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Research Report: Better Theory Through Measurement—Developing a Scale to Capture Consensus on Appropriation

Wm. David Salisbury • Wynne W. Chin • Abhijit Gopal • Peter R. Newsted
Management Information Systems Department, Ohio University, 209 Copeland Hall, Athens, Ohio 45701
C. T. Bauer College of Business Administration, University of Houston, Melcher Hall 280D, Houston, Texas 77204–6282
Richard Ivey School of Business, The University of Western Ontario, 1151 Richmond Street North, London, Ontario, Canada N6A 3K7
Centre for Innovative Management, Athabasca University, 22 Sir Winston Churchill Avenue, St. Albert, Alberta, Canada T8N 1B4
davesalisbury@mail.com • wchin@uh.edu • agopal@ivey.uwo.ca • pnewsted@mba.athabascau.ca

Proper measurement is critical to the advancement of theory (Blalock 1979). Adaptive Structuration Theory (AST) is rapidly becoming an important theoretical paradigm for comprehending the impacts of advanced information technologies (DeSanctis and Poole 1994). Intended as a complement to the faithfulness of appropriation scale developed by Chin et al. (1997), this research note describes the development of an instrument to capture the AST construct of consensus on appropriation. Consensus on appropriation (COA) is the extent to which group participants perceive that they have agreed on how to adopt and use a technology. While consensus on appropriation is an important component of AST, no scale is currently available to capture this construct. This research note develops a COA instrument in the context of electronic meeting systems use. Initial item development, statistical analyses, and validity assessment (convergent, discriminant, and nomological) are described here in detail. The contribution of this effort is twofold: First, a scale is provided for an important construct from AST. Second, this report serves as an example of rigorous scale development using structural equation modeling. Employing rigorous procedures in the development of instruments to capture AST constructs is critical if the sound theoretical base provided by AST is to be fully exploited in understanding phenomena related to the use of advanced information technologies.

(*Adaptive Structuration Theory*; *Scale Development*; *Electronic Meeting Systems*; *Technology Appropriation*; *Structural Equation Modeling*)

Introduction

Technologies designed to support coordination and interpersonal communication represent a new class of information technologies (DeSanctis and Poole 1994). As such, the models used to assess information technology in the past may not be readily applicable to these types of interventions. In the past, information technology primarily supported business functions by enhancing their efficiency. More recently, what has been described as *advanced information technologies* (AIT) are viewed as mediating human interaction (DeSanctis and Poole 1994).

Intended to address phenomena related to AIT, Adaptive Structuration Theory (AST) (DeSanctis and

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Poole 1994, Poole and DeSanctis 1992) asserts that how AITs are called into use, or *appropriated*, will mediate any influence that these technologies may have on the outcomes from their use. Further, group appropriations of AITs are driven to a great extent by social processes that are not readily predictable (see Poole and DeSanctis 1992, DeSanctis and Poole 1994, Wheeler and Valacich 1996, or Chin et al. 1997 for a review of AST).

Essential to AST is the concept of appropriation, which is the mode or fashion in which users *reproduce*, or recreate for their use, an AIT (Poole and DeSanctis 1992). From a global perspective, appropriations may be *faithful* (the technology is used in a manner consistent with its general intent) or *unfaithful. Attitudes toward use* (e.g., beliefs about ease of use or usefulness) may be favorable or unfavorable. Finally, *consensus on appropriation*, (the extent to which group members agree about how to use the technology) may be high or low. An appropriation may be characterized by its *stability*: "Stable" appropriations are distinguished by faithful appropriation of the structures provided by the AIT, favorable attitudes toward its use, and high consensus on appropriation (Poole and DeSanctis 1992).

While AST has intuitive appeal, significant work remains. In particular, few tests of the AST premises have actually been performed (a notable exception being Wheeler and Valacich 1996), with previous efforts focusing mainly on attitudes toward AIT use (Gopal et al. 1993, Sambamurthy and Chin 1994). This may be partly attributed to the complexity of AST, its relative recency, and, consequently, to the fact that few convenient measures (i.e., scales) exist for its constructs (Gopal et al. 1993, Chin et al. 1997, Sambamurthy and Chin 1994).

Complexity and theoretical understanding notwithstanding, we take the position that unless a complete set of reliable and valid self report measures of the AST constructs are available for researchers to use under a variety of circumstances, further theoretical advancement would be stalled. While Poole, DeSanctis, and their colleagues have investigated appropriation using interaction coding methods (Poole and DeSanctis 1990, cf. Wheeler and Valacich 1996), and it is true that these methods have proven advantageous, in particular for capturing group-level phenomenon (as opposed to aggregating individual questionnaire responses), they may prove time consuming (Sambamurthy and Chin 1994, Sambamurthy and Poole 1992) and impractical in some research instances. Moreover, they represent but one lens through which AST phenomena may be viewed. By creating scales to capture respondent-level perceptions, we hope our effort enhances the convenience of capturing critical AST phenomena in a diverse range of settings, adding yet another perspective that should complement techniques such as interaction coding.

