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Learning in “Organized Anarchies”:
The Nature of Technological Search Processes
at Trade Fairs



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Abstract

Trade fairs have become important temporary platforms for the establishment of inter-firm linkages and networks. Despite recent insights into the nature of knowledge flows, the causal mechanisms linking trade fairs to processes of technological searches and choices remain underspecified. Taking this as our starting point, we provide a conceptual and empirical account of the technological search and related learning processes between geographically distant firms at trade fairs. Building on the concept of “organized anarchies” and the “garbage-can model” of organizational choice, we reconceptualize the nature of search processes and apply this conceptualization to an explorative study of four business-to-business fairs in North America. This provides a dynamic explanation of how inter-firm interaction and observation support technological search processes, which may lead to distinct wider patterns of technological specialization and/or diffusion.

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1 Introduction

The “French School of Proximity Relations” has long been interested in the nature and role of different types of proximities in the innovation process. Aside from geographical proximity, other types of proximities have been discussed, including organizational, technological, institutional and cognitive proximity (Rallet and Torre 2005; Boschma 2005; Carrincazeaux and Coris 2011) – or better: affinity. The argument frequently developed is that proximities help to control the coordination of complex production processes and thus enable an extended social division of labor. One common implication of this framework is that the lack of proximity on one dimension (i.e. insufficient geographical proximity) can be overcome by increased proximity on other dimensions (e.g. more organizational and/or virtual proximity).

Yet, as Bathelt explains (2005: 121), “[i]f we formulate problems of economic organization and innovation in abstract terms of multiple proximities which can substitute for one another ... the existing problems and motivations of the economic agents involved can easily be overlooked.” While the proximity approach has been instrumental in developing a multi-dimensional conceptualization of proximity, Carrincazeaux et al. (2008: 620) point out that “one of the main weaknesses of an approach focusing on coordination is that other dimensions of social phenomena, especially conflicts and compromises, are, to a great extent, overlooked.” In response to this limitation, our paper moves beyond recent discussions regarding abstract coordination mechanisms to look more closely at the behavior and practices of economic agents, specifically firms. In the context of this study, we focus on the technological search processes that take place between geographically distant firms at trade fairs. The concept of temporary geographical proximity (Torre 2008) is particularly well-suited to the types of inter-firm learning processes observed at such events, as these processes are based on highly condensed, intensive and temporary face-to-face contact.

Major national and international trade fairs are important venues for learning and knowledge exchange because they bring together agents from all over the world and create temporary spaces for interaction between firms from diverse geographical locations (Borghini et al. 2006; Maskell et al. 2006; Bathelt and Schuldt 2008). They can be viewed as “field-configuring events” (Lampel and Meyer 2008) that attract well-known and less well-known agents of a particular industry, value chain or technology field for the purpose of discussing and scanning the latest technological developments in a given environment. By providing a platform for discussion about new technologies and consumer preferences, flagship fairs support the diffusion of “best-practice” solutions within and across different industries (Gertler 2001). In so doing, they seem to provide ideal conditions for so-called “ubiquitification” processes (Maskell and Malmberg 1999), whereby new technologies become globally available at approximately the same price within a relatively short time period. Yet, upon further exploration, we see a more complex picture of the interactions of participating firms at leading trade fairs. While the concept of the temporary cluster has enabled recent analyses of the role of such events as knowledge-generating ecologies (Bathelt and Schuldt 2010), it does not provide a conceptualization of the nature of the technological searches, choices and transfers that are stimulated during trade fairs. As such, the concept of the temporary cluster has little to say regarding the wider implications of technology diffusion and development triggered by these events.

In light of these shortcomings, this paper aims, first, to develop a conceptualization of technological search processes in the context of temporary proximity relations between distant firms. Second, we intend to verify this concept through an empirical study of North American trade fairs. Third, we aim to draw some conclusions regarding the wider spatial consequences of technology development.

Drawing on the concept of “organized anarchies” and the “garbage-can model” of organizational choice (Cohen et al. 1972), our study, which is both deductive and inductive, finds that the search processes of firms at trade fairs are strongly shaped by the context in which they are embedded. Firms make technological and production-oriented choices that are closely tied to their existing competence base. Such choices pave the way for ongoing contextualization and, in turn, continued specialization of knowledge bases (Storper 1997). Based on over 200 semi-structured interviews conducted in 2009 and 2010 at four leading North American trade fairs, we develop a dynamic and empirically grounded explanation of the processes by which inter-firm interaction at trade fairs supports technological search, choice and learning processes across geographical boundaries. In doing so, we aim to avoid the debate between institutionalist (Kirat and Lung 1999) and interactionist (Rallet and Torre 2005) perspectives, and suggest that the linkages between proximities and innovation are not a matter of abstract coordination; indeed, to understand the relationships between proximities, learning and innovation, we need to analyze the social and economic processes at the very core of such relationships.

The remainder of this paper is organized as follows. In Section 2, we provide a synthesis of the existing literature on technological learning and associated knowledge transfers in spatial perspective. Section 3 explores the role of trade fairs within the global political economy. Here, particular attention is paid to the nature of the technological search processes that occur during trade fairs and the extent to which they enable meaningful interactions between geographically distant firms. In Section 4, we introduce the concept of “organized anarchies” and the “garbage-can model” of organizational choice as a way of conceptualizing technological searches in complex organizational settings, such as trade fairs. Section 5 describes the data and methods used in our research, and Section 6 presents our results from four national/regional and international trade fairs in North America. We conclude, in Section 7, by discussing the potential consequences of our findings and highlighting avenues for further research.

