. "Interpersonal trust, trustworthiness, and gullibility." *American Psychologist* 35, no. 1 (1980): 1-7.
- [88] Rousseau, D.M., Sitkin, S.B., Burt, R.S., and Camerer, C. "Not so different after all: Across-discipline view of trust." *Academy of Management Review* 23, no. 3 (1998): 393–404.
- [89] Rozendaal, Van, C. "Vertrouwen in leidinggevendenden." *Een vergelijkende literatuurstudie naar definities van het vertrouwen in leidinggevendenden en de inhoudsvaliditeit van meetprocedures* (Open Universiteit Nederland), 1997.
- [90] Rusman, E. *The Mind's Eye on Personal Profiles - How to inform trustworthiness assessments in virtual project teams*. Heerlen: SIKS Dissertation Series No. 2011-19, 2011.
- [91] Rusman, E., Van Bruggen, J., Sloep, P., and Koper, R. "Fostering trust in virtual project teams: towards a design framework grounded in a Trust Worthiness Antecedent (TWAN) schema." 2010.
- [92] Rusman, E., Van Bruggen, J., Cörvers, R., Sloep, P., and Koper, R. "From pattern to practice: Evaluation of a design pattern fostering trust in virtual teams." *Computers in Human Behaviour* 25, no. 5 (2009): 1010-1019.
- [93] Rusman, E., Van Bruggen, J., Sloep, P., and Valcke, M. "The Mind's Eye on Personal Profiles; How to Inform Initial Trustworthiness Assessments in Virtual Project Teams." In *Lecture Notes in Computer Science: Vol. 6257. Collaboration and Technology. Proceedings of the 16th International Conference CRIWG 2010*, by T. Herrmann & S. Lukosch (Eds.) G. Kolfschoten, 297-304. Heidelberg: Springer, 2010.
- [94] Santanen, E.L., Briggs, R.O., and Vreede, G.J. de. "Causal Relationships in Creative Problem Solving: Comparing Facilitation Interventions for Ideation." *Journal of Management Information Systems* (Sharpe Inc.) 20, no. 4 (2004): 167–197.
- [95] Sheppard, B.H. and Sherman, D.M. "The grammars of trust: a model and general implications." *Academy of Management Review* 23, no. 3

- (1998): 422–437.
- [96] Simons, T.L. and Peterson, R.S. “Task conflict and relationship conflict in top management teams: The pivotal role of intragroup trust.” *Journal of Applied Psychology* 85 (2000): 102–111.
 - [97] Sternberg, R.J. (Ed.). *The nature of creativity*. New York: Cambridge University Press, 1988.
 - [98] Stewart, G., Manz, C., and Sims, H.P. *Team Work and Group Dynamics*. New York: John Wiley and Sons, 1999.
 - [99] Terveen, L.G. “Overview of human-computer collaboration.” *Knowledge-Based Systems* 8 (1995): 67-81.
 - [100] Trainer, E., Al-Ani, B, and Redmiles, D. “Impact of Collaborative Traces on Trustworthiness.” *4th International workshop on Cooperative and human aspects of software engineering*. New York: ACM, 2011.
 - [101] Tushman, M.L., and Nadler, D. “Organization for Innovation.” *California Management Review* 28, no. 3 (1986): 74-92.
 - [102] VanGundy, A.B. *Techniques of Structured Problem Solving*. 2nd Edition. New York: Van Nostrand Reinhold, 1988.
 - [103] Veryzer, R.W. “Discontinuous Innovation and the New Product Development Process.” *Journal of Product Innovation Management* 15, no. 4 (1998): 304-21.
 - [104] Wheeler, B., and Mennecke, B. *ISWorld Net Research Task Repository*. <http://kelley.iu.edu/bwheeler/ISWorld/index.cfm> (accessed 05-28-2011).
 - [105] Wilson, J.M., Straus, S.G., and McEvily, W.J. “All in due time: The development of trust in computer-mediated and face-to-face groups.” *Organizational Behavior and Human Decision Processes* 99 (2006): 16-33.
 - [106] *XHTML*. <http://xhtml.com/en/xhtml/reference/> (accessed 05-07-2011).
 - [107] Zand, D. E. “Trust and managerial problem solving.” *Administrative Science Quarterly* 17, no. 2 (1972): 229-239.
 - [108] Zolin, R., Hinds, P., Fruchter, R., and Levitt, R.E. “Interpersonal trust in cross-functional, geographically distributed work: a longitudinal study.” *Information and Organization* 14, no. 1 (2004): 1-26.
 - [109] Zolin, R., Hinds, P.J., Fruchter, R., and Levitt, R.E. “Trust in Cross-functional, global teams.” *Stanford: Center for Integrated Facility Engineering (CIFE), Stanford University*. 2002.

Appendix

A.1 Demographics Survey

Question	Field / Scale
Age	
Gender	
Nationality	
Ethnicity	
What degree are you currently pursuing?	Bachelor's
	Master's
	Ph.D.
	Other (please specify)
What department are you in?	
What year are you in the program?	
What is your specialization or specific interest in your field of study?	
List all companies you have previously been employed by:	
List all the awards you have previously received:	
Do you have any specific skills?	
Please list three to five of your hobbies.	Hobby 1
	Hobby 2
	Hobby 3
	Hobby 4
	Hobby 5

Please list three of your favorite movies and three of your favorite TV shows.	Movie 1
	Movie 2
	Movie 3
	TV show 1
	TV show 2
	TV show 3
Do you do any extracurricular activities?	
What kind of music do you like?	
How often do you generate ideas with other people?	Very frequently
	Frequently
	Occasionally
	Rarely
	Never
How often do you evaluate other people's ideas?	Very frequently
	Frequently
	Occasionally
	Rarely
	Never
I do online collaborations very often.	Strongly disagree
	Disagree
	Disagree somewhat
	Undecided
	Agree somewhat
	Agree
	Strongly agree
I feel very confident working with people I have	Strongly disagree

never met before.	Disagree
	Disagree somewhat
	Undecided
	Agree somewhat
	Agree
	Strongly agree
In general people are trustworthy.	Very low trust level
	Low trust level
	Medium low trust level
	Undecided
	Medium high trust level
	High trust level
	Very high trust level

Table 20. Demographics Survey

A.2 Description of Facebook Functionalities

Features

Each user can have a profile page with personal information and upload photos or videos. On the whiteboard of the profile, visitors can leave messages. As an alternative to public news, users can send personal or chat messages to other users. Friends can be invited to groups and events. Facebook also has a marketplace where users can place and view classified ads. Furthermore users can be informed about news, such as new wall posts on the profile pages of friends by a watch list.

Applications

Developers can use a programming interface with which they can write programs that conform to the design of Facebook and furthermore with which they can have access to the user data with the user's permission. Facebook users can integrate these programs (e.g. games or communication applications) into their profile pages.

Connect

With Facebook Connect, the company offers a solution to single-dose application. Registered users can use this function on their credentials on other sites without having to register there, too. In certain cases it is also possible to hold content such as the profile, photos, contact lists, and comments. In turn, Facebook shows activities in their respective portals, in his own supply, so that the friends of a member can see it. Among the partners are well-known companies such as Yahoo, Lufthansa, or the Washington Post. Several game consoles use the registration service (e.g. Nintendo DS, Xbox 360, Playstation 3). Special Facebook clients are now available for various mobile platforms.

Places

This extension allows users to know where other users are in and who they are together now. It can also be displayed which friends have just told their location. The function is only available in the Facebook apps and the Facebook site for smartphones.

A.3 Description of iPad2 Functionalities

Two cameras.

You'll see two cameras on iPad — one on the front and one on the back. They may be tiny, but they're a big deal. They're designed for FaceTime video calling, and they work together so you can talk to your favorite people and see them smile and laugh back at you. The front camera puts you and your friend face-to-face. Switch to the back camera during your video call to share where you are, who you're with, or what's going on around you. When you're not using FaceTime, let the back camera roll if you see something movie-worthy.

LED-backlit display.

iPad is one big, beautiful display — 9.7 inches of high-resolution photos, movies, web pages, books, and more. LED backlighting makes everything you see remarkably crisp, vivid, and bright. Even in places with low light, like an airplane. And there's no wrong way to hold iPad. It's designed to show off everything in portrait and landscape, so with every turn (even upside down), the display adjusts to fit. Because it uses a display technology called IPS (in-plane switching), it has a wide, 178° viewing angle. Hold it up to someone across the room, or share it with someone sitting next to you, and everyone gets a brilliant view.

Multi-Touch.

