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Abstract

As specific parts of a theory are refined over time, the aggregated set of variables and associations of multiple theory instances provide the identity of a theory domain. This research applies a meta-theoretical analysis to the problem of theory identity and the core-periphery distinction. The theoretico-empirical network for quantitative publications over a 20 year span of two top Information Systems journals is analysed and visualized to illustrate these aspects of theory. The analysis provides insight into the density of research in specific theory domains, the verisimilitude and explanatory ubiquity of core versus peripheral postulates, and suggests opportunities for increasing explanatory depth and integration in select theory domains.

Keywords

Nomological networks, theory networks, core theory, philosophy, meta-theoretical approach.

INTRODUCTION

Weber's (2012) theory framework aims to provide "formal and precise foundations for the evaluation of theory" (Weber 2012, p. 2), and to articulate the 'parts' and the characteristics of the 'whole' which are germane to theory quality. This framework raises the question of what, exactly, researches are referring to when applying or evaluating a specific theory. During theory extension and refinement, independent variables may be added or removed in different research instances. In addition, the dependent variable of a theory may change. Although the parts of the theory may vary between instances, researchers in the Information Systems (IS) field generally consider many different instances as exemplars of the same theory. For example, some of the publications commonly considered to be representative of the Technology Acceptance Model (TAM), including TAM (Davis 1989), TAM2 (Venkatesh and Davis 2000), and UTAUT (Venkatesh et al. 2003), provide substantive accounts of focal phenomena relating to technology *use*. But within the overall TAM research stream, in 30% of studies examined, the dependent variable was *behavioural intention*, rather than *use* (Lee et al. 2003). These are accounts of different phenomena based on overlapping, but different sets of independent variables. Here Weber's (2012) framework offers the concept of a *theory domain* as the set of ancillary phenomena that provide an account of a class of focal phenomenon. This conceptualization is the basis for this current meta-study research which extends the IS field's understanding of the relationships among different instances of a theory, of the relationships among different theory domains, and possible pathways for theory integration.

Meta-studies are a class of research approaches that focus "on synthesizing knowledge in a particular area, summarizing the findings, and providing guidelines for future research in the area" (Bostrom et al. 2009, p. 19). One member of that class, meta-theorization, aggregates what is known about the functioning of a theory through examination of multiple instances of the theories' development and use. The goal of this form of meta-study is to enhance theory description and synthesize multiple theories within a nomological framework (Bostrom et al. 2009). In this research, we adopt the specific perspective on theory as proposed in Weber (2012) to visualize the landscape in which quantitative IS theories reside. This landscape is a reinterpretation of the nomological network first proposed by Cronbach and Meehl (1955) as it represents both the law-like associations among ancillary and focal phenomena and the patterns of theory development and knowledge discovery by researchers. The first goal of this research is to demonstrate a meta-theoretical approach to identifying a core-periphery distinction for select theories within this landscape and suggest strategies for theory integration.

The second goal is to expand upon the suggestion that falsifiability is a characteristic of high-quality theory (Weber 2012). All theories are false in the sense they are incomplete or, in the case of social science theories, unable to generate rigorous mathematical models Meehl (1990). Weber (2012) acknowledges that adherence to

strict falsification (Popper 1959) is unwarranted, and suggests that when a hypothesis fails a test, the researcher may elect to revise specific propositions rather than discarding the entire theory. This perspective aligns with the suggestion from Lakatos (1970) that theories are composed of a hard core surrounded by a protective belt of ancillary assumptions, and that researchers protect the core by modifying the peripheral parts of a theory. Meta-theoretical analysis is a starting point for discovery of the core components of a theory that warrant protection as peripheral hypothesis fail tests. For example, the core structural and compositional postulates of Watson and Crick's (1953) theory of gene structure are unlikely to be falsified. In the same vein, few would seriously consider that the association between the behavioural constructs *usefulness* and *ease of use* and the focal phenomenon *behavioral intention* will be falsified (Venkatesh et al. 2003). As some tests of hypothesis will result in "unfavourable" outcomes, a researcher may elect to revise specific parts of the theory (e.g. construct definitions or boundaries, instruments, measurements, hypothetical associations) while defending core propositions of the theory (Lakatos 1970; Meehl 1990; Weber 2012). This "Lakatosian defence" of a theory relies on the ability to identify the core versus periphery distinction within the theory domain such that the core remains protected as the periphery is revised.

