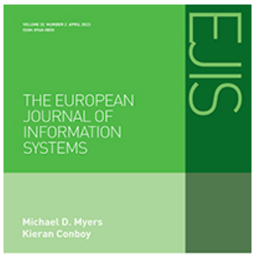

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Splitting versus lumping: narrowing a theory's scope may increase its value

Mikko Siponen[a], Tuula Klaavuniemi[b] and Quan Xiao[c]

[a]Faculty of Information Technology, University of Jyväskylä, Jyväskylä, Finland; [b]Oncology Department, Mikkeli Central Hospital, Mikkeli, Finland; [c]School of Information Management, Jiangxi University of Finance and Economics, Nanchang, China

ABSTRACT
Specialisation, by seeking theoretically deeper explanations or more accurate predictions, is common in the sciences. It typically involves splitting, where one model is further divided into several or even hundreds of narrow-scope models. The Information Systems (IS) literature does not discuss such splitting. On the contrary, many seminal IS studies report that a narrow scope is less strong, less interesting, or less useful than a wider scope. In this commentary, we want to raise the awareness of the IS community that in modern scientific progress, specialisation – an activity that generally narrows the scope and decreases the generalisability of a hypothesis – is important. The philosophy of science discusses such positive developments as splitting and trading off a wide scope in favour of accuracy. Narrowing the scope may increase value, especially in sciences where practical applicability is valued. If the IS community generally prefers a wider scope, then we run the risk of not having the information necessary to understand IS phenomena in detail. IS research must understand splitting, how it results in narrowing the scope, and why it is performed for exploratory or predictive reasons in variance, process, and stage models.

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1. Introduction

Scientific progress typically involves specialisation, in which seeking theoretically deeper or more accurate explanations or predictions has led to narrowing the scope of a model (Craver, 2009). Such developments that lead to narrowing the scope of a model are called *splitting* (Craver, 2009). Alternatively, they are called the trade-offs between accuracy and a wide scope, suggesting that a wide scope generally occurs at the cost of sacrificing accuracy. Unfortunately, in Information Systems (IS), splitting and such trade-offs are not well understood. In fact, many IS views on generalisability outline scope preferences, such as a wider-range model is better than a narrower-range model, or the latter runs the risk of becoming unimportant and uninteresting (Davison & Martinsons, 2016; Hassan & Lowry, 2015; Weber, 2012). Other views explicitly note a wider scope as a strength of scientific modelling; a qualification that is not assigned to narrower-scope models (King & Lyytinen, 2004; Lee, 1989). Furthermore, Aurigemma and Mattson (2019) report that top IS journals have a "strong preference" for publishing "broadly generalisable models" instead of models that account for a specific phenomenon. Similarly, Davison and Martinsons (2016) report a tendency in IS to favour models with a universal scope. The authors criticise this tendency, as it omits contextual understanding, and their solution is to take the "context" of the study seriously (Davison & Martinsons, 2016).

The major aim of this article is to raise the awareness of the IS community that a wider scope is not necessarily stronger or preferred over a narrower scope. Furthermore, the philosophy of science contains important concepts either not discussed in IS (splitting and lumping) or rarely discussed (trade-offs), which shed new light on model scope preferences. IS thinking has not yet benefitted from these concepts. A review of these concepts leads us to contest the influential common (albeit not universal) IS beliefs that studies with a narrower scope are less strong, less useful, less interesting, or less important than studies with a wider scope.

Considering splitting and trade-offs between scope and accuracy also helps move Davison and Martinsons (2016) proposal of "taking context seriously" forward. This proposal (Davison & Martinsons, 2016) raises the crucial question of why adding the context adds value. Splitting and trade-offs help us understand that adding or removing the "context" *per se* is hardly the point. The question is, rather, to what extent does adding the context improve either *explanatory* or *predictive accuracy*. Improving such accuracy, in turn, may lead to choosing narrow-scope models over those with wider scopes.

The commentary is organised as follows. In section 2, we discuss the basic concepts that the philosophy of science uses for cases in which the scope is narrowed and generalisability is decreased. In section 3, we discuss IS scope beliefs. In section 4, we discuss splitting

CONTACT Quan Xiao xiaoquan@foxmail.com

or lumping in common modelling practices in IS. In section 5, we present implications for IS research and finally, conclusions.