Technology is at its best when it feels completely natural, almost like there's no technology at all. That's Multi-Touch on iPad. You use your fingers to do everything, so everything you do — surfing the web, typing email, reading books, and swiping through photos — is easier and a lot more fun. How does it work? When your fingers touch the display, it senses them using electrical fields. Then it instantly transforms your taps, swipes, pinches, and flicks into lifelike actions. Just like that.

Gyro, accelerometer, and compass.

With the built-in accelerometer, you can rotate iPad to portrait or landscape, or even upside down, and whatever you're watching, reading, or seeing adjusts to fit the display. And now the accelerometer, three-axis gyroscope, and compass all work together. They sense which direction iPad is heading and how it's moving. So games, maps, and other apps know your every twist, turn, tilt, and 360.

AirPlay.

All the great stuff on your iPad — your music, photos, and video — can now stream wirelessly to your HDTV and speakers via AirPlay-enabled speakers or Apple TV on a Wi-Fi network. With just a tap on the AirPlay icon, blast some tunes, have a movie night, show off some photos, or watch YouTube. And go big.

Source: [47]

A.4 Idea Clustering

Facebook ideas			iPad2 ideas		
Cluster	Function	#	Cluster	Function	#
Group	Assignment	5	Accessibility	Feedback	1
	Class	2		Keyboard Input	2
	Research	1		Pen Input	2
	Study	7		Sound Quality	1
Infrastructure	SVN	1		Text-to-Speech	3
Market	Books	3		Voice Input	4
	Food	2		Zoom	4
	Travel	1	Activity	Events	1
Networking	Job	1		Reading	1
	Profile	1	Games	Mental Exercise	2
	Research	3		Social Game	5
Personal	Distraction	2	Medical	Diet	2
	Health	1		Emergency	6
	Privacy	1		Exercise	1
	Reminder	1		Information	2
Ranking	Professor	1		Low Cost	1
	University	1		Navigation	1
Resources	History	4		Pill Schedule	8
	Information	1		Records	2
	Multimedia	3		Telemedicine	2
	Notes	5	Memory	Food	2
	Readings	6		Lost and Found	1
Social	Events	3		Photos	1
	Friends	7		Recorder	1
	Relationship	2		Reminder	4

	Schedule	1		Scrapbook	2
Teacher	Admin	1		Shopping	1
	Attendance	1	Money	Low Cost	1
	Award	1		Real Estate	1
	Cheater	1		Retirement Funds	1
	Homework	1		Shopping	1
	Information	2	Social	Family Communica- tion	6
	Q&A	4		Family Photo	1
	Reminder	1		Family Tree	2
	Schedule	1		Friends	3
			Usability	App	1
				Interface	7
				Preference	1
				Tutorial	5
			Utility	Remote Con- trol	2
				Security	1
Total number of ideas		81	Total number of ideas		96

Table 21. Idea clustering

A.5 Applicable Facebook Ideas

Idea Title	Description of Idea	Advantage of Idea
Electronic bulletin board	A bulletin board integrated into Facebook	Can look up cheap stuff and does not need another website
Teacher ranking	Students can rate their teacher on Facebook	Overview about good teachers and bad teachers
Online teaching material	Teachers and students share slides and teaching material of a class on Facebook	Everything is in one spot; better overview about material
Online class	The professor teaches the class over Facebook	Does not have to leave the house
Facebook research	Students and researchers can find cooperations for research projects via Facebook	Platform for research needs
Exam results	Student gets exam results via Facebook message	Only one platform to use
Consultation-hour	Teachers offer consultation-hour on Facebook	Can stay at home; saves time
Homework	Students can upload their homework on their personal page	Can stay at home; saves time
Software project	Sandbox of Facebook can be used for software projects	Works where he is all day anyway
Course credits	Students getting course credits for being active on Facebook	Student gets extra course credits

Table 22. Applicable facebook ideaso of participant 2

Idea Title	Description of Idea	Advantage of Idea
Calendar	Important dates (e.g. exam date) are in a calendar in Facebook	Student is up-to-date
iPhone connection	Student can take notes with iPhone and put it on his personal student Facebook section	Student does not need to bring paper or laptop to class
Video of lecture	Student is allowed to make a video of the lecture and puts it on Facebook for other students	Student can see the same lecture more than once
FB is notebook	Student makes notes about lecture within FB	Does not need a real notebook
Quiz on FB	Every week a new quiz on FB about the last lecture	Student can learn while being on FB
Facebook business	Students can find other people who are interested in a startup company	Student gets connections
Facebook auction	Students can bid on stuff	Student saves money
Facebook glasses	Augmented reality glasses so that the student can see news on Facebook all day long	Student does not need a smartphone
Cheater 2.0	Students can use Facebook for exams	Helps to cheat in exams
FB as e-book seller	Students can buy e-books on Facebook	Education

Table 23. Applicable facebook ideas of participant 3

A.6 Applicable iPad2 Ideas

Idea Title	Description of Idea	Advantage of Idea
Magnifier	Enlargement of news-paper	Senior citizen can read it easier
Randomized suggestions for spending money	Random generator who makes suggestions about possibilities to buy something	Knows what's new teachers
Activity suggestions	Random generator who makes suggestions about possibilities to do something	Knows what to do next
Travel guide	Suggestions for travel tour	Gets ideas
Speech-To-Text	System who helps to type text via speech and reads text	For senior citizens who cannot see very well
Doctor App	Searching for doctors via iPad	For senior citizens who get sick often
Gift suggestions for grandchildren	App who suggests gifts for grandchildren	For senior citizens with grandchildren
Grow-Up-Scrapbook-App for grandchildren	App which documents the grow up of the grandchildren	For senior citizens with grandchildren
Analysis of illness symptoms	App for analyzing illness of senior citizen	For senior citizens who get sick often
Remote control	Use iPad for remote control electrical devices in the household	SC don't have to move that much

Table 24. Applicable iPad2 ideas of participant 2

Idea Title	Description of Idea	Advantage of Idea
Book	Book app with very large letters	Easier to read for senior citizen
iPad 3D	Connect 3D glasses with iPad	SC can watch 3d movies while waiting in the doctor's office
Health monitoring	iPad can be used to monitor own health	Health
Ipad Helper	iPad recognizes when it falls down; signal is send to somebody who checks if everything is ok	Calls somebody when help is needed
iPad as Enlargement	Connect the iPad to small electronic devices	Better handling of small electronic devices
Augmented Reality	iPad for augmented reality, e.g. shows solution for crossword in newspaper	Quick help for SC
Chess	iPad as electronic chess with real chess figures	SC can play real chess with the 'computer'
Ordering food	iPad is connected with local food store	SC does not have to leave the house for shopping
Magnetic iPad	iPad can be put on fridge or microwave	SC does not have to hold iPad all the time...e.g. useful while cooking

Table 25. Applicable iPad2 ideas of participant 3

A.7 Facebook Ideas

Title	Description	Advantage	Average Originality	Average Feasibility
N				
Friend and party finder	People log on when they are going solo to say a beach or other place where it is fun to b with people.	Student will get easy hookup with people who want to meet new people. This could be a great ice breaker	1.5	5
relationship inference	What if we used machine learning to try to get people who are near each other in a social network to start dating conversations	Student could have recommendations made about relationships and friends could comment. ice breaker	3	4
Gym check and food check	People log on and write what they ate and what kind of exercise they did that day. They could put pictures up	Provide accountability on fitness and health goals.	2.5	4.5
Feeling status	People would post their feelings anonymously. Then they could meet with people near them in non judgmental setting	Great way for people to get their problems out there and meet people with helpful experiences	3.5	4.5
Note Board	a forum/group chat type environment that allows students to solve problems better than the standard chat windows	allows for groups to study when in person study sessions are not an option	1	5
Lecture Audio	a place where users can upload audio of the lectures for those who may have missed class	no need to ask other students for notes for missed classes, which may be incomplete or in shorthand	1.5	4
Office Hours	The TA for the class who holds office hours can do so online within Facebook	Allows all students to benefit from the office hour discussions.	1	5

