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Bahlmann, M.D.

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Ch.4

Does distance matter? An ego-network approach towards the knowledge-based view of cluster

Abstract

The purpose of this chapter is to empirically analyze how different forms of proximity influence interactive learning and ease of knowledge transfer among entrepreneurs, in order to advance the knowledge-based theory of clusters. Making use of ego-network data, gathered among entrepreneurs from the Amsterdam IT and new media-cluster, the data lead us to reconsidering the role of geographical proximity as main catalyst of interactive learning and knowledge flow among entrepreneurs. A strong case is put forward for acknowledging other forms of proximity, namely relational, cognitive, and in particular epistemic proximity, as main facilitators of interactive learning and ease of knowledge transfer. [30]

4.1 | Introduction

A central theme in cluster literature revolves around the question to what degree clusters, here defined as agglomerations of similar and related business activities, enhance entrepreneurs' creative and innovative capabilities through facilitating local learning (Bahlmann and Huysman 2008). Put differently, being located in a local

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[30] An earlier version of this chapter appeared in the **Academy of Management Meeting's 2010 Best Paper Proceedings** (TIM division).

knowledge network is considered to intensify one's creativity, learning, and innovative capacities. The spatial clustering of economic activities is supposed to enhance not only local learning (Bathelt, Malmberg and Maskell 2004), but also regional economic revitalization and intensified innovation (Amin and Roberts 2008). Clusters are, thus, seen as the prime vehicles for supporting knowledge dynamics among entrepreneurs, for spatial agglomeration eases the process of knowledge transfer and learning through forming relationship-specific heuristics.

These processes of learning and knowledge transfer are assumed to be spatially sticky due to their context specific nature. This implies that actors can only share new, creative ideas effectively when sharing a similar social context which is, to a large extent, assumed to be defined locally (Sole and Edmondson 2002; Gertler 2003, Lam 1997). As such, it is considered advantageous for entrepreneurs to be located in a cluster, surrounded by similar and related entrepreneurs with whom they can interact (Bathelt *et al.* 2004).[31] In principle, the process of local learning taking place within a cluster is considered to be facilitated by high degrees of geographical proximity (i.e. being located in the same cluster) and cognitive proximity (i.e. the degree to which ego and alter share similar work related knowledge) among the actors involved.

The above line of reasoning, however, is increasingly met with a sense of unease, as recent studies argue that it is not the local knowledge network per se distinguishing successful clusters from unsuccessful ones. Clusters, it is argued, can distinguish themselves through building and maintaining so-called pipelines: "a variety of channels for low-cost exchange of knowledge with relevant hotspots around the globe" (Bathelt *et al.* 2004: 33; see also Saxenian 2006; Owen-Smith and Powell 2004; Tallman and Phene 2007). New creative input is considered to enter the cluster through entrepreneurs with ties to other 'knowledge hotspots' (i.e. clusters), enhancing the creativity of the entrepreneur involved as well as the creative and innovative capacity of the cluster as a whole due to knowledge spillover effects and

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[31] In addition, the co-location of similar and related entrepreneurs is said to increase competition and rivalry, thus serving as a strong incentive for both innovation and product- or service-differentiation (Porter 1990; 1998). Being located in a cluster enhances an entrepreneur's ability to constantly monitor and compare his/her offerings to that of his/her competitors.

local network dynamics. Personal ties between entrepreneurs spanning cluster boundaries are hypothesized to be crucial channels for the transfer of new, creative ideas, whereas local knowledge networks are hypothesized to mainly facilitate a 'local buzz' (Bathelt *et al.* 2004).

These observations appear to contradict the knowledge-based theory of clusters, which seeks to explain the existence of clusters based on their assumed value as facilitators of local knowledge dynamics (Arikan 2009; Malmberg and Maskell 2005; Maskell 2001). In addition, economic geographers nowadays consider knowledge exchange critical to assessing cluster performance (Tallman, Jenkins, Henry and Pinch 2004). Given the latest findings of Saxenian (2006) and Owen-Smith and Powell (2004), the dogmatic belief in knowledge dynamics being confined to predefined cluster boundaries appears to lack a sound theoretical and empirical basis. In particular, the role of geographical proximity as main facilitator for local knowledge dynamics appears to contradict with the apparent ease, speed, and significance of knowledge transfer spanning cluster boundaries. From the field of economic geography, this has resulted in a call for assessing other forms of proximity in facilitating knowledge dynamics among entrepreneurs, such as relational, cognitive, and epistemic proximity (Bunnel and Coe 2001; Gertler 2003). This requires us to critically approach both knowledge dynamics within and knowledge dynamics across cluster boundaries by making use of a relational perspective.

