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DISCURSIVE STRATEGIES AND RADICAL TECHNOLOGICAL CHANGE: MULTILEVEL DISCOURSE ANALYSIS OF THE EARLY COMPUTER (1947–1958)

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Research summary: *This paper uses multilevel discourse analysis to advance strategic management research, focusing on the question of why firms fail in the face of radical technological change. Answering this question requires addressing how customers develop their interpretations and evaluation criteria of the new technology. This interpretive process occurs through discussions with other market participants. Firms can influence customers' interpretations through the use of language and visual images—what we call "discursive strategies." Firms can fail to navigate technological disruptions because their discursive strategies do not communicate effectively with customers. Yet, methodological limitations have restricted the study of discursive strategies. We draw on multilevel discourse analysis and apply this method to explain why IBM outperformed Remington Rand in the early insurance market for computers.* Copyright © 2015 John Wiley & Sons, Ltd.

INTRODUCTION

Why firms fail in the face of radical technological change has been an important area of inquiry for strategy scholars. Existing explanations focus on firms' inability to develop the new technology (Henderson and Clark, 1990; Tushman and Anderson, 1986), the structure of demand (Adner, 2002), and firms' inability to identify the appropriate customer segment (Christensen and Bower, 1996). However, customers often do not understand the meaning and use of novel technologies, and their preferences and evaluation criteria are initially ambiguous and subject to change (Kaplan and Tripsas, 2008). Firms have opportunities to influence strategically customers' interpretations of the technology in ways that favor their offerings. Yet, existing research does not address how customers develop interpretations and evaluation criteria of new technologies. Consequently, if we do not understand how firms strategically influence customers' interpretations of a new technology, we may not completely understand why firms fail in the face of radical technological change.

Customers' perceptions of a new technology develop through discussions between producing firms, the customers themselves, and other market participants (Kaplan and Tripsas, 2008; Rosa *et al.*, 1999). These discussions not only occur through

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written "texts," but also oral expressions, visual representations, and physical designs (Phillips and Hardy, 2002). Collectively, these texts form a discourse in which the interpretations of the technology are created. Firms actively participate in creating this discourse by producing texts, such as product brochures and images in advertisements, and by responding to others' texts. Managers have choices about what words, linguistic structures, and images they use to describe their firm and the technology, and how they position these texts in relationship to the firm's customers. We call these choices a firm's "discursive strategy." These choices, in turn, influence market stakeholders' reactions to and interpretations about the firm and the nascent market in ways that both aid and hinder the adoption of the new technology and firm performance.

In order to study discursive strategies researchers need a methodology to analyze systematically texts and discourse about new technologies. Strategy scholars who study cognitive aspects of markets tend to use textual analysis to examine the content of written and verbal texts, such as press releases, reports, and presentations (see Navis and Glynn, 2010; Rosa *et al.*, 1999 for examples). However, an expanded method is needed to examine discursive strategies. First, firms use not only oral and written texts, but also visual representations and design features to influence customers' understandings (Hargadon and Douglas, 2001). Second, while the textual content that firms use to describe the new technology forms an essential part of the text's meaning, how that content is conveyed, such as the semantic structure of the content, is also important in shaping stakeholders' understanding of the text (Büler, 2011; Franzosi, 2010). Third, the construction of meaning is dynamic and develops through the interplay between firms' and customers' continued interactions. Without considering these additional textual elements, strategy scholars might make false attributions of a firm's discursive strategy and performance in nascent markets.

We introduce Fairclough's (1992, 2003) multilevel discourse analysis as a new method to study discursive strategies. Fairclough's method examines texts across three levels: (1) measuring the content and semantic structure of language within texts (intratextual), (2) the exchanges and relations between texts (intertextual) and (3) their place within the broader historical setting (contextual). This multilevel approach captures firms' discursive strategies by identifying the linguistic elements in which the content is expressed, enabling the analysis of the sequence and exchanges between texts, and situating the texts' content within a historical context.

To advance theory of how firms manage radical technological change, we examine IBM's and Remington Rand's attempts to sell early computers to insurance firms from 1947–1958. IBM gained 76 percent market share in the early insurance market over Remington Rand's 10 percent. Traditional theories do not completely explain this performance difference. IBM and Remington Rand both developed the new technological capabilities and had comparable products. They also targeted similar customers in the insurance industry. To explain this performance differential more fully, we examined the firms' discursive strategies. Initially, we counted words to capture an emphasis in meaning, the most established approach to text analysis in strategic management, but this method revealed no difference between the two firms. We then applied multilevel discourse analysis, which showed a distinctive difference between how IBM and Remington Rand used linguistic features and images both to position the new technology and the firm and how they interacted with insurance firms. This difference in discursive strategies contributed to differences in performance as insurance companies came to view IBM as more accessible, their computers as more familiar, and IBM's position as more aligned with their own understanding of the role of computers in the workplace.

MULTILEVEL DISCOURSE ANALYSIS

When producers introduce a new technology into the marketplace, multiple stakeholders discuss and debate the meaning, importance, and use of the new technology (Kaplan and Tripsas, 2008). This discourse occurs through the creation and interpretation of the various texts that each market participant creates. The choices of language, in terms of both vocabulary (content) and linguistic structure influence the interpretation of the message, additional exchanges, and ultimately the construction of the meaning (Phillips, Lawrence, and Hardy, 2004). In order to assess accurately the creation of interpretations of new technologies and its impact on firm performance, strategy scholars should pay closer attention to the linguistic details of the discourses that create these interpretations.

Linguistic, discourse, and communication theorists highlight different aspects of language that influence the construction of meaning (see Heath and Bryant, 2012; Phillips and Hardy, 2002 for reviews). First, language is highly contextualized (Phillips and Hardy, 2002). The interests of the speaker, the location and timing of what is being expressed, and the broader norms and values of the context all shape how texts are understood. Second, the construction of meaning is inherently a collective process that involves the interplay between multiple people and texts, which help create stakeholders' understandings of the vocabulary and linguistic elements that occur within each text (Fairclough, 2003). Back and forth exchanges are particularly important in new technology introduction because the meaning of technologies often changes as they get used and advance (Kaplan and Tripsas, 2008). Therefore, the method used to study discursive strategies must move beyond the traditional approach of examining individual textual content to analyzing also the interplay between the texts and the context in which each text is produced.