Home work Upload	allows students to upload homework in electronic form to professors	ensures that no homework is "lost" during the grading process since it can be redownloaded by the professor	1.5	4.5
Book Find	Students can find books from members of the previous year to purchase books from	Saves a trip to the book store and saves money since the books will be used.	1.5	4.5
group quizzes and projects on facebook	Students interact in live audio visual and practice group thinking together	great way to work on social skills	1.5	4.5
con-sultation: friendship practice	People who are learning social norms (kids who suck socially) could practice social skills.	It is hard to practice social skills if people don't like your interactions and reject u. this would let people practice	3	4.5
Home work together	People in a class work on the assignment together and discuss live	One big study group. People could mark up answers and discuss it live but people could see past discussion weeks 18	1.5	4.5
Class Forum	Build a Forum for the student in the same class, so that people can chat about the relative topics	Get more open information and know each other better	1	5
Relative Reading Book List	Student can build a list of relative book to this class together	Learn more outside of the class	1.5	5
Student Hang Out Lounge	Send Social activities and events invitation to the all class	Discuss the class relative material face to face together	2	5
Teaching Assistant	Post your questions on Facebook, so that the TA and professor for the class can answer it on	Don't need to go to the office hour	1	5

	facebook			
Text-book Sell	Buy and sell your test book on facebook	Save money and time to get textbook	1	5
Paper Pal	Users can upload links to publications if they have no full access to them and others who do can send the paper to them.	they receive access to papers they might otherwise would not have	1.5	5
Lit Re-view	User uploads a paper and others can add links to similar publications.	get suggestions for a broader lit review and more papers on a topic	1.5	5
Note Share	Students can exchange notes they made in a lecture (and link them to a script of the lecture)	if you missed to take notes on a slide, others can fill you in	1.5	5
My city	an overview of what to do and where important offices are in the university city	helps new students find their way around	3.5	4.5
Access to older exams or exercises	In order to optimize learning it would be could if ordered by classes, exercises and exams are made available	Can use facebook to get documents improving the preparation for exams	2	5
list of former students of a class	If you are searching for help it might be useful to ask people who already took that class	finding people of previous years easier	1.5	5
re-search projects	providing projects you work/worked on to find people of your field easier	easier search for researchers of you area	2.5	5
uni ranking	use facebook to rank your uni	find the right uni easier	3	4.5
white-board	provide a whiteboard like pane where students can share ideas on	don't need access to physical white-/blackboard	2.5	4

P

Learn- ing groups	A feature that is based on the event feature of facebook but which is specialized on organizing learning groups	events can take place periodically, option to support file attachments	1.5	5
Com- bina- tion of Video and Mate- rial	Create a platform for discussions around lessons, including videos and teaching material	above mentioned advantages, plus platform for questions and clarifications	1.5	4
Find fellow stu- dents	When being abroad, a feature based on FB Places can show people around you that are willing to help visiting students	quickly find friend and help when travelling to a foreign country	3	4.5
Achiev- ement s	Students that receive rewards or medals for extra activities can have this achievement posted on their wall	Motivation. Achievement system could be used for more useful stuff than just for games	4	4.5
flirt app	facebook app to flirt which is restricted to people in the class	exchanging notes in the classroom, just fancier	2.5	4
Sched- ule Shar- ing	Allow students to fill in their current class schedules and share them with their friends on Facebook	Students can see if their friends are in their classes	3	4.5
Face- book class group	Students in a specific class can share notes, questions, ideas	They can seek help from other classmates that they might not know personally	1.5	5
Face- book check- in	Students can use their mobile phones to "check-in"; to class	Tracking attendance (I guess this is more of an advantage for the teacher)	2.5	5
Online class real- time chat	Adding onto Participant 2's idea of online class, allowing students to chat real time during an online lecture	Creates discussion at the moment and the professor can answer any questions	1	4.5
Face- book "coun- seling"	Students can share their opinion on which classes are useful to take for their major	they can get expert opinions from people who have had the experience already	1.5	5
Im- proved inter- face	group activity could be better separated from other noisier activities such as news feed	allows for better group collaborations	1	4.5

for group net-working				
Friend marketplace	Students with similar interests could meet each other through facebook, with restrictions as to who can participate	good way to network	1.5	4.5
facebook wiki	group members can contribute to a body of knowledge that any member can update	allows for better communication of ideas and knowledge	1.5	5
better filters for news-feed	make it easy to block out unwanted noise	easier to focus on the information you care about	1.5	4.5
eBooks rentals	facebook could distribute textbooks online	easy and possibly cheaper way for students to get required class material	2.5	4.5
facebook library	provide a database of academic journals that students could search for research projects	easy access to information	1.5	5
open the facebook platform to university use	schools could build their electronic infrastructure through facebook, rather than third party software	less websites to visit	2.5	4
cheater catcher 2.0	Teaching assistants can use facebook to catch cheaters during exams	helps to stop cheater 2.0	4	4.5
University! Use Facebook!	The student gets information provided by professors or his / her timetable via facebook	Time is saved... e.g. if the student is at university, can't find the room, Facebook can be used to find it.	2	4.5
Alumni network	Introduce a network of university alumni's to get support for internships etc.	If a company has an internship, alumni's can post it on facebook and the matching process is accelerated.	2	5

Link face-book with Google chrome	Facebook is interlinked with Google chrome	Find academic paper easier and can discuss about the paper with FB friends.	1.5	5
face-book homework	student learning groups are doing their homework together on face-book	learning through peer group interaction	1	4.5
online shopping / pizza delivery service	pizza can be ordered on facebook	student does not have to visit the pizza service's internet page	4	4
face-book travel	Book flights to visit your FB friends on FB	companies can adv. special offers	3.5	4
Photo tagging for collaborative work	Students could use the photo tagging on face-book to help remember who was participating group project their g	Students can access this info later on. They can say, bring up all the projects I was in with Rachel	3	5
Class Forum	Publish work	Get feedback, new ideas	1	5
Student Groups	Match students based on data about connections	Build stronger teams, integrate students more	2.5	5
Teacher accountability	Flag inappropriate content, comment on students lives, but not a peer clearly a s a mentor	Mark the relationship as a teacher-student	1.5	5
Face-book glasses	See back channel	Access content	3	3.5
uni ranking	Use facebook to rank your uni	find the right uni easier	3	4.5
white-board	provide a whiteboard like pane where students can share ideas on	Don't need access to physical white-/blackboard	2.5	4

aca- demic re- source s	personal study items as part of the profile	can connect with oth- ers based on content, advance academic research through peo- ple	2.5	4.5
book- mark collec- tion	every person got its own universe of useful find- ings on the internet, share this collection makes sense	Directly use web re- sources of co- students, avoid wast- ing time with Google	1.5	5

E

Stu- dent social circle	Basically, facebook could generate a social circle based on student's per- sonal information, ethnic- ity, interest etc.	These kinds of circles help students to meet someone who has similar interest and background. And helps freshmen meet new	2.5	4.5
Re- search group Orga- niza- tion Appli- cation	An application that orga- nize a lab group meeting, equipment purchase, activity, calendar	Just help Professors get in touch in their students and organize lab much easier	1.5	5
Secun- dary con- tact tool	For people who don't use FB, their friend could still send invitation, news etc to their email or text	For these who don't use/have FB can still get contact with their friends easily	3	4
Note Shar- ing	Application that allows students to record and share class notes (similar to Google Docs)	Sharing notes reduces missed information in class. Would also be able to rank notes (show of importance of material)	1.5	5
Cam- pus Spe- cial Appli- cation	Application that displays current events and offer- ings (with a map) of ma- jor businesses and clubs on campus	Enhanced campus life. Feeling of a better understanding of the activities on campus	2.5	5
Face- book Profes- sional	A second page for any user, specified for only their "professional" side of life.	No need to worry about what you put on your social FB page. Now only the "profes- sional" one can be viewable to all	2.5	4.5

Profesor's Choice	Questions that professor has received from students that the professor feels are very important are posted	Student has a better understanding of what the professor thinks is important	1	5
Facebook Professor	Students can rate their professors on Facebook. Quality of education/demeanor/personality/etc	A full evaluation of Professors and TA's from the world's largest network	3	4.5
Facebook Classroom	Class updates, extra discussions, review material, class time changes/cancellations	Quick time updates on course activities	1.5	4.5
Facebook Foods	Where other students rate the best places to eat near campus	don't waste money on bad food	1.5	4
Study course feature	Students can join course groups which exist for a certain time period.	Easy inter course communication without adding everyone as friend.	1.5	5
Exam preparation questionnaires	User can create and add questions related to a course. Points are awarded for question creation and correct answers.	Users actively study provided course material. Ranking helps to motivate the participation	1.5	5
Study buddy recommender	Based on profile and likes potential study buddy are recommended if participant / the class is completely new	foster social interaction	2.5	5
Submission date reminder	Important dates like final exams and homework submission dates are posted on wall / via messages	Students stop playing FB games and do homework. Parents can read wall posts and force their children to work ;-)	2	4.5
Group project tracker	Group with simple bug tracking / ticket system functions for group work	No need to setup complicated tools for simple group work.	4.5	2
Useful books and aids	Students can suggest reading lists and other material that helped them in a lecture	helps with preparing for a class	1.5	5

re-search network	similar to normal groups, researchers can connect in groups specific to their field	helps build a network	2.5	5
Uni calendar	find important dates on facebook	no need to search the uni homepage, which is often useless	1.5	5
Study groups	study together while staying at home	student can stay at home	1	5
To do	list all chores and deadlines on facebook	student doesn't lose track of things	2.5	4.5
peer review of study progress	Students from similar field of studies check each others progress by interviews or questionnaires	community and preparation for exams	1	5
the void	Facebook makes the profile one hour every day inaccessible	more time for self contemplation	4.5	4