2. Basic concepts: splitting versus lumping and scope implications

In this section, we outline the basic concepts used. We first note (section 2.1) how in sciences, activities which lead to widening a model's scope are known as lumping (Craver, 2009). We also note how seeking *generic* explanations or predictions tends to widen the scope (section 2.1). In turn, putting a premium on accuracy, precision, or specific explanations often leads to narrowing the scope, also known as splitting (section 2.2). In section 2.2.1, we summarise why such activities leading to lumping or splitting are performed.

2.1. Lumping and generic explanations

Lumping refers to cases in which a model or hypothesis integrates two or more phenomena into one, resulting in widening the scope (Craver, 2009). Especially in law-based sciences, preferences for lumping, known as unification, have been common (Kitcher, 1981; Niiniluoto, 2016; Thagard, 2010; Whewell, 1840). As a simple example, consider the following laws: (1) "All Berliners are mortal". (2) "All Germans are mortal". (3) "All Europeans are mortal". (4) "All people are mortal". Integrating 1–3 (e.g., "all Europeans are mortal") under 4 ("all people are mortal") is lumping. Outside of laws, lumping makes sense, for instance, when one explanation adequately explains two or more phenomena (Craver, 2009; Darden, 2008). If so, these two (or more) phenomena can be treated as one phenomenon. Alternatively, lumping may also make sense if one wishes to focus on commonalities across different phenomena. Philosophers call such cases generic explanations or predictions (Rosenberg, 1999). A classical, easy-to-understand example is explaining cybercrime as driven by financial gain or poverty (Abia et al., 2010; Burrell, 2008). Following Rosenberg (1999), these two examples can be called generic predictions: Poverty is a predictor of cybercrime. Or a generic explanation: Seeking financial gain explains cybercrime. Such generic explanations and predictions sound appealing, as cybercriminals often seek financial benefits. However, such a generic explanation does not help us understand cybercrimes in detail.

2.2. Splitting and specific explanations

Especially outside of law-based science, where the phenomenon is indeterministic – that is, complex, even emergent, and dynamic – splitting is highly common (Craver & Bechtel, 2006; Craver, 2009; Cummins, 2000). With splitting, "phenomena are often subdivided, consolidated, or reconceptualised entirely as the discovery process proceeds. Researchers may recognise the need to subdivide a phenomenon into many distinct phenomena" (Craver & Bechtel, 2006, p. 473). Usually, the aim of splitting is to increase the explanatory or predictive accuracy of a specific phenomenon, which may result in preferring a narrow-scope model. Schacter (1996) provides an example:

> We have now come to believe that memory is not a single or unitary faculty of the mind, as was long assumed. Instead, it is composed of a variety of distinct and dissociable processes and systems. Each system depends on a particular constellation of networks in the brain that involve different neural structures, each of which plays a highly specialized role within the system. (p. 5)

In other words, splitting means that what was once regarded as one phenomenon was later divided into two (or more) phenomena. In the case of splitting, the scope is narrowed as an outcome, as each "sub-model" has a narrower scope than the original model. In the life sciences, this has led to situations in which what was once regarded as one phenomenon is later subdivided and further subdivided into hundreds of highly narrow models (Sudhakara, 2009). Similarly, as mentioned, understanding in detail how different cybercrimes occur may require crime-type-specific models. For example, an adequate scientific explanation for hacking is hardly the same as that for online romance fraud on dating apps, even if both are financially motivated. Adequate scientific explanations of these cases may require crime-type specific models which focus on *specific* explanations or predictions. These are the opposite of generic predictions or explanations (e.g., seeking money explains cybercrimes; Rosenberg, 1999).

2.2.1. Summary: why do splitting or lumping, and implications of the models' scope

In summary, the usual case of why splitting is performed is straightforward and is related to putting a premium on explanatory or predictive accuracy (Table 1).

Why was memory "divided into echoic, episodic, procedural, and working memory" (Craver, 2009, p. 581)? This was due to "different mechanisms for each" (Craver, 2009, p. 581) or "more or less distinct mechanisms to explain them" (Craver & Bechtel, 2006, p. 473). This is an explanatory reason. Another reason why the scope may narrow, or a narrow-scope model or even a narrow-scope hypothesis is preferred, is related to the predictive results. Following Salmon (1981, p. 117), theories or models which have "predictive content" say something "about future events". Why, in medical research, are there highly narrow scopes or even unique treatments for a particular

Table 1. A summary of key reasons for splitting and lumping. P refers to a phenomenon. Splitting or lumping can occur at the level of models or hypotheses. *M* = model.

