

Consideration in Software-mediated Social Interaction

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Abstract— Software-mediated interactions introduce a new set of etiquettes not necessarily analogous to face-to-face interactions. Current software systems are not prepared to accommodate how users differ in their perception of the considerate nature of an interaction. Being socially inconsiderate affects the relationship between colleagues, their cooperation level, willingness to interact and, ultimately, the entire business. Hence, software acting on behalf of people or facilitating their interaction should be expected to support a rationale where both socialness and business goals are recognised. However, despite this vital role, the sociality of business interactions has rarely been considered within information systems development and research, even among areas that attempt to align the system with business needs. In this paper, we conduct an empirical study, following a mixed method approach, trying to explore the users' attitude and their perception of the elements of consideration in software-mediate interaction and what they would expect future software to provide in relation to consideration. We list a set of research challenges for information systems which embed consideration as a main social requirement.

Keywords—Requirements, Consideration. Social Interaction

I. INTRODUCTION

Many software systems can be viewed as the intermediary among people, supporting human choices in their behaviour, action and interaction with each other. As such, the use of the medium, in this case the software system, does not exempt a user (a person or an organization) from being considerate; a user could still be classified as considerate or inconsiderate by the way they use the software or the way the software behaves on their behalf. For example, inviting someone to a business meeting by sending an SMS or a Facebook message might be seen as an improper interaction style by certain invitees. Similarly, including the manager of the recipient, in the carbon copy of an email when asking that recipient to undertake certain tasks, might be seen as inappropriate.

Indeed, the social concerns related to software-mediated interactions can affect the social relationships among involved parties [1, 2]. This paper advocates that taking into account both measuring and minimizing the inconvenience potentially caused by a software-based operation has to be systematically constructed as an essential part of the engineering process. The ultimate goal would be to build systems that are configurable and adaptable to minimize negative impacts of inconsiderate use, thus maintaining, or even enhancing, social relationships among colleagues.

Supporting socially considerate behaviour means allowing users to enjoy certain autonomy in tailoring their interaction styles. This characteristic relies on the judgement of individual users and is not tied to strict organizational rules. The freedom to choose the way to reach their requirements, and the right interaction styles to use during this process, are essential features for users, thus allowing them to be social entities. Hence, a software system that completely restricts its users to certain deterministic and fully specified behaviours and interaction styles would not be considered as 'truly' social software. For example, if sending a template email is the only permissible way to invite colleagues to a seminar, then there is no space to exhibit the independent character of an inviter. Considerate software enacts interaction styles originally specified by the individual users.

In essence, software provides a mechanism for allowing users to meet their goals, i.e., requirements. Hence, considerate software should be supplied with a space of different variants (alternative solutions) to reach user's requirements. Hence, variability is essential to express personal choices and being social. Some factors affecting this decision include context [3, 4], norms and laws [5], skills and preferences [6]. The considerate nature of an alternative interaction style is yet another factor which influences the decision. Considerate software would need to perform meta-computing [7] and evaluate each of its variants against the colleagues' perception of consideration and react or recommend actions accordingly.

The importance of etiquette and well-mannered interaction in electronic communication is recognized in the literature [2]. This goes back to the early days when people started to use emails [8]. The proliferation of social networks and online shared working spaces introduced a wider set of interaction styles. Also, people's perception of electronic communication has changed over time and we would now need to investigate again how people perceive this wider set of interaction styles. In addition, we still need to study consideration as a class of requirements of social software within the remit of information systems analysis and design. This means that we would need to devise clear and measureable concepts with precise semantics to allow automation and software-based reasoning. Our realisation that there is a fundamental lack of knowledge about users' attitudes to supporting consideration in software-mediated interaction, and about what features users would like such software to offer, was the primary motivation for the research reported in this paper.

In this paper, we advocate the need to study consideration in the design of software-mediated social interaction. We conduct an empirical study following a mixed-method sequential exploratory approach to understand the elements of consideration from users' perspective and what facilities they expect from future software systems in this regard. We elaborate on the findings, draw observations and present a set of research challenges for the engineering of consideration-aware information systems.

The paper is structured as follows. Section 2 discusses the method followed in the paper. Section 3 discusses the results of both the qualitative and quantitative parts of our empirical study. Section 4 introduces research challenges for consideration-aware software and Section 5 concludes the paper.

II. RESEARCH METHOD

In order to explore and identify the key aspects, behaviours and norms related to software-mediated interactions, we conducted a two-stage empirical study and followed a mixed-method sequential exploratory approach [9]. First, we designed an interview to explore users' perceptions of consideration. Second, we specified key findings from the interview and used them to design an online survey for validation and further exploration purpose. It should be noted that our study focuses on interactions in workplace, i.e., in a business context. We have made that clear to all of our participants in both the interviews and the questionnaire.

A. Interview

The aim of the interview was to explore and identify key aspects of consideration related to impersonal and interpersonal software-mediated interaction, which could lead to a conceptual model on its elements and what specification issues we may encounter, as well as what facilities the software could offer. The questions were designed based on the social psychological aspects of software-mediated communication [10,11]. The interviews attempted to explore the following aspects:

1) *Cognitive understanding of consideration*: It is important to understand what people think of consideration in human to human interactions as such understanding will affect their interaction styles in software-mediated interaction. For example, what kind of actions, reactions in daily interaction can be considered as considerate behaviours when people discuss work related issues, share information and collaborate as a team.

