DEVELOPING AN INSTRUMENT TO MEASURE ENTERPRISE SYSTEM USERS' PERCEPTIONS OF SYSTEM-USER COLLABORATION

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Abstract

This paper reports on the development of a survey instrument for measuring enterprise system users' perceptions of collaboration between the system and the user. Based on philosophical and computational models of collaboration, the instrument was designed to assess three features of system-user collaboration: Commitment to Joint Activity (CJA), Mutual Responsiveness (MR), and Commitment to Mutual Support (CMS). The development process included a series of deliberate steps to ensure content validity: reviewing related literature, creating the initial item set, iteratively adding, deleting, and revising the items, three rounds of item sorting with experts and users, and two pilot tests. The result was a 34-item set measuring six constructs regarding enterprise system users' perceptions regarding the levels of collaborativeness exhibited by the system (CJA-S, MR-S, CMS-S) and the user (CJA-U, MR-U, CMS-U). Statistical analyses showed that the instrument achieved satisfactory levels of construct validity and high levels of reliability. This instrument will make theoretical contributions by helping explore the relationship between users' perceptions regarding an enterprise system's collaborativeness and usability and enhance the scholarly understanding of the relationships between the collaborativeness constructs and other key constructs related to information systems use, such as ease of use and usefulness. Practically, this instrument will contribute to the development of design principles and guidelines for next-generation enterprise systems and other large-scale information systems.

Keywords: Enterprise systems, survey instrument, system-user collaboration, collaborativeness, usability.

1 INTRODUCTION

An increasingly large body of scholarly work (Al-Mashari et al. 2003; Babaian et al. 2006; Calisir & Calisir 2004; Scott and Vessey 2002; Strong & Volkoff 2010) and several high-profile research reports (Hestermann 2009; Rettig 2007) have recently focused on enterprise resource planning (ERP) system usability problems as one of the reasons underlying the high failure rate of ERP implementations and lower than anticipated benefits of continuous system use. Recently, a comprehensive program of research has studied ways to improve enterprise systems' usability, with a particular focus on the relationship between an enterprise system's collaborativeness and its usability characteristics (see, for example, (Babaian et al. 2006; Babaian et al. 2010; Cooprider et al. 2010)). Earlier research on this topic published so far has, among other findings, reported results of an interview-based field study, development of collaboration-based design principles, and the use of usage history data to support users' tasks. This paper adds an important component to this line of research in the form of a validated survey instrument.

As described below at a more detailed level, this research specifically focuses on the value of the philosophical (Bratman 1992) and computational (Grosz & Kraus 1996) models of collaboration for improving the design of the interaction between enterprise systems and their users. Based on these theories of collaboration and existing research findings (Babaian et al. 2006; Babaian et al. 2010; Cooprider et al. 2010) we propose that designing the enterprise system-user relationship so that it exhibits a high level of collaborativeness will lead to more usable systems. The current study is a small, but important element in a larger whole; its main intent is to develop instrumentation for measuring some of the key constructs related to the model of collaboration. The study will advance our scholarly understanding of the interaction between enterprise systems and their users; together with other findings of this and related research programs, these results will ultimately contribute to the development of design principles and guidelines for next-generation ERP systems and other large-scale enterprise systems.

This paper reports on the development of an instrument for measuring enterprise system users' perceptions regarding a system's collaborativeness. Specifically, the instrument will contribute in an important way to the exploration of the relationship between users' perceptions regarding an enterprise system's collaborativeness and their perceptions regarding a system's usability. In addition, it will make it possible to evaluate the relationships between the components of collaborativeness perceptions and other types of perceptions regarding the system, such as ease of use and usefulness (Davis, 1989; Venkatesh et al., 2003), which have dominated the IS technology acceptance discussion since late 1980s. This allows us to understand better the relationships between the collaborativeness construct and system design characteristics. In addition, when used to compare actual systems, the instrument will make it possible for us to understand better how changes in system design characteristics affect user perceptions regarding the system. These are the key connections of this research to existing IS research.

To our knowledge, no prior instrument exists for measuring users' perceptions regarding the collaborativeness of the relationship between an enterprise system and its users.