		Explanatory reasons for doing it	Predictive reasons for doing it	Scope implications
Lumping	Integrates two or more phenomena (P1, P2 . . . Pn) into one M	The same set of explanations individually explain P1–Pn without explanatory loss	The same predictors individually are sufficient for P1–Pn without a loss of significant predictive accuracy	The resulting M has a wider scope in terms of the phenomena covered than P1, P2,. . .Pn alone
		Focus on some but not all explanatory commonalities across P1–Pn	Focus on some but not all predictive commonalities across P1–Pn	The resulting M has a wider scope in terms of phenomena covered than P1, P2, Pn alone, but at the expense of predictive or explanatory loss
Splitting	Breaks down one phenomenon (P1) into several different phenomena (P1 and P2) or M1, M2	The explanations for P1 do not offer adequate understanding for P1 and P2	The P1 predictors are ineffective for P1 and P2	The resulting models have narrower scopes

disease? The answer is straightforward. It is hoped that they will be more effective than a general treatment. The aim of such research is not necessarily to explain but to maximise the treatments' (predictive) effects and minimise the side effects. As a simple example, the same influenza vaccine is not expected to be effective for all types of influenza. However, even within the same type of influenza, new variants of the type of influenza virus may require variant-specific models and variant-specific vaccines. We call this prediction accuracy.

In turn, why lumping is preferred is often related to two issues. First, if the same explanations or predictions are adequate for explaining or predicting two (or more) different phenomena without any loss of explanatory or predictive accuracy, then this is a reason to combine them into one model. Second, we can examine commonalities across several phenomena, such as economic benefits as a predictor of cybercrimes. Such cybercrime, for example, focuses on explanatory commonalities (e.g., economic benefits) across different cybercrimes. However, this is at the expense of explanatory accuracy. This is because generic explanations, such as "economic benefit", cannot explain a cybercrime in detail. Most people may prefer financial benefits, yet most of us do not become cybercriminals. However, such generic explanations or predictions are not useless, not even practically. For example, "poverty is a predictor of (cyber) crime" is sometimes used as an argument by politicians or in socio-political debates to argue for minimising the income gap in a state in general or some tax policy in particular. Despite this, for companies to prevent cybercrimes, and for social media companies and internet service providers to stop and find such crimes on their platforms, more accurate or specific accounts are clearly needed.

Finally, since the 1950s, scientists have discussed trade-offs in the context of lumping and splitting (Kuhn, 1970; Laudan, 1971; MacArthur & Levins, 1964). Such trade-offs assume that (in realistic models) one cannot have a wide scope and precision at the same time. Instead, scientists often need to sacrifice one for the other.

3. Scope preferences in IS literature

As noted, scientists and philosophers use various concepts to describe activities that narrow or widen a model's scope: splitting, lumping, trade-offs, and specific vs. generic. What does the IS literature say about these concepts, and does the IS literature on scope preferences recognise that the scope can be narrowed to improve accuracy? Answering these questions suggests that many IS scholars believe that a wider scope is preferred over a narrow scope or that a narrow scope runs the risk of being uninteresting and unimportant. The opposite movement in IS argues for the importance of "context" instead of "universalism" or broad-range models (Aurigemma & Mattson, 2019; Davison & Martinsons, 2016).

3.1. Preference for universal or broad-range models

Davison and Martinsons (2016) argue that IS scholars often "appear to assume that a given theory that they are adopting is universally applicable. The context and the boundary conditions that governed the original instantiation of the theory are commonly ignored" (p. 242). They note several reasons for this activity. One reason relates to scientific preference, according to which "research that is relevant for and applicable to a wider range of phenomena is traditionally considered to be more useful" (Davison & Martinsons, 2016, p. 242). IS literature contains statements according to which a wider-range model beats a narrower-range model, or the latter runs the risk of becoming unimportant (e.g., Hassan & Lowry, 2015; Weber, 2012). Other researchers view a wider scope as a strength of scientific theories, a qualification that is not assigned to narrower-range theories (e.g., King & Lyytinen, 2004; Lee, 1989).