2 Processes of Technological Learning in Spatial Perspective

There is now widespread agreement that knowledge and innovation are essential resources underlying regional economic success (Lundvall and Johnson 1994; Cooke and Morgan 1998; Archibugi et al. 1999; Meusburger 2008). It is also generally acknowledged that learning is the critical process that stimulates innovation (Lundvall 1992; Malecki 2010). Among the many forms of technological learning and searching identified in the literature on space and spatialities, learning by searching is a classic process that is often based on clearly-specified goals (Malecki 1980; 2010). In an economic context, such learning is often carried out in research laboratories and technology centers that are not necessarily based on permanent interaction or co-location with production (Malecki 1991). In contrast, experience-based learning relies heavily on continuous interaction between production, problem-solving and development activities. This involves processes such as learning-by-doing and learning-by-using, both of which seem to favor incremental adjustments or improvements (Arrow 1962; Rosenberg 1982). Whereas these types of learning processes are largely based on the co-location of activities at the firm level, qualification-based, skills-oriented learning through training or hiring (Bell 1984) creates opportunities for learning over distance. This can be achieved through the mobilization of skilled personnel or the temporary co-presence of agents.

Compared to these learning processes, more recent academic work has emphasized the collective aspects of inter-firm learning. Following the work of von Hippel (1987) and Lundvall (1992), a literature has developed

which draws attention to the systematic linkages between producers and users. Such linkages lead to ongoing learning about the performance and failure of existing products and the need for technological improvements and new products (Gertler 2004). Other work has focused on processes of learning-by-observation, where co-location provides the necessary conditions for project teams that are not sufficiently familiar with one another to develop a basis for collective problem-solving (DeFillippi and Arthur 1998; Grabher 2002).

In examining the nature of interactive learning, studies either directly or implicitly suggest that such processes typically take place between firms that are located close to one another (Feldman and Audretsch 1999; Boschma 2005). This is because firms require the presence of specific technologies, tacit knowledge, experienced experts and institutional settings, all of which are not freely available. Rather, they are agglomerated in the form of specific spatial configurations (Asheim 1999). In such configurations, economic interaction benefits from some sort of proximity that supports collective learning (Lawson and Lorenz 1999). This is illustrated in the context of national production settings, as suggested by the literature on national innovation systems (Lundvall 1992; Lundvall and Maskell 2000) or specific industry agglomerations (Porter 1990; Maskell et al. 1998; Archibugi et al. 1999). Geographical co-location and face-to-face interaction are seen as important factors in enabling processes of learning in complex organizational settings because they provide additional information, help communicate messages in understandable ways and reassure interacting partners through the use of non-verbal cues, such as facial expressions, gestures and eye gaze (Short et al. 1976). The importance of geographical proximity or the co-location of firms has been clearly demonstrated in the context of successful industrial clusters, where learning-by-interaction and learning-by-observation generate a specific local communication and information ecology, or “buzz” (Storper and Venables 2004; Malmberg and Maskell 2006; Bathelt and Glückler 2011) that is conducive to innovation.

Although the literature on clusters and global value chains emphasizes the increasing importance of learning across distance in the global economy, relatively little is known about the nature and dynamics of such processes. And it is only recently, in the context of new geographies of circulation (Thrift 2000; Amin and Cohendet 2004), that trade fairs have been recognized as an important platform for “organized proximity” (Rallet and Torre 2009) in the form of a temporary cluster (Maskell et al. 2004). This kind of temporary geographical proximity has far-reaching consequences for processes of learning-by-interaction and learning-by-observation. It is therefore surprising that so little academic attention has been paid to the technological search and related learning processes of firms at such trade fairs. We aim to address this gap in the literature by placing search processes at the forefront of our inquiry. By shifting the focus to the search processes of firms, rather than abstract coordination mechanisms and general knowledge flows, we propose a novel and empirically grounded application of the proximity concept in the field of innovation studies. We begin, in the next section, by discussing how trade fairs connect geographically distant firms and provide a temporary setting for face-to-face-based knowledge generation and exchange.

3 The Role of Trade Fairs in the Global Political Economy

Despite their relative neglect in the literature on inter-firm learning processes, trade fairs have long been recognized as an important medium through which firms promote their products and generate new sales or leads (Kerin and Cron 1987). Beyond these sales and promotional activities, trade fairs also fulfill several important “non-selling” functions, including knowledge exchange and competitor or partner assessment (Sharland and Balogh 1996). In recent years, trade fairs have been conceptualized as critical sites where global knowledge flows are circulated and ideas for innovation are explored (Borghini et al. 2004; Maskell et al. 2006). From this perspective, trade fairs represent an important platform for networking, interactive learning and knowledge exchange because they cultivate intense – albeit temporary – interaction among economic actors regardless of spatial boundaries. Ongoing face-to-face meetings with other trade fair participants provide firms with new insights regarding their competitors, suppliers and customers (Bathelt and Schuldt 2008).

Economic agents benefit from such meetings through repeated, intensive and often short face-to-face encounters, which lead to a specific communication and information ecology referred to as “global buzz” (Maskell et al. 2006). While this phenomenon has been explored in detail elsewhere (Bathelt and Schuldt 2010), it is important to note that global buzz enables unique processes of knowledge generation and dissemination through interactive learning and learning by observation. Central to these processes are integrational and informational cues (Short et al. 1976), such as verbal and non-verbal cues, visual stimuli and feelings or emotions. Such cues are omnipresent in the communication and observation processes that take place during trade fairs. While the concept of the temporary cluster addresses the complex nature of knowledge flows at international trade fairs, it does not provide a conceptualization of the nature of technological search, choice and diffusion processes that are the focus of this paper.

Flagship fairs bring together the agents of an entire industry, value chain or technology field to exchange knowledge about the present and future development of the industry. Such exchanges revolve around displays of products, prototypes and innovations. Since trade fairs are typically organized according to a specific technological or industry focus, they cut across geographical boundaries, thereby encouraging communication and interaction among agents from different regions and countries. They become the places of technological searches, explorations and transfers. The firms that engage in these exchanges often operate in different institutional contexts, utilize different technologies, target different markets and apply diverse practices. Trade fairs are, thus, a unique setting in which agents can acquire an overview of new developments and trends in the world market (Rosson and Seringhaus 1995; Sharland and Balogh 1996; Godar and O'Connor 2001; Prüser 2003). Exhibitors and visitors also benefit from multiple possibilities to scrutinize the booths of other exhibiting firms, and inspect the visualization of different corporate cultures and strategies. This provides an intensive, broad and low-risk environment for technological searches; yet, little is known thus far about the nature of these search processes.