2 THEORETICAL BACKGROUND AND DEFINITIONS OF CONSTRUCTS

The theoretical background for this research is based on both philosophical (Bratman 1992) and computational (Grosz & Kraus 1996) models of collaboration, which are applied to the interaction between enterprise systems and their users. These models conceptualize collaboration as shared cooperative activity (SCA), which has these three features, as described earlier in (Babaian et al. 2006; Cooprider et al. 2010):

- Commitment to Joint Activity (CJA): For CJA to be present, both parties not only have to recognize the joint activity, but they also have to be committed to it. In addition, both parties have to maintain an awareness of the context of their collaboration so that they are able to react and respond as appropriate.
- Mutual Responsiveness (MR): For MR to be present, both parties have to a) react to each other's behavior in a way that is beneficial from the perspective of the optimal joint outcome and b) change their own behavior if this adjustment is necessary to support the achievement of the best possible joint outcome. It is possible that this leads to the need for suboptimal behavior from the perspective of individual goals.
- Commitment to Mutual Support (CMS): CMS is related to the situations when either party needs help in the process of moving towards the joint outcome. CMS is present if each party has made a commitment to support the other when it is facing a problem situation and needs help and follows up with this commitment.

Each of these features can be viewed from multiple perspectives: first, the way a user sees his/her collaboration with the system of interest; second, the way the system has been designed to interact with its users (because the system does not have free will, and we do not expect this to be the case in the foreseeable future); and finally, a joint perspective that captures the extent to which the user and the system together experience these features. It is important to note that we do **not** suggest that any currently existing system has an ability to choose its collaborative position – a system's characteristics are based on its design and, in practice, reflect the designers' decisions regarding the system's characteristics.

The same applies to the joint perspective – a user's perceptions regarding the extent to which the user and the system together choose to collaborate are ultimately dependent on the characteristics of the system as they have been designed and implemented.

These perspectives are an important extension of the core constructs because it is possible that for each of the features, both parties can behave differently (for example, a user can choose a highly collaborative approach when interacting with the system even if the system might have been designed in a way that it does not exhibit any collaborative behaviors). In addition, the different perspectives are potentially interconnected when explored over time, particularly so that the system design could have an impact on the user's collaborative behavior. This study, however, is cross-sectional in nature and the connection between the perspectives was outside its scope.

Space limitations prevent us from presenting a more detailed description of the philosophical and computational models of collaboration; for an interested reader Bratman (1992), Grosz & Kraus (1996), Grosz (1999), and Terveen (1995) are excellent sources.

3 SPECIFICATION OF CONCEPTS FOR INSTRUMENT DEVELOPMENT

Based on Bratman (1992), Terveen (1995), Grosz (1996) and earlier studies in this research program, the authors and two other members of the research team created the following descriptions of the features of SCA in the enterprise systems context (see Section 2 above), specifically focusing on the relationship between the user and the system during task performance driven by a specific goal. These descriptions were used as the foundation of the instrument development process together with the formal construct definitions offered in Section 2, as will be discussed below.

The descriptions with a -U suffix refer to the user's characteristics, and those with -S to the system's characteristics, and those with -T to the joint ("**T**ogether") or relationship characteristics, which were discussed in the previous section.

Commitment to Joint Activity		
Construct	**Description**	**Focus Areas**
CJA-U	This category includes statements that describe the user's commitment to performing the tasks using <the enterprise system>. These statements emphasize the user's understanding of the goals for the tasks and knowledge of how the tasks are performed (including how to communicate with <the enterprise system>). They also highlight the user's commitment to do his/her part in the process and to do his/her best to achieve success.	The essential elements of this specification include the reference to the task performance (and not just any work) and the goal-oriented nature of this performance. The definition also includes a reference to the user's knowledge of how to perform the tasks – part of the commitment is to be knowledgeable of the requirements of the task performance. In addition, the definition refers to the need for the user to do his or her best to achieve success.
CJA-S	This category includes statements that describe the user's perception of the <enterprise system>'s commitment to complete the tasks on which <the enterprise system> is working with the user. These statements emphasize <the enterprise system>'s understanding of the goals for the tasks and <the enterprise system>'s knowledge of how the tasks are performed (including how to communicate with the user). They also highlight <the enterprise system>'s commitment to do its part in the process and to do its best to achieve success.	This specification has the same essential elements as the specification for the user's Commitment to Joint Activity, just expressed from the system's perspective.
CJA-T	This category includes statements that describe the joint commitment by <the enterprise system> and the user to the tasks on which they are working together. These statements emphasize their joint understanding of the goals for the tasks and their shared knowledge of how the tasks are performed (including how to communicate with each other). They also highlight their commitment to collaborate in the process and to do their best to achieve success together.	In this specification, the focus is on the joint commitment, joint understanding, and shared knowledge. In other respects, the specification has the same elements as the CJA-specifications for the user and the system.

