Formulating the direction of a study: Variations across three epistemological traditions in Information Systems

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Abstract

One major purpose of the *Introduction* of a research text is to announce the direction of the study (DoS). Yet, formulating a DoS can be quite a demanding task for the novice writer. This explains why it is a common topic covered in research manuals and guidebooks of English for research and publication purposes (ERPP), with both offering advice on the use of three generic linguistic resources: the purpose statement, the research question and/or the hypothesis - collectively referred to by Lim (2018) as directional determinants (or the determinants hereafter). The coverage of the trio, however, varies greatly between the two types of literature. Research manuals often emphasize the epistemological orientation of an inquiry as a key shaper of the use of the determinants, paying little attention to their textual realizations. In contrast, ERPP guidebooks tend to provide instructions concerning often overly-general linguistic conventions while downplaying how they may be constrained by epistemological considerations. Both lacunae have resulted from a lack of systematic inquiries of the determinants from which empirical insights can be drawn. Addressing these gaps, this paper presents a study that compares the use of the determinants in the *Introductions* of three types of research articles published in Information Systems: behavioural science research, interpretivist research and design science research. Results indicate marked differences in the use of the determinants across the three types of writing in terms of their choices, propositional content and linguistic realizations. Drawing on these observations, the paper also discusses how to instruct novice writers in formulating epistemologically-specific directional determinants.

Keywords: direction of study, directional determinants, English for research and publication purposes, research articles.

Resumen

Formulando la dirección de un estudio: variaciones en tres tradiciones epistemológicas en el ámbito de los sistemas de información

Uno de los principales objetivos de la introducción de un texto de investigación es anunciar la dirección que va a seguir el estudio. Ahora bien, formularla puede ser una tarea bastante exigente para un investigador novel. No es, pues, de extrañar que este sea un contenido recurrente en los manuales de investigación y en las guías de inglés para la investigación y para la publicación (ERPP en inglés), que ofrecen diferentes consejos relacionados con el uso de tres recursos lingüísticos genéricos: los objetivos, la pregunta de investigación y/o las hipótesis, a los que Lim (2018) hace referencia bajo el término *determinantes direccionales* (en adelante, *determinantes*). No obstante, estos tres elementos son objeto de un tratamiento muy diferente en dos tipos de referencias bibliográficas. Los manuales de investigación suelen hacer hincapié en la orientación epistemológica de una investigación como el principal elemento que da forma al uso de los determinantes, sin prestar mucha atención a sus realizaciones textuales. Sin embargo, las guías tienden a proporcionar instrucciones respecto a convenciones lingüísticas que, a menudo, son excesivamente generales, al mismo tiempo que restan importancia al modo en que estas se constriñen por consideraciones epistemológicas. Estas dos lagunas son el resultado de una falta de investigación sistemática de los determinantes de la que podrían abstraerse conocimientos empíricos. Este artículo aborda estas lagunas a través de un estudio que compara el uso de los determinantes en las introducciones de tres tipos de artículos de investigación publicados en el ámbito de los sistemas de información: investigación en ciencia del comportamiento, investigación interpretativa e investigación en ciencia del diseño. Los resultados obtenidos evidencian la existencia de marcadas diferencias en el uso de los determinantes en los tres tipos de investigación en lo que respecta a sus elecciones, contenido proposicional y realizaciones lingüísticas. Con base en estas observaciones, el artículo reflexiona acerca del modo en que cabría instruir a los escritores noveles en la formulación de determinantes direccionales específicos desde un punto de vista epistemológico.

Palabras clave: dirección de estudio, determinantes direccionales, inglés para la investigación y para la publicación, artículos de investigación.

1. Introduction

One extremely important part of a research undertaking is setting its direction concerning what to inquire about and what to achieve, which

dictates how the rest of the project proceeds and keeps the researcher from "going off in unnecessary directions and tangents" (Bryman, 2004: 31). In high-stakes research texts such as the thesis and the research article, the direction needs to be announced clearly in the *Introduction* and is assessed rigorously for, *inter alia*, its merit and alignment with other parts of the study (e.g., theoretical framework, methodology, findings, etc.) (Patton, 2015).

Finding the direction for an inquiry is seldom a straightforward task and is contingent upon a range of exigencies ranging from the researcher's epistemological inclination, his/her theoretical orientation towards the subject matter, resources and to the intellectual currency of the research outcomes (see, Pryor, 2010). If we add to this web of demands the linguistic dexterity involved in articulating the direction, it is not difficult to imagine how taxing the whole process can be to the budding researcher (see e.g., Andrews, 2003; Holliday, 2007; Lim et al., 2014; Patton, 2015; Pryor, 2010; Thomas, 2009). This explains why the topic is often given some attention in research handbooks (e.g., Andrews, 2003; Brown, 2010; Creswell, 2009; Holliday, 2007; Huff, 2009; Krathwohl & Smith, 2005; Newsome, 2016; Patton, 2015; Pryor, 2010; Thomas, 2009) and guidebooks on English for research publication purposes (ERPP) (e.g., Cargill & O'Connor, 2013; Feak & Swales, 2011; Weissberg & Buker, 1990). Discussions often touch upon what Lim (2018) refers to as three common directional determinants ("the determinants" hereafter), namely, the purpose statement, the research question and the hypothesis that can be used to express the goals of an inquiry (e.g., Creswell, 2009; Feak & Swales, 2011; Holliday, 2007; Krathwohl & Smith, 2005; Weissberg & Buker, 1990).

Treatment of the trio, however, varies considerably between the two kinds of literature. Advice is often extensive in research manuals, emphasizing how various exigencies such as those listed earlier may constrain the choice and formulation of the determinants. Among the most often discussed is the epistemological orientation of an inquiry. A distinction is usually made between positivist research (adopting mostly quantitative/statistical methods) and interpretivist research (employing mostly qualitative and hermeneutic methods of analysis), almost to the exclusion of other types of inquiries such as those seeking to solve some real-world problems, such as action research or design science research, which are gaining wide recognition in a number of disciplines.