The discussion above reveals a fundamental question: *under what conditions of proximity can knowledge transfer successfully take place both within and across cluster boundaries*? Based on the knowledge-based theory of clusters, geographical proximity (i.e. being located in the same cluster) combined with some degree of cognitive proximity should be sufficient for facilitating learning (Boschma 2005). It appears, however, that the role of geographical proximity is overemphasized in explaining learning and knowledge transfer (Oinas 1999). Other forms of proximity have been suggested as facilitators, thus limiting the role of geographical proximity (Boschma 2005).

This chapter provides an empirical exploration of how different forms of proximity, including geographical proximity, interact in facilitating knowledge dynamics among

entrepreneurs. In this study, the concept of knowledge dynamics is divided in two subcategories: interactive learning and ease of knowledge transfer. Both subcategories are recognized as important vehicles for understanding knowledge dynamics from both a geographical and relational perspective (Boschma 2005; Reagans and McEvily 2008). To study this, we turned our attention to entrepreneurs located in the Amsterdam IT- and new media-cluster, the Netherlands (see methods-section for an elaboration).

In addition, we would like to use this chapter to draw attention to the concept of *epistemic proximity*, here defined as the degree to which two actors (ego and alter) share a common worldview. This concept emerged during the course of thirty-three preliminary interviews generated prior to the quantitative phase of this research, and takes in a distinctive role in the total pallet of proximities discussed in this chapter by serving as a prominent enabler of knowledge dynamics among entrepreneurs, both within and across cluster boundaries.

In raising this issue, we move away from perceiving the cluster as a 'bounded region' from a knowledge perspective, and instead adopt a social network perspective to interpret and understand innovative dynamics at a regional level. Or, as Thrift and Olds put it, "the network serves as an analytical compromise, in the best sense of the word, between the fixities of the bounded region metaphor and the fluidities of the flows metaphor" (1996: 333).

This chapter is structured as follows. First, in the theory section the various forms of proximity will come under discussion from a theoretical perspective, resulting in an integrative conceptual framework relating the various forms of proximity to the concept of interactive learning and ease of knowledge transfer. Second, the research methodology applied in testing the conceptual model is elaborated on, incorporating the research as well. Third, the results section discusses the relevant findings of testing the conceptual model. Fourth and final, the results and findings are discussed as to their implications for our current understanding of the process of interactive learning specifically, and (regional) innovation in general.

4.2 | Theory

4.2.1 The knowledge-based theory of clusters

The main claim of the knowledge-based theory of clusters involves the believe that clusters are effective vehicles for enhanced knowledge creation and communication, facilitated by the assumed positive influence geographical proximity has on knowledge dynamics among firms and entrepreneurs (Arikan 2009). Much work in this discipline, either implicitly or explicitly, is funneled by the underlying assumptions of the knowledge spillover-perspective, which considers clusters as spatially confined pools of knowledge only available to the actors located within its boundaries (Bell, Tracey and Heide 2009; Feldman and Francis 2004). This view, subsequently, conceptualizes innovation as a process involving joint action of cluster members. Such joint actions focused on innovation are facilitated by a regional social fabric that allows for trust, localized institutions and conventions to develop (Bell *et al.* 2009). Thus, the concepts of interactive local learning and ease of knowledge transfer helps explaining the existence of clusters (Malmberg and Maskell 2005; Reagans and McEvily 2008). Departing from the knowledge-based theory of clusters, it logically follows that interactions among co-located actors have different, if not superior, qualities and outcomes compared to interactions among distant actors (*ibid.*). This makes the effect of geographical proximity on interactive learning a *key issue* in the field of economic geography (Boschma 2005).

  Lately, the knowledge-based theory of clusters has been the subject of critique. First of all, as Oinas (1999) notes, there seems to be little empirical evidence available clearly demonstrating that the process of interactive learning is a predominantly local one. Rather, it is suggested, new knowledge creation and interactive learning is more likely to stem from a combination of local and non-local relationships (*ibid.*). In addition, concerns have been raised with respect to the significance of the local context. More specifically, it has been suggested that the impact of the local context on knowledge dynamics is somewhat overemphasized, not allowing other factors to enter the "geography of learning discourse" (Malmberg and Maskell 2005: 9), such as the role of other forms of proximity (Boschma 2005) or concepts like 'communities of practice' (Wenger 1998; Malmberg and Maskell 2005). It is especially deemed important, however, "to determine in more detail in what way the different

dimensions of proximity are related to each other" (Boschma 2005: 72) when it comes down to facilitating knowledge dynamics among entrepreneurs.