Table 1a. Collaborativeness concept descriptions and specifications of areas of focus for CJA.

Mutual Responsiveness		
Construct	**Description**	**Focuses**
MR-U	This category includes statements that describe the user's willingness to adjust his/her behavior based on <the enterprise system>'s way of working to maximize the success in the tasks that he/she is performing with <the enterprise system>. They also emphasize how the user tries to be aware of <the enterprise system>'s actions so that he/she is able to adapt to its behavior and provide additional information to <the enterprise system> if it is needed.	The key elements here are the user's willingness to adjust his/her behavior based on how the enterprise system acts and to do this so that it maximizes the probability of task success (again, an explicit reference to the task at hand). Another key element is the user's need to maintain awareness regarding the system's actions – it is, after all, impossible for the user to adapt his/her behavior appropriately if the user does not know how the system is acting.
MR-S	This category includes statements that describe <the enterprise system>'s willingness to adjust the way it works with the user based on the user's	The mutual responsiveness specification for the system includes the same elements as the specification

	behavior to maximize the success in the tasks for which it is used. They also emphasize how <the enterprise system> tries to be aware of the user's actions so that it is able to adapt to the user's behavior and provide alternative courses of action if needed.	for the user included, just with the reversal of the roles.
MR-T	This category includes statements that describe <the enterprise system>'s and the user's willingness to adjust their joint behavior based on their prior interaction to maximize the success in the tasks that they are performing together. They also emphasize the system's and the user's willingness to be aware of each other's actions so that they are able to adapt to each other's behavior and respond accordingly.	In MR-T, the focus is on the joint behavior and the user's and the system's task performance together. In other respects, the elements are the same as the elements of MR-U and MR-S.

Table 1b. Collaborativeness concept descriptions and specifications of areas of focus for MR.

Commitment to Mutual Support		
Construct	**Description**	**Focuses**
CMS-U	This category includes statements that describe what the user does to help <the enterprise system> when an error has occurred that prevents it from doing its job. They also emphasize the user's willingness to provide additional information to <the enterprise system> that will assist in resolving error situations.	The CMS specification for the user is much more narrowly focused than the specifications for the other two features of SCA are: CMS-U is specifically related to the user's behavior in situations when an error has occurred that prevents the system from doing its job. Another aspect of this is the user's willingness to provide additional information in error situations.
CMS-S	This category includes statements that describe how <the enterprise system> takes actions that would help the user and move the task forward when the user faces an error working the task. If the actions the user is taking will result in an error, <the enterprise system> alerts the user about this error and provides alternative courses of action.	The CMS-S specification has an equally narrow focus as the CMS-U specification has. A specific element included here is the system's willingness and ability to provide information regarding possible alternative courses of action in a case when an error occurs.
CMS-T	This category includes statements that describe <the enterprise system>'s and the user's joint willingness and ability to offer help to each other when an error is about to occur or has occurred that will prevent them from making progress with the tasks.	The CMS-T specification, emphasizes the joint nature of the behavior ("offer help to each other", "prevent us from making progress") in the case of the relevant context (an error situation in this case).

Table 1c. Collaborativeness concept descriptions and specifications of areas of focus for CMS.

These constructs do not form any higher order constructs (such as a general level CJA, MR, or CMS) because the user's perspective on any of these dimensions can be totally independent of the system's corresponding dimension.

4 INSTRUMENT DEVELOPMENT PROCESS

Our study focuses on users' perceptions regarding the system-user collaboration. Therefore, the instrument is intended to measure a) the users' perceptions regarding their own collaborativeness while performing tasks together with (i.e., using) an enterprise system; b) the users' perceptions regarding the extent to which the system exhibits (i.e., has been designed to exhibit) collaborative characteristics; and c) the user's perceptions regarding the level of collaborativeness in the joint behavior of the user and the system. The system's characteristics could be studied in a number of other ways, too, such as by evaluating the system's design with the collaborative walkthrough approach (Babaian et al. 2006), by interviewing the system's designers to determine their design intent using, for example, the collaborative design principles (Babaian et al. 2010) as the benchmark, etc. In the current research we will, however, focus on the users' perceptions regarding their own and the system's collaborative features.