Despite the fairly heterogeneous composition of participants in trade fairs, partially related communities find each other during such events (Entwistle and Rocamora 2006; Weller 2008). They engage in a variety of formal and informal discussions or meetings, which help to reduce the complexity and uncertainty that characterize changing product and technology markets (Schuldt and Bathelt 2011). While firms generally operate in an uncertain environment, regular attendance at flagship fairs helps them gain an overview of technological developments in an industry or technology field and limit uncertainties regarding the trends in this field. This enables firms to make informed decisions regarding new product, process or technology components.

Recent studies of ongoing search processes of trade fair visitors (Borghini et al. 2006) suggest that many participants do not actually intend to buy products at trade fairs. Instead, attendees are more interested in acquiring knowledge about the new products displayed, their characteristics, potential uses and so on. To paraphrase Polanyi's (1967) famous notion of “tacit knowing”, the participants obtain more knowledge during a trade fair than they can speak of. They also find inspiration regarding their production program (e.g. materials, layout or design) in an environment that supports associations, which may lead to new product ideas or variations in existing products (Borghini et al. 2006). Trade fair participants also try to reassure themselves about the capabilities of other firms. The search processes of visitors at trade fairs appear to be largely experimental in character as “... buyers are ‘immersed’ in an embodied experience that entails all their senses, where they can touch, smell, listen to, and even taste all the stimuli in the environment provided by exhibitors together with trade show organizers” (Borghini et al. 2006: 1156). In other words, trade fairs create unique opportunities for learning, knowledge exchange and searching that may not be easy to replicate through alternative mechanisms, such as virtual forms of communication (Bathelt and Schuldt 2010).

All of this suggests that trade fairs are important sites for interactive learning and the transmission of global best-practice technologies across geographical boundaries. From here, it seems to follow that leading trade

fairs would play a pivotal role in disseminating best-practice technologies and generating homogenous production configurations throughout the world (Maskell and Malmberg 1999; Gertler 2001). Yet, as shown below, the trade fair environment provides a more complex set of dynamics. In the following section, we use the concept of the “organized anarchy” to characterize such dynamics and frame technological search processes.

4 Trade Fairs as “Organized Anarchies” and the “Garbage-Can Model” of Organizational Choice

Having emphasized the importance of trade fairs in enabling processes of interactive learning and knowledge exchange, we now turn our attention to the nature of the technological search processes that occur at these events. This is an important step in clarifying the precise mechanisms linking inter-firm learning to wider patterns of technological specialization and/or standardization. Since the recently discussed temporary cluster concept does not adequately explain technological searches and related decision-making, we introduce the “garbage-can model” of organizational choice and the concept of the “organized anarchy”. In the present context, this conceptualization offers significant advantages over related concepts, such as the temporary cluster or the network, as it directs specific attention to the nature of the search and decision-making processes of firms. We also draw important parallels between the garbage-can model and recent work in behavioral economics, which is currently one of the most dynamic subfields in economics.

The garbage-can model emerged as part of a broader critique of rational-choice theories of organizational decision-making. Originally developed by Cohen et al. (1972) to capture the often ambiguous and non-linear dynamics of decision-making in university settings, the model provides a useful framework for analyzing decision-making processes in a variety of settings that fit the basic criteria of so-called “organized anarchies”. Indeed, over the past few decades, the garbage-can model has been used in many different organizational contexts, including military organizations (March and Weissinger-Baylon 1986), policy-making and agenda-setting in the U.S. federal government (Kingdon 1995), foreign policy choices (Newmann 1998), public sector reform in Denmark (Bundgaard and Vrangbæk 2007), the “greening” of business (Backer and Clark 2008) and strategic decision-making in information systems (Fardal and Sørnes 2008). Despite its demonstrated applicability in a wide range of organizational contexts, the model has not yet been used to analyze the search and related learning processes of firms during trade fairs.

Organized anarchies can be defined by three main properties: problematic preferences, unclear technologies and fluid participation. As discussed below, these properties nicely capture the dynamics of the trade fair, which is an organizational configuration that is both temporal and partially open in nature. In applying the garbage-can model to this context, we suggest that trade fairs are an organizational form like other complex organizational settings, such as university and government settings, where the model has been applied before. Indeed, trade fairs have a clear orientation defined by the value chain focus and operate according to specific rules and regulations set up by the trade fair organizers. This interpretation of trade fairs as an organizational form is similar to views of networks or clusters as organizational configurations.

- The notion of *problematic preferences* refers to a general lack of consensus regarding individual and organizational goals. In our context, this means that firms participating in a trade fair do not necessarily agree about the objectives of that fair or the direction of change in the industry. They also re-think and re-define their own goals over time. Trade fairs thus resemble a loose collection of ideas, where preferences are discovered through action rather than action being based on clearly-defined preferences.

- The second property, *unclear technologies*, refers to the problem of selecting suitable technologies or processes to meet organizational goals (Fardal and Sørnes 2008). In the case of a trade fair, this means that participants often do not have precise ideas of how to select a technology, but proceed on the basis of “trial-and-error” and “pragmatic inventions of necessity” (Cohen et al. 1972: 1). They operate under conditions of technological and market uncertainty and thus tend to proceed experimentally, with only partial knowledge of the consequences of their actions. In garbage-can model terms, “[p]articipants arrive at an interpretation of what they are doing and what they have done while in the process of doing it” (Cohen et al. 1972: 2).
- In the context of trade fairs, *fluid participation* suggests that attendees “come and go” as they please to both the exhibits at the trade fair and the fair itself. Participants devote varying amounts of time and energy to particular problems or issues. Organizational boundaries are, consequently, unclear and characterized by considerable instability, while the core body of decision-makers is re-established on a regular basis.