2) *Motivations for being considerate/inconsiderate*: Being considerate to others is important in our day-to-day interactions. However, this has been treated more as a social skill people should develop rather than a norm or code of practice. Moreover, sometimes people have no option but to be inconsiderate to some of their colleagues. In that case, we need to explore whether there is a link between someone's objectives and business context and the degree of inconvenience they have caused to some of their colleagues.

3) *Popular software means used in workplace*: the interviews aimed to identify common software tools that support social interaction, networking and collaboration and to discover how some of these software features and interaction styles supported considerate interactions or led to inconsiderate interactions.

4) *Consideration/inconsideration in software-mediated interaction*: It is interesting to note how considerate and inconsiderate behaviours in human interaction styles are mapped to software-mediated interactions. Moreover, it is also worth investigating whether some behaviours are either caused by or affected by software features and design.

5) *User's attitude and reactions to consideration and inconsideration in software-mediated interaction*: Social networking is not only changing how we communicate but also such tools have made impact on our traditional interaction styles. In other words, some considerate and inconsiderate interaction behaviours may no longer become an issue when people are using social networking. Therefore, understanding user's attitudes is crucial to help us define another construct of the conceptual model of consideration related to reactions and users profiles.

6) *Expectations of software on consideration-support*: Certain inconsiderate behaviours may be caused by someone who is unaware of software configurations that trigger undesirable outcomes. For example, an online document shared in a team is unexceptionally locked by one of the collaborators as the collaborator forgot to close the online editor properly. It would be useful to find how people would like software to cater for consideration-related issues so that they can avoid unintended inconvenience through reminders, suggestions and built-in assistants.

7) *Decision shift of being considerately or inconsiderately treated in software mediated interaction*: An obvious difference between traditional interaction (e.g., face to face) and software-mediated interaction is that people tend to be more responsive in the former. In other words, even someone has been treated inconsiderately during a discussion, their cooperation level is still unlikely to be significantly affected. However, people tend to avoid sending responses through software means if they feel some behaviours have caused inconvenience to them. Moreover, their decision about their reaction can also be affected by the progression of considerate/inconsiderate behaviours. For example, whether they still want to collaborate or whether they will turn to other interaction methods.

B. Protocol and procedure

We decided to carry out the interview in a traditional FTF (face-to-face) method with a think aloud protocol [12]. This would ensure us to capture important social cues [13] as well as minimizing the risk that the interviewer can impose bias to the answering process [14]. In addition, considering the fact that all participants are voluntary, which may lead to a selection bias, we have also created pre-selection criteria based on demographics, work experience and roles, interaction styles

and preferred software mediated interactions. An experienced interviewer, who is also a senior lecturer, conducted the interview and each session was audio recorded.

Past research on the reliability and validity of interview data, when the sample is small, suggests the data and coding should be cross-compared in a different quantitative approach [9]. The different quantitative approach adopted in our study is an online survey with questions and answers that could be mapped to our findings from the interview.

C. Data collection and analysis

Eight participants were finally recruited in the interview part of our study where all of them had given informed consent before taking part in the interview. The average length of each session was 35 minutes. Interview data was coded following a widely accepted step-by-step guide [15]. Six males and two females who are currently living and working in the UK, were recruited where all of them had given informed consent before taking part in the study. Five participants are English (Participants #1, #2, #5, #6 and #8). There was also one Nigerian (#7), one Iranian (#4) and one Dutch (#3) interviewee. Fig. 1 shows the age distribution of our subjects with the Median: 35; Mean: 37.5.

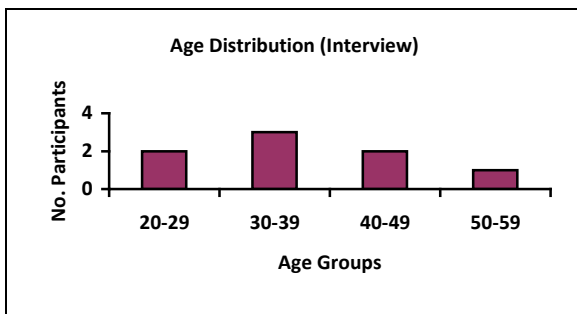


Fig. 1. The age distribution of interview participants

In terms of working experience, there were two business analysts (#1 and #8), two academics with programming backgrounds (#2 and 3) and two academics with background in business (#6, #7), one other academic (#5) and one student (#4). It should be noted that all participants were familiar with software-mediated interaction and they all use social networking and emails. Only one participant (#4) had little experience of using software-mediated interaction for business purposes.

Following the interview analysis, we designed an online survey to confirm and enhance our interview findings. We sent invitations to this online survey through our faculty academic staff mailing list, Chinwag mailing list and several research mailing lists in the UK and US. We received 122 responses (67 males and 55 females) in total within three weeks. This enabled us to validate our findings based on a large representative population from both business and academic sides. Fig. 2 shows the respondents' age distribution. The interview questions together with the questionnaire could be found at <http://goo.gl/Uo3m9o>

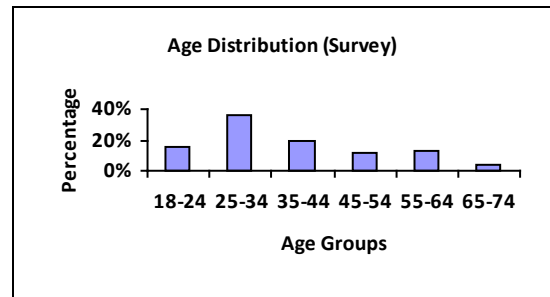


Fig. 2. The age distribution of survey respondents

We gave two scenarios in the interview and used them also to explain the questions of the survey:

Scenario 1: *You work in an enterprise and you are responsible for organizing a meeting. Your meeting organizer software (say Outlook) sent invitations to a list of people and asked them to respond. The meeting is marked as important and a response is requested. Some colleagues did not respond. You could configure the meeting organizer software to keep sending them reminders. Your meeting organizer software allows you to use a stricter template for the reminder when the colleague does not respond to the first and eventually add their managers to the recipients list. Please remember that the way you send the reminder and invitation could affect both the willingness of people to attend and also your relation with them when collaborating for other objectives. Also, consider that you might yourself be in a situation where you find the invitation inconsiderate, i.e., as invitee.*

Scenario 2: *Consider a shared editing scenario, e.g., Google Docs. There could be a number of operations allowed for you as a creator of the file, like inviting colleagues to edit, unsharing at certain point, and rejecting changes. At certain point, when the number of comments increases, you may delete some comments, or create another file where you could put old comments. You may invite new people to the shared document, or add new editors. Please note that when you do that some of the existing editors could be annoyed especially when that new editor can see the history of the discussions. Eventually, when the document is finalized, you may unshare the file. This could be still seen as an inconsiderate by some people. You may unshare it only with a number of people and keep others. How would you decide that? Moreover, you may unshare it with users who are not contributing any new knowledge or remain inactive. However, this may still upset them. How you would think of that? What if that person is important to you? How you define importance?*

III. RESULTS

In this section, we will present our research findings based on the analysis of both the interviews and the survey results.

A. Themes identified from interview data

Three main themes containing 13 sub-themes and 56 codes were identified after following the thematic coding guideline [16]. These themes are shown in Table I. The table also shows which of the survey questions relate to each theme. Note Q1 –

Q3 are generic questions related to demographics, work experience and software experience.

TABLE I. THEMES AND RELATED SURVEY QUESTIONS

Main Themes	Sub-themes	Survey Question	Aspects (Section II.A)
Consideration Modelling Elements (M)	Goal of interaction	Q5	1, 5
	Quantity	Q7	
	Consequence	Q4	
	Audience	Q7	
	Inconsiderate interaction classes	Q6	
	Personality factors	Q8	
Specification Issues (S)	Diversity of interpretation	Q9	2, 4, 7
	Evolution of perception	Q9	
	Tacitness	Q9	
	Consideration awareness	Q14	
	Treating inconsideration	Q11	
	Visibility of consideration regime	Q10	
	Consideration principles	Q12	
Software Expectations (E)	Guidance	Q13	3, 6
	Negotiation facility		
	Novel interfaces		
	Control		
	Variability and Adaptation		

In the next section, key responses and responses in common were extracted from audio transcripts to show how participants perceived considerate software-mediated social interaction in a business context. The **percentages**, written as [**..%**] next to the codes, reflect the percentage of the survey participants who chose that code as an option. Please note that the survey allowed multiple options so the sum might not be necessarily 100%. This was true for most of the questions including those related to the classification of the participant personality so that we could accommodate cases in which the participants would like to state that they might be at different states at different times.

1) *Consideration modelling elements*: This theme refers to the elements which form consideration. The codes serve as a taxonomy of how users would express what makes a software-mediated interaction considerate or inconsiderate and how they would react. The sub-themes (in bold) and codes (in bold italics) relevant to this theme are as follows:

- **The goal of interaction**. To evaluate the considerate nature of an interaction, the participants indicated that they would look at the reason for the interaction. This included the following:
 - **Goal of the interaction itself [65%]**: “if they are not interacting for the right reason, then I am less likely to be considerate”.

- **Constraints on achieving the goal [59%]**: “in my reminders, I could be inconsiderate because of the urgency and importance of attending the event, nothing personalized”. Urgency here is a constraint meaning that the task has to be done in short time.
- **Availability of other methods to achieve the same goal [56%]**: “Some people were in the habit of opening the shared file and then wandering off. They lock it. They could work-offline and then upload all text together”.
- **Quantity [79%]**: This theme refers to the amount of times a person has been considerate/inconsiderate in the past. It is declared as another factor to look at when evaluating an interaction with that person. “I tend to make excuses for people unless the person is impolite I would say 6-7 out of 10”.
- **Consequence**: The participants indicated that they would look at the consequences of an interaction when evaluating how the extent to which it was considerate or inconsiderate. Such consequence had four facets:
 - **Consequence on the organization [63%]**: “consideration needs managing otherwise destroys projects”.
 - **Colleagues’ reactions [59%]**: “Sometimes we may have to sacrifice certain principles just to please the person above. But I would ask why?”, “I would deal with senior managers and close colleagues differently”.
 - **Mental cost [55%]**: “I have to do inconsiderate interactions quite a lot, and yes it doesn’t make me feel good. Mental cost benefit analysis”.
 - **Social Isolation [22%]**: “I want to be a nice person. Most people you work with every day and if not they are your customer”.
- **Audience**: The participants indicated that they would also look at the characteristics and the context of the audience of an interaction when judging how considerate it was. This included the:
 - **Relation with the audience [76%]**: “I would deal with senior managers and close colleagues differently”, “I would deal with friends differently. I would expect them to reply to the first email”.
 - **Value of the audience [54%]**: “The person’s status in relation to me, not just their standing in the workplace, but my respect for their abilities in relation to what I am trying to do”.
 - **Personality of the audience [74%]**: “I tend to make excuses for people unless the person is impolite”. “The more I know about people the more likely I am to be able to categorise them and make decisions”.
 - **Interaction history with the audience [79%]**: “I will always start as a considerate communicator. If they are not considerate then I will tend not be”.