Discourse analysis is a general method that addresses how language influences communication, persuasion, and the construction of meaning (Phillips *et al.*, 2004). While there are many different flavors of discourse analysis (see Vaara 2010 as applied to strategy research), Fairclough's (1992, 2003) multilevel discourse analysis addresses the important contextual and interactional discourse characteristics so vital to the construction of meaning. In multilevel discourse analysis, texts are coded at three different levels: (1) within the text (intratextual), (2) the relations between texts (intertextual), and (3) contextually. The main goal of multilevel discourse analysis is to ensure that each text is understood in context and in relation to other texts in the unfolding discourse, and that the coding of the text captures not only its content but also its linguistic form. Figure 1 provides an overview of the five steps that comprise multilevel discourse analysis. Fairclough (1992, 2003) focuses on the different levels (steps 2, 3, 4). We augment these steps by including the historical method to build the textual sample (step 1) and an iterative cycle between the coding and existing theory (step 5). This model differs from the textual analysis methods used by strategy scholars, which focus primarily on step 2 (intratextual analysis) and the content of these texts.

Step 1: Historical reconstruction

Stakeholders bring their own interests as well as prehistory to the market for the new technology, which influence how they interpret and react to the firms' texts (Kaplan and Tripsas, 2008). To capture the meaning of texts scholars, therefore, need to consider not just what occurs in the text, but also who produces it and the setting in which the text occurs (see Khaire and Wadhwani, 2010). When constructing a textual sample, it is important for researchers to identify the people, place, and temporal sequence that influence stakeholders' production and understandings of the texts. To achieve this goal, we integrate elements of the historical method into Fairclough's (1992, 2003) multilevel discourse analysis.

The historical method identifies texts and develops a contextual and temporal understanding of their sequence (Kipping, Wadhwani, and Bucheli, 2014). Researchers using the historical method analyze each text to identify (1) when it was produced, (2) who created it, (3) where it was generated, and (4) how it relates to other texts in terms of both the content and the people who created the text (Kipping *et al.*, 2014). Scholars using this approach, in turn, do not focus only on the text itself, but also on data about the people and events associated with the texts. Moreover, historians pay attention to the sequence by ordering the texts as they unfold over time. Lastly, historians validate the representativeness of each text by comparing the information within the text to independent sources on the same topic (Golder, 2000). This process helps researchers identify how common a particular idea or way of representing the technology was at a given point in time. It might also uncover new texts related to the new technology, which should be included in the sample, thereby reducing selection bias.

Step 2: Intratextual data coding

Each text contains various linguistic features that combine to convey its meaning (Franzosi, 2010). These elements include vocabulary choices to express the content (Loewenstein, Ocasio, and Jones, 2012), structural choices like semantic and grammatical relations (Franzosi, 2010), and images. Texts also have multiple levels—words,

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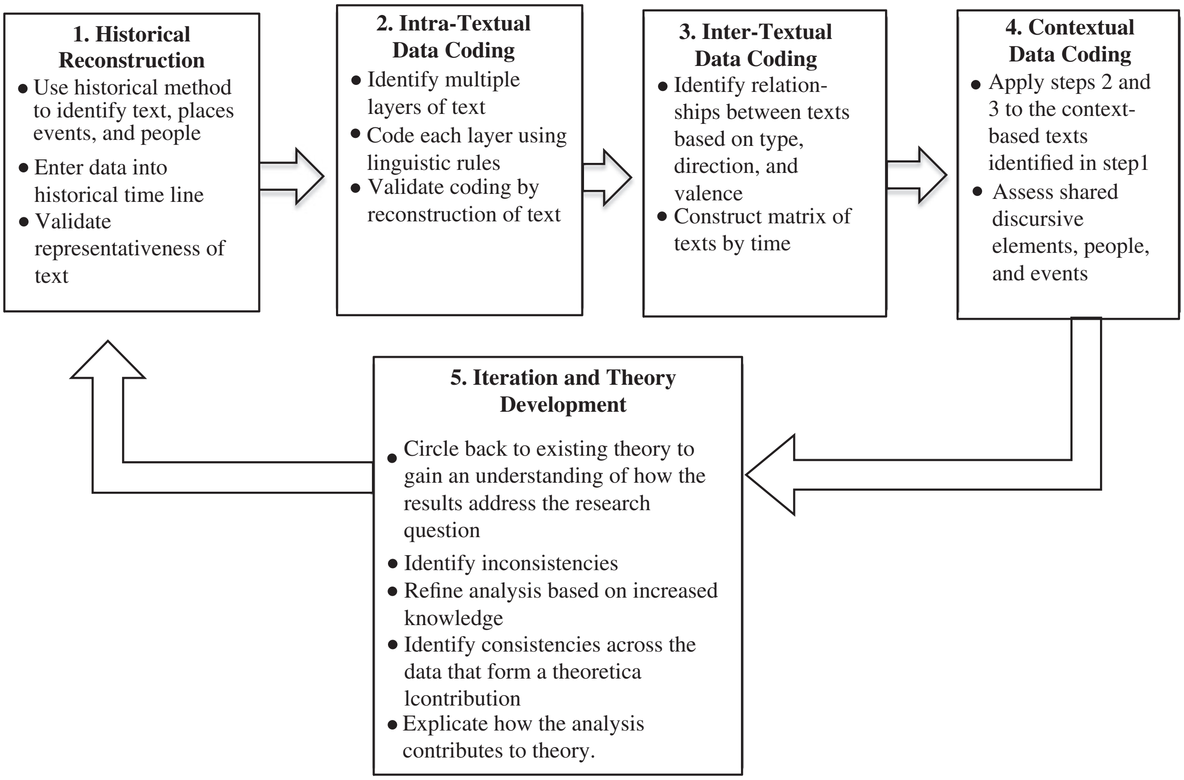

Figure 1. The five steps in multilevel discourse analysis

clauses, sentences, and paragraphs—that have their own set of structures that influence meaning and persuasion. Each of the linguistic features plays a role in building the content of what the text conveys as well as persuading others of that content (Fairclough, 2002). Therefore, scholars need a structured way to code these different linguistic features at the multiple levels at which they occur within texts.

However, strategy scholars using textual analysis have focused only on the vocabulary used in texts and have not paid attention to its other linguistic features (see Kennedy, 2008; Pontikes, 2012; Rosa *et al.*, 1999). The textual approach also has the issue of potentially introducing biases because it often is difficult to judge which noun phrases are the same versus different and what counts as an "important" noun phrase. For example, in our case should "tabulating machine" be coded as separate from "machine" and is "electronic calculator" important? Focusing just on noun phrases also misses how those nouns are used linguistically in the text. Noun phrases can play different linguistic roles, such as being subjects or objects of clauses, which is central to the meaning of words and how they are used (Franzosi, 2010).