To summarize, the garbage-can model suggests that the ambiguous nature of individual and organizational decision-making stems from the absence of stable, clearly defined goals (problematic preferences), the indeterminacy of knowledge and methods required to realize organizational objectives (unclear technologies) and the erratic involvement of agents in different decision-making arenas (fluid participation). In such contexts, decision-making hinges on the interrelations among four largely independent streams of variables: problems, solutions, participants and choice opportunities (Cohen et al. 1972).

Briefly stated, the *problems* stream refers to the processes by which a particular issue or event comes to be recognized as “a problem”. In the present context, firms may, for instance, recognize certain inefficiencies in production as such a problem. There may be objective indicators of a specific problem, such as a downtime in production; in most cases, however, problem definition is highly subjective and open to individual interpretation (Kingdon 1995). Decision-making within this stream, therefore, often requires ongoing deliberation among the participating firms at a trade fair.

The *solutions* stream challenges much of the conventional wisdom about the direction of the problem–solution relationship. It views firms in the trade fair context not as “problem-solvers” but, rather, as “solution-marketers” (Fardal and Sørnes 2008). At a trade fair, a “solution” refers to a firm’s new product or process innovations presented. Since the garbage-can model views the “offering of solutions” as a central part of organizational action (Fardal and Sørnes 2008), trade fairs provide a valuable test environment in which to analyze such behavior (Cohendet et al. 2012). As such, trade fairs might not be primarily places where firms look for solutions to specific problems they encounter or where they try to achieve clearly specified goals.

The *participant* stream simply speaks to the transient nature of participation at trade fairs. Not only do firm representatives “come and go” relatively freely, external factors, such as time, also play a role in determining the amount of energy and interest firms will invest in decision-making.

The final stream, *choice opportunities*, refers to those moments, or “windows of opportunity”, when the various streams come together and decisions are made. In the context of the trade fair, this refers to those occasions when firms have the opportunity to explore specific new products and technologies and discuss their characteristics. Such choice opportunities include the establishment of potential business partners or alliances, evaluations of the viability of new technological innovations, as well as the allocation of time, money and responsibilities to a specific project.

As the literatures on organizational decision-making and behavioral economics suggest, agents rarely select best-practices or optimal solutions. More often, they are drawn to solutions that make the greatest sense within their own production contexts. What is of particular interest here is that both literatures suggest a search and decision-making pattern that is different from what is implicitly expected of rational actors. Although some popular marketing guides portray trade fairs as contexts of problem-led searches and rational decision-making (e.g., Clausen and Schreiber 2000; Stevens 2005), the garbage-can model and recent work in behavioral economics point instead to the non-linear patterns of individual and collective action at these events. In this respect, the search processes of firms at trade fairs may be guided by a more tacit form of knowing, where agents come across solutions that are only later related to actual problems in their local production contexts elsewhere. Providing empirical support for this pattern of technological searches would greatly enhance current understandings of the diffusion of new products and technologies. It would confirm Storper's (1997) assertion that the uptake of new knowledge is never a linear adoption process but always involves contextualization. This process of contextualization is based on combining new explicit knowledge acquired at a specific trade fair locality with tacit knowledge that exists in decentralized forms in the many different places of origin, embedded in localized production processes and embodied in the people that operate them.

It is in this context that we conducted a systematic study of the nature of technological search processes at trade fairs. Following a description of the data and methods used in this study, we present empirical evidence of these processes of search, choice and adaptation.

5 Data and Methodology

Our study investigates the nature of technological search processes of exhibiting firms at four major trade fairs in North America. We adopted a qualitative approach that is both inductive and deductive in nature, as it engages theory and complex empirical realities in "close dialogue" (Clark 1998). In doing so, we aimed to further develop our conceptual understanding of the technological search processes at trade fairs (Eisenhardt 1989). The analysis focused specifically on the processes by which exhibiting firms identify and ultimately select new products and technologies. Our empirical setting consisted of two trade fairs in the United States and two in Canada (Table 1) with either a design or a technology focus. In the United States, we investigated the LightFair International (LFI) in New York and the International Plastics Showcase (NPE) in Chicago. In Canada, we focused on the Canadian Manufacturing Technology Show (CMTS) in Toronto and the Montreal Manufacturing Technology Show (MMTS) in Montreal.

Table 1: *Characteristics of Selected North American Trade Fairs, 2009/2010*

Trade fair	Country	Size (square feet)	Exhibitors (number)	Attendees (number)	International attendees (share)
LFI, New York	USA	170,000	476	23,416	N/A
NPE, Chicago	USA	977,660	1,851	44,000	33 %
CMTS, Toronto	Canada	N/A	500	5,898	4 %
MMTS, Montreal	Canada	N/A	201	5,000	1 %

Notes: N/A = not available; LFI = LightFair International; NPE = International Plastics Showcase; CMTS = Canadian Manufacturing Technology Show; MMTS = Montreal Manufacturing Technology Show.

Although their international significance varies, all of the above trade fairs represent important business-to-business events in broad industry/technology environments in North America. While we cannot generalize our findings beyond the North American context, previous work on international trade fairs in Europe suggests that there may be similarities in the search processes of trade fair exhibitors to those discussed here (Bathelt and Schuldt 2008).

The selected trade fairs allow us to compare design-oriented settings (i.e., LFI) with trade fairs that have a stronger technology focus (i.e., NPE). The fairs also reveal different settings for innovation. The lighting industry, on the one hand, experienced a new wave of innovations in the past decade and opportunities for recombination due to changing environmental regulations (e.g., the phasing out of the classical light bulb). This was different from the more stable technology environments observed in the other trade fairs. On the other hand, the plastics industry showed greater diversity in its focus, with machinery producers, software developers and plastics suppliers presenting their exhibits. In this context, innovation was predominantly incremental in character. Finally, by including trade fairs from both the United States and Canada, we are able to make cross-national comparisons and observe variations in the nature of inter-firm interactions at events that are largely national/regional (i.e., CMTS and MMTS) versus international (i.e., LFI and NPE) in focus. To assist with these comparisons, we developed a typology of exhibitors' technological search behaviors and artifacts based on the interviews conducted.