Among the three global AST constructs described earlier, only consensus on appropriation remains without a convenient means to capture it (i.e., a scale). Attitudes, for example, have been addressed in the form of ease of use and usefulness (cf. Davis 1989, Gopal et al. 1993, Sambamurthy and Chin 1994), while Chin et al. (1997) recently developed a scale for faithfulness of appropriation. Consequently, a consensus on appropriation scale will serve to round out the suite of AST instruments intended to capture global perceptions about appropriation.

Consequently, this research note reports on an effort to develop a scale for consensus on appropriation, employing the context of electronic meeting system (EMS)[1] use. While we develop the scale within this specific technological context, we believe it (as well as the other AST measures) has far wider applicability in the AIT domain. Given the increasingly encompassing nature of organizational information technologies today (enterprise systems and electronic commerce technology spring to mind) and the widespread recognition that their implementation calls for concerted change management efforts (Markus and Benjamin 1997), it becomes crucial to understand how people *in particular contexts* respond to specific technologies. In view of the well-documented difficulties involved in successfully implementing enterprise systems (cf. Davenport 2000), for example, knowledge about the attitudes toward the

[1]The type of information technology support that we describe here has been labeled with several terms, including group decision support systems (GDSS), group support systems (GSS), and electronic meeting systems (EMS). We have chosen to adopt EMS—after Dennis et al. (1988)—for this note since it highlights that these technologies relate to the support of groups in *meetings*.

technology, the manner in which the technology is interpreted, and the extent to which people share their reactions to the technology become crucial inputs into increasingly expensive implementation decisions.

We begin with a description of consensus on appropriation, and devote the balance of the report to a description of the development and validation of the consensus on appropriation instrument. This includes a multistage development/testing approach involving the use of confirmatory factor analysis to identify the appropriate factor structure and the use of structural equation modeling to examine the nomological validity of the instrument.

Consensus on Appropriation

Consensus on appropriation (COA) is defined as the extent to which individuals agree on how to jointly use an AIT intervention (Poole and DeSanctis 1992, DeSanctis and Poole 1994). This agreement may exist a priori or develop as the technology is appropriated, but it is a prerequisite for users to effectively employ the technology. Because AITs represent an intervention into what is essentially a social process, it is critical that the users reach agreement on what this intervention represents, and on how to apply it. There may be uncertainty regarding which features of the AIT intervention (if any) are appropriate to a given task or activity (DeSanctis and Poole 1994), and this uncertainty should be resolved before the AIT can be put to effective use. If consensus on appropriation is not reached, effective coordination of users' efforts may be difficult (Poole and DeSanctis 1992, DeSanctis and Poole 1994), which would likely lead to unfavorable outcomes.

In many environments, the users are not left solely to their own devices to resolve uncertainty about how to appropriate the AIT. Taking EMS as an example, meeting facilitation and training (cf. Wheeler and Valacich 1996) can provide a means to make the EMS procedures more explicit and allow groups to achieve high consensus on appropriation. In the EMS context, AST would suggest that the technology and facilitation provided by this intervention may channel the group interaction in a particular direction; however, the relationship between facilitation and meeting outcomes is not necessarily direct (cf. Wheeler and Valacich 1996). If the structures embedded in the EMS (or any AIT) are not perceived as relevant, uncertainty about how to adopt and use them may remain.

Consensus on appropriation may perhaps be better understood when contrasted with faithfulness of appropriation, which is the extent to which the AIT is used in a manner consistent with its spirit or general intent (Poole and DeSanctis 1990, DeSanctis and Poole 1994, cf. Chin et al. 1997). From an institutional perspective, faithfulness of appropriation may be concerned with the existence of a *rationalized myth* (cf. Meyer and Rowan 1991) representing the perceived relevance of the AIT structures to the users in question. From this perspective organizations and institutions external to the local user group—for example, senior management or occupationally-based expertise—provide a basis for understanding and interpreting the tasks at hand and applying the AIT intervention. On the other hand, consensus on appropriation can be seen as the *local* development and understanding of a methodology, consistent with the *social construction* perspective as described by Lee (1994) in his study of electronic mail use. Lee's study suggests that electronic media do not necessarily have objective qualities in and of themselves, but the properties of electronic media emerge in the interaction with its users (cf. Carlson and Zmud 1999). Users of electronic media are not passive users of the technology, but are active producers of meaning (cf. Huang et al. 1996). In the present case, how consensus on appropriation will emerge in interaction is not directly dependent on the qualities of the AIT provided, but is a function of the interaction between the technology and a particular set of users, and the negotiated order at which they arrive. As users learn about and employ the AIT intervention, each individual will develop perceptions and opinions of this intervention (Fulk et al. 1990). That will influence how they are able to apply it to perform their task. The key is whether or not the group will be able to negotiate an agreement as to how they should apply the intervention *collectively*, regardless of any objective qualities that the technology may possess.

While in the present context consensus on appropriation was addressed in a group setting using EMS, it is important to note that the kind of social construction of reality (cf. Berger and Luckman 1967) reflected

by consensus on appropriation, while quite clear in a small group setting, is also relevant to individual adoption and use of technologies in other, nongroup technology contexts[2] (cf. Poole and DeSanctis 1994). Even when using a technology to enhance the performance of their individual tasks, no one is an island; individual adoption and use of technologies are influenced by relevant others (cf. Fishbein and Ajzen 1975), even outside the small group setting. For example, Jasperson et al. (1999) focus on appropriation in the context of individual use of an auditing application by individual accountants in a particular organization. The appropriation moves they describe are based in local understandings that are created in the adoption and use of the auditing tool, and the local users desire to tap into that socially created reality that they and their colleagues create about the tool's use.