In this research we first demonstrate an approach to the identification of *theory domains* within a large-scale theoretico-empirical network composed of variables and the associations among them from a 20 year period in top journals in the IS field. Second, we introduce the concepts of *explanatory ubiquity* and *verisimilitude* to visualize the core-periphery distinction of the select theory domains. While not providing the nomological landscape of the entire IS field, our meta-theoretical visualization of the network of quantitative data published in highly ranked journals provides valuable additional insights. Our analysis demonstrates the concentrations and saturation of research in specific theory domains, illuminates the lack of replication which pervades all but a small part of the IS landscape, and suggests opportunities for extending, deepening, and integrating theory domains within the discipline.

PRIOR RESEARCH

Research on theory in IS is an expansive and enduring theme encompassing the quality (Weber 2012), construction (Weick 1989; Weick 1995), types (Gregor 2006), and "nativeness" of theory (Straub 2012). Theory classification schemes have been developed to demonstrate the diversity and evolution of IS theories (Barki and Sheetz 2001; Lee et al. 2004). These classifications commonly use author-identification of theory names within a set of publications to develop a classification. In addition, nomological networks have been an aspect of construct validation (Cronbach and Meehl 1955; MacKenzie et al. 2011).

Weber's framework is specific in describing necessary and sufficient conditions of a theory's "parts," and the emergent "whole" which together constitute a specialized ontology (Grantham 2004; Weber 2012). The framework provides developmental and evaluative criteria for theory quality on a theory by theory basis, The definition of parts emphasizes a theory's coherence, which describes the structural conditions justifying belief in a theory and requires that theory elements maintain consistency with other elements and avoid ambiguity (IEP 2012). But as theories survive numerous tests under diverse conditions, their parts are refined and evolve over time. Simply specifying a theory name does not specify the configuration of parts. Therefore, a *theory domain* must be defined from the numerous specific publications in which it appears.

Theoretico-empirical Networks

The fundamental level of analysis for a theory is the paper in which it is published. The associations among ancillary and focal variables provide an explanatory account of the focal phenomena. These associations form a network of nomological (law-like) relationships. Originally, nomological networks were proposed to provide implicit definition for a construct based on the context of the other constructs near it in the network (Cronbach and Meehl 1955).

But theories do not exist in isolation, so while this formulation of the nomological network was crucial for construct validity, our interest lies developing a nomological landscape in which multiple theories reside and can be compared. A theory cannot be limited to a specific instance in a single paper and indeed, "support for a theory grows when its powers of prediction and/or explanation remain robust across different tests of the theory" (Weber 2012) implying presentation within multiple research publications. Individual instances of theories can be compared within the larger context of one or more networks of hypothesized or empirically supported theoretical propositions.

We reinterpret the original nomological network concept and propose *theoretico-empirical networks,* composed of the complete set of tested and hypothetical associations among variables in a given set of publications, as a form of meta-theoretical analysis. These networks are important in IS and broader social-science research in that they underpin any implementation of Benbasat and Zmud's (2003) argument for an IS core identity, research on

interfield theory development (Darden and Maull 1977), and examples of the IS nomological network (Furneaux and Wade 2009). Beyond this, we argue that understanding and use of theoretico-empirical networks can help identification of theory domains and visualization of the core-periphery distinction in these domains. We posit that all theories are approximations of objective reality and that theory identity becomes defined as a broader and deeper set of corroborating evidence as a research program develops among a community of scholars (Lakatos 1970; Meehl 1990). The theoretico-empirical network of a field is the set of hypothesized and empirically corroborated associations among variables. This network defines the landscape in which theory domains can be identified and verisimilitude compared, and for simplicity, we hereafter refer to it as the nomological net, recognizing that it does not fully fulfil the requirements for Cronbach and Meehl's (1955) nomological networks.