Our ultimate interest lies in the behavior of firms, as opposed to the individuals being interviewed. Thus, in choosing potential interviewees, we always tried to talk to executives, owners or senior managers who would be able to speak on behalf of their firm. In the case of small- and medium-sized firms, this did not present a problem. In the case of large multinational firms, however, it was more difficult to get access to senior-level executives. In an effort to eliminate bias in our interviews, we sometimes asked respondents to describe typical patterns of firm representatives. The wording of some of our questions also encouraged respondents to speak on behalf of the firm, rather than in terms of their own personal experiences or impressions. We are, therefore, confident that our results represent important patterns of firm-level search behavior.

That being said, our study does not speak to the general nature of visitors' search processes since we concentrated exclusively on the behavior of exhibitors. Our rationale was informed by prior experience, which suggested that exhibiting firms operate simultaneously as important visitors and exhibitors during trade fairs in the sense that they acquire information about products, technologies and their markets and make technological choices (Schuldt and Bathelt 2011). While it is true that firms rarely make final decisions about the acquisition of a new technology at the actual trade fair, they often collect vital information or, at least, limit the range of options through scanning other booths and talking to a wide range of trade fair participants. It is these choices and selection activities that form the basis of our study.

In selecting potential respondents, we tried to provide adequate representation of the structure and diversity of the four trade fairs. The overall exhibition space was divided into segments according to different product/technology groups and, within each segment, exhibiting firms were chosen randomly from the floor plan. We conducted a total of 216 interviews over the course of the four trade fairs, with a low rejection rate ranging from 12 % at the CMTS in Toronto to 30 % at the NPE in Chicago (Table 2). Of the 216 interviews conducted, 65 focused specifically on the technological search processes of exhibitors. These 65 interviews form the primary basis of our analysis.

Table 2: *Interview Statistics of Selected North American Trade Fairs, 2009/2010*

Trade fair	Interviews conducted		Rejections		Interviews focused on search processes	
	Number	Share	Number	Rate	Number	Share
LFI, New York	55	26 %	12	18 %	17	26 %
NPE, Chicago	69	32 %	30	30 %	19	29 %
CMTS, Toronto	57	26 %	8	12 %	17	26 %
MMTS, Montreal	35	16 %	7	17 %	12	19 %
Total	216	100 %	57	26 %	65	100 %

Notes: LFI = LightFair International; NPE = International Plastics Showcase; CMTS = Canadian Manufacturing Technology Show; MMTS = Montreal Manufacturing Technology Show.

The interviews were conducted with a variety of firm representatives, such as owners, CEOs, engineers, technicians, regional managers and sales representatives. Yet, as noted above, we made a concerted effort in each case to speak with the most senior level person available. Each semi-structured interview lasted, on average, between 10 and 15 minutes. The questionnaire format was divided into three parts. In the first part, we asked exhibitors to describe their reasons for participating in the trade fair, to identify other trade fairs they typically participate in, and describe the expected benefits of participating in this trade fair. In the second section of our survey, we asked exhibitors to tell us whether they informed themselves about other exhibits and, if so, whether they had a particular goal in mind when doing this. We encouraged respondents to provide a detailed account of their method of scanning other exhibits and how they would recognize when they found something interesting or valuable to them. We also asked respondents to provide us with a quantitative estimate regarding the amount of time spent searching other exhibits. The third part of the questionnaire was designed to gather background information regarding the size, structure and geographical origin of the firm. In this section, we also asked firms to compare the value of trade fairs with other ways of contacting customers or acquiring market/industry information, such as specific Internet platforms.

Based on these semi-structured interviews, we developed a typology to categorize different types of exhibitors' search behaviors. This typology is based on two variables: (i) the goal of the search process and (ii) the approach to technological searching. It classifies the types of search behaviors into four categories: type 1 – unclear and unstructured; type 2 – ambiguous but optimistic; type 3 – confident but unclear; and type 4 – clear and structured. The typology, which ranges from completely unstructured to highly structured searches, allows us to draw meaningful analytical distinctions among the different search behaviors and related learning processes. The typology is described more fully in the following section, which discusses our findings.

6 Results and Discussion: Technological Search Processes and Exhibitor Behavior at Trade Fairs

The results of our research shed important light on the technological search processes of firms at trade fairs. Before analyzing the different types of search behavior encountered, we first describe the four prototypes identified (Table 3), which range from unstructured to highly structured in nature.

Table 3: *Typology of Exhibitors' Technological Search Behaviors at North American Trade Fairs, 2009-2010*

Category	Type 1 Unclear and unstructured	Type 2 Ambiguous but optimistic	Type 3 Confident but unclear	Type 4 Clear and structured
Description	No clear goal in searching the other exhibits; no evidence of a clear approach to searching	Only a very general goal; but optimistic that they will be able to recognize what is important or useful when they come across it	Insisting that they know what they are looking for; but no articulation of the precise nature of the goal or approach to searching	Articulation of a clear goal; indication of a systematic approach to searching
Firm interview ID	CMTS 11, 12, 13, 14, 15, 20, 31, 38, 57 MMS 08, 21, 26, 27 NPE 24, 26, 27, 28, 29, 36, 37, 44, 45, 63 LFI 15, 23, 27, 35, 43, 48	CMTS 21 MMS 06 LFI 18, 19, 31, 53	CMTS 39, 46, 50, 51, 52 MMS 07, 17, 20, 32 NPE 23, 25, 31, 32, 62, 69, 70 LFI 14, 20, 21, 34, 44, 47	CMTS 47, 49 MMS 09, 10, 33 NPE 17, 18 LFI 13
Regional trade fair (number of firms)	13	2	9	5
International trade fair (number of firms)	16	4	13	3
Design-oriented fair (number of firms)	6	4	6	1
Technology-oriented fair (number of firms)	23	2	16	7
Total (n = 65)	29	6	22	8
Share of firms	45 %	9 %	34 %	12 %

Type 1: Unclear and unstructured. At the least structured end of the spectrum of search behaviors (45 % of the firms), exhibitors undertook searches without any clear or pre-defined ideas about what they were actually looking for. Respondents that fell into this category were open about this lack of clarity and often suggested that they were simply walking around the exhibits, looking to see if something new or interesting “catches the eye”. These firms did not know what this might be or how to find it. They did not proceed with any kind of plan, but just “wandered around”.