Applying a more grammatically and semantic rule-based approach to coding texts at each level addresses these limitations (Fairclough, 2003). At the sentence level, researchers code triplets or the subject–verb–object relationships (Franzosi, 2010). To illustrate, take the sentence "The computer can sort premium cards." This sentence contains a grammatical triplet (computer–sort–premium cards), where "computer" is the subject, "sort" is the verb, and "premium cards" is the object. The researcher should code each of these linguistic components. Using this approach, the researcher captures not only the words used in the text, but also their grammatical role or what does what and to whom. In this case, the "computer" as a subject does the action of sorting. Deconstructing this grammatical structure, in turn, reveals more information about the meaning of the content (Franzosi, 2010): the author of the text signals that she believes the computer has agency because she uses "computer" as the subject of the sentence.

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Coding based on linguistic rules also helps minimize interpretive errors because researchers can more unambiguously verify the correct application of the coding rule. Researchers can reconstruct sentences based on their coding of semantic clauses independently and then validate their coding with the original sentence. Finally, coding semantic clauses does not preclude traditional text analysis; rather, the noun phrases are now captured in a way that reflects how they are used in the text.

To capture the meaning of the text, researchers need to apply the same semantic and grammatical approach to code not just clauses, but also complete sentences or paragraphs (Fairclough, 2003). For example, researchers can code different kinds of sentences, such as declarative (statements), imperative (commands), or interrogative (questions). Coding the type of sentences helps identify different forms of persuasion (Petty, Cacioppo, and Heesacker, 1981), as well as communication exchanges. Collectively, this linguistic based intratextual coding approach allows for comprehensive analysis of a text's discursive elements and thus minimizes interpretive errors.

Step 3: Intertextual data coding

How stakeholders interpret a text is shaped by the vocabulary that it has in common with other texts and the references to other texts made within it. Researchers, therefore, need to code not just the linguistic features within the text itself, but also how the author references (or does not) prior texts.

While Fairclough (2003) does not specify how to measure these interactions, strategy researchers can use techniques developed in social network analysis to measure systematically how texts relate to each other. Several important dimensions include the kind of relationship between the texts, their directionality, and the valence of the reference (Wasserman, 1994). Texts can relate to each other in different ways that are meaningful to the exchange: (1) direct ties, (2) conceptual ties, and (3) shared location. Direct ties could involve either an explicit mention of other texts or shared authorship. Conceptual ties exist when a text refers to the concepts of another text. Finally, people can create or consume texts in the same location. Moreover, because there is a temporal order in textual exchange, the directionality of the relationships should also be recorded. Lastly, a person may refer to a previous text in different ways, such as affirming or challenging previous points. The sentiment of the relation, or valence, should also be captured. Valence helps overcome the error of assuming that shared content means agreement of the concepts. Capturing the kind of exchange, directionality, and valence between texts helps more accurately characterize the importance of each text and how it should be understood.

Step 4: Contextual data coding

People produce texts within a specific time and place. Broader contextual themes influence what is actually said in texts and how it may be interpreted (Khaire and Wadhwani, 2010). Therefore, it is important for researchers to identify the broader cultural themes and assess their role in the textual exchange. However, strategy scholars using textual analysis often do not explicitly code for these themes (see Paroutis and Heracleous, 2013).

During this fourth step, researchers identify texts produced in other contexts that are related to the focal discourse. Often knowledge of such texts has surfaced during the prior steps, but during this step, the researcher investigates these links explicitly. Coding these texts entails using the procedures outlined in step 2 to identify its shared vocabulary and language. Contextual data coding uses the processes described in step 3 to determine when, how, and to what sentiment these other texts and concepts enter the focal discourse. Based on this coding, the researcher reconsiders the importance of the themes.

Step 5: Iteration and theory development

Developing and analyzing data is unimportant if it does not also inform theory. Therefore, as in many other qualitative methods, it is important to iterate between theory and data (see Glaser and Strauss (2009)). During the fifth step, the researcher first cycles back to the research question in order to relate the evolving understandings of the domain area to the theoretical question (Eisenhardt, 1989). In particular, researchers need to pay attention to findings that augment or are inconsistent with ideas presented in the existing literature.

Researchers address inconsistencies at two different levels. First, by cycling through the data, they need to address inconsistencies that may arise at different levels of the data analysis (Barry, Carroll, and

Hansen, 2006). For example, carrying out the intertextual analysis might reveal texts that ought to have been included in the original sample. The iteration between the different levels of analysis is also a way to increase the robustness of the findings if elements of the same themes are found at several different levels. Second, while iterating through each of the levels, researchers need to relate the findings back to the theoretical question by constantly asking which part of the findings cannot be explained by existing literature, how the data answers the research question, and in which way the findings augment existing understandings. For example, in our case, to identify firms' discursive strategies, we identified various aspects of how firms used language to communicate with their customers and related this to existing theoretical explanations of how firms manage radical technological change.

IBM'S AND REMINGTON RAND'S DISCURSIVE STRATEGIES AND PERFORMANCE DURING THE INTRODUCTION OF THE COMPUTER

By the 1940s, IBM and Remington Rand had become leading providers of tabulating equipment, and insurance companies were among the most significant users (Bashe *et al.*, 1986). Coming out of World War II, both firms invested significantly in developing what we now call the computer, which represented a radical technological change from existing tabulating technology. Also during this time period, the insurance industry became increasingly interested in this new technology because of a postwar insurance boom and a clerical labor shortage (Yates, 2005).

The postwar period included ongoing interaction between representatives of insurance firms and IBM and Remington Rand. Most insurance firms did not interact with computer manufacturers individually, but learned about the computer through sponsored conferences and committee reports of insurance trade associations, most prominently the Society of Actuaries (SOA), Insurance Accounting and Statistical Association (IASA), and Life Office Management Association (LOMA) (Yates, 2005). Insurance firms started acquiring the newly released computers in 1954. By the late-1950s, IBM had come to dominate computer sales in the insurance industry, with 76 percent market share compared to Remington Rand's 10 percent (calculated based on surveys of computer usage conducted by the Controllership Foundation (1954–1958)).

Strategy scholars may explain this performance differential in terms of IBM having superior products and services. However, during this time, IBM and Remington Rand offered similar product portfolios, including an advanced larger version and more hybrid and smaller computers. Remington Rand's advanced offering was the UNIVAC (short for UNIVersal Automatic Computer and released for commercial use in 1954), and IBM developed the large, tape-based 700-series computers (702 was released in 1955). On the smaller side, IBM released the 650 Model and Remington, the UNIVAC 60 and 120 in the mid 1950s (Ceruzzi, 1998). At least initially, IBM was trying to catch up to Remington Rand (Bashe *et al.*, 1986).