In ERPP writing guidebooks, epistemological orientations are seldom mentioned. Embedded mostly in a unit on *Introduction*-writing informed by the well-validated CARS model (Swales, 1990, 2004),[1] instruction mostly focuses on the purpose statement normally found in the last move of the model. Attention tends to be paid to a limited range of linguistic conventions of the determinant, which are usually illustrated using samples comprising simple single sentences. Though complementing what is lacking in methodology manuals, the advice is largely over-general and draws on anecdotal evidence (a limitation also observed in research manuals).

The drawbacks in both types of reference literature are very likely a result of the limited empirical studies on the determinants that can shed light on instruction. Among the few studies addressing this lacuna are three conducted by Lim and his colleagues (Lim, 2014; Lim et al., 2014; Lim et al., 2015), which examined the use of determinants in the *Introduction* chapters in theses in Applied Linguistics and Language Education. Several key findings reported by these authors are worth noting. One is that the purpose statement (Lim et al., 2015) and the research question (Lim, 2014) are used much more frequently than the hypothesis (Lim et al., 2014). Second, the objects of inquiry represented in the purpose statements and the research questions are mostly about causal relationships among variables, a phenomenon attributable to the positivist nature of the experimental studies presented in the theses. Third, the determinants are sometimes used in close proximity and notably in shift patterns (e.g., research questions shifting to hypotheses). Fourth, the purpose statements in the theses were presented in a variety of complex syntactical patterns that stand in sharp contrast to those shown in most writing guidebooks. Taken together, the observations reported in the studies suggest that investigations of the determinants need to take into consideration the epistemological orientation of the research writing in question. Yet, when making recommendations for further studies, the authors only proposed validating their findings through cross-cultural and cross-disciplinary comparisons of positivist theses, while stopping short of calling for investigations of writing manifesting other types of epistemological traditions. Nor did the authors suggest extending inquiries into the determinants used in published articles.

Addressing the research gap highlighted thus far, the study reported in this paper was conducted to compare the use of the three directional determinants in the *Introduction* sections of three groups of research articles (RAs) published in journals from the field of Information Systems, with each

representing one of the distinct epistemological traditions, namely positivist, interpretivist and pragmatist, which make up the diverse paradigmatic landscape of this discipline.

2. Conceptual framework

Section 2 presents the conceptual framework of the study by establishing the operational definitions of the directional determinants. This is followed by a discussion of how the use of the determinants may be constrained by the epistemological assumptions of an inquiry.

2.1. Operational definitions

2.1.1. The purpose statement

Interpretations of the purpose statement (PS) vary in the literature. While some research guidebooks use it as an umbrella term for all three determinants (e.g., see, Wilkinson, 1991), some take it to mean a descriptive statement specifying not only the goals of a study but also its justification (e.g., Locke et al., 2014), context and methods (e.g., Creswell, 2009). In the ERPP literature, a PS is not so much defined as it is exemplified. Based on the examples shown in these sources, it can be concluded that ERPP scholars see a PS as a declarative sentence(s), which announces what a study intends to study and is differentiated from a standalone account that summarises a research context or research procedure (see, e.g., Lim et al., 2015; Swales, 1990). Although the determinant can be realised in various syntactical patterns (see, Lim et al., 2015), it carries an obligatory pair consisting of an investigative verb and an inquiry object realised in different grammatical units, e.g., a finite verb phrase or an infinitive verb phrase (see Lim et al., 2015). Such is the working definition of the determinant adopted in the current study as illustrated in the following examples.

> This study examined [inquiry act] *the effectiveness of daily poetry reading* [*inquiry object*].
>
> This study is designed to investigate [inquiry act] *the relationship between* … [*inquiry object*]. (Lim et al., 2015: 81-82)

2.2.2. The research question

A research question (RQ) is an interrogative about an inquiry object (see, e.g., Andrews, 2003; Creswell, 2009; Lim, 2014) realised in a standalone question form or embedded in a PS-like statement as illustrated in the following examples.

> Do learner factors, such as … have an effect on learner understanding of …? (Lim, 2014: 73)
>
> What is the impact of SIOP on teachers and English Language Learners…? (Lim, 2014: 81)
>
> … this study uses interviews to determine *whether employees ... would give examples that appeared to be pro-social rather than selfish or organizationally destructive*. (Feak & Swales, 2011: 112)

2.2.3. The hypothesis

Following research guidebooks (see, e.g., Creswell, 2009), a hypothesis (H) is taken to mean a declarative sentence that predicts the relationship between two variables. Hs can be signaled using the variant forms of the word "hypothesis" (e.g., "It is hypothesized that…") or synonymous words such as "predict" or "expect" (e.g., "It is predicted that …" or "It is expected that...) (see Lim et al., 2014).

Hs can be differentiated into the null and the alternative type. The former predicts no relationship between two variables whereas the latter predicts that a relationship exists. An alternative hypothesis can be directional (i.e., specifying how two variables are related) or non-directional. (See examples below for each type.)

> There is no significant difference between the effects of verbal cues and … [null]
>
> Publicly traded firms will have higher growth rates than privately field firms. [alternative: directional]
>
> Gender identity of religious and secular Arab and Jewish women is related to different sociopolitical social orders ... [alternative: non-directional] (Creswell, 2009: 134-135)

2.3. Epistemological orientations and use of the determinants

As briefly pointed out earlier, the epistemological orientation of an inquiry is key to the choice and the formulation of determinants. Notably, H is unique to studies with a positivist orientation (see, e.g., Creswell, 2009; Krathwohl & Smith, 2005) and in particular those operating with a hypothetico-deductive logic. Inquiries of this sort normally start with formulation of hypotheses about variables, which are then proved or disproved through quantitative methods involving statistical tests. As for the RQ, though it is believed to be common in both positivist and interpretivist studies, its formulations are distinct in the two types. For the latter type of research, which often adopts an inductive approach and employs qualitative methods, open non-polar RQs are usually suggested, mainly because of their exploratory or emergent rather than confirmatory nature (see, e.g., Andrews, 2003; Creswell, 2009)[2]. Positivist RQs have received somewhat less attention. Among the few references that have dealt with the determinant in some detail is Creswell (2009), who proposes using the descriptive question to ask about the measurement of a variable and the inferential question to ask about the relationship between two variables. The former type begins with an interrogative word such as "how" and "what" whereas the latter is realised in polar form (see examples below). Creswell also suggests that the inferential question and the hypothesis can be used interchangeably.