- **Situation awareness [63%]:** “I have had people chasing me for responses to emails and quite angrily. But they don’t have the full context there. They are assuming I am ignoring them”.
 - **Visibility of the interaction to other audience [56%]:** “I have received unnecessary emails and there are all sorts of people copied in”.
 - **Inconsiderate interaction classes:** The participants indicated categories of interaction which were typically seen as inconsiderate. This included:
 - **Membership termination [59%]:** “I would feel upset if I was working on a shared file and thinking I was contributing and then I was no longer allowed to make a contribution”.
 - **Locking [49%]:** “locking a shared file for editing long time I would consider inconsiderate”.
 - **Ignoring [70%]:** “It is annoying when people are copied in for a reason and don’t reply”.
 - **Flame wars [50%]:** “in email-based group communication, two opposing opinions, instead of trying to understand each other better they become entrenched in their own opinions”.
 - **Laziness/Carelessness [61%]:** “In Outlook you end up receiving the whole of an email discussion. The sender should tell you what exactly to look at”.
 - **Formality level [19%]:** “I think that business use of software entitles the user to have a certain amount of formality”.
 - **Timeliness [60%]:** “Yes I respond timely. I am the same outside work although response times are not so significant”.
 - **Pressure [49%]:** “when the sender keeps sending reminders, I feel that is very inconsiderate.” “I never do response requests and I configure my system not to reply on them.”
 - **Invading personal space [50%]:** “I don’t put tags on everything; that is inconsiderate. It looks like they are checking up on everyone”.
 - **Irrelevance [36%]:** “I have received unnecessary emails and there are all sorts of people copied in”.
 - **Violation of the norms [31%]:** “I think it depends on the culture, when I have worked in a deadline driven environment, reminders were normal”
 - **Curt/ Abrupt wording [61%]:** “The written word can come across as brusque if you are not careful with it”.
 - **Personality factors:** We observed that the sensitivity to consideration depended a great deal on the intrinsic characteristics of the user. We identified four groups of users from this perspective:
 - **Resilient or Do not care [4%]:** “For the most part I am fairly resilient because we kind of got used to it”.
 - **Relaxed and Tolerant [20%]:** “I have high tolerance of these flame wars, eventually I will get cross. Not good for the community. Not high tolerance for unfairness”.
 - **Cautious [75%]:** “When I want to send invites to people I tend to read through several times and try to see if anything sounds offensive or impolite”.
 - **Anxious and Panic [21%]:** “Openness in work environments is often the wrong thing to do and could start a panic and anxiety”.
- 2) **Specification issue:** The identification of the elements of consideration in software-mediated interaction is only one part of the specification process. We realized that there were other aspects which need to be handled if we want to introduce modelling languages and CASE tools to support users and software to be consideration-aware. This includes the following sub-themes and codes:
- **Diversity of interpretation:** People are different in their views on what is considerate and inconsiderate. [**Agree: 81%, Partially Agree: 18%, Disagree: 1%**]: “He realises that things he thinks are inconsiderate are not seen that way by other people”.
 - **Evolution of perception:** People change their perception of what considerate and inconsiderate is over time. [**Agree: 54%, Partially Agree: 36%, Disagree: 10%**]: “View of the environment will evolve over time”, “I have to ensure that I wasn’t carrying old conventions”.
 - **Tacitness:** People could feel if an interaction is considerate or inconsiderate but they might not be able in articulating that in words or say the reasons [**Agree: 29%, Partially Agree: 38%, Disagree: 33%**], “Maybe we should be more open, but I feel it difficult for individuals to articulate what consideration is about themselves”.
 - **Consideration awareness:** The participants indicated that knowledge about colleagues’ perception of consideration and their exposure of their own perception are important facets of software-mediated interaction. This includes the following three cases (the percentages indicate how many users would like to have that option):
 - **The user’s awareness of colleagues’ perception of consideration [53%]:** “If I could do this thing [defriending] if I had the expectations that it is no big deal for my contact then I could probably do it”.
 - **The mutual awareness of each other perception of consideration [28%]:** “I always try and think about what other people want but it’s no good if no one else is doing the same thing”.