Construct Identity

In Weber's (2012) interpretation, each variable is an "attribute in general of some class of things in its domain" (p. 9). Some attributes in IS theories can be directly measured (e.g. age, gender, education), while many are unobservable. Because constructs are not directly observable, a surrogate to observation is needed, which is often supplied through measurement instruments composed of a set of survey questions. Unobservable attributes or constructs of interest in IS are frequently cognitive attributes (e.g., attitudes, beliefs, motivations) or emotions (e.g., anxiety, frustration). As behavioural research has grown and researchers seek novelty, there has been a proliferation of constructs, models, and theories which result in "a clutter of partially articulated, partially tested theories in the information systems discipline that leads to 'overload' and 'disarray'" (Weber 2012, p. 17). The specialization in behavioural research has resulted in an "ever-increasing proliferation of labels that are sometimes offered as synonyms, sometimes presented as specific aspects of the subsuming construct, or, more often, simply loosely used to refer to the related constructs without self-conscious attempts at a more precise or consensual usage" (Alexander 1991, p. 315). In many cases researchers include constructs which have different names as found in prior literature but measure the same latent phenomenon (synonymy) or include constructs which have the same name but measure different phenomenon (polysemy). Each of these situations reduce the ability to determine the coherence of a theory and contribute to fragmentation and unintentional replication of research (Larsen and Hovorka 2012; Li and Larsen 2011).

The domain of a theory is the set of ancillary and focal phenomena for which a theory provides an account (Weber 2012). But this definition begs the question of which publications, constructs, time frame, and associations (e.g., only significant or including non-significant hypotheses). As many constructs may be synonymous but carry different names, we first reduce the complexity of the nomological net by determining construct synonymy. A reduced set of construct categories will enable the visualization of the network of associations in which theories are embedded. In turn this will enable recognition of the density of theory corroboration and the amount of overlap (Larsen and Hovorka 2012). Construct categorization is a critical step in visualizing the nomological net in any large sample. Although one future goal of this research stream is the automatic identification and categorization of constructs (Li and Larsen 2011), this current research utilizes a manually categorized variable for visualization of the nomological net.

Evidentiary support: Verisimilitude

The classic concept of a nomological net provides a *justificationist* account of constructs and theories in which construct validity and theories "could be fully justified or fully disproved based on observation or empirical evidence" (Smith 2005, p. 397). Philosophical analysis and observation of the scientific enterprise now recognize that no theory can be either fully proved or fully disproved (Lakatos 1970; Meehl 1990; Weber 2012) and strict falsification fails is supporting ongoing research programs. Instead, researchers seek insights into those parts of a theory domain which warrant continuing efforts in testing, amending, and in "honest *ad hockery*". As noted by Meehl (1990, p. 113), "a scientific theory doesn't consist of a single statement about 'simples'… but is a conjunction of interrelated statements about complexes." Therefore a method by which we can engage in retreating to the theory's hard core in the face of apparent falsifying tests must include a means of determining the theory core versus the ancillary periphery.

One insight available through the visualization of nomological networks is the degree of evidentiary support, or *verisimilitude*, of empirical results. We observe that theories in social sciences are too weak to predict a specific numerical value. Therefore when testing for the difference between the observed value and a chance ("null") value, "statistical significance speaks for the theory" (Meehl 1990) rather than supplying a strong or risky test which could falsify the theory. As social science theories are not amenable to strong falsification (Meehl 1990; Smith 2005; Weber 2012), verisimilitude is an indication of core components of theory domain which have been the focus of a high level of research activity. Verisimilitude is not equivalent to the truth of the theory and its auxiliaries or a truth frequency count of the parts. In "speaking for" a theory, significance or associations among

constructs increase "the degree of evidentiary support, the number variety and stringency of empirical tests that the theory has passed or failed" (Meehl 1990, p. 113).