Type 2: Ambiguous but optimistic. The exhibitors in this category (9 % of the firms) did not appear much clearer than type 1 firms with respect to their initial search objectives. Many suggested that they did not know what exactly they were looking for. Yet, when asked how they might determine the potential value of an artifact, respondents insisted that they would recognize it when they see it or come across it.

Type 3: Confident but unclear. These types of searches (34 % of the firms) were characterized by a high degree of confidence on the part of the respondents, but little evidence to support this claim of certainty. Respondents were often very emphatic, saying “yes, absolutely” when asked if they had a particular goal when searching through the exhibits. Yet, when asked to elaborate, they were rarely able to pin-point a specific objective or a systematic approach in the method of searching.

Type 4: Clear and structured. The last type of exhibitor search behavior (12 % of the firms) was characterized by a clear focus and a systematic approach to searching. Respondents in this category were able to refer to specific goals and had a clear idea of how to meet them. They often developed lists or plans prior to coming to the trade fair and were in consultation with different parts of the firm to modify these plans if necessary

and discuss each other's progress at the end of each day. These respondents often had a post-event plan for assessing the outcome of the trade fair with respect to pre-defined goals.

This basic typology of search behaviors allows us to describe more fully the technological dynamics at trade fairs and their wider consequences. To begin, it is important to note that nearly all respondents participated at the trade fairs not only to display their own products, but also to examine the exhibits of other firms and inform themselves about new trends, markets and technologies (Table 4). As one interviewee explained, “[w]e try to see who has got something that is faster, better, quicker. And if something catches our eye that is similar to the industry that we are in or that we are targeting, then, for sure, we will stop by and ask some questions.” This statement points to the dual role of trade fair exhibitors. Rather than simply showcasing their latest products and technologies, exhibitors were also visitors in the sense that they aimed to learn about other exhibitors and their exhibits. The bulk of our responses provided clear evidence of the importance of such events in strategic decision-making, looking for potential partners and collecting ideas for new products.

Table 4: *Characteristics of Technological Search Processes at Selected North American Trade Fairs, 2009/2010**

Trade fair	Exhibitors that inform themselves about other exhibits during the trade fair	Exhibitors that spend at least one hour per day inspecting other exhibits	Exhibitors that do not have a particular goal when searching through other exhibits
LFI, New York	94 %	79 %	35 %
NPE, Chicago	100 %	64 %	53 %
CMTS, Toronto	100 %	50 %	53 %
MMTS, Montreal	100 %	40 %	33 %
Total	99 %	59 %	47 %

Notes: LFI = LightFair International; NPE = International Plastics Showcase; CMTS = Canadian Manufacturing Technology Show; MMTS = Montreal Manufacturing Technology Show.

* This table refers to n = 65 interviews that specifically focused on technological search processes.

As a general rule, exhibitors spent a considerable amount of time examining other firms' exhibits at the trade fair. At the LFI, firms spent an average of 2.5 hours per day scanning the other booths, and nearly 80 % devoted at least one hour to this task. At the NPE, approximately two-thirds of the trade fair participants spent at least one hour per day inspecting other exhibits. In the Canadian context, the trade fair participants spent somewhat less time inspecting other exhibits. Yet, 50 % of CMTS exhibitors and 40 % of MMTS participants spent at least 60 minutes per day on such activities (Table 4). These differences may be due to fact that the Canadian-based fairs were substantially smaller than the U.S. fairs studied. The exhibitors at Canadian fairs required less time to get an overview of the industry trends or of their competition.

In general terms, nearly half (47 %) of the firms interviewed across all trade fairs did not have a specific goal in mind when inspecting other exhibits (Table 4). Given the high costs of participation and the fact that some of the events take place only once every two years, we would have expected firms to be better prepared in terms of what they look for at a trade fair. This did not seem to be the case, as is clearly expressed by the two types of search processes located on the unstructured pole (Table 3). Type 1 respondents were usually forthcoming about not knowing their goals. They would simply reply “No” when asked whether they had a particular goal, or provide an expression along the following lines: “No, it’s all open. [We] just want to see what is out there.” The few respondents that fit the second type were less up-front but similarly vague in pin-pointing the actual goals of their search behavior. That being said, they were decidedly more optimistic than the first type in terms of being able to recognize the potential importance of an artifact if they saw it. The following quote from the manager of a furniture design firm nicely captured this sentiment: “Yes and no... Sometimes

we are looking for people to partner up with, sometimes we are looking for potential customers, and sometimes we just want to see what is out there. We kind of just know, or we ask enough questions to see if it fits." Thus, while the two groups were not identical, they both indicated a large degree of ambiguity regarding the objectives underlying their search behavior.

Despite the amount of time devoted to search and learning-related activities, the goals described by firms that were supposedly confident in their objectives were also diverse and often poorly defined. Some participants focused on what their competitors were doing, some looked for partners or new suppliers to assist in making improvements to their equipment, and others simply said they were searching for new technological innovations. The following quote illustrates this point: "Oh yes, absolutely. During the day actually, when we see if there is a bit of a down time, we will maybe pick an aisle and go see other guys. Now the thing is, coming to this thing many times, we know a lot of the players and we have kind of made acquaintances. It is good to see old faces and also when we go talk to them we can very quickly find out what new innovations they have come up with..." Confidence clearly defined this third type of search behavior. Yet, compared to the fourth and most structured type, their behaviors were characterized by a lack of precision in describing the goals and methods underlying the search processes. The following statement made by the CEO of a small machine manufacturing firm illustrates this distinction: "Yes, we have objectives on the customer lead side as well as on the partnership side. So, yes we have plans and we have worked with the marketing company to be apprised of the show and to make sure that we have our objectives and make sure that we have those leads and people to follow up afterwards." The methods of type 4 firms were much more clearly defined; however, the goals themselves were still more implied than actually specified.