More importantly, during this early period, insurance firms were still figuring out what aspects of the computer mattered to them (Yates, 2005). Initially, insurance representatives favored UNIVAC over IBM's products. While representatives were impressed with Remington Rand, they expressed skepticism about IBM's ability to create a computer "because of their paramount investment and interest in punch card accounting machines, and the great backlog of demand for such machines" (Berkeley, 1946). A more complete account of how IBM came to dominate the market for early computers must address how IBM was able to change this perception.

Computer historians note that during this period Remington Rand made acquisitions that adversely impacted their sales and marketing efforts (Bashe *et al.*, 1986; Campbell-Kelly and Aspray, 1996). Differences in sales and marketing execution could explain Remington Rand and IBM's performance differences. However, while Remington Rand might have had marketing problems generally, they were highly engaged with the insurance industry. Similar to IBM, Remington Rand had worked closely with insurance representatives to develop studies on the use of the computer (see also Yates, 2005) and first presented to insurance representatives in a 1950 forum on computing that they hosted. At least initially, IBM and Remington Rand were equally represented at insurance computer conferences.

A more complete explanation of the performance differences between Remington Rand and IBM requires investigation of the ways the firms used language to interact and influence the insurance firms' perceptions of the computer. Applying multilevel

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discourse analysis to our case revealed that IBM and Remington Rand developed distinctive discursive strategies. Generally, IBM engaged with insurance companies to develop a familiar understanding of the computer that fit with how insurance companies had begun to understand it. In contrast, Remington Rand acted as an authority on the computer and developed an interpretation of the computer that emphasized its novelty. Insurance companies came to view IBM as more accessible, their computers as more familiar and more aligned with their own understanding of the role of the computer in the workplace. Since the goal of this paper is to both develop multilevel discourse analysis as a method for strategy research and advance theory on technological change, we present our explanation of how we applied each step of the method together with the findings.

Step 1: Historical reconstruction

We begin our analysis in 1946 because this is when interactions between IBM, Remington Rand, and insurance started, and we end in 1958 when newer versions of the computer were released. Because trade associations were the main locus of discussion about the computer (see Yates, 2005), we started building the textual sample with the texts from the trade association meetings and conferences. This generated 44 texts. We applied the historical method to identify the key texts, people, events, and references within these texts in order to identify other texts of relevance to our study. This approach expanded the number of texts in our sample to include texts outside of the core exchanges within the trade associations. For example, Edmund Berkeley, an insurance representative who was one of the first to interact with computer firms, published an influential book outside of the associations and created additional ties through participation in other computing organizations. Malvin Davis, the head of the Society of Actuaries' committee on computing, created ties to more texts through participation in conferences on business automation. In total, applying historical reconstruction yielded a sample of 61 texts. Table 1 shows an example of the timeline of the texts from IBM, Remington Rand, insurance companies, and others using the historical method.

Using historical reconstruction revealed an important sequence within the discourse on the computer. Each of the insurance trade associations formed computing committees that interacted with IBM and Remington Rand. The Society of Actuaries' committee published their computer report at a 1952 conference, and the IASA and LOMA hosted conferences on computing in which both firms presented. This meant that IBM and Remington Rand were not simply educating insurance firms about the computer, but participating in a discourse in which the insurance associations started forming their own opinion. This dynamic required that they acknowledge and respond to these developing interpretations.

Step 2: Intratextual analysis

For comparison, we processed each text using traditional textual analysis used by strategy scholars identifying key noun phrases in the texts and measuring their frequency over time. We identified key words around the computer, such as *machine, magnetic tape,* and *computer*. Table 2 compares the results of IBM's and Remington Rand's most frequently used terms. Since there were different levels of total word usage, the results represent the percent of each word of the total frequency of computer-related words.

The top words are very similar, with the only differences being IBM's use of "large-scale machines" and Remington Rand's use of "electronics" and slight variations in the relative emphasis placed on these terms. Accordingly, IBM and Remington Rand used very similar nouns when talking about the computer, so traditional text analysis approaches do not allow us to differentiate these two firms or explain the differences in outcomes.

We then expanded our analysis using the linguistic approach outlined earlier. To illustrate, Table 3 shows how we coded a paragraph from a Remington Rand presentation at the 1953 IASA Electronics Conference and a paragraph from an IBM presentation at the same conference. Purposefully, the content of the paragraphs is similar to control for topic differences. The sentence table, subject table, verb table, object table, and indirect object table in Table 3 represent different levels of coded text. The id columns of each table link them together. For example, the first coded sentence is number 282 and is part of paragraph 31. When we coded the subjects of this sentence, such as "UNIVAC", we connected them back to the sentence by using the sentence number (in this case 282) in the id column of the subject table.

Table 1. Historical reconstruction of texts for computer in insurance, sample years

		Texts (author [location])			
Events academic, etc.)	General (media, Insurance	Remington Rand	IBM	Other producers	
Year: 1947		Berkeley [LOMA] Berkeley [IASA] Berkeley [SOA] Rieder [SOA] Barber [SOA] Wells [SOA] Berkeley [SOA—response]			
Edmund Berkeley meets with computer manufacturers on behalf of Prudential LOMA committee on computing; Edmund Berkeley heads Harvard Symposium Macy Cybernetic Conferences					
Year: 1953	Diebold HBR article on Automation	Davis [EJCC] Beatty [LOMA] Weisman [LOMA] Seeley [LOMA] Boulanger [LOMA] Tabor [LOMA] Streeter [LOMA] Cooley [LOMA] Hughes [IASA] Hamilton [IASA] Q&A with Remington Rand and IBM at IASA Conf	Boyd [IASA Conf] Bruce [IASA Conf] Colburn [IASA Conf] Harr [IASA Conf] Mitchell [IASA Conf] Smith [IASA Conf] Hawks [IASA Conf]	Learson, et al. [IASA Conf] Hague [IASA Conf] Movie [IASA Conf] Visit to see IBM 701	
IASA Electronics Conference LOMA Electronics Seminar Macy Cybernetic Conferences					
Year: 1954	Osborn [HBR] Higgins/Gilkauf [HBR]	Dotts [LOMA] Hamilton [IASA] McCandless [IASA]	Boyd [IASA Conf] Smith (GE) [IASA Conf]	Knaplund [IASA Conf] Smith [IASA Conf] Hague [IASA Conf]	McLeod (Burroughs) [IASA Conf]
IASA Electronics Seminar Macy Cybernetic Conferences		Vanselow, Office Mgm			