> How do students rate critical thinking skills? [descriptive question].
>
> What are students' achievement levels in science classes? [descriptive question].
>
> Does critical thinking ability relate to students' achievement? [inferential question]. (Creswell, 2009: 137)

Further, Creswell offers the following two model scripts to distinguish the writing of a quantitative and a qualitative PS. The two can be differentiated respectively as inferential and non-inferential, although Creswell does not specifically remark on that:

> *Script of quantitative PS*
>
> The purpose of this _____ (experiment? survey?) study (was? will be?) to test the theory of _____ that (compares? relates?) the _____ (independent variable) to _____ (dependent variable), controlling for _____ (participants) at _____ (the research site).

Script of qualitative PS

> The purpose of this _____ (strategy of inquiry such as ethnography, case study or other type) is (was? will be?) to (understand? describe? develop? discover?) _____ (the central phenomenon being studied)… (Creswell, 2009: 131, 133)

The advice of PS and RQ formulation Creswell provides, unfortunately, is not entirely borne out by the findings of the studies by Lim and his colleagues. Lim (2014) found that the RQs in his thesis corpus are predominantly inferential realised both in polar and non-polar forms while making no mention of the descriptive question. Also, Lim et al. (2015) identified nine syntactical patterns, suggesting the presence of a variety of possible ways of stating a purpose, which depart quite markedly from the script Creswell proposed (and also from what is exemplified in ERPP guidebooks). Further, the determinant shift in Lim et al.'s (2014) study is not mentioned either. Indeed, such gaps can also be observed in other research manuals and writing guidebooks. Taken together, the observations suggest a need for systematic inquiries to validate existing instruction regarding the three determinants in terms of their use propensity and linguistic realisations in research texts that assume various epistemological orientations, such as the three examined in this study.

3. The study

This section first canvasses the epistemological background of Information Systems, showing how the field is an appropriate one for studying epistemology-sensitive use of directional determinants. It then reports the data collection strategies and the coding procedures.

3.1. Information Systems (IS)

IS started out in the 1950s as a type of techno-centric research in business schools conducted by scholars trained primarily in Computer Science and Systems Engineering. Work in this period was concerned mainly with designing technological systems ("systems research" hereafter) to tackle the increasing demands and problems in data management in business organisations (Goes, 2014). When various social issues revolving around the use of information technology (IT) emerged in the 1970s, the scope of IS

research gradually widened to include social IT-related phenomena. Non-systems research traditions were brought in from other social sciences (Westin et al., 1994). In the 1990s onwards, IS evolved into an applied social science discipline of its own with a multi-paradigmatic landscape (Avison & Elliot, 2006), which now embraces three notable traditions: behavioural science research (BSR), interpretivist research (IR), and design science research (DSR) (Bhattacharjee & Paul, 2004; Hevner et al., 2004). Each tradition is distinguishable by its own goals and mode of inquiries, which in turn dictate its research methods.

BSR in IS is positivist in nature, as one of its main goals is to devise and prove hypotheses about the shapers of IT-related social or behavioural phenomena. Methods used are mostly quantitative, relying heavily on statistical tests (Avison & Pries-Heje, 2005). Classic examples are studies which develop and test hypotheses predicting acceptance of specific forms of IT within organisations based on users' perceptions of the usefulness of the IT in focus (Hevner et al., 2004).

Different traditions of IR are practised in IS (Chen & Hirschheim, 2004) to understand holistically various cultural and social facets of IT-related phenomena using various types of qualitative methods. IR is inductive in nature and analyses are mostly done hermeneutically, with many following canonical procedures of grounded theory. An example is an ethnographic case study examining what attracted software companies to outsource services to facilities in countries lacking track records of software development (Abbott & Jones, 2012).

Systems research was consolidated and renamed in the early 2000s as design science research (see, Hevner et al., 2004), which is often differentiated from BSR and IR by DSR scholars in the field as pragmatist in nature in that it is concerned with generating IT artefacts that have utility values. RAs framed explicitly as DSR started to appear in 2008 after Hevner et al. (2004) had published their influential paper that lays out the framework and guidelines of DSR. One primary goal of DSR is to create novel technological artefacts to solve "wicked problems" (Hevner et al., 2004: 81) in various real-world domains and to generate knowledge about artefact designs. DSR thus operates with a problem-solving mode, which usually involves five phases of work: problem/need identification, artefact design, construction, implementation and evaluation (see, e.g., Hevner & Chatterjee, 2010). In DSR studies, methods take on different meanings in different phases of work.

They may mean empirical or literature search methods applied to study a target problem, empirical or theoretical methods used to evaluate artefacts, or methods of designing and implementing artefacts (see Kwan, 2017). An example to illustrate such diverse method types can be found in the study by Yang et al. (2012) in which the authors designed an integrated information platform for emergency response management in the Beijing Olympic Games. Their study began with a literature review and field studies involving interviews, on-site observations and round-table discussions about types of emergency that might arise in the event and the types of management response required. Outcomes were fed into the design of the response system architecture, its construction and its implementation using various methods such as the compartmentalisation approach and visualisation by an online desktop Geographic Information System. The artefacts were evaluated in multiple iterations using methods such as laboratory testing, trial runs with personnel of the event, and interviews (Yang et al., 2012).

Taken together, the co-existence of BSR, DSR and IR in IS characterised above makes the discipline an appropriate case for comparing the use of the three directional determinants in the writing of the three types of research. Data for this study comprises three corpora of *Introductions*, each carrying 25 sourced from RAs representative of each epistemological orientation in question.