METHOD

Developing the Construct and Hypothesis Dataset

The data set used in this study was manually extracted by a team of advanced undergraduate and master-level students from a large North American research university. Student team members were given a construct extraction test to determine those likely to perform the task successfully and consistently. About 3% of applicants were selected and given further training in the extraction protocol.

The variables and associations were collected from two of the most significant IS research journals, i.e. MIS Quarterly and Information Systems Research. These journals have previously been considered to provide a suitably representative sample of IS research interest (Furneaux and Wade 2009; Nevo et al. 2009; Sidorova et al. 2008) and should contain a set of constructs and a associations which will provide a poof-of-concept. All articles published in the two journals between 1990 and 2009 (20 years) were studied with 327 papers found to contain at least one construct. For these articles, all variables together with their definitions, applicable items and construct citations were collected together with associations between variables. 228 articles contained hypotheses, for a total of 1,713 hypotheses, which in aggregate represent 3,324 variable relationships, including direct relationships, mediated relationships, and moderated relationships. Variables that did not fit in the classification of constructs, demographics and behaviours were removed. Each hypothesis was coded for independent, dependent, mediating, and moderating relationships as well as directionality and significance. In this analysis only direct relationships were visualized.

To make the network more comprehensible, the variables were grouped into categories. Variables were categorized based on the correspondence (as defined below) of each variable with all other variables. Variables which were judged to be essentially the same (e.g. *time-in-job* and *tenure*) or the same latent construct (e.g. *usefulness* and *performance expectancy*) were put in the same category. Construct correspondence was defined as:

> *a construct, C', is correspondent to another construct, C, if some construct measurement items for C' could also be used to measure the latent construct measured by C.*

To operationalize the definition, a construct C' is considered correspondent to a construct C if one or more construct measurement items could be used to measure either construct. The domain experts would base this on similarity between construct measurement items, definitions, names, citations, unit of analysis or other forms of evidence. For non-construct variables like age or gender, it is relatively straightforward to determine whether items are correspondent. In cases where there was some discrepancy, given that items are "closer" to latent constructs than definitions, and undergo rigorous testing, experts reviewed the items concerned. The process was intended to establish whether constructs were sufficiently similar so that knowing about the relationships that construct A exhibited would provide some knowledge of the relationships of construct A'. Categorization allows reduction of the complexity of the nomological net. The process produced a data set of 744 variable categories with inter-rater agreements at 85% and 90% with resulting Cohen's Kappas of 0.68 and 0.79. The agreement levels measured may be considered substantial as a Cohen's Kappa of 1 would indicate complete agreement.

ANALYSIS

Figure 1 shows the whole network of statistically significant associations among construct categories. The width of the directional arrow between construct categories signifies the number of significant associations between variables in the construct categories. In this visualization non-significant hypothesis tests have been excluded. It is apparent that within the data, "everything is somewhat correlated with everything (crud factor)" (Meehl 1990, p. 108) and the breadth of associations in the nomological net renders theory identification difficult.

Figure 1: Nomological network of significant associations among construct categories in 20 years of MISQ and ISR

To locate theories in the network we must first identify what constitutes a specific theory and the publications which provide accounts of the phenomenon the theory explains or predicts. As theories are represented across multiple publications in which the ancillary phenomena are different, the *theory domain* becomes the identifiable unit of analysis. We define a theory domain as "the subset of phenomena in the world that the theory is intended to cover" (Weber 2012, p. 5), and we analyse the data to identify the most frequently researched focal phenomena as these phenomena are what the theory explains. The amount of evidence for an association (Meehl 1990) was represented by the total number of significant associations directed toward the terminating focal categories. The data contain approximately 80 focal phenomena that could be used to identify specific theories. Ranking the number of statistically significant associations terminating in the focal variables suggested a natural break at 14 construct categories which were selected for further analysis. Two experts then combined focal constructs which are ontologically related (Grantham 2004) (e.g. *behavioural intention to use* and *actual use*) resulting in seven highly researched theory domains. The seven resultant theory domains were selected for visualization (Table 1). The domain names do not correspond to the names of the theories provided in the publications. Rather, the names are descriptive of the overall terminating focal construct category.