The Jasperson et al. (1999) study's emphasis on appropriation moves highlights another point we wish to make. While both appropriation moves addressed by Jasperson et al. (1999) and instrumental uses (cf. Poole and DeSanctis 1994) are relevant, we believe that consensus on appropriation reflects a global-level phenomenon that would be critical to the microlevel appropriation moves and instrumental uses, because these may depend on a local understanding about how to use the technology that either exists a priori or is created in the process of adoption and use of the technology by individuals. We will not speculate about whether or not consensus on appropriation is an antecedent or outcome of appropriation moves and instrumental uses in any given circumstance; a preexisting consensus on how the tools should be adopted and used may drive appropriation moves and instrumental uses, and a greater degree of consensus on appropriation will likely result from the repeated use of the tools by the local users. This discussion is beyond the scope of the present effort, but should be addressed in the future.

Developing the Consensus on Appropriation Scale

The development of the consensus on appropriation scale involved a multistage process. First, initial items reflecting consensus on EMS appropriation were developed based on the work of Poole and DeSanctis (1992, 1990). Initially the items were reviewed for content by several researchers familiar with AST to ascertain that they indeed reflected the construct of interest. Next, the items were subjected to several stages of rigorous analysis where both exploratory and confirmatory factor analyses were conducted. The steps in these analyses are presented here in abbreviated form, and interested readers may refer to Chin et al. (1997), who apply a similar methodology to the development of the faithfulness of appropriation scale.

Initial Item Development

In forming an initial set of items for a scale, a solid definition of the construct is crucial. For the present effort, the following working definition for consensus on appropriation was developed, based on Poole and DeSanctis (1992, 1990). This definition has four major components, which are underlined here:

The extent to which:

- *group members*
- are able to *reach agreement*
- on how *to apply an advanced information technology*
- *to their work.*

Items were created in such a way as to express (or strongly imply) the four concepts embedded in the construct definition. Statements such as ". . . members of our group agreed on how we should use the EMS for our work" were generated, leading to the development of the 10 initial items in Table 1. These items were reviewed for face validity both by researchers familiar with AST and lay persons prior to their use with experimental subjects.

Item Testing and Refinement

The development of the COA scale took place within the context of an EMS study. The 10 initial consensus-on-appropriation items were administered in a questionnaire to students at a western Canadian university after they had completed a session in which they performed a task using an EMS. There were 50 groups in the sample, with either four or five members per group ($n = 236$) seated in a horseshoe configuration. The task performed by the groups was *The School of Business Policy Task*, developed by Wheeler and Mennecke

[2]We thank the anonymous reviewers for providing the impetus for this discussion.

Table 1 Consensus on Appropriation Items

Item	Initial	Revised	Final
Our [My] group members were able to reach consensus on how to apply the EMS to our task.	*coa1*	*coa1*	*coa1*
Members of *our* [my] group always agreed on how the EMS should be used for our work.	*coa2*	*coa2*	
There was some disagreement in *our* [my] group on how to utilize the EMS *for our work* [in our meeting].*	*coa3*	*coa3*	
My group was not able to reach *consensus* [mutual understanding] on how to make use of the EMS to perform our task.*	*coa4*	*coa4*	
Overall, members of *our* [my] group agreed on how we should use the EMS for our work.	*coa5*	*coa5*	*coa2*
There was no conflict in *our* [my] group regarding how we should incorporate the EMS into our work.	*coa6*	*coa6*	*coa3*
[My group engaged in little debate about how the EMS should be used in our meeting.]*	*coa7*		
*Our group had difficulty agreeing about how the EMS should be used for our work.**	*coa7*		
Our [My] group reached mutual understanding on how we should use the EMS to perform our task.	*coa8*	*coa8*	*coa4*
Members of our [My] group *differed* [argued] about how the EMS should be used *for our work* [in our meeting].*	*coa9*	*coa9*	
Our [My] group was able to reach consensus on how we should use the EMS to perform our task.	*coa10*	*coa10*	*coa5*

Note. Between the first and second phases, italicized terms outside brackets [] were substituted with the terms inside brackets (e.g., the revised form of coa9 was, "Members of our group differed about how the EMS should be used for our work").

Entries in the last three columns are variable names assigned to items.

*These items were reverse coded for the analyses in which they were used.

Responses were given on a seven-point Likert scale with the following anchors: strongly disagree, quite, slightly, neither, slightly, quite, strongly agree.

(1992), and adapted for use in Canada with the assistance of a Canadian lawyer and Canadian university officials. The School of Business task is a *hidden-profile* (Stasser 1992) task. In this task, the participants are each given roles (e.g. Dean, Faculty Senate President) with differing information about the overall situation in the case. Because each group member is made aware of only a portion of the task information, the group must work together to reach the best solution. The EMS used was *VisionQuest*™, a product of Collaborative Technologies Corporation.[3] Subject demographics are provided in Table 2.

