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Interactive visualization for research contextualization in international business

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ABSTRACT

We respond to calls for advances in the contextualization of international business (IB) research by introducing interactive visualization as a methodology for generating contextual insights during the exploratory phases of IB research projects. We suggest that applying interactive visualization early on improves contextualization by means of simultaneous dynamic representations of various phenomena and their respective properties and relationships, even for phenomena that have been widely researched before, like in the cases of international joint ventures and MNE foreign direct investment. The goal of this introduction is to make interactive visualization more accessible to IB scholars.

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1. Introduction

Despite repeated calls for a more advanced treatment of context in international business (IB) (Buckley, 2002; Child, 2009; Teagarden et al., 1995), most extant IB research has deployed only static contextualization approaches and has been mainly based on categorical dimensions including country, nationality, and/or industry (Shenkar & Von Glinow, 1994). Oesterle and Wolf (2011) urged that because the scope of IB is expanding rapidly, new conceptual and methodological approaches are overdue in order to remain relevant. In this paper, we show how interactive visualization improves research contextualization and insight generation from spatial, temporal, and other relational data beyond those generated by existing approaches. Our contribution does not lie in the introduction of a novel methodology, but in making an emerging methodology developed in other domains more accessible to IB scholars.

Visualization in organization and management research, including IB, is only slowly gaining popularity (see Appendix I). Most extant visualization applications are post hoc illustrations of traditional statistical analyses. Recent technological advances, however, have encouraged some researchers in adjacent domains to take visualization beyond merely illustrating findings. For example, in strategy, DeSarbo and Grewal (2008) (see also

DeSarbo, Grewal, Hwang, & Wang, 2008) deployed a new approach for dynamic visualizations of strategic groups. Similarly, Taracki et al. (2014) introduced a new visualization approach for multidimensional, multilevel, and longitudinal analyses of strategic consensus amongst team members. Increasingly, interactive visualization is used in exploratory, discovery, spatial, and network analyses across various disciplines. However, a major challenge thus far has been the development of a ‘common language’ (Meyer, Höllerer, Jancsary, & van Leeuwen, 2013: 536) for applying visualization systematically. With this paper, we provide a starting point for resolving this issue.

Visualization in its most narrow sense is a static image, illustration, graphic, or any other visual representation (e.g., map or network chart). Scientific visualization goes far beyond static representations. Here, the term ‘visualization’ implies interactions as part of information processing, visual analytics, and geo-visualization (Dykes & MacEachren, 2005; Keim et al., 2008; Robinson, 2010; Wise et al., 1995). “Interactive visualizations are graphical models or visual representations from data that support direct user interaction for exploring and acquiring insight into useful information embedded in the underlying data” (Ferreira de Oliveira & Levkowitz, 2003: 378). Wise et al. (1995) suggested that interactive visualizations support the discovery of otherwise difficult-to-identify contextual properties in data. Visualizations open up new opportunities for early-stage research contextualization in ways that have not been possible in the past (Thudt, Hinrichs, & Carpendale, 2012).

IB research, in general, is notably more phenomenon- rather than theory-driven. Regularly, the exploration of unusual patterns

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in international data leads to analyses of contextual connections. Some of the most important theoretical advances in IB have come from exploratory investigations of patterns in data (Cheng, Guo, & Skousen, 2011). Examples include Hymer's (1976, 1979) seminal work on the theory of the MNE, Bartlett and Ghoshal's (1989) transnational configuration, and Birkinshaw's (1997) work on MNE subsidiary initiatives. Even though these examples are powerful, most extant IB research defaults on static contextualization approaches and testing of existing management theories. We argue that the major reason for the apparent absence of interactive visualization from IB research is not its applicability. Instead, two major assumptions seem to prevail amongst IB scholars, including (a) most of the relevant visualization tools are already well established in the field (Bell & Davison, 2012; Meyer et al., 2013) and (b) visualization is only applicable for results illustration and not for exploratory contextualization.

We suggest that a different, visualization-supported, interactive contextualization approach that is positioned at the beginning of a research project will help to overcome current theory development gridlocks caused by an overreliance on static contextualization (Knigge & Cope, 2006). Interactive visualization also lends itself as a contextualization tool for grounded theory building, although visualization is not theory and does not replace theorizing, as pointed out by Sutton and Staw (1995).

We contribute to IB research in three ways. First, we show that incorporating interactive visualization during the early stages of emerging phenomena exploration permits systematic rather than random contextualization by identifying masked or weak patterns in complex data. Such an approach also helps to avoid losing contextual power because it avoids limiting empirical analyses to predetermined, more manageable contextual settings. Second, we make interactive visualization more accessible to scholars unfamiliar with these tools. Third, Beugelsdijk, McCann, and Mudambi (2010) and Beugelsdijk and Mudambi (2013), in two interdisciplinary special issues, encouraged connecting economic geography and IB research both methodologically and theoretically, because of their substantial contextual overlap. We therefore also provide a tool for building bridges between different research disciplines by improving communication and sense making within interdisciplinary research teams (Gilbert, Reiner, & Nakhleh, 2007).