Table 1. Select Theory domains

	Theory Domain	Number of papers in theory domain[1]	Number of significant associations in theory domain
1	Use	49	601
2	IS Development	9	241
3	Satisfaction with Technology	8	70
4	Organizational assimilation	3	76
5	Business Performance	2	22
6	Sourcing	3	28
7	Creativity	5	32

Each theory domain included all publications in the data set in which the terminating construct categories listed in Table 1 were the focal phenomenon. Thus each theory domain was represented by a set of publications in the data set. All variables and significant associations from each set of domain publications became a subset of the entire data set and were clustered in a visualization (Figure 2). It is apparent that two of the domains (1 & 2) are quite extensive in the number of construct categories, the number of constructs in the categories, and the density of evidentiary support. Indeed, theory domains 1 and 2 account for 56% and 23% respectively of all the hypothesised associations in the subset of data visualized. Figure 2 also illustrates that although there are some construct categories which "bridge" theory domains and may provide pathways for theory integration, the theory domains are largely isolated with few behavioural constructs which have demonstrated influence on other behavioural phenomena outside the specific theory domain.

[1] Due to space restrictions these papers have not been referenced. References are available upon request.

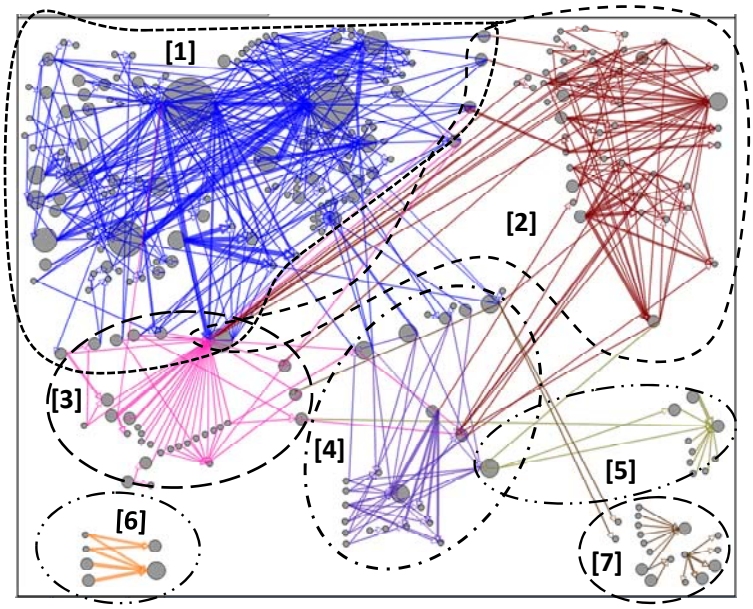


Figure 2. Seven Select theory domains in Information Systems

Although we have now located a set of theory domains in relation to each other, we are as yet unable to determine the core or periphery of the theory domains. As previously discussed, a high level of verisimilitude of the associations between construct categories decreases the likelihood that future research will falsify that association. Verisimilitude increase as associations are tested multiple times in varying contexts and found to provide regular evidentiary support. We posit that these high verisimilitude associations represent *explanatory ubiquity* by showing the core concepts of a theory which "recur when explaining facts in all (or almost all) of the phenomenal domains that the theory purports to address" (Meehl 1990, p. 112).

Figure 3 illustrates the construct categories in the *use theory* domain ([1] in Figure 2). In Figure 3, only those associations which have 3 or more significant results between category pairs are shown. To be clear, these illustrated associations are aggregated between the categories, not between individual constructs. The visualization makes clear that a minority of constructs categories have significant associations ≥ three instances. The thickest lines indicate that only three associations among four construct categories have been corroborated ten or more times. This visualization also reveals the emergence of a subset of the use theory domain identified as EDI Intention. This sub-network is interesting, because although the focal phenomenon is a specific intention, the ancillary constructs remain disconnected from other use domain constructs until single significant hypotheses are included (single associations are not shown).