In line with the garbage-can model, trade fairs were thus often seen by the respondents as complex, fluid and somewhat ambiguous environments. Consequently, many participants at these events were disinclined to approach the fair with a single, predefined goal, as this was often considered to be too limiting or counterproductive. A large design firm at the LFI aptly illustrated the multiple goals that may be associated with trade fair participation: "Personally, I have several goals: to educate myself about what is new, the latest thinking in product design and product development, but also in technology. So I have multiple goals: to learn what is new from a technological standpoint in sources and control here, and then also what our competitors are doing in terms of product development, product design and optical system design."

As documented in Tables 3 and 4, a large proportion of firms lacked a specific goal when looking through the exhibits of other firms. This group of firms did not differ systematically by international/regional character of the trade fair, by orientation of the fair (i.e., design or technology focus), or by host country (Table 3). More than half of the exhibitors at the NPE and CMTS openly suggested that their searches were not guided by a clear objective, while roughly one third of the respondents at the LFI and MMTS fit this same profile (Table 4). When we include Type 2 and Type 3 respondents as part of a general unstructured or ambiguous category, these proportions increase substantially (see Table 3 for a clear breakdown). Taken together, these respondents identified very broad and ambiguous goals that reflected the complex and non-linear nature of decision-making in "organized anarchies" (March and Olsen 1989; Cohen et al. 1972). Such goals included social networking, acquiring an overview of the competition, checking out new product technologies, and finding new applications to complement an existing product line. In other words, the majority of the firms interviewed were unable to provide a precise description of their technological search processes at trade fairs. While their stated goals often seemed to be closely linked to the existing production or market context, such processes rarely followed a rational trajectory. In one of the few cases where the goals were explicitly stated, the manager of a lighting manufacturing firm explained that "[w]e have a list of priorities that we have already discussed back home, [things] that we need to improve on, or what the next step is in the generation of our products [...] This is more or less a guideline of what we are looking for." In a similar vein, a representative from a machinery fabrication firm described the process as follows: "I know exactly where I am going – I have

taken the map. I have narrowed it down to, say there might be 750-800 exhibitors, and ... I am basically only interested in looking at about 12-14 [booths]. I do all that homework before." The focus of such pre-determined priorities varied across firms and trade fairs. This may relate, for example, to the acquisition of specific technologies, to enhancing consumer relations, to product comparison strategies and even to new marketing techniques.

It is important to note that the responses of firms that had a clear goal when looking through the exhibits were, in fact, not substantially different from those that admitted they did not have a specific goal. The majority of the firms we spoke to emphasized that they were looking for innovations in general, or anything that might be new or useful to them. Very few firms were able to describe exactly how they proceeded to check for interesting developments or how they knew when they had stumbled upon something that might be interesting or valuable. As the owner of a firm specializing in industrial 3D laser scanners observed, "[w]e just see if there is something useful to our product and look at the competition. We do not always know what we are looking for; we might just see something that is new and cool, and wonder how we might apply it to our own products." A broad focus on new technologies or innovations was also apparent at the LFI, where one representative of a lighting firm noted that "[f]or me, it is more about general information. I go through the entire show, quickly scanning each aisle, and if something interests me I focus on that." In this sense, it may be fair to say that our typology likely overestimates the number of firms which truly reflect a clear and structured form of search behavior.

As the garbage-can model predicts (Cohen et al. 1972), trade fair participants tend to see the exhibits they encounter as ready-to-apply solutions. They subsequently look for a potential problem to which to apply this solution. This may include assessing an artifact's ability to prevent future problems or determining whether there is an accessible interface to the firm's existing production structure – whether that be problem- or performance-related. Thus, while over half of our interviewees insisted that they had a particular goal in mind when walking through the fairgrounds, their responses indicated little more than a general idea of what they were actually looking for.

Whereas our interviewees were rarely able to provide a clear description of their search behavior at the fair, many insisted that they could recognize something that would be useful to them once they came across it. As one manager of a lighting control firm explained, "I will see something and instantly recognize what problems it solves." Many other trade fair exhibitors felt that they knew "just by looking at a product" whether it would be useful to their firm. In part, this had to do with whether the new product or technology fit with – or could be adapted to – a firm's existing production context. Such an assessment necessarily implies a great deal of implicit knowledge, which is difficult to clearly explicate when asked to do so. We observed this pattern in both design-intensive and technology-oriented trade fairs. This finding helps understand why it is important for firms to send experienced managers and technical experts to these events, rather than just sales personnel, as the latter may be unable to identify relevant developments.

Although exhibitors rarely make final decisions at the trade fair, the representatives that inspect the other exhibits often have a great deal of experience. Consequently, their impressions carry considerable weight in the respective firms' decision-making processes. This is particularly true in industry segments with a strong technology focus, where agents may select or test solutions more closely after a trade fair to determine which ones are relevant for them (Bathelt and Schuldt 2008). In design segments, decisions might be made more quickly, or a repertoire of potential solutions may be orchestrated, from which partners and solutions can be drawn later on when needs arise. In each of these circumstances, the choices made during trade fairs tend to be guided by a firm's local production context, as well as its past experiences in innovation and problem-solving. As one regional manager put it, "[w]e look for applications that would fit our product [context] ... [and] for applications that are new that we have not thought of – that we could fit our product to." In other

words, the selections made by firms during the trade fair are rarely a linear result of precisely-defined goals or existing problems. Rather, they are influenced by past experience and a desire to identify products and technologies that fit or complement the firm's pre-existing production set-up and its specific challenges or advantages.