However, Davison and Martinsons (2016) do not advocate such a wide-scope preference. For instance, due to this preference, "cultural and contextual details may be ignored or neglected as they may impede that wider application" (Davison & Martinsons, 2016, p. 242). The authors (2016) suggest adding context to the model, which implicitly limits its scope. Similar to Davison and Martinsons (2016), Aurigemma and Mattson (2019) see top IS journals as having a "strong preference" for publishing broad-range models at the expense of models that focus on specific phenomena. Their evidence is from IS security, where studies note "limitations" of cases in which the model does not explain a range of phenomena (Aurigemma & Mattson, 2019). For these authors, these limitations are not genuine. Aurigemma and Mattson (2019) link this activity to top IS journals' "strong preference" for broad or universal models. In IS, reporting such "limitations" occurs outside of IS security as well. For instance, findings specific to a certain type of technology, type of worker, or country are often reported as "limitations", because they may not generalise to other types of technology or workers, or countries (Aahuja et al., 2007, p. 11; Bala & Venkatesh, 2013, p. 1135).

3.2. Justifications for wide-scope preferences in IS

Davison and Martinsons (2016) and Aurigemma and Mattson (2019) document common preferences in literature for broad-range or universal models, which they criticise (section 3.1). Less documented in IS is the justification for why a wide scope beats a narrow scope.

Many seminal articles in IS warn or imply that theories covering a limited set of phenomena are unimportant or cannot be strong theories. These IS views are sometimes justified with reference to the natural sciences or economics. Consider, for example:

> the strongest of theories tend to be broadly applicable and enhance multiple lines of inquiry, as seen in many theories of economics, psychology, and social behavior. Likewise, theories of thermodynamics had great influence across a huge swath of fields, from high-energy physics to molecular biology. (King & Lyytinen, 2004, p. 547)

This implies that a theory with a narrow scope cannot enjoy the status of a strong theory, and different fields, from economics to life sciences, are pointed out as evidence. First, regarding molecular biology and psychology (King & Lyytinen, 2004), this view omits the fact that numerous breakthroughs in these fields have, in fact, occurred through specialisation, resulting in narrowing the scope (as discussed in section 2). Second, this view omits the fact that many theories in different sciences, including those mentioned by King and Lyytinen (2004), are wide in scope at the expense of precision and accuracy (Cartwright, 1983; Wimsatt, 2007). For example, regarding economics (King & Lyytinen, 2004), Nobel laureate Friedman's (1953) methodology of positive economics highlights such trade-offs (Mäki, 2009). It is definitely not self-evident that in such trade-offs, a wide scope is automatically preferred. For instance, making such trade-offs and focusing on generic predictors is a major criticism of classical economic theory. According to Rosenberg (1999, p. 567), "economic theory seems permanently stuck at the level of what I have called generic predictions", as it "failed to explain economic processes with anything like improving accuracy and precision". We use economic benefit as a predictor of cybercrime as an example of a generic prediction (section 2).

Moreover, many method articles contain preferences which can be interpreted in favour of widening rather than narrowing the scope. For example, a seminal case study method known as "scientific methodology for MIS case studies" notes that "an often admired quality of theories in natural sciences is their applicability to a range of settings" (Lee, 1989, p. 35). However, first, a case can also be made that an admired quality of theories in natural sciences, especially in life sciences, is increased precision, resulting in targeted vaccines or other medical treatments. Without narrow-scope models, we would not have these specific treatments. Second, this natural science justification also omits the fact that natural science theories are often made wide in scope at the cost of sacrificing accuracy (Cartwright, 1983; Wimsatt, 2007).

Scope preferences are also found in IS theory accounts. Although Gregor (2006, p. 616) notes that "varying degrees of generality are possible in theories", many other IS scholars have outlined wide-scope preferences. Weber (2012) offers theory evaluation characteristics, which we cannot cover fully here. We focus on "levels of theory", and among these, he highlights two: One is very narrow, while the other is broad (Weber, 2012).

Narrow: "Some theories cover a very narrow, constrained set of phenomena... its predictive and/or explanatory powers might be high in relation to the phenomena it covers. Because of the limited range of phenomena it covers, however, it runs the risk it will be deemed uninteresting and unimportant" (Weber, 2012, p. 15).

Broad: "Some theories cover a broad range of phenomena... It has a high level of generality ... its predictive and/or explanatory powers in relation to the more-specific phenomena that are a researcher's focus are limited" (Weber, 2012, p. 15).