- **The colleagues' awareness of the user's perception of consideration [47% yes, 14% no, the rest chose mutual awareness or other]:** "I tend to try and tell people how they can get the best out of me so that kind of thing happens, doesn't always work".
 - **Treating inconsideration:** We observed that the participants have different styles and attitude in how to handle inconsideration. Some could have more than one depending on the situation. This included the following styles:
 - **Behave in an ad-hoc way [25%]:** "I don't like keeping secrets. I have fewer problems if I know nothing [if people see my interaction inconsiderate]. My natural tendency is to be open".
 - **Conservative [37%]:** "I don't like to offend people so would always be polite".
 - **Receptive [48%]:** "if I realise my behaviour seems inconsiderate, I am happy to correct it, but sometimes I just don't notice".
 - **Anxious [35%]:** "The absolute worry is to come across as inconsiderate".
 - **Practical [32%]:** "It is all about doing what is needed for the business".
 - **Authority seeker [17%]:** "If there was still no response I would tell the boss that I had got no response".
 - **Evasive [14%]:** "I would show I was just the messenger and I sent it on behalf of the boss".
 - **Apologetic [36%]:** "I always start apologising and the first words are always an apology".
 - **Visibility of consideration regime:** The interviewees indicated that there could be different communication channels to declare their perception of consideration, generally and with respect to a certain interaction. This included the following styles:
 - **Explicitly said [40%]:** "It would be nice if we were honest about it. Yes this is a really good idea transferring it to the electronic world".
 - **Anonymously said [24%]:** "I would like colleagues to know what annoys me in an anonymous way. It may be things such as 50% of people you send your email to immediately delete it".
 - **Said by an authority [28%]:** "Unwritten social rules, usually pointed out by senior users. Meritocratic behaviour".
 - **Learned over time [59%]:** "Most knowledge should be gained by learning the community over time."
 - **Consideration principles:** The participants demonstrated general principles that describe their character regardless of a specific software-mediate interaction. This included:
 - **Adhering to the norms [21%]:** "You need to come up with social norms and a way to enforce those."
 - **Similar treatment [65%]:** "I like to treat people the way I would like to be treated".
 - **Altruism [36%]:** "Also considerate at the everyday level, my favourite thing is doing things for other people".
 - **Negotiation [40%]:** "We haven't done the basics, we don't negotiate, and we carry on as if everyone is allowed their own assumptions".
- 3) **Expectation from software:** This theme expresses what users would like to see in future software systems with regard to the help and guidance in shaping their interaction and managing consideration. The following sub-themes and codes were identified:
- **Guidance on what is right and wrong [49%]:** "It may not be inconsideration but more a lack of architecture to guide people through where to put things".
 - **Negotiation facility [42%]:** "Quite often there were things that felt as if they were personal, but they weren't. There should be possibility to negotiate".
 - **Novel interaction interfaces [28%]:** "It would be useful in email if the sender could indicate the priority of every single receiver. How important is this receiver?".
 - **Control:** The participants indicated that they would like the software to give them control and helping them controlling inconsiderate interactions:
 - **Control of the interaction [41%]:** "In shared editing, I only give people editing rights if I feel they really need them thus avoiding inconsideration".
 - **Gatekeeper [14%]:** "If the software could help with the differentiation between friends and others with sending the follow up responses that would be good".
 - **Variability and Adaptation:** The participants said they would like to see variety of interaction styles so that they can choose or rely on the software to recommend certain styles:
 - **Supporting adaptability [36%]:** "But there is a complexity issue there about what the software would need to do. I would still expect the software to take account of situations".
 - **Balance between control and consideration [25%]:** "Software should help you set the thing to ensure you are not bothered, but in the business world you may need to be bothered by so it is difficult."
 - **Options to accommodate diversity [44%]:** "The software could give you more options, e.g., collaboration without seeing other comments, or soft-locking if editing a specific section".

B. Online survey results

A, questionnaire was constructed in a way that can be used to reflect interview findings in depth. That is, it was designed with questions related to sub-themes and analytical codes identified from interview data. Close-ended questions were mainly used in the survey for understanding respondents' thoughts of those codes with summarized themes. For example, considering the set software-mediated interactions which could be seen inconsiderate (Q6), the survey participants were given the chance to tick one or more choices of the 12 categories of the interactions. Comment areas were also provided in case a respondent does not agree with the predefined choices or they do not think the list of choices is complete and they like to add others. That is, we wanted to make sure the themes and codes deduced from the interviews are generalizable enough and whether we missed something and hence the comment area and the larger scale of the large scale of the questionnaire phase (122 people) in comparison to the interview (8 people).

1) Completeness of Codes

Fig. 3 and Table II show the general completeness of codes based on the number of respondents who used comment areas and the number of respondents who only considered predefined choices. In detail, 8%, 9% and 7% of respondents who used comment areas to add more thoughts respectively. This indicates that the majority (> 90%) of respondents either agreed on the completeness of the codes used across all themes, or could not think of further themes to add, or, possibly, may have simply chosen not to do so.

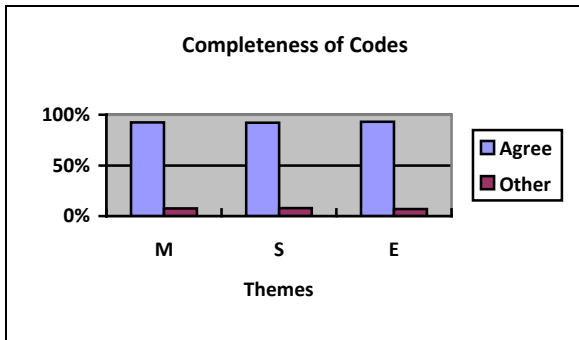


Fig. 3. Completeness of codes

TABLE II. DETAILED CODE COMPLETENESS DISTRIBUTION

Questions	Completeness Results		Themes
	Those who only used options	Those who added comments	
Q4	89%	11%	Modeling elements (M)
Q5	94%	6%	
Q6	92%	8%	
Q7	93%	7%	
Q8	94%	6%	
Q9	85%	15%	Specification issues (S)
Q10	88%	12%	

Questions	Completeness Results		
	Those who only used options	Those who added comments	Themes
Q11	95%	5%	
Q12	93%	7%	
Q13	93%	7%	Expectation from software (E)
Q14	93%	7%	Specification issues (S)