3.2. The data

Text selection began with identifying DSR articles in journals belonging to the Basket of Eight (B8) that are listed on the Social Science Citation Index (SSCI) and considered by IS scholars as the most prestigious in the discipline (Association of Information Systems, 2011). Searches done using a judgement method were first conducted in the Science Direct Database using keywords associated with the type of research (e.g., "design science") and names of widely cited DSR scholars (e.g., Hevner and DSR proponents cited in Hevner et al., 2004). The articles generated in the search output were then read to decide whether the studies reported were qualified as DSR. The key attributes of DSR described in Section 3.1 and in particular the characteristic key phases of work typical of DSR were used for the screening, namely, problem identification, design, implementation, and evaluation. In most of the articles, the first phase tends to be presented in the literature review sections whereas the other phases tend to be reported in separate sections named after the phases of work although there are a few which

present the phases in a single section named as "Methodology".[3] Although a considerable number of qualified articles were found, they were distributed unevenly across the B8 journals owing to their varied scopes and orientations. With five having published very few DSR papers, searches were extended to other SSCI-listed journals. The 25 articles eventually chosen were sourced from three B8 and two non-B8 journals (see[4] for the titles), with five articles selected also using judgement sampling from each. All the DSR articles collected were published between 2008 (see Section 3.1 for the reason) and 2015. The BSR and the IR articles were also sourced from the same five journals published in the same period (see[5] for the breakdown by years). The representative characteristics of the two types of research as discussed in Section 3.1 and 3.2 were used as criteria to determine the suitability of the articles. The BSR articles needed to involve hypothesis or model development[6] and quantitative analyses, whereas the IR articles needed to involve primarily qualitative methods in data collection and analysis, and had no hypothesis development or testing.

3.3. Coding

The articles chosen were downloaded and converted into Word files. The determinants used in their *Introductions* were identified and coded in different phases using Win Max QDA 12 (see below). To minimise subjectivity, coding in all phases was conducted independently by the author and a research assistant trained in academic discourse analysis. Prior to the coding in each phase, the assistant was briefed on the coding criteria and tried out the coding procedures. At the end of each coding phase, the author and the assistant compared their coding and resolved discrepancies through discussions. When all the three phases of coding were completed, there were nine segments which both the author and the assistant agreed on as ambiguous or unclassifiable. These segments were excluded from the analysis. Inter-rater reliability of coding in Phases 2 to 3 was measured using the Kappa statistic in SPSS version 23. The Kappa value obtained was 0.722.[7]

Phase 1: Each *Introduction* was read and the parts with the announcement of the direction of the reported study were coded. As determinants are located in the third move of Swales's CARS structure (Swales, 1990, 2004), this model was used to facilitate the searches. Various linguistic cues signalling the move as reported in the literature (e.g., Lim, 2014; Lim et al., 2014; Lim et al., 2015; Swales, 1990, 2004) were used to identify the move.

Phase 2: All coded Move 3 segments were read to identify the determinants in them, if any. Manifest determinant segments were examined and coded according to the working definitions presented in Section 2.1. A determinant segment may span one or more consecutive clausal units. For example, an H segment may be realised in one independent clause with only one hypothesis. It may also straddle several coordinated and/or independent clauses with each carrying one hypothesis (or more).

Phase 3: This phase was prompted by the observations in Phase 2, in which nuanced differences were found in the coded PS and RQ segments. For example, the PS segments display two distinct types of inquiry act - inquiry object pairing. One type, which fits the description in Section 2.1, carries an *investigative verb* (e.g., "confirm", "examine", "explore", "study", "test", etc.) and an *inquiry object associated with a phenomenon or a type of behavior* (e.g., "governance practices", "the information flows", etc.). The other pairing type is characterised by *a generative verb* (e.g., "develop", "produce" or "design") and *an object associated with an artefact sought after as a research outcome* (e.g., "a model", "a method", or a "system"). The two types of PS were respectively differentiated as investigative and generative (see examples in Figure 1).

Among the investigative PSs, two further types were distinguished. One group is inferential i.e., examining the relationship between two phenomena, and these segments were coded as inferential PSs. The other group was coded as non-inferential. Inquiry objects found in these segments are non-relationship oriented. Examples include experience, methods, practices, and processes (see examples in Figure 1). A similar inferential/non-inferential distinction was also drawn for RQs, which were coded accordingly. Note that the non-inferential RQs are different from the descriptive RQs exemplified by Creswell (2009) which ask about the measurements of variables and, in fact, do not exist in these corpora.

The coding generated a taxonomy[8] of variants of the three generic determinants (see Figure 1). The variants were subjected to a series of cross-corpora comparative analyses. Details about the analytical procedures and the results are provided in Section 4.

Determinants & sub-types	Glossary and sample texts
Purpose Statement (PS)	
Investigative PS	– Announces the object the author investigated – Can be inferential[i] or non-inferential[ii], e.g., Inferential …we *examine the role of VWs in the context of organizational team performance…* Specifically, *we explore the dispositional factors that may contribute to VW use…* BSR_JAIS_2012_13_735 Non-inferential *We explored patterns of benefits realization in the years after "go-live"* by conducting case studies of ERP system use in four manufacturing companies in Australia. IR_JAIS_2012_13_424
Generative PS	– Announces artefact the author produced – Can be inferential or non-inferential, e.g., Inferential Using cognitive emotion theory [18] as a theoretical lens, *we proposed… a model relating the online store beliefs about merchandise attractiveness, site ease of use, enjoyment, and website communication style to consumer im*pulse buying behavior, mediated by the consumers' emotion. BSR_IM_2011_48_320 Non-inferential In an effort to tackle this problem, *we have developed a Bayesian-network-based mobile application prototype…* DSR_DSS_2008_44_710
Research Question (RQ)	
Inferential RQ	– Asks about the relationship between two phenomena, e.g., The current study asks this research question: *How do business and IT change affect the alignment of IS strategy and business strategy via the SISP horizon and the planning process?* BSR_EJIS_2008_17_198 We hope to find out *whether social contextual information can help improve the effectiveness of identity matching techniques…* DSR_JAIS_2007_8_524
Non-inferential RQ	– Asks about experience, processes, methods, and practices, e.g., *The study addresses a central topic in trust theory, namely what the premium on trust is.* BSR_MISQ_2008_32_3_531 *To make our research operational, we focused on the following research questions: (1) How did Grupo Santander manage the M&A process to generate these synergies? and (2) What role did Partenón (the ICT platform) play in the evolutionary M&A process?* IR_EJIS_2015_24_178 … how can we incorporate security as a functional requirement in the analysis and modelling of business processes? DSR_EJIS_2008_17_538
Hypotheses (H)	
Directional H	– Specifies how one phenomenon is related to another, e.g., *… this study argues that in the context of OSS development projects, TD positively affects both development speed and the quality of the code generated. This study also hypothesizes that these relationships are moderated by the complexity of the software being developed.* BSR_JAIS_2010_11_684
Non-directional H	– Does not specify how one phenomenon is related to another, e.g., *Our main thesis is that CFP is influenced by an individual's dispositional differences or personality traits.* BSR_EJIS_2008_17_387

[i] focusing on casual relationship between phenomena
[ii] non-relationship-oriented, e.g., experience, methods, practices or processes

Figure 1. Taxonomy of determinants developed in the current study.