To enhance variance in consensus on appropriation, two levels of *restrictiveness* (Silver 1990; cf. DeSanctis and Poole 1994, Wheeler et al. 1993, Wheeler and Valacich 1996) were provided. One-half of the groups received the restrictive treatment, in which the facilitator led the groups through an on-screen agenda, thereby limiting the range of options in using the system. The other groups received a nonrestrictive treatment in which they were allowed to use (or not use) the EMS in any manner they wished. Wheeler and Valacich (1996) demonstrated that appropriation mediators such as restrictiveness increased faithful appropriation of the EMS. We expected a similar effect would result from the presence of a more restrictive EMS agenda with respect to consensus on appropriation. The effect of appropriation mediators is to reduce the range of options that groups face when calling the EMS intervention into use. Therefore any intervention that caused the range of options (and potential interpretations) to be limited would likely enhance consensus on how to adopt what has been provided by EMS. As a consequence, providing the two restrictiveness treatments was believed to enhance variance in consensus on appropriation for the overall sample.[4]

[3] *VisionQuest* has since been acquired by Ventana Corporation.

[4] As a posthoc assessment of this supposition, we performed three assessments using a measure consisting of the summed COA items. While we might not necessarily anticipate a mean difference due to treatment, we would expect greater variability in the responses to COA items in the nonrestrictive treatment than in the restrictive treatment. We first simply noted the standard deviation in each treatment, finding that this was greater in the nonrestrictive treatment than in the restrictive treatment (6.88 versus 5.38). Next, Levine's test indicated the variances between cells were unequal ($F = 9.36$, $p = 0.002$), which would also indicate a treatment influence on variance. In light of the unequal cell variances, the most appropriate test of mean difference was a t-test assuming unequal cell variances, hence we made our third assessment using this analysis. The mean for COA in the restrictive treatment was 25.07, while in the nonrestrictive treatment it was 23.64 ($t = 1.96$, adjusted $d.f. = 243.57$,

Exploratory components analysis using principal components extraction was performed on this data. Using a combination of the scree plot and eigenvalue greater than one rule, a two-component solution was considered most appropriate. Although the scree plot suggested fewer components than the eigenvalue rule, we opted to err on the conservative side by including more factors to avoid the possibility of missing relevant factors, consistent with the exploratory nature of this analysis. The results of the varimax rotation are presented in Table 3.

The goal was to be inclusive during initial item development. Hence, items that loaded higher than 0.6 on the consensus-on-appropriation factor but less than 0.4 on any other factor were considered to be acceptable items, and were kept without modification. Under this criterion, six of the items loaded on Factor 1, which we designated as consensus on appropriation, while three loaded on a second factor, and another did not load on either factor.

Given the results of the initial testing, items were modified in the hope of improving their psychometric properties, by eliminating strong wordings, or by making the items more specific to the context (i.e., groups performing a task). Table 1 contains the revised scale.

Analysis of Revised Items

The revised items were administered to 309 undergraduate subjects (forming 13 groups) at a western Canadian university (again as part of an EMS research project) after they had completed their task using an EMS. After eliminating cases due to missing responses on some items, the actual sample size was 298. The median number of subjects per group was 23 (mean = 22.62, s.d. = 2.14). Refer to Table 2 for subject demographics.

As before, the EMS used was *VisionQuest*™. Group participants were seated in a tiered classroom, with a computer available to each participant as the groups

Table 2 Demographics

Gender	Initial Study		Confirmation Study	
Males	125		156	
Females	111		142	
Total	236		298	
Demographic	Mean	Standard Deviation	Mean	Standard Deviation
Age	21.51	3.57	21.12	3.30
Work Experience (months)	19.54	30.56	15.87	27.54
GPA	2.82	0.49	2.92	0.40
Previous EMS Uses	0.88	3.47	0.26	1.06

Table 3 Principal Components Analysis on Initial Items

	Item Loadings	
Item	Factor 1	Factor 2
COA 1	*0.77*	0.04
COA 2	*0.79*	0.12
COA 3	0.23	*0.75*
COA 4	0.32	*0.76*
COA 5	*0.74*	0.11
COA 6	*0.62*	0.20
COA 7	0.40	−0.39
COA 8	*0.79*	0.21
COA 9	0.07	*0.71*
COA 10	*0.70*	0.18
Eigenvalue	3.99	1.51

Table 4 CFA Item Loadings for Final COA Scale

Item	Factor 1
COA 1	0.62
COA 5	0.75
COA 6	0.64
COA 8	0.77
COA 10	0.86

two-tailed significance $p = 0.051$). had we obtained equal cell variances, the mean differences could be interpreted as significant as well ($t = 2.013$, $d.f. = 296$, $p = 0.045$). Hence, we feel fairly confident that our restrictiveness treatment did indeed achieve its purpose, which was to create variability in responses to our COA items. We thank the associate editor for suggesting this analysis.

performed their tasks. As in the earlier study, a training session was given to groups in both treatments prior to task performance. The Canadian version of the *School of Business Policy Task* (Wheeler and Mennecke 1992) was again used. Groups were balanced on gender with the intent that no group would include more than 60 per cent of one gender; cf. Kanter (1977). The same restrictiveness treatments as in the initial study were employed in the second study.