Table 2. Comparing IBM and Remington Rand's discourse on computers using traditional textual analysis

Top words for IBM	%	Top words for Remington Rand	%
Machines	23	Program	19
Magnetic tape	11	Machine	18
System	9	System	12
Large-scale machine	8	Equipment	9
Equipment	7	Computer	7
Program	7	Electronics	6
Computer	4	Magnetic tape	4

At the sentence level, we measured the use of the four types of sentences—declarative, interrogative, imperative, and exclamatory. Remington Rand only used declarative sentences to inform the audience of its advanced computer (marked by "D" in the sentence type column). In contrast, IBM's presentation used a mix of declarative and interrogative sentences to engage in a dialogue with the audience. At the clause level, we measured how often computer vocabulary was used as a subject or object. Remington Rand used "UNIVAC" as the subject of clauses; whereas, IBM used the "computer" as an indirect object and "people" as the subject.

These linguistic patterns were not unique to the sample for Table 3, but persisted across all the presentations in the 1953 IASA Conference by both firms. IBM's ratio of interrogative sentences to declarative sentences across all the presentations was 12 percent, much higher than Remington Rand' ratio of less than 1 percent IBM and Remington Rand developed distinctive styles of engaging with the audience. The use of interrogative sentences engaged the audience by asking them to answer a question; whereas, the use of declarative sentences speaks to the audience by stating facts. At the clause level, IBM used computer vocabulary as the subject in just 27 percent of the grammatical clauses in these presentations, compared to 73 percent of the time as the object. In contrast, Remington Rand's used computer vocabulary as a subject in 75 percent of the grammatical clauses and 25 percent as the object. Remington Rand's use of the computer as a subject in clauses portrayed the computer as having the agency to perform tasks; whereas, IBM emphasized the computer as a tool that people used to perform tasks.

Additionally, Remington Rand's presentation included 10 figures of the UNIVAC. Traditional textual analysis does not allow for the coding of images. However, images can be integrated into our linguistic-based approach by treating an image as comprising different textual levels (Gee, 2011). At the highest level, images can be interpreted holistically (Meyer *et al.*, 2013) (e.g., we coded each image for whether the UNIVAC was present or not). At a lower level we decomposed the elements of each image (e.g., some images included activities with someone working on the computer). In these cases, we coded these activities semantically; for example, an image of a clerk using on a computer would therefore be coded with "clerk" as the subject, "using" as the verb, and "computer" as the object.

Consequently, even though both firms used the computer in the images, they differed significantly in how they used that content linguistically. IBM and Remington Rand had different grammatical roles for the computer and constructed different kinds of sentences to convey this information. Simply doing textual analysis that focuses on the computer vocabulary would miss these important differences and could lead to erroneous conclusions about the similarity of the firms' discursive strategies.

Step 3: Intertextual analysis

To measure intertextual relations, we constructed a matrix of all texts in our sample and measured the characteristics of relations between texts. See Table 4 for a sample of this matrix and the different characteristics of the textual relations.

Using the intratextual analysis revealed how certain interpretations of the computer became more salient. In 1947, a Prudential representative, Edmund Berkeley, argued that the computer should be thought of as a "giant brain." The computer-as-brain metaphor reappeared in the 1953 IASA conference presentations. Just measuring conceptual ties between texts, as advocated by traditional approaches, would lead researchers to the false conclusion that this conceptualization gained acceptance. However, many subsequent people reacted negatively to Berkeley's framing of the computer (see Table 4 for an example). This suggests that, while Berkeley's ideas were frequently referenced, they were never widely adopted. In contrast, the aforementioned Society of Actuary Report in 1952 was the most positively cited text in subsequent discourse and became a central reference

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Table 3. Intratextual coding

Sentence table

Text	paragraph_id	sentence_id	sentence	Type
Colbum (RR)	31	282	As UNIVAC adds, subtracts, multiplies, divides and compares, and performs these functions, it does it in two separate and distinct circuits simultaneously	D
Colbum (RR)	31	283	It compares the results, and if the results are the same, then UNIVAC will go on.	D
Colbum (RR)	31	284	If they are not the same— UNIVAC stops at that point	D
Colbum (RR)	31	285	It will, to quote Mr. McPherson, of the Bureau of Census, “give no wrong answers.”	D
Hague (IBM)	8	1261	One can compare, add, subtract or print; we can perform many functions with a single large scale machine.	D
Hague (IBM)	8	1262	What does this mean to you?	I

Subject table

Text	paragraph_id	sentence_id	clause_id	refferent	subject
Colbum (RR)	31	282	524		UNIVAC
Colbum (RR)	31	282	525		UNIVAC
Colbum (RR)	31	282	526		UNIVAC
Colbum (RR)	31	282	527		UNIVAC
Colbum (RR)	31	282	528		UNIVAC
Colbum (RR)	31	282	529		UNIVAC
Colbum (RR)	31	282	530	UNIVAC	it
Colbum (RR)	31	283	531	UNIVAC	it
Colbum (RR)	31	283	532		results
Colbum (RR)	31	283	533		UNIVAC
Colbum (RR)	31	284	534	results	they
Colbum (RR)	31	284	535		UNIVAC
Colbum (RR)	31	285	536	UNIVAC	it
Hague (IBM)	8	1261	2383	collective	one
Hague (IBM)	8	1261	2384	collective	one
Hague (IBM)	8	1261	2385	collective	one
Hague (IBM)	8	1261	2386	collective	one
Hague (IBM)	8	1261	2387	collective	we
Hague (IBM)	8	1262	2388		this

Verb table

Text	paragraph_id	sentence_id	clause_id	Verb
Colbum (RR)	31	282	524	adds
Colbum (RR)	31	282	525	subtracts
Colbum (RR)	31	282	526	multiplies
Colbum (RR)	31	282	527	divides
Colbum (RR)	31	282	528	compares
Colbum (RR)	31	282	529	performs
Colbum (RR)	31	282	530	does
Colbum (RR)	31	283	531	compares
Colbum (RR)	31	283	532	are
Colbum (RR)	31	283	533	will go
Colbum (RR)	31	284	534	are not

Table 3. continued

Verb table

Text	paragraph_id	sentence_id	clause_id	Verb
Colbum (RR)	31	284	535	stops
Colbum (RR)	31	285	536	will give
Hague (IBM)	8	1261	2383	can compare
Hague (IBM)	8	1261	2384	can add
Hague (IBM)	8	1261	2385	can subtract
Hague (IBM)	8	1261	2386	can print
Hague (IBM)	8	1261	2387	can perform
Hague (IBM)	8	1262	2388	mean

Object table

Text	paragraph_id	sentence_id	clause_id	Object
Colbum (RR)	31	282	529	these functions
Colbum (RR)	31	282	530	it
Colbum (RR)	31	283	531	the results
Colbum (RR)	31	283	532	same
Colbum (RR)	31	284	534	not the same
Colbum (RR)	31	285	536	no wrong answers
Hague (IBM)	8	1261	2387	many functions
Hague (IBM)	8	1262	2388	what

Indirect object table

Text	paragraph_id	sentence_id	clause_id	Indirect object
Hague (IBM)	8	1261	2387	with large scale machine
Hague (IBM)	8	1262	2388	to you

point that captured the insurance industry's initial interpretation of the computer.