The instrument development process followed closely the methodology specified in Moore and Benbasat (1991) and the first two stages of the research guide specified in Lewis et al. (2005). It consisted of several phases including literature review, creation of the initial pool, scale development, and pilot tests. The authors first **reviewed the literature** on collaboration theories (Bratman 1992) and system-user collaboration (Grosz 1996; Grosz & Kraus 1996), and identified and described the nine constructs listed in Table 1. In the **creation of an initial pool** stage, 83 items were generated based on the conceptualizations of the constructs in the theories and the authors' understanding of the constructs, with the intent of creating items that exhibit a high level of content and face validity and that lead to an instrument with a high level of construct validity. At the end of this stage, at least 5 items were associated with each of the nine constructs. The items were divided between the constructs as specified in Table 2.

User		System		Total	
CJA-U	11	CJA-S	13	CJA-T	5
CMS-U	12	CMS-S	15	CMS-T	5
MR-U	9	MR-S	9	MR-T	4

Table 2. Number of initial items in each category.

The initial items were reviewed by a group of enterprise system researchers and experts. Based on this evaluation, the wording of several of the items was modified to achieve a higher level of clarity.

After the expert evaluation, the **scale development** stage with three rounds of item sorting started. In this stage, three groups of participants representing prospective survey users were asked to assign the items into categories either with or without predefined category descriptions.

In the first round of sorting, two participants were instructed to sort 83 candidate items without the support of predefined category descriptions. The first round participants were trained researchers and understood the conceptual background of the study well. The number of categories was constrained to be between seven and ten in the instructions. In addition, the participants had the opportunity to leave an item uncategorized if it did not fit any category in the scheme that the participant had created. At the end of the sorting process, the participants were asked to name and briefly describe the categories that they had created.

Based on the evaluation of the results from the first round of sorting, 24 items were removed from the pool. This was done if the items were either unsalvageably unclear, consistently placed either in no category at all or consistently placed into an incorrect category. In addition, the wording of 32 of the items was clarified based on the feedback from the first round participants. After the first round of sorting, the item pool size reduced to 59 items.

In the second round of sorting, a new set of participants were given category descriptions for the nine target categories. The descriptions were the same ones presented above in Section 3. Four participants conducted the sorting during this round. Two of them were researchers, one was an enterprise systems user in a managerial position and one an enterprise systems user in an administrative assistant position. Based on the results of the second round, the pool of the items was further reduced to 51 (after removing 8 items). Moreover, 14 additional items were clarified by changing their wording.

The third and final round of sorting was also conducted by a new set of four participants. This group consisted of a doctoral student in IS, an SAP support expert, a finance professional, and an IT support professional, again representing a large number of different perspectives and levels of expertise. Based on the third round of sorting, three items were discarded, leading to a final set of 48 items. Three items were clarified based on the feedback from this round. These items in the final set (see Appendix 1) were associated with the various constructs as specified in Table 3. At this point the sorting process was deemed to have achieved a stage where additional changes would be minor and, therefore, the process moved to the pilot study stage.

User		**System**		**Together**	
CJA-U	6	CJA-S	7	CJA-T	5
CMS-U	6	CMS-S	6	CMS-T	5
MR-U	5	MR-S	4	MR-T	4

Table 3. Number of items in each category after sorting.

The **pilot study** was conducted among the users of a higher education enterprise system widely used in North America on a campus of a small, specialized university located in northeastern United States. The pilot process consisted of three phases: first, two experienced enterprise system users were asked to fill out the survey to verify the time required to complete the survey and to test the logistical procedures. After this phase demonstrated that the completion time was within the promised 10-15 minute time frame and that the instructions were clear, the invitation to complete the survey was sent to an additional 50 enterprise system users. Of these, 8 (16%) provided usable responses. Because this limited test did not reveal any additional technical problems with the instrument or the process, the test was expanded to an additional 215 users of the enterprise system. Of these, 30 (14%) provided usable responses after two reminders. In the statistical analysis, the 38 responses were analyzed together. The population consisted of a variety of users of an enterprise system designed for institutions of higher education for purposes such as financial management, scheduling, student record management, etc. The 14% response rate was typical for a study that approached a broad population without specific incentives.