To Weber's credit, his account introduces and associates predictive and/or explanatory powers with the level of generality. For a narrow theory, roughly speaking, the power is high; for a broad theory, the power is limited. Although Gregor's (2006) theory account does not discuss trade-offs or splitting, Weber (2012, p. 15) recognises trade-offs: "Generality can be attained only by trading off a theory's accuracy and/or simplicity (parsimony)". Despite recognising such trade-offs, Weber (2012) does not explain why a narrow theory runs the risk of being unimportant if (as he notes) its exploratory or predictive power is high. As noted in section 2, narrowing a model to focus on a constrained set of phenomena by increasing the explanatory accuracy, contrary to Weber (2012), may render the narrow scope theory important.

Our final example is Hassan and Lowry (2015, p. 2), who see "the range and scope of theories" as superficially discussed. In this regard, in the context of Merton's middle-range theories, they claim, "Presumably, the wider the range of the theory's application, the more generalisability it offers and the stronger the theory" (Hassan & Lowry, 2015, p. 9). Unfortunately, this view cannot do justice to splitting. In such cases, the range of a theory or model is narrowed with the hope of improved strength in terms of explanatory and predictive accuracy. For example, a theory which covers all kinds of IT use, such as the unified theory of acceptance and use of technology (UTAUT; Venkatesh et al., 2003) or the technology acceptance model (TAM; Davis, 1989), may be weaker in terms of being explanatory or predictive than a specific narrower-scope theory or model focusing on specific applications of IT use.

3.2.1. Summary: scope preferences in IS

Wider-scope preferences are introduced to IS as a traditional scientific preference or an admired characteristic of the sciences, especially the natural sciences (Davison & Martinsons, 2016; Lee, 1989). Typically, it is just taken for granted that the wider the scope (or explanatory breadth), the more interesting, useful, and important the study. Many of these scope preferences in IS are written as precision in terms of either explanatory or predictive accuracy having no role, or its role is minimal.

Some editors and reviewers of the top IS journals have dismissed the debate of narrow vs. wide scope by simply telling us as a self-evident fact that high-quality journals in the sciences publish studies with wide scopes, and that "low quality" journals publish studies with narrow scopes. Such views are potentially dangerous (Aurigemma & Mattson, 2019), as they cannot account for the scientific progress in sciences, called specialisation, which occurs by narrowing the scope and generalisability. Had such views been imposed by top medical journals, the consequences could have been life-threatening. In medical research, top journals, such as the *New England Journal of Medicine* (NEJM) and *The Lancet*, also publish narrow-scope studies in which one or two specific treatments are examined for a specific cancer or a specific virus mutation (Connors et al., 2018). Scholars decrease the scope and focus on the narrow-scope phenomenon for theoretical depth (explanatory accuracy) or the hope of improved predictive results (predictive accuracy). Broad-scope preferences in IS (cf., Aurigemma & Mattson, 2019), if imposed, run the risk of ignoring or downplaying specific findings (or accuracy), thus limiting scientific progress.

4. Possible indicators of splitting and lumping in typical IS models

As noted, the key reasons for splitting are explanatory or predictive. To give a simple example, if people have different reasons for using Facebook rather than Twitter, then this is a possible indication that separate theorising or different explanations may be required for each – if we want to understand them in detail. In such a case, we can have a more abstract and general model that explains Facebook and Twitter use, but this model may offer less accurate explanations for Facebook and Twitter use than specific models for each. More concretely, what are the splitting indicators in IS theories and models?

There are some theory accounts in IS. IS theories are "statements of relationships" (often propositions or hypotheses) between "primary constructs" (Gregor, 2006). According to Gregor (2006), theories have scope, means of representation, and testable propositions. According to Weber (2003, p. iv), "The theory we seek to build in essence is an attempt to articulate a law (or less formally an association or statement) that relates the value of two components". According to Tan et al. (2008), most IS theories are

> valid knowledge claims that seek to explain causally why something occurred by means of an outcome, criterion, or dependent variable in the context of specific conditions that are captured as a set of antecedent variables denoted as independent or mediating variables. (p. 41)

It is also useful to relate splitting to specific modelling practices in IS. According to Rivard (2014), "most theoretical models that are developed in the IS domain are either variance or process models" (p. ix). There are also stage models (Tsohou et al., 2020). Indicators of splitting and lumping are summarised in Table 2.