The concept of *explanatory ubiquity* refers to those concepts which appear in a majority of all studies belonging to a theory domain (Meehl 1990), is illustrated in Table 2. For example, the *usefulness* construct category is composed of 36 correspondent constructs indicting that researchers used a large number of conceptually synonymous constructs in the studies. Constructs in the category were found in a majority of the studies in the domain indicating that it is a core postulate of the theory domain. In addition, the association between the *ease of use* category (20 correspondent constructs) and the *intention* category (32 constructs) has been found to be statistically significant for 15 hypotheses in 9 unique studies. Both of these examples have a higher verisimilitude as indicated by a greater number of significant test results across a wide range of studies than the construct category of *vividness*, which only appears in one study.

Table 2. Explanatory ubiquity and verisimilitude of select associations in the *Use theory* domains

Antecedent Construct category name	# constructs in category	Consequent construct category name	# of constructs in category	Number of Significant hypotheses	Number of studies
Usefulness	36	Intention	32	13	11
Ease of Use	20	Intention	32	15	9
Social Influence	14	Intention	32	16	9
Intention	32	Use	11	9	2
Usefulness	36	Use	11	6	4
Technology functionality	9	Usefulness	36	9	1
Vividness	8	Affect towards technology use	13	8	1
Affect towards technology use	13	Intention	32	5	5

The *usefulness* category has 13 significant associations to the *intention* category in 11 unique studies. As there are a relatively high number of significant tests across multiple studies, these can be interpreted as representing high verisimilitude associations. As causal inference chains are extended outward from these well corroborated core construct categories, explanatory ubiquity and the number of significant associations decreases suggesting less well established peripheral parts of the theory domain. Table 2 shows the number of constructs per category, the number of significant associations, the number of non-significant hypotheses and the number of unique studies for the network connection ≥ 3 associations in the Use theory domain illustrated in Figure 3.

Although the table displays only a sample of the network shown in Figure 3, it is apparent that as the chain of associations is extended out from the core categories, the verisimilitude decreases sharply, both in the number of significant hypotheses and in the number of studies which test the associations under different contexts. For example, the derivation chain *Vividness – Affect toward technology use – Intention—Use*, verisimilitude is much

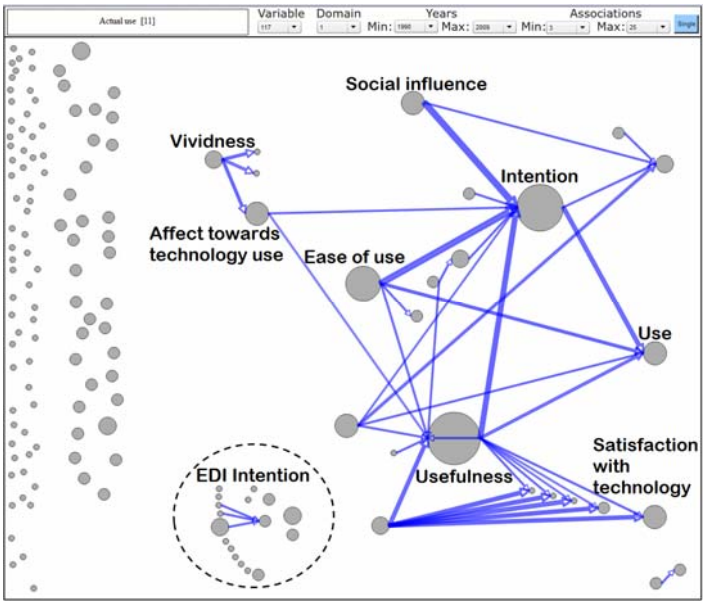
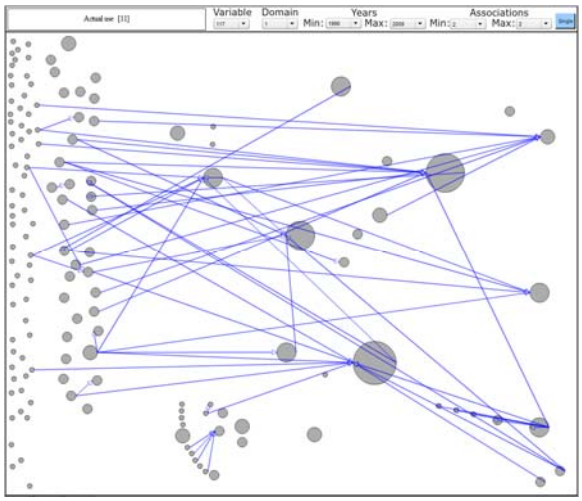