5 ANALYSIS OF THE RESULTS AND FINDINGS

The results of the second pilot test were next analyzed using exploratory factor analysis in order to use statistical methods to understand how the instrument could be improved. After the initial principal component analysis of the entire 48-item set, we made a major discovery that led to a significant change in the instrument: the items created to measure the joint behavior between the system and the user all loaded on the same component and, in general, appeared to produce confusing results. The written qualitative comments provided by some of the respondents gave some hints regarding the reasons why this happened: these items appeared to suggest that the system had characteristics that are too anthropomorphic (Marakas et al. 2000). We also revisited the conceptual analysis of the reference literature and came to the conclusion that our original modeling of a separate joint perspective was incorrect: there is no actor that could hold the view represented by the joint perspective. Consequently, the items referring to the joint behavior (CJA-T, CMS-T, and MR-T) were removed from the analysis, which continued with the remaining 34 items and six theoretical constructs (CJA-S, CJA-U, CMS-S, CMS-U, MR-S, and MR-U).

In the follow-up analysis, based on the recommendation by Costello & Osborne (2005), we chose to use factor analysis with maximum likelihood factor extraction instead of principal component analysis. Varimax-rotated results of this analysis are presented in Table 4 (factor loadings less than 0.3 were removed from the table).

Based on these results, the next step was to drop items in order to achieve more parsimonious and internally consistent scales. As part of this analysis, the following items were dropped:

- 15, 20, 35, 45, 47, and 53 because primary loadings on a factor were not aligned with the expectations based on the theoretical foundation introduced in Section 2 and because they had strong secondary loadings;
- 12 and 49 because of relatively low primary loadings and existence of secondary loadings;
- 10, 16, 34, 36, 43, 44, and 50 because of the lack of clear primary loading.

Theorized scale	Item#	Fact1	Fact2	Fact3	Fact4	Fact5	Fact6
CJA-S	20	0.54		0.31			
CJA-S	45	0.76					-0.38
CJS-S	53	0.64		0.31			
CMS-S	11	0.74					
CMS-S	12	0.64		0.34			
CMS-S	17	0.76					
CMS-S	40	0.85					
CMS-S	49	0.61			0.43		0.35
CMS-S	51	0.74					
CMS-U	44	0.50					0.38
CJA-U	16		0.55	0.38		0.30	
CJA-U	30		0.58			0.46	
CMS-U	24		0.67				
CMS-U	25		0.84				
CMS-U	50		0.57	-0.41			
CMS-U	55		0.87				
MR-U	42		0.76				
MR-U	54		0.94				
MR-U	57		0.77				
CJA-S	14	0.38		0.77			
CJA-S	18	0.42		0.54			
CJA-S	56	0.48		0.64	0.33		
MR-S	13			0.73			
MR-S	35	0.39		0.70	0.37		
CJA-S	47	0.42			0.77		
MR-S	46	0.34			0.87		
MR-S	48				0.85		
CJA-U	22		0.48			0.67	
CJA-U	26					0.83	
MR-U	10					0.52	
CMS-U	15		0.44				0.83
MR-U	34		0.46				0.56
CJA-U	36		0.43	-0.35			
CJA-U	43	0.50					

Table 4. Results of the factor analysis on the complete instrument.

This leads us to the items and allocations to scales described in Table 5. A clear challenge at this time is the fact that there are only two MR-S items remaining. Unfortunately, there are no additional items that could be considered as candidates for this scale. In addition, item 30 has a relatively weak loading on CJA-U (0.46). However, because of its strong consistency with the theoretical model, we decided to keep it in the item set. Finally, the items that belong to CMS-U and MR-U loaded on the same factor, which will be unlikely to change in the future analyses.

Scale	Nbr of items	Items (see Appendix A)
CJA-S	3	14, 18, 56
MR-S	2	46, 48
CMS-S	4	11, 17, 40, 51
CJA-U	3	22, 26, 30
MR-U	3	42, 54, 57
CMS-U	3	24, 25, 55

Table 5. Revised scales and items.

To perform an initial test of the condensed scales, the pilot data was used again to conduct a maximum likelihood factor analysis with varimax rotation (unfortunately, the sample was not large enough to make it possible to hold part of it back). The results of the analysis are in Table 6 (with factor loadings less than 0.5 removed from the table).