Step 4: Contextual analysis

Our historical reconstruction of the early period of computing history had revealed that at the time there were ongoing discussions and conversations about other technologies that were relevant to how people came to understand the computer. The aforementioned Edmund Berkeley started participating in the emerging field of cybernetics—the study of control, communications, and self-regulation in animals and machines (Wiener, 1948). Simultaneously, within business and academic circles, the concept of automating the information flow of operations emerged. One prominent proponent of automation, consultant John Diebold, published a popular book on automation in 1952, which led to a host of conferences on automation.

Because discussions of cybernetics and automation involved computers, we investigated whether these concepts shaped understandings of the computer within the insurance industry. We identified texts on automation and cybernetics and compared their language use with data gathered during the earlier intratextual analysis. When we analyzed whether and how texts on automation and cybernetics were linked (either in type, direction, or valence) to our focal discourse, we identified several relationships. However, although individuals participated in discussions on automation and cybernetics, these broader themes did not influence discourse on computers among insurance firms.

Step 5: Iteration and theory development

Thus far, we had generated substantial data on the linguistic features of the various texts, the sequences and interplay between texts, and a better understanding about the context in which the discourse unfolded. To identify the discursive strategies within this data more systematically, we consulted communications theories about key elements

Table 4. Intertextual coding

	Berkeley (Ins 1947 SOA)	Rieder (Ins 1947 SOA)	…	SOA Report (1952)	Hawks (RR-1953)	Learson et al. (IBM-1953)
Berkeley (Ins 1947 SOA)		Type: Direct tie (person) Direction: Reider to Berkeley Valence: Negative response				
Rieder (Ins 1947 SOA)						
…						
SOA Report (1952)					Type: Direct tie (text) Direction: Hawks to SOA Valence: Reference text	Type: Direct tie (text) Direction: Learson to SOA Valence: Reference text
Hawks (RR-1953)						Type: Location Direction: Mutual Valence: N/A
Learson et al (IBM-1953)						

in effective communication. Scholars have emphasized the role of the speaker, the topic, and the audience in communicating ideas (see Büler, 2011; Heath and Bryant, 2012 for an overview). These three elements align with how IBM and Remington Rand positioned themselves (the speaker), characterized the computer (the topic), and related to the insurance industry (the audience). We then cycled through our data analyses in steps 1–4 to group our emergent findings along these dimensions. Table 5 summarizes the comparison of IBM's and Remington Rand's discursive strategies along the three communicative dimensions.

Characterizing the firm: engaging or authoritative

During a technological disruption, firms face the challenge of being perceived as a credible provider of the new technology (Santos and Eisenhardt, 2009). IBM and Remington Rand positioned themselves differently as credible suppliers of the new technology. IBM developed the strategy of *signaling engagement* whereas Remington Rand *acted authoritatively*.

IBM signaled engagement by embracing the insurance industry and by positioning itself, not as an expert, but as another participant in the market trying to find joint solutions to the problems facing the insurance industry. IBM invited the insurance companies to provide their perspective on the computer. At the 1953 Insurance Accounting and Statistical Association (IASA) conference, IBM discussed the computer within the context of the insurance industry's issues and problems. For example, rather than talk about file organization and storage abstractly, IBM's representative, Hague (1953: 99), talked about how the computer would organize data from insurance policies:

> Now, the next question is how do you organize the file? Do you organize alphabetically, by district, by debit, by due date, or by policy number, or just what organization should there be to this file? I think one of the answers to that—at least, one of the answers I have had—is to organize the file in almost the most permanent way that you can find, and what I mean is: Organize it in such a way that it is difficult to upset the sequence of the file. … What should we include in such a file?

In IBM's presentations at the 1953 IASA conference, 26 percent of the sentences discussed

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Table 5. Comparing discursive strategies

Kind of discursive strategy	IBM's discursive strategies	Remington Rand's discursive strategies
Characterizing the firm	*Signaling engagement*	*Acting authoritatively*
Interrogative/declarative	12% (85/689)	0.6% (4/691)
Collective "we"	20% (323/1623)	4% (55/1285)
Insurance setting	26% (209/808)	5% (35/695)
Characterizing the technology	*Making the new technology familiar*	*Making the new technology novel*
Verbal	Continued the naming convention used for tabulating machines (600-series)	Gave the UNIVAC a distinct name to signal the discontinuity from tabulating machines.
Visual	Displayed the IBM 650 on a table with tabulating equipment to show continuity	Diagrams focused on unique features of the UNIVAC
Design	IBM 650 designed to look like tabulating machine	UNIVAC 60 closer to tabulating machine. But, did not bring up
Relating to the customer	*Aligning with customers' evolving understanding*	*Constructing a new understanding*
Technology as object	73% (124/170)	25% (84/339)
Technology as agent	27% (46/170)	75% (255/339)

Data for Characterizing the Technology comes from IBM's and Remington Rand's texts in the computer discourse. Data for the Characterizing the Firm and Relating to the Customer section primarily comes from the firms' texts at the 1953 IASA Conference on Computing.

how computers might solve insurance-related problems. Note also how IBM used a series of questions and answers within the specific context of insurance-related problems to help engage the audience. Finally, IBM frequently employed "you" or the collective "we" in their communication to indicate that understanding the computer was a joint effort. For instance, following the example above, Hague (1953: 99) talked about organizing files within the insurance context: " … how do you organize the file? … What should we include in such a file?" IBM framed the problem as one that "you" or "we" might have in order to highlight computing as a problem that it and insurance companies might address together.