The data collected using the revised items was first used for item testing and potential model modification. In addition to performing a principal components analysis, confirmatory factor analysis was first used to test the factor analytic structure of the COA items in a single-factor confirmatory analysis, followed by a test of the scale's convergent and discriminant validity with other relevant constructs. Next, a causal model consistent with the premises of AST was tested in a confirmatory manner using structural equation modeling to assess the nomological validity of the COA construct.

While we were willing during the exploratory phase of this scale development to use principal components factor analysis, we believed it critical to apply more rigorous analyses aimed at assuring the convergent, discriminant, and nomological validity of the COA scale. As a consequence, we performed the remainder of our analyses using structural equation modeling.

Convergent Validity. Reliability of the COA scale was first examined by specifying a single-factor model in a confirmatory factor analysis using AMOS 4.0 (Arbuckle 1999).[5] This model was to assess convergent validity (i.e., the extent to which the items appear to be indicators of a single underlying construct). Assuming the overall model fit indices are adequate, convergent validity is established if the loadings of the measures to their respective constructs are at least 0.60 (Bagozzi and Yi 1988). From the results, 5 of the original 10 items demonstrated loadings of 0.6 or greater (see Table 4 for single-factor CFA item loadings) and, as well, acceptable model fit. Overall, the model fit indices (Table 5) surpass the recommended value for a good model (as indicated by the references cited in the table) and therefore suggest the measures are reflective of a single factor. Consequently, Items 1, 5, 6, 8, and 10, with a Cronbach alpha of 0.85 and a *composite reliability*[6] (cf. Chin 1998, Bagozzi and Yi 1988, Werts et al. 1974) of 0.85 as well were designated as the final COA items. These are reproduced in Table 6.

Discriminant Validity. In addition to convergent validity, we needed to assess the discriminant validity of the construct. Convergent validity suggests that the items are reflective of one underlying construct, whereas discriminant validity indicates that the items are measuring only the construct of interest and not other constructs. To test discriminant validity, we tested our scale against scales with established credentials, *perceived ease of use* (EOU) and *perceived usefulness* (UFL) (Davis 1989), as well as *faithfulness of appropriation* (Chin et al. 1997).[7] A series of confirmatory factor analyses was performed where the COA construct was modeled to correlate with EOU, UFL, or FOA.[8] Discriminant validity is indicated statistically by using a χ^2 difference test where the χ^2 measures for two analyses are compared. This involves setting the correlation between constructs at 1.0 for one analysis while the other analysis allows the correlation to be freely estimated. The difference in degrees of freedom between the two models is 1 (i.e., the correlation between constructs), and hence a χ^2 difference greater than 3.84 (alpha of 0.05) would suggest the two constructs are statistically different. Table 7 presents a summary of the χ^2 discriminant validity tests for all three pairings of constructs, which clearly demonstrates the discriminant validity of the COA scale.

Nomological Validity. The nomological validity of the COA instrument was tested by including an endogenous construct in a causal model. Specifically, we examined whether the COA instrument is useful in predicting satisfaction with the meeting process. Thus,

[5]The covariance matrix is provided in Table 6 to facilitate replication of our analyses.

[6]Chin and Gopal (1995) suggest that while Cronbach's alpha represents a lower-bound estimate of internal consistency, *composite reliability* (Werts et al. 1974) is a better reliability estimate. We report both types of reliability measures with the scales in Table 7. See Chin (1998) for the formula to calculate composite reliability.

[7]These items are found with the COA items in Table 7.

[8]Each of the pairings was run as a separate model. Due to space limitations we do not depict these graphically.

Table 5 Model Fit Indices for Validity Testing

			Discriminant Validity COA paired with:			
Statistic	Suggested Value	Convergent Validity	EOU	UFL	FOA	Nomological Validity
χ^2		13.00	134.44	112.88	92.53	613.25
χ^2, baseline model		616.11	2809.42	2815.55	1758.78	7180.39
d.f.		5	43	43	34	314
d.f., baseline model		10	55	55	45	351
χ^2 significance (*p*-value)	$p > 0.05$	$p = 0.02$	$p = 0.00$	$p = 0.00$	$p = 0.00$	$p = 0.00$
χ^2/*d.f.* (Wheaton et al. 1977)	<5.0	2.60	3.13	2.63	2.72	1.95
RMR (C) (Hu and Bentler 1995)	<0.10	0.03	0.03	0.04	0.05	0.05
GFI (Joreskog and Sorbom 1988)	>0.90	0.98	0.92	0.93	0.94	0.87
AGFI (Joreskog and Sorbom 1988)	>0.80	0.95	0.88	0.90	0.91	0.84
δ 1 (Bentler 1990)	>0.90	0.98	0.95	0.96	0.95	0.92
ρ 1 (Bollen 1986)	>0.90	0.96	0.94	0.95	0.93	0.91
δ 2 (Bollen 1989)	>0.90	0.99	0.97	0.98	0.97	0.96
ρ 2 (Tucker and Lewis 1973)	>0.90	0.97	0.96	0.97	0.96	0.95
CFI (Bentler and Bonnet 1980)	>0.90	0.99	0.97	0.98	0.97	0.96
RNI (McDonald and Marsh 1990)	>0.90	0.99	0.97	0.98	0.97	0.96

Note.