Table 26. Facebook ideas

A.8 iPad2 Ideas

Title	Description	Advantage	Average Originality	Average Feasibility
N				
Easy Family Photo Sharing	The senior citizen can easily see new photos of the family for example new photos of grandchildren.	The senior citizen does not have to receive the photos by email or other complicated software or web pages.	3	5
Pill Watch	The application keeps track of what pills the senior citizen has to take, how many and when.	No more forgetting or taking too many pills.	3	5
Health Watch	The user enters his blood sugar level or blood pressure or other symptoms.	The doctor can see the data online and might be able to adjust medication.	3	5
TV Remote	Remote with interface optimized for older people.	Easier TV operation, leaving out of unused buttons.	4	4
Drug Calendar	An Application like a Calendar to know on which day and which time to take medicine.	Better Control for daily drug taking struggle	3	5
Feedback	Improved Input feedback for numbers and words. Not only visual, but with audio output.	Better Control of Inputs into the iPad	1	3
Location Plus	Smart Navigation to doctors and pharmacy.	Better Orientation	2	5
iPad as Remote Control	Control Cooker and Light, prevent forget to switch something of with alert	Better Control of Home	4	4
Remote Camera	Use iPad as screen for door camera	know who is there, secure	4	4
Nearby People	Use Navigation to show who is nearby	Help finding friends	3	5
Market	Scan stuff on market	Know what bought and know what to buy	3	4

Fridge inspec- tor	A System to be aware of expiration date of food	Do not eat expired food	5	3
Voice conver- tor	convert voice in move- ment in the screen be- cause an old person can have problems with mobility in hands	/	2	2
Connect iPad with emer- gency center	In case of emergency you can click a button in the iPad	/	2	4
apple ipad2 for senior citizens	how senior citizens can make use of apple ipad2 for their routines	ease of access	1	5
apple ipad2 applica- tions	how well the applica- tions can be used	to carry out their works using apple ipad2	2	5
task man- ager	acts as a reminder and let them know about their tasks and connects them with world	it helps the senior citizens to carry out their task and get con- nected with world	3	5
Card game	Playing card games on iPad with other SC	Interaction with oth- ers	1	5
Help- Button	Button that calls help if SC needs it	Safety	2	5
Easy User Inter- face (UI)	When a UI has a lot of icons, the senior citizen don't memorize the functionality of each icon,	The senior citizen can be happy if he/she identify easily each icon	1	5
Natural lan- guage	The device should rec- ognize a natural lan- guage	The senior citizen can use a natural language	2	3
Read text	Use a system what use a recognize a text an read it	Don't use all time the glasses	2	2

P

Apriori Action Descrip- tion	For people/seniors that are not too familiar with the iPad (concept) being able to anticipate all actions by knowing	/	1	5
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Continued	What a click will do by means of a help icon on the field (e.g., single touch tip, double touch execute)	more likely to explore all possibilities, as you always know what happens after a certain action	1	5
Back button for everything	Every action can be undone by a clearly marked back button that also outlines what will be undone	clear understanding what they can do or don't do	1	5
Observer / Activity Recorder	Records, takes picture of activities of memory impaired elderly	Easier to follow an activity as reminder what has been completed already	4	4
iPad magnifying glass	Use the rear camera to magnify small text or use to read product barcode and extract info from the internet	Easier access to information	1	3
Fridge reminder	Scan all products by the iPad to extract info about contents and expiration date	Reminder what products are no longer good	5	3
Larger keyboard	Display larger keys	people with clumsy hands, lack of fine finger control can still type	1	3
Quick communication links	Direct access to communication with family member or friends	communication more easily established, also in case of emergency	3	5
Virtual / real card game	Play with you friend but on the iPad	F2F interaction but task like card shuffling do not need to be carried out by hand	1	5
zooming feature	Allow zooming in/enlargement of everything on the iPad, not just enlarging text and pictures, but also the UI elements	make it easier for the senior citizen to see what's on the screen	1	3
text to speech	being able to convert everything on the screen to text	for people with bad eyesight	2	2
randomized photos	When the iPad is idle on its lock screen, randomly show photos	allow reminiscing and memories	2	5

video conferencing over 3G	enable video conferencing [e.g. face-time and skype] over 3G so people don't have to be dependent on wifi	connecting to loved ones more easily	3	5
calendar alerts	Pop up notifications for iCal for reminders and to-do lists	reminders	2	5
diary entries	integrate a diary/notebook feature into ical so people can write about what they did	Memories and reminiscing	3	5
Make the iPad bigger	Make the iPad screen bigger	More screen real estate. easier to see stuff, especially within a larger group of people [e.g. show and tell]	1	5
stylus	include a stylus so people can handwrite stuff	for people who don't like or can't type well	3	2
external input devices	Let people use external keyboards and mice with the iPad	more screen real estate that's not taken up by a software keyboard	1	5
scrapbooks	Let people create scrapbooks using photos on the iPad	memories	3	4
Sound Adjustment	More range of sound/sound quality	Beneficial to have a feature that allows them to have more control over the quality of what they're hearing	1	2
Medical Camera	Ability to use the camera as a way of communicating with their doctor/care provider	Might help facilitate health care over distances (doctor doesn't necessarily have to be there to give advice)	4	4
Medicine Cabinet	Tracking prescriptions	May be useful for those with multiple prescriptions to keep track of medicine intake and when to refill, etc	3	5
Health medical records	A way for senior citizens to keep track of their medical records	Can track medical records from home	3	5

pill tracker	using the back-facing camera to detect when pills have been taken; requires docking location near pills	often have a hard time keeping track of which pills are taken, medication tracking takes up a lot of time/effort	3	5
pill tracker 2	Assuming pill boxes have capacitance sensing, could touch the iPad which would help track	many older adults have to take pills	3	5
speech recognition	allow seniors to operate the device via voice	keyboard layout can be difficult for seniors b/c it's small or in an unusual position for them	2	2
automatic scrapbooking	Allow other users to upload media files to a designated feed where the iPad can pull from and generate a scrapbook pages	allows seniors to keep better updated with what's going on with their friends and/or family	3	4
automatic zoom for text	using front-facing camera sensors to automatically enlarge the text on different apps	many seniors find it easier to read text when it's a larger font\	1	3
light-weight awareness app	Allows others to send short messages to seniors that require only a short response. Keeps barrier low for keeping in touch	often times extended family finds it difficult to keep in touch with their grandparents	1	5
tele-medicine	Allow seniors to take photos of their ailments and send them to doctors	Sometimes transportation can be difficult for seniors. allowing them to remotely connect with physician can be helpful	4	4
Emergency Drop Layer	Always-running background application to aid seniors who fall and need help.	Safety, receiving aid despite incapacitation.	3	4
Camera-based Text Resizing	Based on arm-length setting, far-sighted/near sighted seniors can set optimal text size utilizing camera	No need to squint, easier readability/accessibility.	1	3
Medication Notification Calen-	Based on prescription, notifier will pop-up and remind user to take X-amount of Y medication and verify task as done.	Prevent over/under-dosage of required medication. Better log for doctors to check.	3	5

dar				
Walk- ing/Exe rcise Tester	Using gyroscope on various points of the body, can recommend better walking stance for healthy exercise without strain.	Less damage to body, healthy exercise, teaches gyroscopic interface.	2	5
Com- munity Activity Finder	Based on GPS/wireless location, can track and find relevant activities friendly for people of similar age groups	Social mingling, teaches mapping program usage, builds WOMM for iPad	3	5
County- Spon- sored Pre- scrip- tion App	Utilizing required medications, duration of requirement and dosage local counties can determine bulk-order rates	Lowers medicaid costs, helps track prescription usage for public/private hospitals.	3	4
Simple Brain Exer- cise Games	Utilizing simple brain exercise games, can sharpen minds	Mental health. Teach more about the UI of the iPad system.	2	5
higher resolu- tion	improve screen resolution	Poor vision in the elderly requires large print format. ipad2 is not great for eBooks.	1	5
easier user inter- face	simplify	though not complex currently, seniors made have difficult time learning how to find certain applications or features	1	5
Tree App	Creating family tree	Memories	3	5
Med App	Helps with medical issued	Health	1	5
Brain Games	Exercise for games	Fun	2	5
Falling App	Calls help when senior citizen falls	Safety	2	5
Call- Help- Button	Calling for help	Safety	2	5