In the remainder of this paper, we introduce a series of interactive visualization tools which we regard as most relevant for IB research contextualization. Because it is practically impossible to provide an exhaustive introduction of all visualization tools available or to go into deep technical detail in describing each of the tools within the journal's space constraints, we developed an interactive online IB toolbox with links to plug-in visualization packages for the statistical software R and to other software resources (<https://www.ivey.uwo.ca/internationalbusiness/research/ibvisualizationtoolbox/>). The IB toolbox allows researchers to begin experimenting with some of the most applicable visualization tools available. In this paper, we will first briefly introduce the key conceptual foundations of interactive visualizations, including representations, visual interactions,¹ and community detection. We will then illustrate how interactive visualization advances early-stage contextualization in IB research by highlighting examples of some tools using international joint venture (IJV) and foreign direct investment (FDI) data (Toyo Keizai, 2014). We chose the IJV and FDI contexts because they are amongst the most widely researched phenomena in IB.

¹ Note that the term 'interaction' is used in the relational sense, with the assumption that interacting variables may influence one another. The direction of the relationship still needs to be developed from both the context and the theoretical arguments that form the underpinnings of hypotheses development.

2. Conceptual foundations

2.1. Contextualization

Contextualizing based on interactive visualizations requires reconsideration of some IB research paradigms. When using interactive visualizations, both the theory development process and the generation of insights through exploratory analyses need to be taken into account in an iterative way. Cheng et al. (2011) referred to this process as theory conception and articulation. It allows for a better development of key concepts, including formal meanings of phenomena, constructs, and relationships, which subsequently facilitates a deeper understanding of context (Morrow & Brown, 1994).

Interactive visualization supports exploratory IB research for identifying, locating, distinguishing, categorizing, clustering, distributing, ranking, associating, and correlating variables (Wehrend & Lewis, 1990). However, first-order insights are not the final step in the interactive visualization process (Chernoff, 1973; Pickett & Grinstein, 1988; Yi, Kang, Stasko, & Jacko, 2008) and are often insufficient to fully understand the research context at hand. For this reason, information visualization scholars suggest using visual reasoning based on visual task analysis (Kohlhammer, Keim, Pohl, Santucci, & Andrienko, 2011; Turkay, Jeanquartier, Holzinger, & Hauser, 2014). Visual reasoning is defined as "the process of distinguishing between ideas in order to create new relations and insights based on collected evidence" (Meyer et al., 2013: 229), whereas evidence is derived from distributed sources, data, analysis, or prior knowledge. In this paper build on the relatively new visual forms of meaning construction (Meyer et al., 2013).

When using visualization for contextualization, both the theory development objective of a research project and the specifics of computer-based visualization have to be taken into account, where "computer-based visualization tools have two principally new properties: interactivity and dynamics." (Andrienko, Andrienko, & Gatalsky, 2003: 511). In our view, the most promising application of interactive visualization in IB is the exploration of phenomenological linkages with weak or complex signals across three main manipulation dimensions, including (a) space, (b) time, and (c) other, non-spatial characteristics (see Fig. 1). Examples of other contexts can include various cultural characteristics, institutional characteristics, or political environment characteristics (e.g. variations in political systems or the magnitude of political violence).

Fig. 1 illustrates how interactive visualizations can support the simultaneous examination of all these contexts across different levels of analysis and multiple dimensions, features that are limited in descriptive statistics techniques. By 'zooming in' on a visualized set of IB phenomena on a geographic map, we can explore a close-up view of those objects at a location or regional

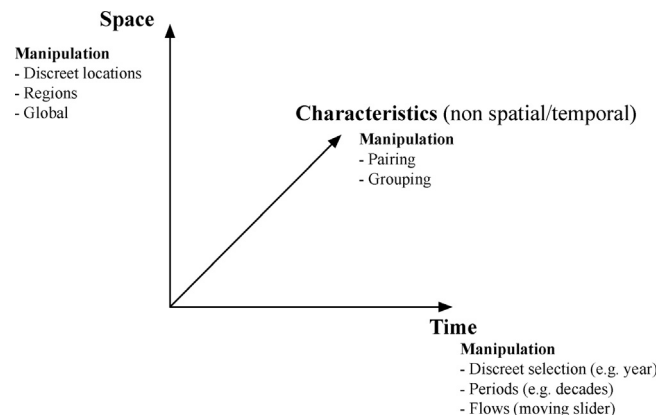


Fig. 1. Conceptual framework for interactive visualization in IB research.

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