To assess the role of geographical proximity in relation to other forms of proximity, two dependent variables are central in this chapter: 'interactive learning' and 'ease of knowledge transfer'. Taken together, these concepts represent the knowledge-based theory of clusters, which posits that geographical proximity positively influences the amount of learning taking place among cluster-based actors (interactive learning) as well as the ease of transfer of the knowledge involved through facilitating the development of relationship-specific heuristics (ease of knowledge transfer) (Arikan 2009; Reagans and McEvily 2008). The four forms of proximity mentioned above are considered independent variables.

The remaining part of this theoretical section discusses how different forms of proximity can play a role in facilitating knowledge dynamics among entrepreneurs. More specifically, it is explored how different forms of proximity can serve as complement to geographical proximity in this matter. This review emphasizes the role of relational, cognitive, and epistemic proximity in addition to geographical proximity.

4.2.2 A conceptual framework of proximity

Relational proximity: The issue of relational proximity and its effect on interactive learning and ease of knowledge transfer relates to the notion of embeddedness, which can be regarded a response to the traditional economic (utilitarian) perception of behavior. The utilitarian perception of behavior assumes that actors act in a rational, self-interested fashion, and in doing so, are not or modestly hindered by social relations. The embeddedness perspective, in contrast, accepts the notion of relations posing a serious constraint on behaviors and institutions (Granovetter, 1985). Granovetter basically argues that the "level of embeddedness of economic behavior is more substantial than is allowed for by formalists and economists" (1985: 482). Similarly, relations are still a prime source for people to turn to when in need of knowledge or information. Having ready access to the Internet or a company's intranet doesn't change this general tendency to turn to people for knowledge (Levin and Cross 2004; Cross and Sproull 2004).

The embeddedness perspective is known for its seminal distinction between weak ties (low relational proximity) and strong ties (high relational proximity). Central is the effect of tie-strength on (knowledge and information) diffusion. This debate heavily relies on Granovetter's (1973; 1983) ideas concerning the strength of weak ties. Essential to Granovetter's argument is the notion that "whatever is to be diffused can reach a larger number of people, and travels greater social distance (...), when passed through weak ties rather than strong" (1973: 1366). The fundamental assumption is that the actors to whom one is weakly connected, will probably move in different social circles compared to one's own, and thus will have access to different kinds of information (Granovetter 1973; 1983). Or, as Burt (1992: 47) emphasizes, "contacts strongly connected to each other are likely to have similar information and so provide redundant benefits." Weak ties, hence, can for instance form a crucial bridge between two densely structured social networks (Granovetter 1983), and are consequently argued to be of importance in obtaining new information (e.g. regarding business opportunities).

Whereas weak ties are valuable in that they provide access to new information and knowledge, according to Granovetter (1983) strong ties have their advantages as well. Strong ties are usually more willing to help and generally are more easily available. In addition, stronger ties involve a higher degree of trust, making such ties more suitable for transferring tacit forms of knowledge and information exchange (Hansen 1999; Uzzi 1997; 1996). Finally, strong ties reduce the risk of opportunistic behavior. Combined, the characteristics of strong ties are considered important in facilitating interactive learning. Effective interactive learning therefore requires a durable relationship, characterized by a high level of relation proximity, as opposed to arm's length ties (Boschma 2005; Uzzi 1997). This leads to the following hypothesis:

> *Hypothesis R1: higher relational proximity between ego and alter increases the amount of interactive learning taking place in that relationship.*

Similarly, we posit that stronger ties are positively related to ease of knowledge transfer. Due to a higher frequency of contact, relation-specific heuristics will develop

that foster shared understandings (Reagans and McEvily 2008), which consequently ease the transfer of knowledge (Uzzi 1997). In addition, stronger ties involve more trust, creating a sense of confidence that the knowledge that is transferred will not be used inappropriately (Reagans and McEvily 2008). Thus, we hypothesize the following:

Hypothesis R2: higher relational proximity between ego and alter increases the ease with which knowledge is being transferred between ego and alter.