E

Pre- scrip- tion Filler	A helpful tool for sr. citizens to be able to get the medicines needed without all the hassle.	Could remind them to take their pills and when, could notify company when to refill prescriptions for them, etc.	3	5
Family Connect	be able to add and follow family members lives all in one app., less hassle	Combines different internet aspects of one person i.e.: facebook pages, websites, photo bucket, Skype, to easily connect	2	5
Bingo notifier	lets you know where around you Bingo Games are going on and when	everyone loves bingo	2	5
chess	adding to the chess idea, where they can connect with other friends who have the ipad2 and play virtual chess with them	saves the hassle of driving	1	5
Gift sugges- tions	adding to the gifts idea, including a calendar to remind them a week or two ahead of time that they need to get a gift	for fading memories	3	5
Things to do when Retired	list of local events, places to go visit or do, catering to those retired	for ideas	1	5
Life like usage	Making the product similar to the process of using pen and paper for administrative work/ requirements	Senior citizens are unfamiliar with computer processes. Anything that resembles pen and paper would help	2	3
Pro- mote com- muni- ca- tion advan- tages	Enhance calling and video conversation tools like Skype	Senior citizens stay in contact with family across geographical borders	3	5
Simpli- fication	Allow the iPod to be simplified to apply to user's personal needs	Makes the product relevant to the user emphasizing things user will use most	1	5
Real estate guide	Provides information about real estate purchase/rent opportunities	resource for wealthy senior citizens	2	5

Finan- cial planner	Helps individuals manage 401ks and retirement funds	helps senior citizens manage finances	2	5
Health planner	Provides dietary and physical advice for individuals given specific health conditions	applies to senior citizens with specific health concerns	1	5
Library	Provides up to date books and magazines	for the reading senior citizen	1	5
Price checker	compares prices of products across different local stores	for the senior citizen who needs the best deal with minimal travel	2	5
menu and nutri- tion library	provides menus based on nutritional facts	for the healthy person	1	5
call for help	just by an easy click, the senior will be connected to a call center in order to get help see a person using t. camera	Given that the senior is using the iPod, she/he is given a further option to call for help	2	5
call family	with this application the senior could call his/her family with a single click, using both cameras	"see" family talk to them	1	4
text-to- speech	reading books aloud	for senior that cannot see very well, the app. will read books aloud	2	2
play cards	Play cards with other iPod/online users or against the computer	for senior that cannot hold cards very well anymore	1	5
social net- work	connect to other seniors	finding other people that might be alone and looking for friends	2	5
quick intro- duction guide	get in touch with the device	getting used to it, break down barriers	1	5
Media Integra- tion	inking to old media usage e.g. newspaper preferences	Senior citizens can adopt the device without resigning on old habits	1	5
Family Tree App	lets SC create a family tree	SC can reflect on life	3	5

Medical App	an reminder for getting medicine on time	get medicine on time	3	5
Enhanced(As-sisted) Visual Display	The display of the basic functional icons such as exit, next page and make it more obvious to the users.	Seniors tend to have trouble locating the smaller icons, enlarging or using vivid colors will help guide their usage.	1	5
Automatic audio typing function	Using voice recognition function to assist the senior to enter words or use command without having to type	Typing (esp. without keyboard) can be burdensome for seniors with bad vision and typing skills.	2	2
Medicine Look-up Function	Enable seniors to look up the description for medicine and understand its function and usage	a lot of times the seniors have too much medicine and forgot about their function and usage	1	5
Make Amends with flash	Add flash	Seniors want access to all media and probably wouldn't appreciate a product that makes some sites unviewable.	1	5
price	lower price	Seniors on social security often live well beneath their means in order to retire comfortably. 499 is expensive for them	1	5
Locator function	Aids in finding misplaced iPad	I'm 25 and lose things all the time. A senior would need some sort of sound activated locator to find misplaced items.	2	4

Table 27. iPad2 ideas

A.9 Questions for the Idea Generation Session

Each question is assigned to a 7-point Likert-scale: strongly disagree (1), disagree (2), disagree somewhat (3), undecided (4), agree somewhat (5), agree (6), and strongly agree (7).

Questions
I trust 'participant 2' because he/she shares the same interests.
I trust 'participant 3' because he/she shares the same interests.
I feel that I can count on 'participant 2' to help me with a crucial problem.
I feel that I can count on 'participant 3' to help me with a crucial problem.
'Participant 2' was available during the session.
'Participant 3' was available during the session.
I felt I could freely share my ideas in this group.
I think 'participant 2' has good intentions.
I think 'participant 3' has good intentions.
I think 'participant 2' cares about the well-being of others.
I think 'participant 3' cares about the well-being of others.
I was very committed to the task.
I think 'participant 2' was very committed to the task.
I think 'participant 3' was very committed to the task.
I think 'participant 2' is friendly and approachable.
I think 'participant 3' is friendly and approachable.
I think 'participant 2' is secretive.
I think 'participant 3' is secretive.
I trust 'participant2' to contribute relevant expertise to this project.

I trust 'participant3' to contribute relevant expertise to this project.
I have confidence in the skills of 'participant 2'.
I have confidence in the skills of 'participant 3'.
I think 'participant 2' does things competently.
I think 'participant 3' does things competently.
I feel that 'participant 2' will not keep his / her word.
I feel that 'participant 3' will not keep his / her word.
I think 'participant 2' behaves in a very consistent manner.
I think 'participant 3' behaves in a very consistent manner.
I think that 'participant 2' is very self-confident.
I think that 'participant 3' is very self-confident.
Even in hard working circumstances I can count on 'participant 2' to follow through on work commitments.
Even in hard working circumstances I can count on 'participant 3' to follow through on work commitments.
I can rely on 'participant 2' not to make my work more difficult by careless work.
I can rely on 'participant 3' not to make my work more difficult by careless work.
I am satisfied with my own performance.
I am satisfied with the performance of 'participant 2'.
I am satisfied with the performance of 'participant 3'.
I am satisfied with the overall result.
I enjoyed working on this particular problem.
I ignored the contributions of 'participant 2'.
I ignored the contributions of 'participant 3'.
I think 'participant 2' is trustworthy.
I think 'participant 3' is trustworthy.

Table 28. Questionnaire for the idea generation session

A.10 iPad2 Ideas for the Idea Evaluation Session

Number	Titel	Description	Advantage
1	Analysis of illness symptoms	App for analyzing illness of senior citizen	For senior citizens who get sick often
2	Grow-Up-Scrapbook-App for grandchildren	App which documents the grow up of the grandchildren	For senior citizens with grandchildren
3	Magnifier	Enlargement of newspaper	Senior citizen can read it easier
4	Activity suggestions	Random generator who makes activity suggestions	Knows what to do next
5	Speech-To-Text	System who helps to type text via speech and reads	For senior citizens who cannot see very well
6	Gift suggestions for grandchildren	App who suggests gifts for grandchildren	For senior citizens with grandchildren

Table 29. iPad2 ideas for the idea evaluation session

A.11 Facebook Ideas for the Idea Evaluation Session

Number	Titel	Description	Advantage
1	Electronic bulletin board	A bulletin board integrated into Facebook	Can look up cheap stuff and does not need another website
2	Teacher ranking	Students can rate their teacher on Facebook	Overview about good teachers and bad teachers
3	Online teaching material	Teachers and students share slides and teaching material of a class on Facebook	Everything is in one spot; better overview about material
4	Online class	The professor teaches the class over Facebook	Does not have to leave the house
5	Facebook research	Students and researchers can find cooperations for research projects via Facebook	Platform for research needs
6	Exam results	Student gets exam results via Facebook message	Only one platform to use

Table 30. Facebook ideas for the idea evaluation session

A.12 Questions for the Idea Evaluation Session

Each question is assigned to a 7-point Likert-scale: strongly disagree (1), disagree (2), disagree somewhat (3), undecided (4), agree somewhat (5), agree (6), and strongly agree (7).

Questions
I trust 'participant 2' because he/she shares the same interests.
I trust 'participant 3' because he/she shares the same interests.
I feel that I can count on 'participant 2' to help me with a crucial problem.
I feel that I can count on 'participant 3' to help me with a crucial problem.
'Participant 2' was available during the session.
'Participant 3' was available during the session.
I felt I could freely share my ideas in this group.
I think 'participant 2' has good intentions.
I think 'participant 3' has good intentions.
I think 'participant 2' cares about the well-being of others.
I think 'participant 3' cares about the well-being of others.
I was very committed to the task.
I think 'participant 2' was very committed to the task.
I think 'participant 3' was very committed to the task.
I think 'participant 2' is friendly and approachable.
I think 'participant 3' is friendly and approachable.
I think 'participant 2' is secretive.
I think 'participant 3' is secretive.
I trust 'participant2' to contribute relevant expertise to this project.