4. Results of analyses and discussion

This section presents the results of the series of cross-corpora comparative analyses performed on the determinant variants (or the variants hereafter). The following analytical questions based on the discussions in the Conceptual Framework section and observations in the coding procedures were developed to anchor the comparisons:

1. Do the rates of use of the determinant variants differ markedly within each type of RAs, and do they differ markedly across the three kinds?
2. What types of inquiry objects are represented in each determinant variant and do such objects vary across the three kinds of RAs?
3. Do the linguistic realisations of the determinant variants vary across the three kinds of RAs, and if so, what are some notable differences?

To address the first question, the proportion (%) of articles in each corpus carrying a particular variant (e.g., a generative PS) was calculated. The results were then used to determine the variant's status (i.e., obligatory, quasi-optional or optional) using the benchmarking norms employed by Lim (2014) for his thesis corpus: 100% as obligatory, 51-99% as quasi-obligatory, and 1-50% as optional. To ascertain that there are cross-variant and cross-corpus variations in use rates of the variants, coded segments of each variant type found in each corpus were first counted. The counts were then subjected to statistical tests run on SPSS Version 23. The one-way (univariate) Analysis of Variance (ANOVA) was first conducted (measured in effect size, η^2). An effect size of .01 is considered to be a small difference, .06 medium, and .14 large (see Cohen, 1988). If a significant degree of difference was detected, the Tukey post-hoc test was conducted for pairwise cross-corpora comparisons (i.e., BSR vs DSR, BSR vs IR and DSR vs IR). A p-value of less than 0.05 (<.05) indicates a significant difference. To address the second and the third analytical questions, semantic and linguistic attributes of individual variants found in each corpus were examined qualitatively also for cross-corpora comparison purpose. Answers to the analytical questions are presented in the following subsections.

4.1. Distribution of the generative ps and the investigative ps

The generative PS (GPS) and the investigative PS (IPS) were found distributed

unevenly across the three corpora. GPS is quasi-obligatory in the DSR corpus but optional in the other two (see Table 1). The skewed pattern was ascertained by the statistical tests (see Table 2), indicating that GPS is typical of DSR writing only.

Sub-determinant	BSR				DSR				IR			
	Freq	*M*	*SD*	*%articles*□ *(status)*	*Freq*	*M*	*SD*	*%articles*□ *(status)*	*Freq*	*M*	*SD*	*%articles*□ *(status)*
GPS	7	.28	.54	24.0 (o)	20	.80	.65	**68.0 (qo)**	5	.20	.41	20.0 (o)
IPS	26	1.04	1.02	**68.0 (qo)**	3	.12	.33	12.0 (o)	21	.84	.75	**68.0 (qo)**

□ *N=25* *qo: quasi-obligatory* *o: optional*

Table 1. Descriptive statistics of GPS and IPS in the three sub-corpora.

Test	Results
ANOVA test	$F(2, 72) = 9.08$, $p < .000$, $\eta^2 = .201$
Post-hoc test (paired-corpora comparisons)	DSR vs BSR p=.032 DSR vs IR p=0.01 BSR vs IR p=.860

Table 2. Inferential statistics of GPS in the three sub-corpora.

As explained earlier, GPS is characterised by an obligatory pairing of a generative act – an artefact. Three key verbs observed in the DSR generative PSs are "develop", "design" and "create", which are followed by various types of technological artefacts produced by the authors (see the underlined part in Text 1). The high occurrence rate of the variant in the DSR texts is attributable to their ultimate research goals of developing solutions to tackle existing problems of system design (Hevner et al., 2004). Such goals are encapsulated conspicuously in Move 2 and Move 3 of many of the DSR *Introductions* as also illustrated in Text 1. The matching problem together with the ineffectiveness of existing methods to tackle it as highlighted in Move 2 of the text only makes it natural for the authors to announce in Move 3 the new method they designed to solve the problem as a key goal of their study.

(1) **[Move 2]** Information technology has played a critical role in tackling the identity matching problem. Various techniques have been proposed. Unfortunately, the effectiveness of these techniques still needs to be improved. **[Move 3 generative PS]** … we design a new method for tackling the problem of matching criminal identities. (DSR_JAIS_2007_8_524)

GPSs also exist in the BSR and IR corpora but in small quantities only. They are, however, qualitatively different from those in the DSR texts. The inquiry objects in the seven BSR GPSs found are primarily predictive models consisting of hypotheses (see Text 2), and the generative verb "develop" was exclusively used, as opposed to others employed in the DSR generative PS such as "create" and "design" that denote some type of creativity. The BSR GPSs are in line with the goal of the hypothetical stage typical of positivist inquiries, but probably since BSR studies do not normally end with hypothesising, they are rare in the corpus.

(2) we developed a model of the dispositional factors that contribute to team technology use …(BSR_JAIS_2012_13_735)

The five IR generative PS identified vary somewhat, ranging from developing metalanguage and proposing a frame of reference to advancing a theory (as illustrated in the underlined part of Text 3).

(3) In this paper, we take a step to narrow the chasm by advancing a dialectic theory of collective minding… (IR_MISQ_2012_36_1081)

The purpose statements in both the BSR and the IR texts are predominantly investigative (IPS). Quasi-obligatory in both corpora (see Table 1), these are only minimally optional in the DSR articles. The lopsided distribution was further confirmed by the statistical test results (Table 3).

Test	Results
ANOVA test	$F(2,72) = 10.289$, $p = .000$, $\eta^2 = .222$
Post-hoc test (paired-corpora comparisons)	BSR-IR pair p=.619 BSR-DSR pair p=.000 IR-DSR pair p=0.003

Table 3. Inferential statistics of IPS in the three sub-corpora.