The results of this study therefore suggest that the search processes of firms at trade fairs privilege processes of knowledge contextualization, whereby new technologies are adapted to a specific industry context or a particular set of problems that exists in the firm's production and institutional environment (Storper 2009a; Bathelt and Glückler 2011). From a garbage-can model perspective, this means that the search patterns of firms are a function of the combined effects of the solutions presented at the fair, the economic context of the participants, and the existence of specific "windows of opportunity" in the sense of plausibility, utility or even easy applicability of a "solution". In this context, old and new knowledge resources are combined and ultimately coupled with the specific knowledge bases of experienced employees. This kind of combination and recombination of knowledge leads to foreseeable changes in the technologies used by the firms. While, in some cases, it may encourage the diffusion of state-of-the-art technologies, it particularly supports existing patterns of technological specialization at the level of the firm and, in collective terms, the industry. Through this contextualization process, less specific resources are re-configured into locally embedded innovations, learning processes and new forms of uncodified knowledge that are not readily available to agents outside of this context (e.g., Asheim 1999).

Our findings suggest that the technological search processes of firms at trade fairs often – or even mostly – do not readily correspond to a rational or linear model of decision-making, in which the relevant actors make choices based on a complete overview of the market. Rather, in the face of continuously changing markets and technologies, there are clear limitations on what economic actors can predict or control in terms of new developments. While the garbage-can model provides a useful framework for characterizing the complex interactions that take place at trade fairs, recent work in behavioral economics also sheds light on this issue. In recognizing that decisions are often made in the face of imperfect or limited information, studies in behavioral economics emphasize the importance of "local" reference points or "anchors" (Ross and Nisbet 1991; Glaeser 2003; Storper 2009b) in guiding human action. And, as the concluding section suggests, these processes may have broader implications regarding the convergence or divergence of technologies in broader spatial perspective.

7 Conclusion: Trade Fairs and Production Systems in Spatial Perspective

This study is set in the context of the proximity debate which argues that proximity favors economic interaction, yet often does not specify such processes in detail. To fill this gap, this study explores the nature of the technological search processes of firms at national and international trade fairs in order to elucidate specific patterns of interactive learning and the resulting knowledge flows in spatial perspective. Trade fairs are viewed as critical venues for such exchanges because they bring together agents from all over the world to present and scan the latest technological developments in an industry, connect with new and existing customers, create or maintain international business networks and identify new markets (Bathelt and Schuldt 2008; 2010). The unique gathering of specialized agents at these events generates a complex and dynamic environment, in which firms use face-to-face interaction and observation to enable processes of learning and inform technological choices across geographical boundaries. Leading business-to-business fairs can, thus, be viewed as important vehicles through which intensive – albeit often tacit and indirect – knowledge about an industry's products, technologies and best-practices are exchanged.

Our empirical analysis demonstrates that the choices made at – or through the support of – trade fairs are heterogeneous and rarely follow a clear or linear trajectory. The technological search processes of trade fair participants are clearly oriented towards the acquisition of new knowledge – be it product-, technology-, industry-, market- or management-related. Rather than leading to processes of technological standardization, our study reveals persistent patterns of knowledge contextualization and path-dependence. This is largely due to the complexity of the trade fair environment and the fact that the fusion of participants, problems and solutions in this context resembles a garbage-can process, rather than a rational-comprehensive process. As recent work in behavioral economics suggests, preference formation in such cases is strongly shaped by the economic context in which agents are embedded (Camerer and Lowenstein 2004).

Inter-firm learning in the organized anarchy of the trade fair environment presents clear challenges because the very lessons drawn under such conditions are ambiguous. Yet, our findings lend support to the argument that adaptation and learning can occur within organized anarchies and that a certain degree of disorder may even stimulate processes of learning and innovation (March and Olsen 1979).

This paper focuses on the nature of technological search processes and the exchange of corresponding knowledge at leading business-to-business fairs in North America. However, our research results may have implications regarding the role of such processes in the evolution of broader, even territorial, production systems. Having established a more complete picture of the nature of the search processes at these events, further research into the subject might seek to address the following questions: how and in what ways do the search processes of firms at major international trade fairs shape processes of convergence and/or divergence among different territorial production systems? And, to what extent do leading national and international trade fairs facilitate the transfer of specific products, technologies or practices across diverse national political economies?

Although trade fairs represent important nodes in the global political economy, where knowledge is exchanged among geographically dispersed economic agents, the search processes that occur during these events seem to simultaneously support two opposing processes associated with economic globalization – namely, “ubiquitification” (Maskell and Malmberg 1999) through which new technologies and knowledge resources are increasingly codified and disseminated across space, and “contextualization” (Storper 1997; 2009a) by which innovations are translated into the agents’ established production environment.

While the literature on field-configuring events (Lampel and Meyer 2008; Möllering 2010) emphasizes the capability of certain types of events to actively shape the configuration of a new field, most trade fairs are less agenda-oriented and less rigidly structured (e.g., Schuldt and Bathelt 2011) – although some differences exist (Weller 2008; Rinallo and Golfetto 2006). The business-to-business events analyzed in this paper strongly contribute to the evolution of industrial and technological fields but in a more decentralized, less organized and more incremental way. They simultaneously support both field configuration and reproduction. As such, while trade fairs are clearly important stages in gaining stronger market legitimacy for new products and technologies (Aldrich and Fiol 1994; Cohendet et al. 2012), search and choice processes contribute not only to a broad diffusion, but also to specific contextualization processes that differ between places and territories.

Conceptualized in terms of an organized anarchy, in which decisions are largely a function of the random coupling of solutions, problems, participants and opportunities, the exact relationship between trade fairs and processes of convergence or divergence still remains somewhat puzzling. Whereas technological convergence and the diffusion of best practices are often viewed as a consequence of these events, the results of this study suggest that the technological searches closely relate to the individual competence bases of the firms. Therefore, if the competence bases of firms systematically vary according to the national economic systems in which these firms are embedded (Hall and Soskice 2001; Crouch 2005), trade fairs may encourage patterns of

ongoing national specialization, rather than convergence of different national economic models. Supporting such a claim would, however, require further investigation into the aggregate outcomes of these technological search processes. As such, trade fairs are not only interesting as temporary clusters, but the nature of technological searches and choices and related knowledge flows may have distinct consequences for industrial clusters and even wider territorial industry settings.

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