Abbreviation	Expansion
GFI	Goodness of Fit Index
AGFI	Adjusted Goodness of Fit Index
RMR(C)	Root Mean Square Residual, calculated from the correlation matrix
CFI	Comparative Fit Index
RNI	Relative Noncentrality Index

beyond examining how COA correlates with EOU, UFL, and FOA, we tested a model where all four exogenous factors are hypothesized to influence meeting satisfaction. It is important to note that the specified model was developed solely as a plausible means to assess the nomological validity of the COA scale, and should be viewed in this light.

The dependent construct, *decision scheme satisfaction* (Green and Taber 1980) has been used in a wide variety of prior EMS research, and thus offers some basis for comparison between the present study and earlier studies (the items are found in Table 6). The four AST constructs were modeled to have a causal impact on decision scheme satisfaction depicted in Figure 1.[9] We reiterate that we do not suggest this model is necessarily the most appropriate model; however, it does represent a plausible model for testing the nomological validity of the COA construct since we draw upon established theory to devise the model (cf. Chin et al. 1997).

In particular, when groups are faced with novel technologies, their use is influenced by the attitudes they form about the technology and its role in their task activities (DeSanctis and Poole 1994, Poole and DeSanctis 1992, Sambamurthy and Chin 1994; cf. Weick 1990). These attitudes can influence the outcomes of that use (Gopal et al. 1993, Sambamurthy and Chin 1994), and therefore EOU and UFL are modeled as having direct influences on decision scheme satisfaction. Faithfulness of appropriation is also modeled as a direct influence on decision scheme satisfaction based on the reasoning that it results from group members accepting the appropriateness of the EMS method

[9]To save space, Figure 1 contains the models for all three analyses. The smallest box depicts the convergent validity assessment, the next largest box discriminant validity, and the full figure depicts nomological validity.

Table 7 Items Used to Assess Convergent, Discriminant, and Nomological Validity

Construct	Item
Consensus on Appropriation $\alpha = 0.85$, composite reliability = 0.85	Our group members were able to reach consensus on how to apply the EMS to our task. Overall, members of our group agreed on how we should use the EMS for our work. There was no conflict in our group regarding how we should incorporate the EMS into our work. Our group reached mutual understanding on how we should use the EMS to perform our task. Our group was able to reach consensus on how we should use the EMS to perform our task.
The items above represent the final COA items. They were measured on seven-point Likert scales anchored by the following: strongly disagree, quite, slightly, neither, slightly, quite, strongly agree.	
Faithfulness of appropriation $\alpha = 0.91$, composite reliability = 0.91	The developers of the EMS would disagree with how our group used the system. Our group probably used the EMS improperly. The original developers of the EMS would view our group's use of the system as inappropriate. Our group failed to use the EMS as it should have been used. We did not use the EMS in the most appropriate fashion.
The items above were measured on seven-point Likert scales anchored by the following: extremely likely; quite likely; slightly likely; neither; slightly unlikely; quite unlikely; extremely unlikely.	
Ease of use $\alpha = 0.96$, composite reliability = 0.96	Learning to operate an EMS *is [would be]* easy for groups I work with. Groups I work with *find [would find]* it easy to get an EMS to do what they *want [would want]* it to do. Groups I work with *find [would find]* their interaction with an EMS clear and understandable. Groups I work with *find [would find]* an EMS to be flexible to interact with. It *is [would be]* easy for groups I work with to become skillful at using an EMS. Overall, groups I work with *find [would find]* an EMS easy to use.
Usefulness $\alpha = 0.96$, composite reliability = 0.96	Using an EMS *enables [would enable]* groups I normally work with to accomplish their tasks more quickly. Using an EMS *improves [would improve]* the performance of groups I work with. Using an EMS *increases [would increase]* the productivity of groups I work with. Using an EMS *enhances [would enhance]* the effectiveness of groups I work with. Using an EMS *makes it [would make it]* easier for groups I work with to carry out their tasks. Groups I work *find [would find]* an EMS useful for group work.
The two scales above were administered in exactly the form shown. All items were measured on seven-point Likert scales anchored by the following: extremely likely; quite likely; slightly likely; neither; slightly unlikely; quite unlikely; extremely unlikely.	
Decision Scheme Satisfaction $\alpha = 0.81$, composite reliability = 0.81	How would you describe your group's problem-solving process? *efficient/inefficient* *Coordinated/uncoordinated* *fair/unfair* *confusing/understandable* *satisfying/dissatisfying*
The scale above is from Green and Taber (1980) and was administered as shown. The five decision scheme satisfaction items were measured on five-point scales anchored by the adjective pairs shown.	

and its potential to help them achieve their desired results. As a consequence of believing they are using the structures provided by the EMS in the "correct" manner (cf. Collins 1992), they may be expected to be satisfied with the method. Finally, consensus on appropriation is seen as having a direct influence on decision scheme satisfaction. In the presence of agreement on how to adopt and use the technology for their task, group participants would be expected to view their decision process favorably, because the sense of social support that would derive from the apparent agreement on how to proceed (cf. Collins 1992, Asch 1952).

The overall model fit indices (Table 5) indicate that the model is reasonably consistent with the data, with the majority of fit indices above the recommended values. The parameter estimates from this analysis are in

Figure 1. The COA scale seems to exhibit favorable convergent validity, even when assessed with other scales in a nomological model; i.e., the item loadings exhibit little change in this assessment (cf. Chin and Marcolin 1995). The discriminant validity among the exogenous factors is apparent because the largest correlation between any two factors (EOU and UFL) is 0.62. In the case of COA, the correlations with EOU, UFL, and FOA are 0.20, 0.19, and 0.46, respectively.