4.1. Variance or continuum models

Viewing theory as a statement of relationships, articulating a "law" (Weber, 2003) and relationships between independent variables (IVs) and dependent variables (DVs; Tan et al., 2008) fits best with

Table 2. Possible indicators of splitting and lumping. Splitting and lumping are often symmetric in terms of explanatory or predictive reasons (e.g., same explanations -> lumping, explanatory differences -> splitting). The table contains possible indicators, which require case-by-case considerations.

Models	Possible indicators for splitting and lumping
Variance or stage-less models	1) the relationship between an independent variable (IV) and a dependent variable (DV), 2) lacking some variables, 3) needing some variables, 4) the same variable seems to have important variations in different settings.
Process models	1) Different event(s), 2) variation in the causality of the events, i.e., event progression is different, 3) lacking some events, needing some events.
Stage models	1) differences between stage-dependent variables, 2) differences between ordering of the stages, 3) a lack of some stage(s), 4) needing some stage.
Switching between models	e.g., stability assumption in variance models may not hold

variance model types of theories, sometimes called continuum models. In such models, a theory generally contains a set of hypotheses, for example, between IVs and DVs. For the sake of simplicity, we focus on an individual hypothesis from the theory instead of the whole theory as a set of hypotheses.

IS generalisability accounts often describe the applicability of a theory as either-or affairs, such as "yes or no", "true or false", "valid or not valid", and "statistically supported or not" (Davison & Martinsons, 2016; Lee & Baskerville, 2003; Seddon & Scheepers, 2012). Following this path, a lack of empirical support for a hypothesis (e.g., an IV and DV relationship) in a specific context may indicate splitting.[1]

Furthermore, in dynamic settings, a theory, or its individual hypotheses, is expected to vary in degrees (Siponen & Baskerville, 2018; Ylikoski & Kuorikoski, 2010). Viewing the applicability of a theory or model as either-or affairs, such as "yes or no", "true or false", "valid or not valid" (Davison & Martinsons, 2016; Lee & Baskerville, 2003; Seddon & Scheepers, 2012) is insufficient to capture probabilistic hypotheses. For example, saying that vaccine 1 offers 80% protection within 8 months against a serious SARS-CoV-2 condition is more informative than saying vaccine 1 is "valid". It is also useful in IS statistical studies to measure such probabilities (Siponen & Klaavuniemi, 2020), which simply measuring statistical significance does not capture. Consider, for example, a dual platform, which many companies offer to their customers (Song & Zahedi, 2001). There are different versions of the same application for the web, tablets, and smartphones. For example, if you access Amazon or your bank through a web interface, different features are available compared to mobile apps. Which features are available can depend on the type of application. Take online shopping, for example. Perhaps sitemaps and product categories are more useful features for web apps than for tablet and mobile apps (Islam & Bouwman, 2016). Gesture zooming might be a useful feature in tablet apps compared to web apps (Tarute et al., 2017). Mobile payments might be useful for mobile apps, and this feature might be less useful for web and tablet apps (Xiao et al., 2022). The issue is not "valid or not valid", but such probabilistic-like evidence might look like the following:

> The app feature sitemap increases the likelihood of IT use in web apps by 20% to 30%, all other things being equal.
>
> The app feature sitemap increases the likelihood of IT use in tablet apps by 15%, all other things being equal.
>
> The app feature mobile payment increases the likelihood of IT use in mobile apps by 70%, all other things being equal.
>
> App feature 1 increases the likelihood of IT use in web, tablet, and smartphone apps by 25%, all other things being equal.

In other words, the degree of support a hypothesis enjoys can vary according to the setting. If we measure such probabilities, we may realise how they vary, which, in turn, leads to splitting. A dual platform is a case in point. For example, some app features can have different results for web versus mobile apps. Such cases can limit the scope or call for splitting.

Recognising the possibility of varying degrees of support may lead to reconsidering the applicability of known models, even those we consider most well-supported, requiring no further studies. This may lead to splitting. Consider the UTAUT (Venkatesh et al., 2003) or the TAM (Davis, 1989). To simplify this point, we further focus on ease of use (the TAM), which the UTAUT refers to as effort expectancy and "defines . . . as [the] degree of ease associated with the use of the system" (Venkatesh et al., 2003, p. 450). In the TAM, ease of use is considered a fundamental determinant of user acceptance of IT (Davis, 1989, p. 319), and the scope of ease of use appears to be wide: IT use. The same applies to the UTAUT's effort expectancy.