In contrast, Remington Rand asserted itself as the expert on computing and signaled that insurance companies ought to consult them to understand the new technology. We call this *acting authoritatively*. Remington Rand opened its presentations at the IASA 1953 conference by stating that most insurance representatives probably did not know anything about computers: "No doubt many of you will operate computers as you would a telephone, without knowing how to take them apart and put them together again (Boyd, 1953: 10)." Remington Rand then highlighted its own expertise: "Our own studies along this line revealed to us some years ago the limitations of conventional mechanical accounting devices and the desirability of accelerating our electronic research activities at this time in the field of high-speed data processing equipment" (Boyd, 1953: 10). Remington Rand used the term "studies" to suggest they had specialized knowledge to impart on the insurance companies.

In essence, Remington Rand let insurance companies know that it had the answers; no conversation was required. As noted, Remington Rand's ratio of interrogative to declarative sentences was less than one percent, with only four interrogative sentences in its presentations. Remington Rand also distanced itself from the insurance companies by only using the collective "we" and "you" in four percent of its sentences. Finally, Remington Rand did not frame its discussion of the computer within the context of the insurance companies. Only five percent of the sentences related to insurance specifically. This use of different linguistic structures signaled that they had specialized knowledge and had authority within the computer domain that the insurance companies lacked.

	604	607	CPC	650	701	702
1. Announcement Date	1948	1953	1949	1953	1953	1953
2. Storage (number of decimal digits)	50	66-162	290-930	10,000-20,000	20,000-8,000,000	2,000,000-575,000,000
3. Card input/output	100/100	100/150	100-150/35	200/100	150/100	250/100
4. Magnetic tape	No	No	No	No	Yes	Yes
5. Page printer	No	No	Yes	No	Yes	Yes
6. Program control	Wired	Wired	Wired/Stored	Stored	Stored	Stored
7. Monthly rental	$550 up	$800 up	$1,775 up	$3,250-3,750	$11,900-15,000	$20,000 up

Figure 2. IBM's comparison of the 650 and 700 series. Source: Recreated from Hague (1954: 463)

IBM's strategy of signaling engagement gave them a competitive advantage over Remington Rand's strategy of acting authoritatively because before IBM and Remington Rand entered formal discussions on the computer, insurance companies had expressed interest in working with technical engineers. The Society of Actuaries' 1952 report on computing stated: "[H]e [an actuary] quickly learned that life insurance people and electronic engineers were two groups who did not speak each other's language. It became apparent that some medium was necessary to bridge the gap between the two" (Davis *et al.*, 1952: 1). As noted, this report was a central reference in the discourse. IBM capitalized on this interest by signaling that it was an engaging partner, while Remington Rand failed to capitalize on this interest by positioning itself as a distinct authority.

Characterizing the technology: familiar or novel

Because a new technology is largely unfamiliar to customers, firms face the challenge of explaining its core characteristics to potential users (Kaplan and Tripsas, 2008). Firms trade-off whether to stress the technology's familiar versus novel aspects (Bingham and Kahl, 2013). Familiarity encourages recognition, but may come at the cost of leveraging its distinctive features. IBM used a strategy focused on *making the new technology seem familiar*; whereas, Remington Rand focused on *making the new technology seem novel*.

IBM used a combination of verbal, visual, and material strategies to create the impression of a continuum between the tabulating machine and the computer. Recall that IBM had two versions of the computer: the larger 700-series and the smaller 650. IBM's use of the 600-naming convention meant that IBM signaled that the computer was a continuation of its class of tabulating machines, the 604 and the 607. In the 1954 IASA conference, IBM displayed a table that positioned both the 650 and 700 computers on a continuum with the tabulating machine (see Figure 2). In fact, IBM designed the 650 to resemble physically a tabulating machine (Bashe *et al.*, 1986).

In contrast, Remington Rand used the discursive strategy of *making the technology seem novel* by minimizing similarities with tabulating machines and highlighting the computer as a new design. Remington Rand chose to call all of their computers by the distinctive name UNIVAC even though their smaller computer, the UNIVAC 60, was technically more similar to the firm's 409 tabulating machine (Campbell-Kelly and Aspray, 1996). Remington Rand also avoided visually comparing the computer with tabulating machines. The firm's presentation at the 1953 IASA computing conference had 10 pictures of the computer, all devoid of work context or comparison to other technologies. The pictures also emphasized the larger UNIVAC design, which filled an entire room and diverged from existing tabulating technology.

IBM's strategy of *making the new technology seem familiar* aided them in gaining a competitive advantage over Remington Rand. As time progressed, the trade associations gave more air time to IBM's 650 than all other products. The IASA even held a dedicated conference for the IBM 650 in 1955. This increased focus also translated to more sales. According to data from the Controllership Foundation surveys from 1954 to early 1958, insurance companies bought 63 computers, 43 of which were IBM 650s.

Relating to the customer: aligning versus constructing

Customers develop their own understandings of the technology by drawing on multiple sources (Abernathy and Clark, 1985; Kaplan and Tripsas, 2008). Producing firms, in turn, need to relate to these evolving views to facilitate uptake of their own discursive strategies. IBM engaged in a dialogue with insurance companies in order to make sure that its representation of the computer was *aligned with the customers' evolving understandings*. In contrast, Remington Rand tried to *construct a new understanding* of the computer.

As noted, the insurance industry took an early interest in developing their own interpretation of the computer in trade association committees and conferences. The aforementioned influential 1952 Society of Actuaries' report developed an understanding of the computer as a tool that insurance workers could use to accomplish their tasks. This report emphasized that computers required instruction and were acted upon: "Automatic machinery [one way the report identified computers], however, slavishly follows a given routine; it cannot exercise judgment or reflect experience" (Davis *et al.*, 1952: 16). Consistent with this explicit statement, the report used the computer (or equivalent terms) as an object or indirect object in 71 percent of the semantic clauses in which it appeared. Managers within insurance companies pushed this conception partially to avoid inciting fear among clerical workers that the computer would take over their jobs, therefore resisting its adoption. In fact, Metropolitan Life Insurance Company placed a model of a computer in the lobby with a sign that spelled out UNIVAC as "Undying Need is for Volume of Additional Clerks" (Yates, 2005).

Both IBM and Remington Rand positively acknowledged the 1952 Society of Actuaries' report. However, as noted, they differed dramatically in the role that the computer played in the clauses in their promotion (see Table 5). IBM's use of the computer in clauses as an object that workers could manipulate aligned with insurance firms' own use of the computer and their evolving understanding of the role of the computer in the workplace. In contrast, by framing the computer largely as the subject of their sentences, Remington Rand tried to construct a new role for the computer as a technology that could perform tasks independently. This difference in IBM's and Remington Rand's discursive strategies was critical because it positioned IBM's offerings as less threating to office workers, a key issue among managers.