I trust 'participant3' to contribute relevant expertise to this project.
I have confidence in the skills of 'participant 2'.
I have confidence in the skills of 'participant 3'.
I think 'participant 2' does things competently.
I think 'participant 3' does things competently.
I feel that 'participant 2' will not keep his / her word.
I feel that 'participant 3' will not keep his / her word.
I think 'participant 2' behaves in a very consistent manner.
I think 'participant 3' behaves in a very consistent manner.
I think that 'participant 2' is very self-confident.
I think that 'participant 3' is very self-confident.
Even in hard working circumstances I can count on 'participant 2' to follow through on work commitments.
Even in hard working circumstances I can count on 'participant 3' to follow through on work commitments.
I can rely on 'participant 2' not to make my work more difficult by careless work.
I can rely on 'participant 3' not to make my work more difficult by careless work.
I am satisfied with my own performance.
I am satisfied with the performance of 'participant 2'.
I am satisfied with the performance of 'participant 3'.
I am satisfied with the overall result.
I enjoyed working on this particular problem.
I ignored the ratings of 'participant 2'.
I ignored the ratings of 'participant 3'.
I think 'participant 2' is trustworthy.
I think 'participant 3' is trustworthy.

Table 31. Questionnaire for the idea evaluation session

A.13 Results of Idea Evaluation Session

In the following table the results of the evaluation session are shown.

- C = condition (no information, personal information, expertise level)
- T = task (Facebook, Ipad2)
- P = participant id
- G = gender
- I = idea number
- P2 = rating of participant 2
- P3 = rating of participant 3
- A = average of the ratings of participant 2 and 3
- R = rating of participant
- S = scale (originality, feasibility)

C	T	P	G	I	P2	P3	A	R	S
N	I	p012	m	1	3	4	3.5	1	O
N	I	p012	m	2	4	3	3.5	2	O
N	I	p012	m	3	3	4	3.5	1	O
N	I	p012	m	4	4	3	3.5	1	O
N	I	p012	m	5	3	5	4	4	O
N	I	p012	m	6	4	4	4	4	O
N	I	p012	m	1	2	3	2.5	1	F
N	I	p012	m	2	4	4	4	5	F
N	I	p012	m	3	5	5	5	5	F
N	I	p012	m	4	5	5	5	5	F
N	I	p012	m	5	4	4	4	4	F
N	I	p012	m	6	5	3	4	5	F
N	I	p022	m	1	3	4	3.5	2	O
N	I	p022	m	2	4	3	3.5	4	O
N	I	p022	m	3	3	4	3.5	3	O
N	I	p022	m	4	4	3	3.5	2	O
N	I	p022	m	5	3	5	4	4	O
N	I	p022	m	6	4	4	4	3	O
N	I	p022	m	1	2	3	2.5	3	F
N	I	p022	m	2	4	4	4	5	F
N	I	p022	m	3	5	5	5	5	F
N	I	p022	m	4	5	5	5	5	F
N	I	p022	m	5	4	4	4	3	F
N	I	p022	m	6	5	3	4	4	F

N	I	p009	f	1	3	4	3.5	2	O
N	I	p009	f	2	4	3	3.5	4	O
N	I	p009	f	3	3	4	3.5	3	O
N	I	p009	f	4	4	3	3.5	2	O
N	I	p009	f	5	3	5	4	4	O
N	I	p009	f	6	4	4	4	3	O
N	I	p009	f	1	2	3	2.5	3	F
N	I	p009	f	2	4	4	4	5	F
N	I	p009	f	3	5	5	5	5	F
N	I	p009	f	4	5	5	5	5	F
N	I	p009	f	5	4	4	4	3	F
N	I	p009	f	6	5	3	4	4	F
N	I	p023	f	1	3	4	3.5	3	O
N	I	p023	f	2	4	3	3.5	4	O
N	I	p023	f	3	3	4	3.5	3	O
N	I	p023	f	4	4	3	3.5	2	O
N	I	p023	f	5	3	5	4	3	O
N	I	p023	f	6	4	4	4	3	O
N	I	p023	f	1	2	3	2.5	3	F
N	I	p023	f	2	4	4	4	5	F
N	I	p023	f	3	5	5	5	5	F
N	I	p023	f	4	5	5	5	5	F
N	I	p023	f	5	4	4	4	4	F
N	I	p023	f	6	5	3	4	4	F
N	I	p028	f	1	3	4	3.5	1	O
N	I	p028	f	2	4	3	3.5	5	O
N	I	p028	f	3	3	4	3.5	3	O
N	I	p028	f	4	4	3	3.5	4	O
N	I	p028	f	5	3	5	4	3	O
N	I	p028	f	6	4	4	4	3	O
N	I	p028	f	1	2	3	2.5	2	F
N	I	p028	f	2	4	4	4	2	F
N	I	p028	f	3	5	5	5	5	F
N	I	p028	f	4	5	5	5	5	F
N	I	p028	f	5	4	4	4	4	F
N	I	p028	f	6	5	3	4	4	F
N	I	p032	m	1	3	4	3.5	3	O
N	I	p033	m	2	4	3	3.5	4	O
N	I	p034	m	3	3	4	3.5	2	O
N	I	p035	m	4	4	3	3.5	4	O
N	I	p036	m	5	3	5	4	2	O
N	I	p037	m	6	4	4	4	4	O
N	I	p038	m	1	2	3	2.5	2	F
N	I	p039	m	2	4	4	4	4	F
N	I	p040	m	3	5	5	5	5	F
N	I	p041	m	4	5	5	5	5	F
N	I	p042	m	5	4	4	4	4	F
N	I	p043	m	6	5	3	4	5	F
P	I	p010	m	1	3	4	3.5	4	O

P	I	p010	m	2	4	3	3.5	3	O
P	I	p010	m	3	3	4	3.5	3	O
P	I	p010	m	4	4	3	3.5	4	O
P	I	p010	m	5	3	5	4	3	O
P	I	p010	m	6	4	4	4	4	O
P	I	p010	m	1	2	3	2.5	1	F
P	I	p010	m	2	4	4	4	5	F
P	I	p010	m	3	5	5	5	3	F
P	I	p010	m	4	5	5	5	5	F
P	I	p010	m	5	4	4	4	5	F
P	I	p010	m	6	5	3	4	4	F
P	I	p013	f	1	3	4	3.5	4	O
P	I	p013	f	2	4	3	3.5	5	O
P	I	p013	f	3	3	4	3.5	4	O
P	I	p013	f	4	4	3	3.5	3	O
P	I	p013	f	5	3	5	4	3	O
P	I	p013	f	6	4	4	4	3	O
P	I	p013	f	1	2	3	2.5	1	F
P	I	p013	f	2	4	4	4	4	F
P	I	p013	f	3	5	5	5	4	F
P	I	p013	f	4	5	5	5	5	F
P	I	p013	f	5	4	4	4	3	F
P	I	p013	f	6	5	3	4	3	F
P	I	p002	m	1	3	4	3.5	5	O
P	I	p002	m	2	4	3	3.5	2	O
P	I	p002	m	3	3	4	3.5	4	O
P	I	p002	m	4	4	3	3.5	1	O
P	I	p002	m	5	3	5	4	2	O
P	I	p002	m	6	4	4	4	2	O
P	I	p002	m	1	2	3	2.5	5	F
P	I	p002	m	2	4	4	4	3	F
P	I	p002	m	3	5	5	5	5	F
P	I	p002	m	4	5	5	5	5	F
P	I	p002	m	5	4	4	4	3	F
P	I	p002	m	6	5	3	4	5	F
P	I	p020	m	1	3	4	3.5	5	O
P	I	p020	m	2	4	3	3.5	3	O
P	I	p020	m	3	3	4	3.5	4	O
P	I	p020	m	4	4	3	3.5	1	O
P	I	p020	m	5	3	5	4	3	O
P	I	p020	m	6	4	4	4	4	O
P	I	p020	m	1	2	3	2.5	3	F
P	I	p020	m	2	4	4	4	5	F
P	I	p020	m	3	5	5	5	5	F
P	I	p020	m	4	5	5	5	5	F
P	I	p020	m	5	4	4	4	5	F
P	I	p020	m	6	5	3	4	5	F
P	I	p026	f	1	3	4	3.5	4	O
P	I	p026	f	2	4	3	3.5	5	O