The distribution of IPS is somewhat expected since both BSR and IR in IS aim at gaining some understanding of some under-investigated phenomena as exemplified in Texts 4-5 (see the underlined parts). It is logical that such phenomena are made primary objects of investigation (see the italicised parts of Texts 4-5).

(4) **[Move 2]** However, the nature of the factors influencing the utilization of KM technologies has not been well understood …. [R]elatively few studies

have empirically examined this topic. **[Move 3]** Hence, this study builds on existing literature by *examining the utilization of KM technologies, specifically, knowledge portal (K-portal)...* (BSR_EJIS_2008_17_558).

(5) **[Move 2]** … Notwithstanding their evident relevance, it remains unclear how exactly information systems can contribute to the sustainability transformation of organizations. …. **[Move 3]** In this paper, *we aim to identify the functional affordances information systems can provide to assist organizations in* … (IR_MISQ_2013_37_1275)

The investigative PS exists in several DSR texts only but their inquiry objects are all artefact-related as exemplified in Text 6, which announces the approach the authors explored for designing a supply-chain. A search for a solution method is typical of the initial phase of the artefact design stage (see Section 3.1) that leads to the actual design, implementation and evaluation of the artefact. The variant is rare in DSR *Introductions* most probably because it is seldom the ultimate purpose of a DSR project to examine ways of designing an artefact only but to build it and demonstrate its effectiveness. Where it is used, the DSR investigative PS is followed by an implicit generative goal as alluded to in Text 6 (underlined part).

(6) In the study reported here, we have *explored a specific approach* to creating a reliable and fault-tolerant supply chain capable of delivering facts stated anywhere in the entire web... (DSR_JAIS_2008_9_175)

4.2. Distribution of the inferential and the non-inferential investigative determinants

As explained earlier, both the investigative PS and the investigative RQ can be inferential or non-inferential. Expectedly, the inferential PS and the inferential RQ show up as quasi-obligatory in the BSR corpus only (Table 4) but are very rare in the IR texts. In the DSR corpus, the inferential RQ is also rare but the inferential PS is non-existent. The uneven distribution pattern was further confirmed statistically (see Table 5).

The non-inferential investigative PS shows a rather different occurrence pattern. Optional in the BSR and the DSR texts (see also Table 4), it is quasi-obligatory in the IR corpus, a propensity also ascertained by the statistical tests (Table 5). Again, the observation is somewhat expected because of the non-inferential goals of the studies reported in the IR articles.

Sub-determinant	BSR				DSR				IR			
	Freq	*M*	*SD*	*% articles□ (status)*	*Freq*	*M*	*SD*	*% articles□ (status)*	*Freq*	*M*	*SD*	*% articles□ (status)*
Inf PS	19	.76	.88	**56.0 (qo)**	0	.00	.00	0.0	1	.004	.20	4.0 (o)
Inf RQ	16	.64	.64	**56.0 (qo)**	1	.04	.20	4.0 (o)	4	.16	.37	16.0 (o)
Non-inf PS	7	.28	.54	24.0 (o)	3	.12	.33	12.0 (o)	20	.80	.65	**68.0 (qo)**
Non-inf RQ	3	.12	.33	8.0 (o)	7	.28	.46	28.0 (o)	7	.28	.46	28.0 (o)

□ *N=25* *qo: quasi-obligatory* *o: optional*

Table 4. Descriptive statistics of the inferential (Inf) and the non-inferential (Non-inf) investigative determinants.

Test	Results
ANOVA	
Inf PS	$F(2,72) = 38.853$, p=.000, $\eta^2 = .350$
Inf RQ	$F(2,72) = 21.077$, p = .000, η^2=.233
Non-Inf PS	$F(2,72) = 26.318$, p=.000, η^2=.264
Non-Inf RQ	RQ $F(2,72) = 1.314$, p = .272, η^2= .018
Post-hoc (paired-corpora comparison)	
Inf PS	BSR vs IR p=.000 BSR vs DSR p=.000 IR vs DSR p=.834
Inf RQ	BSR vs IR p=.000 BSR vs DSR p=0.00 IR vs DSR p=.205
Non-Inf PS	IR vs DSR p=.000 BSR vs IR p=.000 BSR vs DSR p=.455
Non-Inf RQ	BSR vs IR p=.276 BSR vs DSR p=.318 IR vs DSR p=1.000

Table 5. Inferential statistics of the inferential (Inf) and the non-inferential (Non-inf) determinants.

Interesting to note also is the scarcity of the non-inferential RQ, which only shows up in small portions of the three corpora (see also Table 4), making it optional in all three. The statistical tests show no significant cross-corpora differences. This goes against what some literature suggests about RQ as a common determinant of qualitative inquiries (see, e.g., Andrews, 2003). Despite their paucity, the non-inferential RQs in the BSR and the IR corpora are qualitatively different from those found in the DSR texts as exemplified by Texts 7-9 with each representing one of the traditions. The RQs in the three texts are all open-ended. Text 7 (BSR) and Text 8 (IR) ask about some social phenomena (also observed in the investigative PSs of the two corpora). In contrast, the RQs in Text 9 ask specifically about an IT artefact, first about

the way to create it and then its effectiveness in solving the problem highlighted in a preceding Move 2. The two questions are similar to those in the other few DSR texts.

(7) The goal was to better understand and explain how and why these organizations experienced the outcomes they did… (IR_JAIS_2012_13_424)

(8) …we are going to address the following research question: what portfolios of exchange relationships are formed by buyers with their suppliers…? (BSR_DSS_2009_47_297)

(9) Two research questions were examined: (1) how should an e-learning system be designed to align learning with work performance in the workplace? and (2) to what extent is such an e-learning system effective for learning in the workplace? (DSR_IM_2011_48_260)

4.3. Rarity of H

H was expected to be predominant in the BSR corpus owing to the positivist orientation. However, this was not borne out by the data. Only 10 segments of H were identified, with 9 found in 7 (28%) of the BSR texts, making it optional in the BSR corpus. Among these 7 instances, 5 are non-directional and 2 directional while the null hypothesis is non-existent. The rate of H in the corpus is markedly lower than that (50%) observed by Lim et al. (2014) in their Applied Linguistics thesis corpus, in which both directional and null Hs were used.