However, a closer look might reveal that ease of use (i.e., effort expectancy) varies according to the application features and system type. For example, some app features might lead to a 40% increase in user acceptance of a system in some restricted situations in which the study applies. There could be many different ease-of-use characteristics, which could vary, for example, per user type, hardware type (smartphone, tablet versus PC), software type, and so on. Such studies are practically useful because practitioners arguably want some information regarding the extent to which some system characteristics influence, for example, IT use. Such cases can limit the scope of the extant model, thus resulting in splitting.

4.2. Process models

Process model theorising is an event-based explanation (Burton-Jones et al., 2015; Pentland, 1999; Rivard, 2014), typically involving a causal sequence of events (Pentland, 1999; van de Ven & Poole, 1995). Process explanations answer why (Pentland, 1999, p. 711) or "explain how and why changes unfold" (van de Ven & Poole, 1995, p. 511). To briefly illustrate splitting, consider cybercrimes known as advance-fee fraud (AFF). AFF models capture various cyber scams, from investment opportunities to online romance fraud involving advance payments (Dobovšek et al., 2013). However, the actual process by which these cyber frauds unfold can vary according to the type of cybercrime.

In process models, splitting typically occurs if there is an important phenomenon in which the events or the causal sequence of events is significantly different from existing model(s). In turn, if the events or the causal sequence of events for two distinctive phenomena turns out to be the same, it raises the question of whether they should be regarded as the same phenomenon or explained by the same model (lumping if the two phenomena are combined).

4.3. Stage models

Stage models, such as process models, also explain change or development (Weinstein et al., 1998). In stage models, however, understanding occurs by dividing the development into phases called stages (Tsohou et al., 2020), as shown in Figure 1.

In stage models, the indicators for splitting are differences in terms of stages, stage-independent factors, or movements between the stages (e.g., the order of the stages or jumping between the states). For differences in terms of stages, consider the following simple example of a generic AFF model. A generic AFF stage model may contain the following: 1) Setting the hook (e.g., a phishing email sent to millions). 2) Some victims buy the hook: Explaining the investment or romance opportunity to victims. 3) Asking for money in advance. However, a closer look may suggest that these three high-level steps with the generic AFF model miss some key activities – stages—of specific AFF cybercrimes. This can lead to splitting, resulting in specific AFF models for (say) romance scams in dating apps, which have a narrower scope than a generic AFF model.

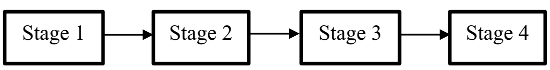

Figure 1. Example of a stage model with four stages.

In turn, differences in stage-dependent variables mean that each stage has stage-specific variables. If two stages (e.g., stage 1 and stage 2) have the same explanations or predictors, then at least these stages can be combined (Weinstein et al., 1998). In turn, realising that some set of phenomena, which stage model A represents, varies from model A in terms of stage-dependent explanations, could lead to splitting.

Finally, movements between the stages mean, for example, that they are the same for phenomena A and B, but the order of the stages is different (Tsohou et al., 2020). Another issue is jumping between stages. Consider a model that accounts for phenomena A and B. The stages for the two phenomena, A and B, are the same, but phenomenon A may have a movement bypassing the typical sequence of stages, which is important for understanding the phenomenon. Splitting happens if this leads to a new model to account for phenomenon A.