2) Comments Categorization

Each key question (Q4 – Q14) was supplied with a comment box (“Other, or I would like to add a comment”) to allow respondents to add additional thoughts which cannot be reflected by pre-defined choices. We defined four categories to study the relevance of comments to our pre-defined choices:

- Additional thoughts leading to possibly new choices. This is used to capture possible additional choices respondents suggested which were not covered by the list of predefined choices offered. For example, “The difference in authority (if any) and the difference in culture (if any)” adding to Q5 options: the “goal”, “alternative approaches” and “constraints on the achievement”.
- Additional explanations to existing choices. Some respondents used comment area to add to some information for their choices as additional evidence. For example, “social isolated is risky but I think...” in response to the choice “You may become socially isolated” in Q4 or “all of them sound nice” in response of all choices provided.
- Comments on the question. Sometimes respondents put their comments on the question to restate the context of question interpretation. For example, “I assume that the question was ...?” or “It would depend if it were...”.
- Not constructive or duplicate to the options. Respondents could express their feelings in a way which is not very constructive. For example, “what to say? It is going to be a long document... better to let it go” or “even if I say it, it does not help...”. Since it is difficult to elaborate their thoughts in the analysis due to the nature of the surveying method, these comments were classified as irrelevant/not constructive. Moreover, a comment would be considered as duplicated if the respondent provided a comment which is similar to one of the choices provided. For example, “relax” to “I don’t give much attention...”.

Fig. 4 shows the distribution of all 75 comments based on the four categories. 64% of comments (n = 48) are related to further explanations and justifications of answers. Only 12% of comments (n = 9) are related to new choice suggestions. These new suggestions will be discussed in conjunction with other choices in the next following sections. Nevertheless, the two figures can be seen as supplement evidence of the completeness of our codes.

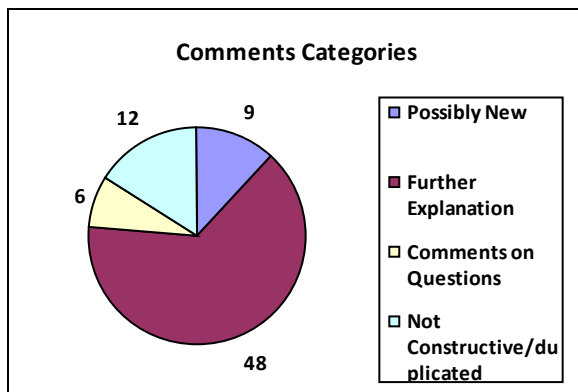


Fig. 4. Completeness of codes

3) Age and gender effects

A cross tabulation analysis was conducted to understand whether answers given by respondents were independent of age variables. It is interesting to note that there is no significant difference between males and females in all questions (Chi-square, $p > 0.05$). This indicates that the gender of an individual is very unlikely to have effect on the individual's perception of consideration, consideration degree and reaction of interpersonal considerate and inconsiderate interactions in software-supported workplace. Indeed, this in itself is an intriguing finding, particularly when there is often a general perception of differences in gender communication styles.

Similarly, we did another analysis for understanding the significance of age effects. It was found that an individual's age group would particularly affect their ways to declare their perception of considerate interactions (Chi Square, $p < 0.05$). For this question (Q10), respondents were asked how they would like to declare their perception of considerate interactions in a business environment and they were given four options and one optional comment field. The four options were:

- I prefer to say my view of consideration explicitly to colleagues.
- I prefer to say that anonymously.
- I prefer to let an authority to handle this on behalf of me.
- I prefer others learn my view of consideration over time through the way I interact with them.

Most respondents between 18 and 24 years old chose the last option which means they would act more passively. In comparison, nearly a half of respondents between 35 and 64 years old would say that explicitly to their colleagues when necessary although most of the time they would still prefer to let others learn their way. Moreover, respondents between 25 and 34 years old would like to be more proactively than other groups as their choices (from 1 to 4) were evenly distributed. It is also interesting to note that respondents aged over 35 showed far less interest to let an authority to act on behalf of them or say it anonymously than the two younger groups (18 – 24 and 25 - 34).

4) Perception impact

Results show that respondents' perception of considerate interactions (including inconsiderate interactions) either impersonally or interpersonally has some impact on consideration specification. In particular, there are four areas where perception would affect specification.

- The consequences of inconsiderate interaction, such as the effect on the business organization, reactions of colleagues and recipients, senders' mental cost and social cost depend on whether how people feel they can express considerate and inconsiderate interaction in words (Chi Square, $p < 0.05$). When it is difficult to express in words what makes an interaction considerate or inconsiderate, 60% of respondents showed more concern about their own mental cost. That is, they would become more sensitive to what the recipients think of their interaction styles. On the contrary, when it is easy to express it in words, 71.88% of respondents were worried more about their colleagues and recipients' reactions. Furthermore, as long as the difficulty of expression was not definite, respondents were less worried about the social cost (i.e., whether they would be socially isolated). It should also be noted that over a half of respondents agreed that inconsiderate interactions, no matter how they will be perceived and expressed, would bring negative impact on the entire business organization.
- The ways people would use to declare their perception of considerate and inconsiderate interactions in a business environment relied on the aspects used to evaluate the considerate nature of an interaction and their own attitude to inconsiderate interactions (Chi Square, $p < 0.05$). 59.68% of respondents would prefer that others learn their view of consideration over time through the way they interact with them based on factors such as the goal, constraints and alternative approaches of interaction. This means that most respondents would treat the interaction only as a means to achieve business goals between two different enforcedly formed parties. Moreover, when considering their personal relationships with their colleagues, the value of their colleagues (e.g., whether they have to be relied on) and their personality (e.g., are they easy to deal with) and past interaction history in an interaction, most respondents (min: 62.07%, max: 79.31%) would like an authority to get involved to monitor the process and publish guidelines.
- People's reactions to inconsiderate interactions are significantly related to their own attitude to inconsiderate interactions (Chi Square, $p < 0.05$). That is, whether they can treat it more easily or whether they can be more considerate to inconsiderate interactions initialized by the other party. Results show that majority of respondents ($>=73.5\%$) were cautious in their interaction not to look inconsiderate. In other words, they would pay adequate attention to their interaction styles used in an interaction so that it would not look inconsiderate to others. Among those respondents, less than a half of them (max: 46.83%, min: 40.51%) would