P	I	p026	f	3	3	4	3.5	4	O
P	I	p026	f	4	4	3	3.5	3	O
P	I	p026	f	5	3	5	4	3	O
P	I	p026	f	6	4	4	4	3	O
P	I	p026	f	1	2	3	2.5	1	F
P	I	p026	f	2	4	4	4	4	F
P	I	p026	f	3	5	5	5	4	F
P	I	p026	f	4	5	5	5	5	F
P	I	p026	f	5	4	4	4	3	F
P	I	p026	f	6	5	3	4	3	F
P	I	p034	f	1	3	4	3.5	3	O
P	I	p034	f	2	4	3	3.5	4	O
P	I	p034	f	3	3	4	3.5	3	O
P	I	p034	f	4	4	3	3.5	4	O
P	I	p034	f	5	3	5	4	3	O
P	I	p034	f	6	4	4	4	4	O
P	I	p034	f	1	2	3	2.5	2	F
P	I	p034	f	2	4	4	4	4	F
P	I	p034	f	3	5	5	5	5	F
P	I	p034	f	4	5	5	5	5	F
P	I	p034	f	5	4	4	4	4	F
P	I	p034	f	6	5	3	4	4	F
E	I	p003	f	1	3	4	3.5	4	O
E	I	p003	f	2	4	3	3.5	5	O
E	I	p003	f	3	3	4	3.5	3	O
E	I	p003	f	4	4	3	3.5	4	O
E	I	p003	f	5	3	5	4	2	O
E	I	p003	f	6	4	4	4	4	O
E	I	p003	f	1	2	3	2.5	3	F
E	I	p003	f	2	4	4	4	5	F
E	I	p003	f	3	5	5	5	4	F
E	I	p003	f	4	5	5	5	4	F
E	I	p003	f	5	4	4	4	3	F
E	I	p003	f	6	5	3	4	3	F
E	I	p001	m	1	3	4	3.5	4	O
E	I	p001	m	2	4	3	3.5	5	O
E	I	p001	m	3	3	4	3.5	1	O
E	I	p001	m	4	4	3	3.5	4	O
E	I	p001	m	5	3	5	4	2	O
E	I	p001	m	6	4	4	4	4	O
E	I	p001	m	1	2	3	2.5	2	F
E	I	p001	m	2	4	4	4	5	F
E	I	p001	m	3	5	5	5	5	F
E	I	p001	m	4	5	5	5	5	F
E	I	p001	m	5	4	4	4	3	F
E	I	p001	m	6	5	3	4	4	F
E	I	p016	m	1	3	4	3.5	1	O
E	I	p016	m	2	4	3	3.5	5	O
E	I	p016	m	3	3	4	3.5	3	O

E	I	p016	m	4	4	3	3.5	1	O
E	I	p016	m	5	3	5	4	4	O
E	I	p016	m	6	4	4	4	1	O
E	I	p016	m	1	2	3	2.5	1	F
E	I	p016	m	2	4	4	4	3	F
E	I	p016	m	3	5	5	5	5	F
E	I	p016	m	4	5	5	5	3	F
E	I	p016	m	5	4	4	4	2	F
E	I	p016	m	6	5	3	4	3	F
E	I	p018	m	1	3	4	3.5	3	O
E	I	p018	m	2	4	3	3.5	4	O
E	I	p018	m	3	3	4	3.5	3	O
E	I	p018	m	4	4	3	3.5	3	O
E	I	p018	m	5	3	5	4	3	O
E	I	p018	m	6	4	4	4	4	O
E	I	p018	m	1	2	3	2.5	3	F
E	I	p018	m	2	4	4	4	4	F
E	I	p018	m	3	5	5	5	4	F
E	I	p018	m	4	5	5	5	5	F
E	I	p018	m	5	4	4	4	4	F
E	I	p018	m	6	5	3	4	5	F
E	I	p004	f	1	3	4	3.5	4	O
E	I	p004	f	2	4	3	3.5	5	O
E	I	p004	f	3	3	4	3.5	3	O
E	I	p004	f	4	4	3	3.5	4	O
E	I	p004	f	5	3	5	4	2	O
E	I	p004	f	6	4	4	4	4	O
E	I	p004	f	1	2	3	2.5	3	F
E	I	p004	f	2	4	4	4	5	F
E	I	p004	f	3	5	5	5	4	F
E	I	p004	f	4	5	5	5	4	F
E	I	p004	f	5	4	4	4	3	F
E	I	p004	f	6	5	3	4	3	F
E	I	p031	f	1	3	4	3.5	1	O
E	I	p031	f	2	4	3	3.5	4	O
E	I	p031	f	3	3	4	3.5	2	O
E	I	p031	f	4	4	3	3.5	4	O
E	I	p031	f	5	3	5	4	2	O
E	I	p031	f	6	4	4	4	3	O
E	I	p031	f	1	2	3	2.5	1	F
E	I	p031	f	2	4	4	4	4	F
E	I	p031	f	3	5	5	5	2	F
E	I	p031	f	4	5	5	5	4	F
E	I	p031	f	5	4	4	4	2	F
E	I	p031	f	6	5	3	4	3	F
N	F	p017	m	1	2	4	3	3	O
N	F	p017	m	2	3	3	3	3	O
N	F	p017	m	3	3	4	3.5	4	O
N	F	p017	m	4	3	5	4	4	O

N	F	p017	m	5	3	4	3.5	4	O
N	F	p017	m	6	3	2	2.5	4	O
N	F	p017	m	1	5	4	4.5	5	F
N	F	p017	m	2	3	4	3.5	1	F
N	F	p017	m	3	4	3	3.5	5	F
N	F	p017	m	4	2	4	3	3	F
N	F	p017	m	5	4	5	4.5	4	F
N	F	p017	m	6	3	4	3.5	4	F
N	F	p021	m	1	2	4	3	2	O
N	F	p021	m	2	3	3	3	3	O
N	F	p021	m	3	3	4	3.5	4	O
N	F	p021	m	4	3	5	4	1	O
N	F	p021	m	5	3	4	3.5	4	O
N	F	p021	m	6	3	2	2.5	1	O
N	F	p021	m	1	5	4	4.5	2	F
N	F	p021	m	2	3	4	3.5	3	F
N	F	p021	m	3	4	3	3.5	4	F
N	F	p021	m	4	2	4	3	1	F
N	F	p021	m	5	4	5	4.5	4	F
N	F	p021	m	6	3	4	3.5	1	F
N	F	p005	f	1	2	4	3	2	O
N	F	p005	f	2	3	3	3	3	O
N	F	p005	f	3	3	4	3.5	3	O
N	F	p005	f	4	3	5	4	2	O
N	F	p005	f	5	3	4	3.5	5	O
N	F	p005	f	6	3	2	2.5	3	O
N	F	p005	f	1	5	4	4.5	4	F
N	F	p005	f	2	3	4	3.5	3	F
N	F	p005	f	3	4	3	3.5	3	F
N	F	p005	f	4	2	4	3	1	F
N	F	p005	f	5	4	5	4.5	5	F
N	F	p005	f	6	3	4	3.5	5	F
N	F	p025	m	1	2	4	3	4	O
N	F	p025	m	2	3	3	3	3	O
N	F	p025	m	3	3	4	3.5	5	O
N	F	p025	m	4	3	5	4	5	O
N	F	p025	m	5	3	4	3.5	4	O
N	F	p025	m	6	3	2	2.5	1	O
N	F	p025	m	1	5	4	4.5	5	F
N	F	p025	m	2	3	4	3.5	4	F
N	F	p025	m	3	4	3	3.5	4	F
N	F	p025	m	4	2	4	3	3	F
N	F	p025	m	5	4	5	4.5	4	F
N	F	p025	m	6	3	4	3.5	3	F
N	F	p030	f	1	2	4	3	3	O
N	F	p030	f	2	3	3	3	3	O
N	F	p030	f	3	3	4	3.5	3	O
N	F	p030	f	4	3	5	4	2	O
N	F	p030	f	5	3	4	3.5	5	O