The scarcity of H can be explained by the strong presence of the inferential PS and the inferential RQ in the corpus (see Tables 2a & 2b), which suggests that the two are more preferred in the *Introductions*. However, its paucity does not mean that it is not common in the BSR articles. In fact, the determinant variant occurs in large quantities in some post-*Introduction* sections, many of which are directional and expand the inferential PSs or inferential RQs announced in the *Introductions*. This is illustrated in the following two texts. Text 10a, cited from the *Introduction* of an article, is an overall inferential RQ spearheading the study. It is expanded into a total of 15 sets of Hs in a *Hypotheses* section of the article, four of which are captured in Text 10b.

(10a) The current study asks this research question: How do business and IT change affect the alignment of IS strategy …? (BSR_EJIS_2008_17_198)

(10b) H1 More rapid business change predicts shorter strategic information systems planning horizons.

H2 More rapid IT change predicts shorter strategic information systems planning horizons.

H3 A longer strategic information systems planning horizon predicts more strategic information systems planning.

H3a A longer strategic information systems planning horizon predicts more strategic awareness.

H3b […].

H3c […].

H15 A longer strategic information systems planning horizon predicts more strategic information systems planning. (BSR_EJIS_2008_17_198)

The strong presence of Hs in a post-*Introduction* section can be explained by the limited space that an *Introduction* can afford for the writer to list and explain how the Hs have been developed. Text 10b again is a good example to illustrate this point. The *Hypothesis* section from which the text is cited takes up four pages of the article (as opposed to the 2-page *Introduction*), with each set of the 15 Hs preceded by an extensive review of the literature (the longest one carrying 377 words) showing how the writers had arrived at the set. In fact, the section is the third in the article preceded by a three-page *Constructs* section, in which the writers discuss at great length the variables appearing in the fifteen hypothesis sets. This is impossible in the *Introduction*.

Drawing together the findings presented so far, it can be concluded that among the three generic directional determinants, PS is the most common in all three corpora. Yet PSs used in the DSR writing are predominantly generative. Those used in the BSR and the IR texts are mostly investigative, with those used in the BSR writing being mostly inferential as opposed to the non-inferential ones in the IR texts. RQ on the other hand is less frequently used. RQs tend to be employed in BSR writing mainly and are mostly inferential in the corpus. Lastly, the use of H is somewhat restricted to a post-*Introduction* section in the BSR texts only. This propensity suggests cross-epistemological variations in the choice and formulation of the three determinants.

4.4. Integrated use of determinants

Notable in the data is the integrated use of multiple variant types that are

tightly knit, as illustrated in Text 11. The segment begins with a two-sentence investigative inferential PS announcing the overarching goal of the study that is elaborated in the subsequent parts. In the first half of the sentence in the ensuing paragraph, a generative PS (the italicized part) is used to introduce the interim aim of model-building associated with the hypothetical part of the study, which is immediately followed by an investigative inferential RQ (the underlined part). In the last paragraph, the deductive goal of the study (i.e., validating the model) is announced through an investigative inferential PS.

(11) This research *examines the role of VWs in facilitating team performance. To do this, we explore the dispositional antecedents and downstream consequences of VW use in teams*. As such, we:

(1) *developed a model of the dispositional factors - both general and IT-specific - that contribute to team technology use* to understand how these relationships are affected over time by the technology design; and

(2) empirically *tested the model* in a year-long longitudinal field study… (BSR_IM_2013_50_197)

Integrated use of determinants was observed mostly in the BSR texts (48% of the articles as opposed to 12% and 8% of the IR and the DSR texts respectively). This observation resonates somewhat with the determinant shifts noted in Lim and his colleagues' studies of experimental theses. Two notable patterns they found were PS-RQ shifts (Lim, 2014) and RQ-H shifts (Lim et al., 2014), which, however, were not observed in the BSR corpus. Some of the shifts found are realised in rather complex syntactical structures, as can be observed in the second paragraph of Text 11, which displays an integrated use of a generative PS in a main clause with an inferential RQ nested within the infinitive verb phrase of "to understand…", as also part of the direction of the study.

4.5. Syntactical complexity of PS

Structural complexity was also observed within purpose statements alone. An examination of the variants of PSs shows that in addition to the types reported by Lim et al. (2015), there is a host of other realisations, which can be far more complex. It was also observed that some of the PSs are integrated with various types of epistemic information manifested in different phrasal units. For example, in a few BSR articles, the writers

incorporated phrases showing how their studies are connected to the existing literature or indicating sites and/or methods of studies. This can be illustrated by Text 12, in which the authors use the main verb (the underlined part) to state upfront the connection between their work and the existing literature before announcing the study aim through a post-modifying phrase (the italicized part), which is further specified in a noun phrase insertion (the bolded part). The sentence ends with a prepositional phrase about the method and context of study (the boxed part).

(12) Hence, this study builds on existing literature by *examining the utilization of KM technologies*, **specifically, knowledge portal (K-portal),** *through a survey of knowledge workers in consulting firms.* (BSR_EJIS_2008_17_558)

In some IR PSs, methodological or theoretical orientations are also included. In Text 13, for example, methodological framing is done through a participial phrase in the marked theme position. In Text 14, the theoretical orientation is represented as the object of the main verb followed by the infinitive of an investigative verb phrase. In Text 15, the theoretical lens is realised as the object of a prepositional phrase placed in a final position. Inclusions of methodological and theoretical orientations can be ascribed to the interpretivist traditions the authors followed, as they needed to rely on existing theories to frame their studies (e.g., the object of inquiry as in Text 15) or to interpret their data (see review by Wernet, 2014).

(13) Using a grounded theory approach, we determine the ways in which the system consisting of […] assist [*sic*] the skilled routine work of the caregivers on the ward. (IR_EJIS_2011_20_510)

(14) […] this paper takes a socio-technical approach to investigate the interaction of cotton growers […] with the agricultural DSS CottonLOGIC by exploring both the societal and technical aspects of DSS implementation. (IR_DSS_2009_47_143)

(15) We identify the imperative issues in FOSS deployment through the lens of the Technology–Organization–Environment (TOE) framework [36]. (IR_DSS_2013_55_1)

Likewise, inclusions of the design science approach as an epistemological frame were observed in some of the DSR generative PSs (see the underlined parts of Texts 16 and 17), which include also the goals or capabilities of the artefacts (the italicised parts).