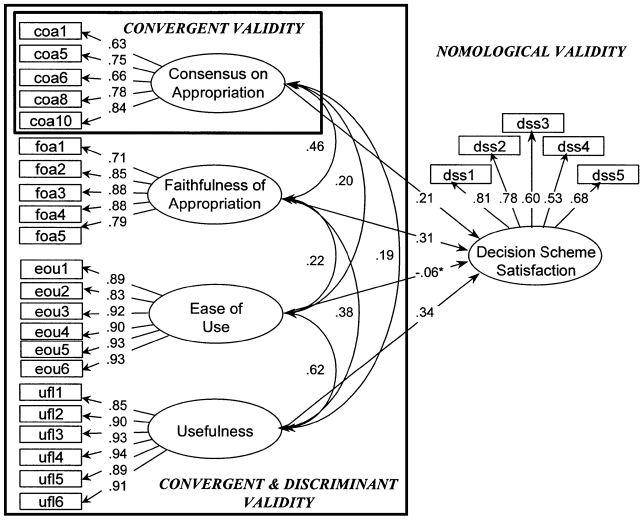
Although the model depicted here was not intended as an empirical test of AST, it is interesting to look at the findings in light of AST. It can be seen that, as we might expect, consensus on appropriation has a significant direct effect on decision scheme satisfaction ($\beta = 0.21$), and faithfulness of appropriation has a significant effect as well ($\beta = 0.31$). Perceived usefulness also has a significant impact ($\beta = 0.34$). On the other hand, there is no significant relationship between ease of use and decision scheme satisfaction. The estimated path coefficient ($\beta = -0.06$ for EOU) is not significantly different from zero. The substantive structural impact of COA on decision scheme satisfaction in the presence of the other AST factors provides evidence of nomological validity. These findings (minus the COA results) are similar to those of Chin et al. (1997).

Table 8 **Summary of χ^2 Discriminant Validity Tests for COA Paired with EOU, UFL, and FOA.**

Model	*d.f.* (EOU & UFL)	COA/ EOU	COA/ UFL	*d.f.* (FOA)	COA/ FOA
Fixed	44	710.39	687.45	35	525.17
Free	43	134.44	112.88	34	92.53
Difference	1	575.95	574.57	1	432.64
Distinct Constructs?		*yes*	*yes*	*yes*	

Note. Critical χ^2 for above analyses ($\alpha = 0.05$) is 3.84.

Figure 1 **Convergent, Discriminant, and Nomological Validity with Path Coefficients (Nonsignificant Coefficients Denoted by *)**



Convergent and discriminant validity are denoted by the smaller rectangles within the full nomological model.

Conclusion

The purpose of the present effort has been to establish a reliable and valid new scale that captures the key AST construct of consensus on appropriation. Through the use of confirmatory factor analysis and structural equation modeling, we demonstrate the scale's convergent, discriminant, and nomological validity.

Still, the study is not without its limitations. First, we have developed the scale in the context of student use of an EMS. It is clear that the scale should be validated with organizational groups at some point. On the other hand, the case as presented to the students asked them to address financial and academic problems at a fictitious university, during a time that their university was undergoing severe financial constraints. Hence, the issues in the case were very relevant to the subject pool.

Although the scale was originally developed for the context of EMS use, we also believe, as we noted earlier, that consensus on appropriation is an important construct, and that our scale may have utility beyond the EMS literature as well, in particular for implementations of other advanced information technologies, or AIT (DeSanctis and Poole 1994).[10] We described earlier our belief that no individual is an island; adoption and use of technologies (even those intended to enhance individual performance) are influenced by relevant others (cf. Jasperson et al. 1999, Fishbein and Ajzen 1975). Further, many AIT are intertwined to a great extent with the organization in which they are implemented, and hence would depend on consensus as to their use, which our scale may be useful to assess.

[10]We thank the senior editor for suggesting this discussion.