N	F	p030	f	6	3	2	2.5	2	O
N	F	p030	f	1	5	4	4.5	4	F
N	F	p030	f	2	3	4	3.5	4	F
N	F	p030	f	3	4	3	3.5	4	F
N	F	p030	f	4	2	4	3	3	F
N	F	p030	f	5	4	5	4.5	4	F
N	F	p030	f	6	3	4	3.5	3	F
N	F	p033	f	1	2	4	3	1	O
N	F	p033	f	2	3	3	3	4	O
N	F	p033	f	3	3	4	3.5	2	O
N	F	p033	f	4	3	5	4	3	O
N	F	p033	f	5	3	4	3.5	4	O
N	F	p033	f	6	3	2	2.5	3	O
N	F	p033	f	1	5	4	4.5	5	F
N	F	p033	f	2	3	4	3.5	4	F
N	F	p033	f	3	4	3	3.5	5	F
N	F	p033	f	4	2	4	3	2	F
N	F	p033	f	5	4	5	4.5	5	F
N	F	p033	f	6	3	4	3.5	4	F
P	F	p006	m	1	2	4	3	2	O
P	F	p006	m	2	3	3	3	2	O
P	F	p006	m	3	3	4	3.5	2	O
P	F	p006	m	4	3	5	4	4	O
P	F	p006	m	5	3	4	3.5	2	O
P	F	p006	m	6	3	2	2.5	3	O
P	F	p006	m	1	5	4	4.5	5	F
P	F	p006	m	2	3	4	3.5	4	F
P	F	p006	m	3	4	3	3.5	4	F
P	F	p006	m	4	2	4	3	2	F
P	F	p006	m	5	4	5	4.5	3	F
P	F	p006	m	6	3	4	3.5	2	F
P	F	p011	f	1	2	4	3	2	O
P	F	p011	f	2	3	3	3	1	O
P	F	p011	f	3	3	4	3.5	2	O
P	F	p011	f	4	3	5	4	2	O
P	F	p011	f	5	3	4	3.5	4	O
P	F	p011	f	6	3	2	2.5	3	O
P	F	p011	f	1	5	4	4.5	5	F
P	F	p011	f	2	3	4	3.5	5	F
P	F	p011	f	3	4	3	3.5	4	F
P	F	p011	f	4	2	4	3	4	F
P	F	p011	f	5	4	5	4.5	4	F
P	F	p011	f	6	3	4	3.5	4	F
P	F	p019	f	1	2	4	3	1	O
P	F	p019	f	2	3	3	3	1	O
P	F	p019	f	3	3	4	3.5	4	O
P	F	p019	f	4	3	5	4	3	O
P	F	p019	f	5	3	4	3.5	4	O
P	F	p019	f	6	3	2	2.5	3	O

P	F	p019	f	1	5	4	4.5	5	F
P	F	p019	f	2	3	4	3.5	3	F
P	F	p019	f	3	4	3	3.5	4	F
P	F	p019	f	4	2	4	3	2	F
P	F	p019	f	5	4	5	4.5	4	F
P	F	p019	f	6	3	4	3.5	3	F
P	F	p027	f	1	2	4	3	2	O
P	F	p027	f	2	3	3	3	3	O
P	F	p027	f	3	3	4	3.5	2	O
P	F	p027	f	4	3	5	4	4	O
P	F	p027	f	5	3	4	3.5	2	O
P	F	p027	f	6	3	2	2.5	2	O
P	F	p027	f	1	5	4	4.5	5	F
P	F	p027	f	2	3	4	3.5	5	F
P	F	p027	f	3	4	3	3.5	5	F
P	F	p027	f	4	2	4	3	2	F
P	F	p027	f	5	4	5	4.5	4	F
P	F	p027	f	6	3	4	3.5	5	F
P	F	p008	m	1	2	4	3	3	O
P	F	p008	m	2	3	3	3	3	O
P	F	p008	m	3	3	4	3.5	5	O
P	F	p008	m	4	3	5	4	5	O
P	F	p008	m	5	3	4	3.5	5	O
P	F	p008	m	6	3	2	2.5	5	O
P	F	p008	m	1	5	4	4.5	5	F
P	F	p008	m	2	3	4	3.5	5	F
P	F	p008	m	3	4	3	3.5	4	F
P	F	p008	m	4	2	4	3	3	F
P	F	p008	m	5	4	5	4.5	3	F
P	F	p008	m	6	3	4	3.5	1	F
P	F	p036	m	1	2	4	3	3	O
P	F	p036	m	2	3	3	3	3	O
P	F	p036	m	3	3	4	3.5	4	O
P	F	p036	m	4	3	5	4	4	O
P	F	p036	m	5	3	4	3.5	4	O
P	F	p036	m	6	3	2	2.5	3	O
P	F	p036	m	1	5	4	4.5	5	F
P	F	p036	m	2	3	4	3.5	4	F
P	F	p036	m	3	4	3	3.5	4	F
P	F	p036	m	4	2	4	3	3	F
P	F	p036	m	5	4	5	4.5	4	F
P	F	p036	m	6	3	4	3.5	4	F
E	F	p014	f	1	2	4	3	2	O
E	F	p014	f	2	3	3	3	1	O
E	F	p014	f	3	3	4	3.5	4	O
E	F	p014	f	4	3	5	4	1	O
E	F	p014	f	5	3	4	3.5	4	O
E	F	p014	f	6	3	2	2.5	5	O
E	F	p014	f	1	5	4	4.5	4	F

E	F	p014	f	2	3	4	3.5	3	F
E	F	p014	f	3	4	3	3.5	4	F
E	F	p014	f	4	2	4	3	1	F
E	F	p014	f	5	4	5	4.5	4	F
E	F	p014	f	6	3	4	3.5	2	F
E	F	p015	m	1	2	4	3	2	O
E	F	p015	m	2	3	3	3	2	O
E	F	p015	m	3	3	4	3.5	2	O
E	F	p015	m	4	3	5	4	2	O
E	F	p015	m	5	3	4	3.5	3	O
E	F	p015	m	6	3	2	2.5	2	O
E	F	p015	m	1	5	4	4.5	5	F
E	F	p015	m	2	3	4	3.5	5	F
E	F	p015	m	3	4	3	3.5	5	F
E	F	p015	m	4	2	4	3	2	F
E	F	p015	m	5	4	5	4.5	5	F
E	F	p015	m	6	3	4	3.5	3	F
E	F	p007	f	1	2	4	3	2	O
E	F	p007	f	2	3	3	3	1	O
E	F	p007	f	3	3	4	3.5	4	O
E	F	p007	f	4	3	5	4	3	O
E	F	p007	f	5	3	4	3.5	4	O
E	F	p007	f	6	3	2	2.5	4	O
E	F	p007	f	1	5	4	4.5	4	F
E	F	p007	f	2	3	4	3.5	1	F
E	F	p007	f	3	4	3	3.5	4	F
E	F	p007	f	4	2	4	3	1	F
E	F	p007	f	5	4	5	4.5	3	F
E	F	p007	f	6	3	4	3.5	4	F
E	F	p024	m	1	2	4	3	3	O
E	F	p024	m	2	3	3	3	3	O
E	F	p024	m	3	3	4	3.5	3	O
E	F	p024	m	4	3	5	4	2	O
E	F	p024	m	5	3	4	3.5	5	O
E	F	p024	m	6	3	2	2.5	2	O
E	F	p024	m	1	5	4	4.5	4	F
E	F	p024	m	2	3	4	3.5	4	F
E	F	p024	m	3	4	3	3.5	4	F
E	F	p024	m	4	2	4	3	3	F
E	F	p024	m	5	4	5	4.5	4	F
E	F	p024	m	6	3	4	3.5	3	F
E	F	p029	f	1	2	4	3	3	O
E	F	p029	f	2	3	3	3	1	O
E	F	p029	f	3	3	4	3.5	4	O
E	F	p029	f	4	3	5	4	2	O
E	F	p029	f	5	3	4	3.5	4	O
E	F	p029	f	6	3	2	2.5	4	O
E	F	p029	f	1	5	4	4.5	5	F
E	F	p029	f	2	3	4	3.5	4	F

E	F	p029	f	3	4	3	3.5	3	F
E	F	p029	f	4	2	4	3	1	F
E	F	p029	f	5	4	5	4.5	5	F
E	F	p029	f	6	3	4	3.5	1	F
E	F	p035	m	1	2	4	3	1	O
E	F	p035	m	2	3	3	3	1	O
E	F	p035	m	3	3	4	3.5	1	O
E	F	p035	m	4	3	5	4	1	O
E	F	p035	m	5	3	4	3.5	3	O
E	F	p035	m	6	3	2	2.5	1	O
E	F	p035	m	1	5	4	4.5	5	F
E	F	p035	m	2	3	4	3.5	5	F
E	F	p035	m	3	4	3	3.5	5	F
E	F	p035	m	4	2	4	3	2	F
E	F	p035	m	5	4	5	4.5	3	F
E	F	p035	m	6	3	4	3.5	3	F

Table 32. Results of idea evaluation session

Declaration

I declare that this thesis has been created by myself, that the work contained herein is my own except where explicitly stated otherwise in the text and that this work has not been submitted for any other degree or professional qualification except as specified.

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September 23, 2011

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