In general, IBM's discursive strategies of positioning itself as willing to engage with the customer, making the new technology familiar and aligning with the customers' emerging understanding helped IBM outperform Remington Rand. IBM's strategy was more effective because, despite its initial skepticism, the insurance industry was looking to work with computer manufacturers and was developing a similar interpretation of the computer. These findings move beyond the focus in the existing literature on technological capabilities and customer segmentation as explanations for how firms successfully manage radical technological change to emphasize the importance of how firms communicate with their customers.

DISCUSSION

We introduce a modified version of Fairlcough's multilevel discourse analysis as a new methodology to examine the strategic aspects of how firms communicate with their customers about a new technology. Firms may struggle not because of a lack of technical skills or an inability to identify a customer segment, but because they do not develop discursive strategies that effectively communicate with customers. These findings add to the literature on the cognitive interpretations of new technologies and markets (Abernathy and Clark, 1985; Kaplan and Tripsas, 2008; Navis and Glynn, 2010; Rosa *et al.*, 1999; Santos and Eisenhardt, 2009) by highlighting how market participants' construction of collective understandings opens up strategic opportunities for firms. To gain a competitive advantage, firms must use discursive strategies that effectively bridge their own interpretations of new technologies with those of their customers. The central elements of firms' discursive strategies are how they position the firm, the technology, and how firms shape customers' understanding of the technology. Firms must make strategic choices in each of these domains: whether to signal engagement with the customer, how novel to make the technology appear, and how aligned to be with the customer's evolving interpretations.

Given these strategic choices, innovating firms often act like Remington Rand, establishing their authority and imposing their view because they have specialized knowledge gained through the innovation process. These firms "educate" the market about the new technology. In contrast, we found that an important aspect of firms' discursive strategies is to listen and respond to—not dictate—the evolving views of market participants. IBM's more engaging and conversational strategy gave them a competitive advantage vis-à-vis Remington Rand's more authoritative stance. Moreover, when trying to gauge customers' evolving understanding, firms need to be cognizant of where these understandings come from. Customers might import understandings of the technology from existing and/or related industries (Benner and Tripsas, 2012; Eggers and Kaplan, 2009). And, as illustrated in this case, market intermediaries, such as trade associations, might play an important role in shaping customers' evolving understandings (Kaplan and Tripsas, 2008). Successful communication requires firms to look beyond just the technology to engage multiple participants in an evolving dialogue.

Finally, where the current literature focuses on the content of the evolving understandings of new technologies and markets (Kennedy, 2008; Navis and Glynn, 2010; Rosa *et al.*, 1999), we suggest that how firms communicate this content also influences market outcomes. Using multilevel discourse analysis, we showed that IBM and Remington Rand used very similar words to characterize the computer (Table 2), but they had distinctive discursive strategies (Table 5), hinging on how those words were used. There is a linguistic dimension of industry dynamics that can contribute to firms' abilities to navigate technological disruptions. Beyond how firms represent the new technology in terms of vocabulary choices, firms need to be strategic about how they communicate this information. Future work should further explore the connection between the linguistic structure and the content of discourse.

Limitations

Peculiarities of our context might limit the external validity of our findings. We only considered incumbent firms, but new firms might require the use of other discursive strategies to be successful. Moreover, because the powerful trade associations began to form opinions about computers early on it might have been too late to employ Remington Rand's more authoritative approach. In markets where no powerful organizations have begun to shape the understanding of the new technology, firms might have more leeway to impose their own views on the market. Future research should explore the market conditions that favor different discursive strategies.

A second limitation to our study and proposed method is that multilevel discourse analysis requires extensive in-depth analysis, which limits the number of texts and thus the breadth of discourse that can practically be analyzed. For example, if researchers are interested in studying strategic changes in firms over several decades historical reconstruction might lead them to identify thousands of texts, which will be impractical to code using intratextual analysis. One remedy for this concern is that some of the coding might be automated. Improved textual analysis software can increase the efficiency of the linguistic-based coding of texts, which allows the researcher to focus on historical reconstruction, intertextual analysis, contextual analysis, and iteration. Multilevel discourse analysis helps answer questions about the construction and maintenance of meaning and interpretations. If, on the other hand, researchers are interested only in the uptake of certain words, for example "corporate social responsibility," several steps of multilevel discourse analysis are not necessary.

Application of multilevel discourse analysis to strategy research

Multilevel discourse analysis has broad application to other areas of strategic inquiry. Scholars of the industry lifecycle have begun to examine the influence of interpretive processes on the evolution of technologies and products (Kaplan and Tripsas, 2008; Kennedy and Fiss, 2013). Applying multilevel discourse analysis to the industry life cycle literature raises intriguing questions, such as how do discursive strategies evolve over the industry life cycle? How do discursive strategies influence the shift toward a dominant design? How do discursive strategies relate to competitive dynamics?

There has also been an increasing interest in the role of discourse in the practice of strategy making (Paroutis and Heracleous, 2013; Samra-Fredericks, 2003; Sillince, Jarzabkowski, and Shaw, 2012; Vaara, 2010). However, these studies primarily engage in intratextual analysis and do not address the exchange dynamics of doing strategy, such as responding to other's point of view, building coalitions of support, and negotiating (notable exceptions include Heracleous and Barrett, 2001; Samra-Fredericks, 2003). The historical reconstruction and intertextual steps of multilevel discourse analysis capture these exchanges to allow for a more systematic and comprehensive method to study the practice of strategy making.

Lastly, multilevel discourse analysis holds promise as a method to advance research on dynamic capabilities. Scholars have become increasingly interested in the mental activities of managers as a microfoundation of dynamic capabilities (Eggers and Kaplan, 2013; Helfat and Peteraf, 2014). Helfat and Peteraf (2014) define these activities in terms of the knowledge they represent, the mental processes themselves and also the use of language. Managerial mental activities get instantiated within discourse as managers engage in problem solving and try to persuade others to act on new initiatives. To date, much of this work has been conceptual and theoretical. Multilevel discourse analysis enables the empirical study of these processes by providing a linguistic-based coding scheme to measure mental heuristics as instantiated in the firm.

As these extensions highlight, the field of strategy could benefit from applying multilevel discourse analysis to a wide range of topics. Our study marks but an initial step toward this application by examining the role of linguistic choices in firms' abilities to manage radical technological change.

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