Appendix. Confirmation Data Set Covariance Matrix

	eou1	eou2	eou3	eou4	eou5	eou6	ufl1	ufl2	ufl3	ufl4	ufl5	ufl6	foa1	foa2	foa3	foa4	foa5	coa1	coa2	coa3	coa4	coa5	dss1	dss2	dss3	dss4	dss5
eou1	2.856																										
eou2	2.236	2.738																									
eou3	2.203	2.074	2.554																								
eou4	2.021	1.889	2.096	2.333																							
eou5	2.268	2.031	2.253	2.130	2.733																						
eou6	2.273	2.019	2.183	2.021	2.411	2.625																					
ufl1	1.353	1.521	1.439	1.441	1.382	1.495	3.054																				
ufl2	1.232	1.442	1.311	1.307	1.312	1.361	2.131	2.409																			
ufl3	1.254	1.389	1.362	1.240	1.307	1.328	2.187	2.041	2.511																		
ufl4	1.180	1.343	1.333	1.245	1.267	1.291	2.085	2.051	2.218	2.406																	
ufl5	1.268	1.413	1.338	1.289	1.306	1.327	2.139	1.930	2.041	1.986	2.470																
ufl6	1.262	1.491	1.405	1.343	1.391	1.407	2.139	2.047	2.097	2.103	2.142	2.546															
foa1	0.343	0.370	0.454	0.539	0.355	0.342	0.689	0.597	0.630	0.606	0.648	0.752	3.180														
foa2	0.341	0.388	0.474	0.423	0.230	0.267	0.847	0.670	0.746	0.629	0.694	0.752	2.033	3.224													
foa3	0.634	0.624	0.672	0.632	0.537	0.603	0.983	0.836	0.904	0.827	0.833	0.915	2.090	2.445	3.213												
foa4	0.501	0.624	0.645	0.542	0.367	0.477	0.984	0.961	0.917	0.858	0.932	0.908	1.799	2.347	2.469	3.120											
foa5	0.428	0.611	0.584	0.564	0.367	0.439	0.997	0.867	0.900	0.788	0.895	0.840	1.897	2.263	2.219	2.427	3.506										
coa1	0.186	0.276	0.464	0.396	0.379	0.288	0.551	0.444	0.323	0.343	0.377	0.452	0.724	0.769	0.758	0.924	0.796	2.723									
coa2	0.259	0.283	0.419	0.298	0.372	0.312	0.222	0.332	0.244	0.329	0.224	0.357	0.655	0.703	0.677	0.843	0.553	1.335	2.231								
coa3	0.397	0.432	0.475	0.478	0.316	0.412	0.458	0.492	0.356	0.436	0.467	0.587	1.059	1.055	1.071	1.122	0.748	1.071	1.224	2.793							
coa4	0.376	0.311	0.357	0.286	0.347	0.461	0.343	0.278	0.329	0.307	0.333	0.397	0.683	0.998	0.996	0.952	0.781	1.113	1.175	1.248	2.127						
coa5	0.326	0.230	0.291	0.223	0.256	0.390	0.243	0.192	0.284	0.266	0.187	0.353	0.684	0.797	0.796	0.738	0.421	1.230	1.436	1.343	1.477	2.194					
dss1	0.254	0.400	0.354	0.260	0.165	0.283	0.638	0.487	0.513	0.560	0.529	0.480	0.419	0.615	0.724	0.814	0.703	0.432	0.383	0.377	0.460	0.415	1.107				
dss2	0.368	0.399	0.408	0.292	0.243	0.336	0.606	0.484	0.579	0.572	0.550	0.489	0.433	0.594	0.629	0.696	0.740	0.328	0.261	0.361	0.351	0.285	0.720	1.118			
dss3	0.304	0.315	0.406	0.310	0.241	0.359	0.409	0.398	0.460	0.455	0.367	0.355	0.258	0.308	0.226	0.321	0.328	0.268	0.265	0.330	0.224	0.203	0.457	0.479	0.878		
dss4	0.316	0.420	0.483	0.410	0.348	0.323	0.533	0.607	0.549	0.590	0.490	0.499	0.564	0.583	0.586	0.709	0.597	0.466	0.539	0.535	0.378	0.347	0.440	0.449	0.310	1.131	
dss5	0.075	0.182	0.239	0.157	0.061	0.162	0.380	0.280	0.366	0.460	0.351	0.356	0.474	0.500	0.506	0.621	0.595	0.206	0.295	0.351	0.360	0.327	0.616	0.574	0.440	0.368	1.093

One example of an AIT that is substantively intertwined with the adopting organization is found in the study of enterprise resource planning (ERP) systems. For organizations to achieve success using ERP systems, it would be useful to assess the degree to which key organizational members (and indeed all potential users) agree on how the technology is to be applied in their particular situation within the organization (cf. Sarker and Lee 2000); some may see it as a way to merely enhance the efficiency of what is already being done; others may see it as a way to change fundamentally the processes by which business is conducted (cf. Davenport 2000). In reality, it likely has elements of both; if the understandings among key organizational members are not shared as to what the ERP system means to that organization, one or more of these groups may not fully adopt the resulting implementation, and it almost certainly would not achieve the ends for which it was installed. Given the large sums of money that are spent on systems of this kind, the ability to gauge such reactions through the scale we have proposed might prove especially beneficial. Moreover, in customer-related systems such as different forms of electronic commerce technology or customer relationship management (CRM) systems, in which a thorough and consistent understanding of the technology among organizational members is especially important in order to present a unified corporate approach, scales such as this one, as well as the other AST scales, could provide a convenient and economical means of gauging responses to technology.

We also envisage this scale, along with the suite of AST scales to which it belongs, proving useful in research settings related to other technologies. With the growing complexity and scope of new information technologies, as well as with more researchers concerning themselves with the particular social and cultural contexts within which technologies are embedded, these scales provide a means both of capturing these nuances as well as helping divine reactions from the larger numbers of people whose work lives these technologies influence.

While the causal model applied in this study should be subjected to further revisions, it has served its purpose as a nomological net in which to assess the COA scale in the present study. The outcome is a compact, five-item scale that may be used for capturing the COA construct. With this and other instruments (such as for faithfulness of appropriation; see Chin et al. 1997), the AST model may be more conveniently tested under a variety of conditions, and with a variety of technologies besides EMS, and in a variety of contexts other than small groups, after additional validation in those settings as appropriate.

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