Theorized scale	Item#	Fact1	Fact2	Fact3	Fact4	Fact5	Fact6
CMS-U	24	0.60					
CMS-U	25	0.83					
CMS-U	55	0.86					
MR-U	42	0.75					
MR-U	54	0.97					
MR-U	57	0.74					
CMS-S	11		0.55				
CMS-S	17		0.74				
CMS-S	40		0.98				
CMS-S	51		0.67				
CJA-U	22			0.78			
CJA-U	26			0.79			
CJA-U	30			0.60			
CJA-S	14				0.94		
CJA-S	18				0.57		
CJA-S	56				0.64		
MR-S	46					0.88	
MR-S	48					0.87	

Table 6. Factor analysis of the condensed instrument.

Construct	Cronbach's Alpha
CJA-S	0.825
MR-S	0.949
CMS-S	0.890
CJA-U	0.840
MR-U	0.850
CMS-U	0.867

Table 7. Scale reliabilities.

Except for items 11 and 18, all loadings are above 0.6 and there are no crossloadings above 0.5. This fulfills the criterion of loadings at least 0.4 suggested in (Straub et al. 2004) based on (Hair et al. 1998).

The reliabilities of the scales (using Cronbach's alpha) are included in Table 7. All are clearly above the recommended threshold of 0.7 (Nunnally 1967).

6 LIMITATIONS AND FUTURE RESEARCH

The current study has several limitations. First, it is very difficult to measure the system's collaborativeness objectively and directly; therefore, all measures are based on the users' perceptions. This approach of using users' subjective perceptions as surrogates for system characteristics undoubtedly has its drawbacks. Different users evaluate the system's collaborativeness in different ways. Users' perceptions may, to some extent, be influenced by their personal characteristics such as education level, knowledge and competence, computer experience, job role, and more importantly, their own willingness to collaborate with the system. However, using such an approach is not uncommon in computing research; for example, survey-based usability evaluations are based on users' perceptions (e.g., Chin et al. 1998). We believe that although individual users' perceptions are not totally objective and accurate, they still can, to a large extent, reflect the true level of system's collaborativeness when collectively evaluated by a large number of users. In addition, any general, objective measure of system's collaborativeness is irrelevant if it does not lead to relevant changes in user's perceptions.

It should be noted that the level of collaborativeness exhibited by a system may be assessed indirectly using other methods such as heuristics evaluation (Hornbæk 2006) and collaborative walkthrough (Babaian et al. 2006). In heuristic evaluation, for example, it is possible to create a set of heuristics (or checklists), based on the principles of collaboration, of system features and characteristics that exhibit the collaborative behavior (e.g., the auto-complete feature in which, given a few user inputs, the related fields in a form is automatically filled out by the system). The system is then examined against the heuristics and its level of collaborativeness is determined. Similarly, the collaborative walkthrough is a task-specific method, in which a group of experts are given a set of tasks and asked to complete these tasks using the system in order to identify potential problems that users may encounter. However, both the heuristic and walkthrough methods are rather time-consuming and costly. Another possible way to tackle the problem is through the interview with the software designers of the system by asking them to report on the design decisions that they made in alignment with the idea of system-user collaboration. However, the interview method is subject to all kinds of biases (e.g., memory bias and self-serving bias) and still cannot ensure the result's objectivity.

Second, the results reported in this study are only preliminary. In our pilot tests we evaluated one enterprise system in a single organization. Because of the various factors specific to the setting of this survey research, including the specific design characteristics of the software, the customization (or the lack of customization) performed by the organization on the top of the standard software, and the nature and culture of the organization, the encouraging results from this study cannot guarantee the success of the full-scale test of our survey instrument.

Our future research will proceed in two major directions. The immediate next step following the pilot tests is to perform the full-scale field tests of the survey instrument, enabling the third stage of the process outlined in Lewis et al. (2005). We will distribute the condensed instrument to users in multiple companies and organizations in various industries that use different enterprise systems. The large sample size, heterogeneity in the user samples, and the variations in the organizational settings beyond the university context will allow us to further test our survey instrument's quality and fully establish its validities mandated or highly recommended in IS research (e.g., content validity, construct validity, reliability, nomological validity, and external validity) (Straub et al. 2004).

Our second direction will be toward theory testing using this survey instrument. The ultimate goal of creating this instrument is to use it to test the theoretical model regarding the causal relationships between enterprise systems' collaborativeness and the systems' usability. Used together with existing, widely adopted system usability instruments (e.g., QUIS (Chin et al. 1988)), our survey instrument will allow us to quantitatively assess users' perceptions of systems' level of collaborativeness and the three dimensions of systems' usability: system effectiveness, system efficiency, and user satisfaction (ISO 1998). The quantitative data collected will help us statistically test the hypotheses concerning the collaborativeness-usability relationship.