Figure 3: Use Theory Domain with associations ≥ 3 significant tests

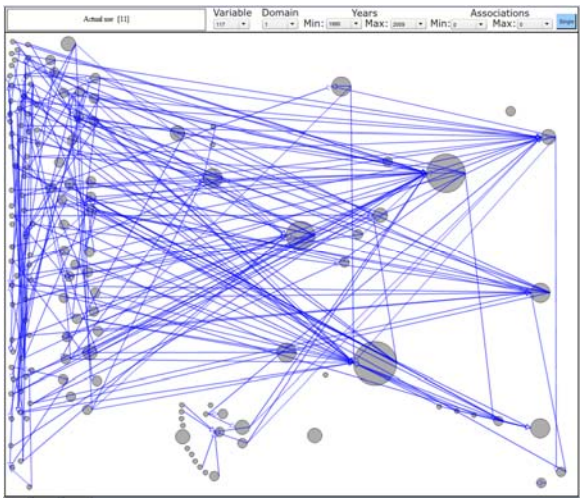
greater on the *Use* end of the chain, while the *Vividness—Affect* association has only been tested in one research publication. Also of note in Figure 3 is the emergence of a separate theory domain accounting for the adoption of EDI. Although the associations among its core constructs have at least three significant associations, that network remains disconnected from the main use theory network until single corroborations of low

verisimilitude are considered. This indicates an opportunity for research to integrate EDI adoption theory domain with the overall *use theory* domains.

To contrast the theory core illustrated in Figure 3, we illustrate two views of the periphery of the *use theory* domain. Figures 4a and 4b illustrate the associations that form the periphery of the *Use theory* domain. In Figure 4a only associations which have been tested and found significant two times are visible (constructs categories are in the same relative positions in each figure). In Figure 4b the associations which are supported by only a single reported test are shown. In comparison to the higher verisimilitude associations illustrated in Figure 3, in the face of "unfavourable outcomes" in future research, the associations at the periphery shown in Figure 4 a & b could be discarded or revised without affecting the core components of the theory domain**.**

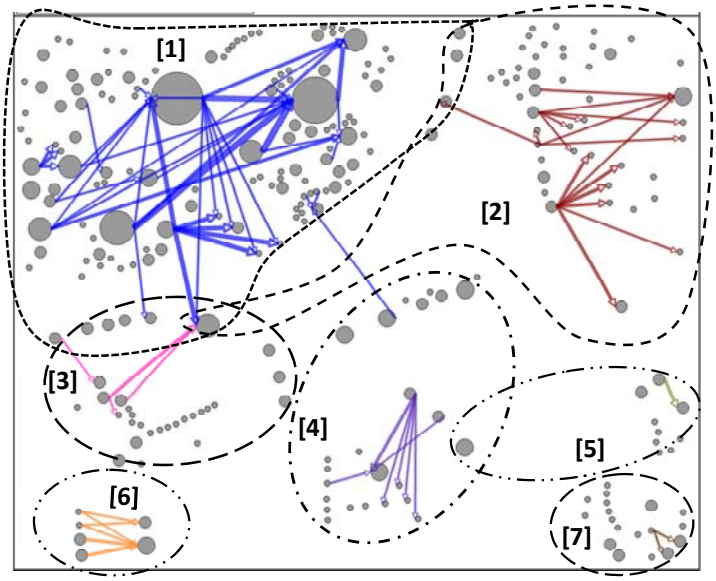


Figures 4a: *Use theory* domain illustrating periphery associations with two significant tests.