(16) Guided by the design science approach by Hevner et al [27], we develop Nano Mapper, a Web-based knowledge mapping system *capable of providing researches and practitioners with comprehensive depictions of knowledge in the nanotechnology domain*. (DSR_DSS_2011_50_415)

(17) We follow the design science research guidelines of Hevner et al. [7] and Peffers et al [12] to develop a methodology *for dealing with form-based knowledge storage and representation based on the principles of factoring and synthesis and cognitive fit theory*. (DSR_IM_2009_46_365)

These observations suggest not only the syntactic complexity of a PS but also the possible variations across the three types of writing in terms of the additional information packed into the determinant variants through various grammatical units.

5. Conclusions and pedagogical implications

The study reported above initially examined the three directional determinants, PS, RQ and H (Lim, 2018) and their textual realisations in the *Introduction* sections of BSR, IR and DSR articles published in journals of Information Systems. However, as the coding of the determinants unfolded, both PS and RQ each need to be differentiated further to capture more precisely their nuanced manifestations in the three types of writing, a need that has seldom been pointed out in existing methodology manuals and writing guidebooks (e.g., Andrew, 2003; Creswell, 2009; Feak & Swales, 2011). This led to the development of a taxonomy of the variants of the determinants (see column 2 in Figure 2). Results of analyses show that while none of the determinant variants is obligatory, each type of RA has its own characteristic, quasi-obligatory ones, which calls for an epistemologically-sensitive determinant typology such as the one presented in Figure 2 (see columns 3-5).

Determinants	Variants	BSR	DSR	IR
PS	Investigative-inferential	Quasi-obligatory	Optional	Optional
	Investigative-non-inferential	Optional	Optional (generative implícit)	Quasi-obligatory
	Generative-inferential	Optional	—	Optional
	Generative-non-inferential	—	Quasi-obligatory	Optional
RQ	Investigative-inferential	Quasi-obligatory	Optional	Optional
	Investigative-non-inferential	Optional	Optional (generative implícit)	Optional
H	Null	—	—	—
	Directional	Optional	—	—
	Non-directional	Optional	—	Optional

Figure 2. Characteristic determinants in Introductions of BSR, DSR and IR articles.

The findings also point to some other kinds of varied use of the determinants across the three types of writing, including the more integrated use of multi-determinant types in BSR writing, integration of theoretical and epistemological framing in the PSs of IR and DSR writing, or goals of artefacts as well as their functionalities in generative PSs in DSR writing. Such manifestations of the PS variants and in particular the structural complexities involved stand in sharp contrast to the rather simple, standalone PS structures exemplified in methodology and writing guidebooks. Taken together, the outcomes of the study have extended the current understanding of the use of the three generic determinants.

Yet the findings would benefit from further validation using data from a larger sample of RAs in IS and other disciplines. Research is also required to confirm whether Hs and in particular directional ones tend to be used in a post-*Introduction* section such as *Literature Review* or *Theoretical Framework* in place of inferential PSs and inferential RQs. Research could also be conducted to examine the determinants used in other epistemological traditions such as action research (Kwan, 2018) or research that relies on theoretical proof.

As alluded to at the outset of this paper, one major motivation for conducting the study was to generate empirical findings that can inform pedagogy. To address this, several implications are drawn here. First, following the practice in research manuals, instruction needs to underscore the connection between the use of directional determinants and the epistemological orientation of an inquiry. Second, the determinant variants observed in this study (e.g., those for DSR projects) and their possible linguistic realisations can also be introduced. In an ERPP course, students' awareness of these can be raised through a series of exploratory activities, preferably after they have gained some knowledge about the epistemological traditions involved and the CARS model. A procedural framework targeting instruction in IS research writing is proposed below for illustration.

Students can first be asked to brainstorm for ways to express the direction of a study to draw out their knowledge of the three generic determinants (PS, RQ and H). They can then be shown *Introductions* from the three types of IS articles in question and guided to observe the determinants used in Move 3 of the texts. Students can then share their observations, and the teacher can comment on the students' sharing and introduce the typology shown in Figure 2 to confirm and/or add to their observations. Students can be further guided to explore the integrated use of determinants and their

possible linguistic realisations (e.g., theoretical insertions in IR writing and methodological framing in DSR). The syntactical profiles of PS and RQ developed by Lim et al. (2014) and Lim et al. (2015) can also be introduced to show the variety of ways inferential determinants can be constructed.

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NOTES

[1] The cars (Creating a Research Space) model posits that Introductions in research articles tend to be realised in three different moves: *Staking the territory*, *Establishing a research niche*, and *Occupying the niche*. The model has also been found applicable to the description of the rhetorical structures in thesis Introductions. The three determinants are primarily found in the last move of the model.

[2] In many research manuals, quantitative research is used to mean positivist research while qualitative research is used to as a covering term for interpretivist research as in Creswell (2009). However, this is misleading. Positivism and interpretivism represent two distinct philosophical systems (beliefs) about knowledge and govern approaches to knowledge production whereas the two modifiers quantitative and qualitative mainly represent research methods or strategies.

[3] There was no intention to differentiate DSR articles according to the methods of evaluation. But it was observed that in the studies presented in the DSR articles harvested for the current study, the researchers evaluated their artefacts using mostly empirical methods involving participants, but also some simulation methods. None of them reported theoretical proof.

[4] The three B8 journals selected are: *European Journal of Information Systems*, *Journal of the Association for Information Systems*, and *MIS Quarterly*. The two non-B8 journals are: *Decision Support Systems* and *Information and Management*.

[5] Breakdown of the number of articles (n=75) by publication years: 2008 (N=17); 2009 (N=11); 2010 (N=4); 2011 (N=12); 2012 (N=13); 2013 (N=11); 2014 (N=4); 2015(N=3).

[6] A model in a BSR study normally refers to a set of interrelated hypotheses, which are represented schematically using arrows.

[7] Kappa values ranging from 0.61 to 0.80 are regarded as substantial and those between 0.81 and 1.00 suggest "almost perfect agreement" (Landis & Koch, 1977: 165).

[8] The taxonomy only includes types that were manifested in at least two separate segments in the data.