4.4. Switching between models

Splitting may also result, for example, in continuum or variance models being divided into stage models. What does this mean? Many IS models called variance models, such as the TAM (Davis, 1989) and the UTAUT, assume stable predictors (Burton-Jones et al., 2015). In such models (e.g., the TAM and the UTAUT), the independent variables do not change over time (Burton-Jones et al., 2015). Again, consider the TAM's (Davis, 1989) ease of use, which the UTAUT refers to as effort expectancy (Venkatesh et al., 2003, p. 450). If we look closely, we may realise that ease-of-use or effort expectancy considerations, for instance, vary even within one type of IT use. Consider the use of apps on a mobile device. Before using an app, one searches for various apps in an app store (i). It is difficult to imagine ease of use as a difference-maker in this activity, assuming that, at this point, the user has no information about how easy the app is to use. Then, the user selects a particular app to download (ii). Again, at this stage, ease of use may not be a difference-maker for the same reason as previously. A price can be a difference-maker; for another person, it can be a friend's recommendation; for a third person, it is the catchy name of the app, and so on. These difference-makers vary from one person to another, and even within the same person. Then, the download can be interrupted by inadequate network coverage, or the user cannot remember his or her password, or due to some other activity (iii). They are not related to the ease-of-use characteristic of the app being downloaded. Then, the user opens the app (iv). This point seems to be the first time that ease of use of the app could play a role. Of course, the difference-makers at this stage could be something else. Later, the use of the app can become habitual. Again, ease of use could be irrelevant, as users have learned how to use the app (v). Finally, the user quits using the app or gets bored, or there is a bug (vi). Again, these reasons may have nothing to do with ease of use. The point of running an example with six phases is that such inquiries may lead to switching from variance models to stage models. In this scenario (phases i – v), the scope of ease of use in IT use in apps is limited by narrowing it to one stage (phase iv).

5. Implications for IS research, reviewers, and editorial practices

First, we wish to raise the awareness of the IS community that narrowing the range of phenomena, and thus resulting in a decrease in generalisability, does not necessarily mean weakening contributions or value. Moreover, doing so does not necessarily result in the study becoming unimportant. On the contrary, by limiting the range of phenomena and focusing on a specific phenomenon, for example, the resulting narrower-range model may better account for something than the wider-range model. Of course, we are not saying that narrowing the scope automatically leads to improvements (and in some cases, a scope that is too narrow can also make a theory useless). The improvements are an increase in *explanatory* or *predictive accuracy.*

Second, we wish to raise the awareness of the IS community that traditional scientific preferences, and similar views, according to which a wider-range model beats a narrower model (see Davison & Martinsons, 2016), can lead to inappropriate judgements. It can also halt scientific progress, as such views cannot do justice to splitting (Craver, 2009).

The third issue is accuracy versus context. As noted, many IS articles suggest a preference for a wider scope; notable exceptions are Davison and Martinsons (2016) and Aurigemma and Mattson (2019). In short, they advocate particularism and context (Aurigemma & Mattson, 2019; Davison & Martinsons, 2016) or theory-contextualisation (Hong et al., 2014). Adding context tends to decrease the scope (Aurigemma & Mattson, 2019; Davison & Martinsons, 2016). But why does anyone need to add context? Here, the philosophy of science, which discusses the issue under splitting, specific vs. generic predictions or trade-offs between wide scope and accuracy, helps. Following this, adding context is useful only when it leads to an improvement in either explanatory or predictive accuracy.

Fourth, although emphasising explanatory or predictive accuracy may lead to splitting, lumping may sometimes be preferred, even at the expense of explanatory or predictive accuracy. For example, if the research aim is to look for similarities among different broad categories of phenomena, then lumping is valued over splitting. However, simply because one lumps, for instance, different types of IT use into the same model with confirmatory results, it does not necessarily mean that the model offers accurate explanations for each type of IT use (see Aurigemma & Mattson, 2019).

6. Concluding remarks

Many influential IS scholars outline an *a priori* belief: A wider scope beats a narrower scope, or studies with a narrower scope are less strong, less useful, less interesting, and less important than studies with a wider scope. These scope views cannot account for common developments in psychology or the life sciences, known as splitting. For example, in psychology or the life sciences, many developments have occurred by narrowing the scope. The key reason is that wide-scope models or hypotheses may not offer enough accuracy for either explanation or prediction purposes.

It is necessary and important to acknowledge that narrowing the scope does not necessarily decrease the value of the study (scientific or practical impact). A narrower scope may increase value and contribution by offering more specific explanations or predictions. However, we are not saying that a narrower scope is *a priori* preferred over a wider scope. Our view is that in empirical sciences (outside logic or mathematics), as Darden (1996) noted, “scope determination is an empirical issue, to be settled by theory testing”. If the goal is practical understanding through explanation or prediction accuracy, one may expect the scope to be narrow. In turn, if the goal is to find commonalities across different phenomena at the expense of explanation accuracy, then that may result in a wider scope. Finally, our proposal helps to move the context idea further (Davison & Martinsons, 2016). Our argument is that adding context is useful only when it leads to an improvement in either explanatory or predictive accuracy.

Note

1. However, a lack of empirical support may result from other issues, such as methodological reasons or the use of different research instruments.

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