like to be more responsive to inconsiderate behaviors and interactions. For example, they would be receptive and anxious if they did something inconsiderate. A similar pattern was discovered in those people who classified themselves as “anxious to inconsiderate” (max: 63.63%, min: 53.09%).

- People’s self-awareness on their impersonal and interpersonal communication styles relied on how they evaluated inconsiderate interactions (Chi Square, $p < 0.05$) in the context of business. An obvious fact discovered is that most respondents ($\geq 58.82\%$) would treat others the way they like to be treated regardless of the grounds that they would use to distinguish inconsiderate behaviors from interactions. In other words, they pay less attention to inconsiderate interactions if they have already done similar things to others. This is in line with the results that over 54.54% of respondents admitted that they would not give much attention if colleagues see their interactions as inconsiderate as long as they follow the norms. Furthermore, over 54.05% of respondents would “let it go” when they received inconsiderate interactions so that the business can still progress smoothly as they treated this reaction as a common practice on professionalism.

5) Anticipations on software support

Respondents’ anticipations of software support showed a positive effect on the ways they would like support to “speak out” their perception of considerate interactions to others (Chi Square, $p < 0.05$).

Results showed that respondents who preferred to let others learn over time relied more on software support. This reflects the importance of software in passive interpersonal interactions. In particular, respondents stated that software would be helpful if the interactions were “an occasional event”, “with new staff”. Furthermore, those respondents who preferred to express themselves explicitly to colleagues also showed strong interest in using the support offered by software; as they thought it would be useful when the feedback “cannot be given face-to-face” and “is going to be a long document” or “will hurt colleagues”.

For both groups, the most anticipated software support is “the diversity of alternative interaction styles to accommodate the diversity of users and their perception of consideration” (57.37% and 45.23% respectively). However, for the secondary preferred support, proactive respondents would like to see software that “offers a communication channel between colleagues to set up their interaction protocol” (38.10%) while passive respondents would like the software to “give users control over the design of social interaction” (55.73%). In addition, respondents were less interested in using software as a gatekeeper to handle interactions (e.g., filtering, prioritizing and flagging etc.) no matter which ways they would prefer.

C. Threats to Validity

Our study has three main threats to validity:

1. The interview was conducted face to face with interviewees who are known to at least one of the authors. This could lead to hide some information especially that the topic of consideration is somehow private and could relate to previous interactions between the interviewer and the interviewees. To minimize this risk, we considered think-aloud protocol in the interview and tried to utilize a language in which we allowed the interviewees to talk about stories which happened to their colleagues or they heard about thus minimizing the personal nature of the opinion.
2. The questionnaire questions were supported by examples to explain the codes. The examples given may have influenced the perception of the code by the participants. To mitigate that, we have given scenarios and generic examples in the beginning of the questionnaire to familiarize the participants with the overall concept alleviating the bias the separate examples in the questions could introduce. We also tried to make the examples as representative as possible taking examples given by the interviewee and making sure the examples come from different scenarios.
3. Given the fact that there is a relatively long list of choices for each question, the questionnaire was relatively long and required an average of 10-15 minutes to complete. This might have discouraged the participants to put effort on providing additional comments after each question. However, looking at the comments given (see Fig. 3), these comments did not notably add options and codes to what were already presented. Thus we would consider the likelihood of missing some knowledge because of this reason is low.

IV. RESEARCH CHALLENGES

In this section we present a set of observations and open research questions to be addressed for the development of considerate software. This set was deduced and extracted from a talk given by one of the authors and followed by a brainstorming session. The talk and the session took place as a part of a project meeting, which included 11 researchers from the computing departments of three universities. The participants have a variety of relevant expertise including Requirements Engineering, Self-adaptive Systems, Human Factors in Computing, Social Computing and Artificial Intelligence. In the following, we only discuss the software engineering aspects of the session.

The session concluded that the real challenge was centred on the capture of the elements of consideration and style from each user. It has been agreed that deciding a considerate software-mediated interaction is a classical decision making problem once these elements are captured. The researchers in Artificial Intelligence and Self-adaptive Systems noted that the literature in agent computing [17] deals with the definition and formalization of norms and policies and has already algorithmic solutions on deciding an agent’s behaviour. However, the focus there is still on an artificial agent. An artificial agent can be programmed to follow a design created

by a developer. A similar observation could be made about initiatives which try to make the software itself adaptive to norms [18] or considerate [19], e.g., in the language used in the error messages.