Figures 4b: *Use theory* domain illustrating periphery associations with only a single significant test.

We now return to the seven theory domains from Figure 1 to illustrate the concept of *explanatory ubiquity* in the context of multiple theory domains. We reanalyse the nomological net and visualize only the associations with ≥ three significant associations (Figure 5). The absolute value of three associations is arbitrary but serves to demonstrate that, in most domains, a limited percentage of associations are found across multiple studies to have explanatory power. All of the construct categories in the seven domains are projected, and comparison with Figure 1 indicates that few associations are ubiquitous across studies. Those that are represent the core, or axiomatic associations in the theory domain. In addition, construct categories which are distant from the central concepts (e.g. *vividness*) have few significant hypothesis and have been tested in few contexts.



Figures 5: Select theory domains illustrating periphery associations with ≥ three significant tests

LIMITATIONS

This research illustrates one approach to the core-periphery distinction in theory domains from a particular perspective on theory. Weber's (2012) exposition stands in contrast to other descriptions of theory (Gregor 2006; Straub 2012) about which our approach is silent. In addition, our approach limits the data to only those quantitative research papers in two top journals that include constructs and hypotheses. Other theoretical forms (e.g. design theory, process theory, systems theory) are not represented here. Definitive identification of the high verisimilitude core of specific theory domains is not resolvable with only two journals in our data sample, and we make no claims about theoretical density regarding the IS field as a whole. The addition of constructs and hypotheses from other journals would reinforce some patterns and change the verisimilitude of theory domains and thus the core-periphery distinction. This research focuses on the subset of the data that are directly involved in the seven most highly researched theory domains. In addition, the manual development of construct categories is open to interpretation and a different categorization approach would result in a similar but different nomological network.

DISCUSSION

Our research goal is to extend theorizing about theory to include the concepts of explanatory ubiquity and verisimilitude as distinguishing characteristics of the core-periphery distinction. This research contributes to our understanding of theory in three ways:

First, visualization of the theoretico-empirical network of associations among construct categories reveals the landscape in which theories reside. Analysis of this landscape reveals patterns of constructs and associations that have high verisimilitude and form an explanatory core for each theory domain. These core concepts have accumulated a high level of evidence for the theory across multiple contexts and have become ubiquitous in explanation and prediction of the focal phenomenon of the domain. In contrast, low verisimilitude peripheral associations and constructs, while providing novelty and extension of the theory, are vulnerable to falsification and refinement in the face of non-significant or contradictory outcomes. Verisimilitude is currently insufficiently defined to allow quantitative appraisal, in part because measures are dependent on the specific data set used in the analysis. But even the fuzzy notion supplied here permits the identification of theory domains and core postulates that enable researchers to better describe, bound, and extend theory development. Future research on meta-analytic methods may increase our ability to appraisal and testing of theory domains.

Second, the analysis suggests a means to distinguish the axiomatic theory core, which is unlikely to be falsified, from the novel but more tenuous periphery of the theory. In defending theory from inevitable "unfavourable outcomes" a Lakatosian defence requires that researchers recognize which parts of the theory are most amenable to refinement, redefinition, or removal. The core-periphery distinction also reveals that some theory domains are "all core" suggesting research opportunities to extend or integrate theory domains. For example, the current *IS Development* domain is focused on the focal phenomenon of *project success* but poorly integrated with any constructs relating to *actual use* or the antecedents of *ease of use,* or *usefulness.* Integration of these theories would extend the *use theory* domain and lead to an account of IS development practices which result in systems which are actually used, rather than unrelated measures of project success.

Finally, the analysis highlights a remarkable focus on two specific theory domains in highly ranked IS journals. Although a large number of the constructs in the domain are novel, there is little evidentiary support for the associations (e.g. in the *use theory* domain, 60% of the significant associations have been tested only once) suggesting that, in addition to continued extension of the theory domain, corroborating tests would strengthen the theory domain and extend the theory core. Current core parts of the theory domain may have reached saturation such that research efforts and publication can turn to encouraging increasing theory depth and integration.

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