7 CONCLUSION

This instrument development study offers several contributions. The most important is the creation of the survey instrument to measure the level of perceived system-user collaboration in enterprise system use. Our instrument focuses on users' perceptions of the level of collaborativeness that the systems exhibit as well as the users' self-perceived collaborative intentions and behavior. The development process included a series of deliberate steps, namely, reviewing related literature, creating the initial item set, iteratively adding, deleting, and revising the items, and three rounds of item sorting with enterprise system experts and users. This rigorous development process provided a high degree of confidence in the content validity. The further refined and condensed item set based on the exploratory factor analysis achieved satisfactory levels of construct validity and reliability. The resulting parsimonious survey instrument consists of 34 items intended to measure six constructs concerning users' perceptions of CJA-S, MR-S, CMS-S, CJA-U, MR-U, and CMS-U. To the best of our knowledge, this survey is the first instrument measuring perceptions regarding system collaborativeness in the context of large-scale enterprise systems.

This survey development study also has important implications for researchers and practitioners. With a validated survey instrument, enterprise systems researchers will be able to systematically assess the level of collaborativeness exhibited in enterprise systems, and quantitatively test theories related to enterprise systems' collaborative behavior. This will allow us to advance our knowledge about the collaboration between human and computer and the consequences of presence and absence of system-user collaboration. From the practical point of view, this survey instrument can also provide guidance for enterprise system designers, developers, and managers so that they are better able to understand the strengths and weaknesses of current enterprise systems in terms of collaborativeness. This will, in turn, help them design better, more usable future systems that successfully collaborate with users in achieving the users' business goals. The measurement of the three features of Shared Collaborative Activity separately will provide additional information regarding the specific system characteristics that are linked to favorable system use outcomes.

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APPENDIX 1: THE COMPLETE INSTRUMENT

Construct	Nbr	Item
MR-U	10	I have learned <enterprise system>'s ways of doing things and adjust my way of doing things accordingly for greater success
CMS-S	11	In case of an error, <enterprise systems> provides mechanisms for fixing the problem
CMS-S	12	<Enterprise systems> helps me when it detects that I have run into an error
MR-S	13	<Enterprise systems> takes into account my prior interactions with it

CJA-S	14	<Enterprise system> always informs me of the progress of my tasks
CMS-U	15	I do my best to find a solution when the system has run into an error situation
CJA-U	16	I try to stay aware of the progress of my tasks
CMS-S	17	<Enterprise system>'s error messages provide detailed guidance and instructions to help me solve problems
CJA-S	18	In general, I feel that <enterprise system> knows how the tasks should be completed
CMS-T	19	<Enterprise system> and I work together to diagnose and fix problems in error situations
CJA-S	20	<Enterprise system> knows the business goals my organization is trying to achieve in using it
MR-T	21	<Enterprise system> and I are being helpful to each other by having learned each other's ways of working
CJA-U	22	In general, I know how to complete tasks in <enterprise system>
MR-T	23	<Enterprise system> and I are always aware of how we work together so that we can adjust our ways of working when necessary
CMS-U	24	I recognize the error situations in which <enterprise system> needs additional input from me
CMS-U	25	I do my best to understand <enterprise system>'s error messages in order to solve the problem
CJA-U	26	I know how to perform my tasks with <enterprise system>
CJA-T	27	<Enterprise system> and I have a shared understanding about how to complete business tasks while we work on them together
CMS-T	28	<Enterprise system> and I are ready to help each other whenever an error situation occurs
CMS-T	29	<Enterprise system> and I use common terminology when dealing with problems in error situations
CJA-U	30	I know the business goals I am trying to achieve using <enterprise system>
CJA-T	31	<Enterprise system> and I share goals for tasks that need to be completed when we work together
CJA-T	32	<Enterprise system> and I understand each other's terminology when we work together
CMS-T	33	<Enterprise system> and I work together to solve problems in error situations
MR-U	34	I take into account <enterprise system>'s prior actions to be more effective at completing my tasks
MR-S	35	<Enterprise system> takes into consideration my previous actions
CJA-U	36	I know my goals for my tasks when I'm using <enterprise system>
CJA-T	37	<Enterprise system> and I share understanding about the progress of our tasks while we work on them together
CMS-T	38	<Enterprise system> and I recognize each other's need for help in error situations
CJA-T	39	<Enterprise system> and I work together to complete tasks
CMS-S	40	<Enterprise system>'s error messages provide task specific diagnoses
MR-T	41	<Enterprise system> and I adjust our behaviors based on our interactions in ways that help our work
MR-U	42	I have learned how to use <enterprise system> in order to adapt to its way of working
CJA-U	43	When using <enterprise system>, I am motivated to complete the tasks that I am working on
CMS-U	44	In case I encounter an error situation, I use all the tools available within <enterprise system> to resolve it
CJA-S	45	<Enterprise system> does well in its part with completing tasks
MR-S	46	<enterprise system> is able to learn from how I work with it
CJA-S	47	<Enterprise system> knows the goals for my tasks
MR-S	48	<Enterprise system> adjusts to the way I perform tasks
CMS-S	49	In case of an error, <enterprise system> provides clear alternatives for moving forward towards achieving my goals
CMS-U	50	I use all relevant resources to address an error situation
CMS-S	51	<Enterprise system>'s error messages use terms that I can understand