The mental model of a human on consideration is apparently not a designer decision as it is the case for artificial agents. Thus, the core problem relates to elicitation and specification of users' mental models. We now elaborate further on this core challenge:

- **Users as modellers:** The source of consideration requirements is the individual users themselves. User diversity makes it hard to fully rely on previous knowledge and patterns for the elements of considerate software. The themes related to cognitive factors, like Treating Inconsideration, and Consideration Principles, are even hard to tell to the system analyst for their private and dynamic nature. We advocate that users need to act as modellers and convey their perceptions to software. The challenge here is in developing such an explicit communication channel and a counterpart implicit intelligent inference to capture users' mental model of consideration. This communication platform has to be engineered, together with the software itself, so that the model correlates with the functionality of the system as proposed in a previous work [20, 21]. This requires novel techniques, which exempt users from the complexity of such a task and also avoid affecting users' experience. To facilitate this, Gamification [22] could be a promising technique.
- **Tacitness:** Though some users feel uncomfortable when others act in an inconsiderate manner they may struggle to specify what considerate behaviour would be a priori. 67% of the participants in the survey indicated that they agree or partially agree that consideration is a tacit knowledge. They can say what they feel only when it happens and, still, might not be able to express the exact reason using software-related terms. We need novel approaches to reveal such tacit knowledge [23] in expressing such social requirements.
- **Personal vs. Public:** The user mental model of consideration is typically private. Only 40% of the survey participants feel comfortable to announce their opinion about the considerate nature of social interactions while the majority prefer that this is learned over time or said anonymously. This learning has to be done in a controlled way. Users' concerns and views of the value of each other are often personal and sensitive and are likely to undesirably leak through their interaction patterns over time, especially when the software follows the same rule. Considerate software should accommodate a correct integration and interaction between a user's personal space and the public space, which includes interactions visible to other users. This "correctness" itself will be judged by users and, as software

engineers, we need to devise novel mechanisms to help them specify such correctness.

- **Evolution of perception:** 90% of or survey participants agreed, or partially agreed, that their perception of an interaction from the considerate point of view could change over time. Some of our interview participants mentioned that they became resilient and stopped to note interactions were one day seen very inconsiderate. We observed that users do not like to commit to one model of their social interaction preferences and delegate the authority to their software to enact it. Concerns and judgement of colleagues' powers are not static. They evolve as a result of the real world changes, including the person perception and the emerging norms of using social software over time. This would create an additional challenge to maintain the up-to-date nature of the mental model of a user in a way that is not obtrusive.
- **Context-dependency:** consideration and inconsideration are context dependent. A high percentage (>50%) of the survey participants agreed on the importance of the codes related to context awareness such as the goal for the interaction, the available methods, the constraints on the communicator, the situation awareness, the personality and the audience characteristics. This means that in addition to the evolution, diversity and 'tacitness' of our proposed elements of considerate software, there is an additional complexity in expressing the relevant contextual factors that affect them, including the context effect on the degree of anxiety of a concern. There is also a challenge on the automated monitoring of some contextual factors, especially those related to human feelings such as the user's mood. Recent advances in mobile and wearable computing and in Neuroinformatics provide some promising mechanisms by which we might infer feelings in a non-obtrusive way.
- **Measurement.** Users are also diverse in how they measure core elements of consideration, such as the degree of a concern and the power of a colleague. Normalization of users' cognition of such measures is inherently challenging and requires multidisciplinary research including psychology and measurement theory. For example, the participants indicated that they will look at the value of the contacts, their personality, the relation with them, and the mental cost of potentially causing inconsideration. However, having crisp measure for such factors is challenging and this would lead us to the first challenge, i.e., giving users the role of modellers and utilize their cognition to specify and enrich the software models initially put by the analysts.
- **Learning and adaptability:** a high percentage of the survey respondents (59%) preferred that their perception of consideration is learnt over time. However, they still did not feel confident enough to give software much control on learning and taking

decision on their behalf. This is obvious through the relatively low percentage of those who wanted the software to act as a gatekeeper and to balance between the control over the interaction on one side and being social on the other. A supervised learning would be a good option for this kind of social requirements while users still need to tailor the interaction explicitly to ensure it fits their real interaction style. In that case, software could act as a recommendation system and suggest options instead of enacting them directly.

V. CONCLUSION

Within communication among people the notion of consideration is well understood. Indeed, even rules for manners and etiquette in the way that people communicate are well formed. Furthermore, sets of etiquette are also understood to vary widely both across cultures and, importantly according to a variety of contextual variables, such as status of participants, intention of communication and so on. Therefore, it is perhaps surprising that although consideration is well known in traditional communication, it has not been explored fully in relation to its potential impact on the requirements for software-mediated interaction and the emerging forms of that interaction.

This paper has advocated the need to deal with the notion of consideration where software systems act as an intermediary among human communications. This is particularly timely and relevant when organizations are multi-national and multicultural, so exacerbating the potential for being inconsiderate to others when attempting to fulfil a particular requirement.

The paper presents an empirical study and deduces a number of observations on the nature of consideration, which we hope will act as a starting point for understanding how to move towards building information systems that are consideration-aware. Such systems would be expected to allow users to tailor their interaction styles and balance between their business requirements and social requirements including consideration. Issues like privacy, tacitness, diversity, and negotiation remain challenges for research to clarify their nature within the context of considerate software-mediated interaction.

In our short-term future work we will develop models and tools to capture users concerns of software-based interactions and explore users' attitudes in reconciling being considerate and being pragmatic and reflect that in forms of automated decision making. Ultimately, we believe that with the increased focus on socio-technical systems as entities, such work on considerate requirements will become a core part of the requirements engineering process.

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