MR-T	52	<Enterprise system> and I take into consideration each other's way of working in our interaction
CJA-S	53	In general, <enterprise system> is helpful to its users in completing their tasks
MR-U	54	I take into consideration how <enterprise system> does things
CMS-U	55	I do my best to diagnose and solve problems in error situations
CJA-S	56	<Enterprise system> knows how business tasks should be completed
MR-U	57	I understand how <enterprise system> typically gets things done and adjust my work accordingly

APPENDIX 2: ITEMS REMOVED FROM THE ORIGINAL SET

Label	Item
CJA-S	<Enterprise system> allows me to perform the same task in different ways
CJA-S	<Enterprise system> provides explanation to terms that I am not familiar with
CJA-S	When using <enterprise system>, I feel that <enterprise system> wants to assist me in completing my tasks
CJA-S	If I am unable to complete a task using <enterprise system>, it presents alternative options
CJA-S	If I am unable to complete a task using <enterprise system>, it offers me alternative ways to reach my goals
CJA-S	At any moment in time, <enterprise system> knows the business goals for which it is being used
CJA-U	I can perform the same task in different ways with <enterprise system>
CJA-U	I am familiar with terms used in <enterprise system>
CJA-U	If I am unable to complete a task using <enterprise system>, I explore alternative options
CJA-U	I do my part well to complete my tasks when using <enterprise system>
CJA-U	If I am unable to complete a task using <enterprise system>, I use all available resources to find alternative ways to reach my goals
MR-S	I feel that <enterprise system> is aware of how I typically use it
MR-S	<Enterprise system> automatically chooses an option for me because it knows I frequently use the option
MR-S	<Enterprise system> is always aware of the progress of the tasks
MR-S	The actions of <enterprise system> are determined by my previous input to it
MR-S	<Enterprise system> notices when I need guidance
MR-U	<Enterprise system>'s prior actions guide the actions I take with it
MR-U	I do my best to perform tasks in <enterprise system> in a way it expects me to
MR-U	I am always aware of the progress of my tasks
MR-U	I notice when <enterprise system> needs my input
CMS-S	<Enterprise system> is ready to assist me if I need help
CMS-S	I believe that in case I encounter an error, <enterprise system> will help me move forward
CMS-S	<Enterprise system> reacts with additional guidance if I am not able to proceed with my task as planned
CMS-S	<Enterprise system> provides help functionality
CMS-S	<Enterprise system> recognizes my need for help and alerts me when I encounter a problem
CMS-S	<enterprise system> notices when I am not able to proceed with my task as planned
CMS-S	If I get stuck, <enterprise system> tries to figure out what is wrong
CMS-S	<Enterprise system> provides help when I need it
CMS-S	<Enterprise system> actively provides additional input if I am not able to complete my task
CMS-U	I am ready to provide input to <enterprise system> when necessary
CMS-U	It is my role to help <enterprise system> if it needs additional input
CMS-U	I notice when <enterprise system> needs my input in a problem situation
CMS-U	If I get stuck using <enterprise system>, I try to figure out what is wrong
CMS-U	I am ready to provide additional input if <enterp. system> does not understand what I am trying to do
CMS-U	I provide a response to <enterprise system> when it needs it

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