Cognitive proximity: Knowledge is dispersed among different actors. Hence, it is consistent to conclude that interactive learning requires bringing together different knowledge from different, heterogeneous sources (Boschma 2005; Nooteboom 2000). Combining the input of heterogeneous agents, located in clusters different from one's own, is a difficult task especially given the tacit nature of the knowledge in question. Simple access to this knowledge, through either strong or weak ties, may not suffice. Instead, the effective transfer of knowledge requires a certain degree of cognitive proximity (Boschma 2005). More specifically, a certain amount of absorptive capacity is necessary for the effective exchange of knowledge to take place (Cohen and Levinthal 1990), for a high degree of absorptive capacity enhances one's ability to identify, interpret, and utilize new knowledge and information. As such, the degree of cognitive proximity between ego and alter is likely to influence the amount of learning taking place and the ease with which knowledge is being transferred between them. It is for instance assumed that acquiring new knowledge close to one's current knowledge base is less costly (Perez and Soete 1988).

The cognitive distance should not be too great for interactive learning to take place successfully. People sharing a high degree of proximity, presumably are better equipped to learn from each other. Cognitive proximity is assumed to facilitate effective communication between ego and alter (Boschma 2005), assuming a direct and positive linear relationship between the level of cognitive proximity and interactive learning. However, an equally strong case is made for allowing a certain degree of cognitive distance in order to enhance the process of interactive learning. It is argued that interactive learning and knowledge building requires a certain degree

of dissimilarity. Basically, cognitive distance increases the potential for interactive learning, for building knowledge "often requires dissimilar, complementary bodies of knowledge" (ibid.: 63). In sum, this implies that some sort of balance needs to be established between cognitive distance and cognitive proximity in order for interactive learning to be effective.

> *Hypothesis C1: the amount of interactive learning taking place in a given ego-alter relationship has an inverted U-shaped relation with the level of cognitive proximity between ego and alter.*

While some cognitive distance may be needed in order to secure the potential for learning something new, this may not be the case for the ease with which knowledge is transferred. Especially in the case of transferring non-codified knowledge, access alone does not suffice. "For the sake of communication, there must be sufficient cognitive overlap" (Boschma 2005: 64). Therefore, we hypothesize the following with respect to ease of knowledge transfer:

> *Hypothesis C2: higher cognitive proximity between ego and alter increases the ease with which knowledge is being transferred between ego and alter.*

Epistemic proximity: Epistemic proximity involves the extent to which ego and alter share a similar world view. The more similar this shared understanding of reality, the higher the amount of epistemic proximity between ego and alter. This concept can serve as a powerful complement to geographical proximity because it bridges the contextual and cultural gap associated with interactions that are geographically distant.

Epistemic proximity differs conceptually from cognitive proximity in the sense that the latter deals with cognition and knowledge background (as explained above), while the former deals with a belief system and world view. Ones' epistemic understanding of reality can be viewed as the result of a personal sensemaking process (Weick 1995) influenced by one's physical and social environment. In relation to the context of this chapter, it involves an actor's view of the current state

of the industry as well as in what direction the industry should develop (Faulconbridge 2006; Blanc and Sierra, 1999).

In a sense, the concept of epistemic proximity closely matches social world theory which deals with "structures consisting of individuals with a shared collective interest" (Elkjaer and Huysman 2008: 172). Social worlds are "groups with shared commitments to certain activities, sharing resources of many kinds to achieve their goals, and building shared ideologies about how to go about their business" (Clarke 1991: 131). The building of shared ideologies, or ideal types of the future, is of central importance with respect to the concept of epistemic proximity.

The concept of epistemic proximity emerged in the course of thirty-one qualitative interviews with entrepreneurs, conducted in preparation of studying the interaction effects across relational, cognitive, and geographical proximity and their influence on knowledge dynamics among entrepreneurs. Many of the entrepreneurs interviewed notice the importance of having ties to people outside the cluster in order to take part in or keep informed about fundamental developments taking place in the industry. As one entrepreneur recalled:

> *"You know, as I see it there are two kinds of creativity. There is market creativity with respect to the Netherlands, I have to do something in the Dutch market you know, versus long-term undercurrents, and those long-term undercurrents stem from bigger markets and people with broader visions, who are involved in those fundamental developments and who spent a lot of time and effort in attending these conferences to invest in things globally, which of course is very inspiring. (…) To me this is important as it helps me to decide in what to invest." (R17).*

Examples of such debates are legion (Benkler 2006). One striking illustration of a debate exemplary for long-term undercurrents to which the respondent above refers, is conveyed under the heading of the 'semantic web'. Under the semantic web-umbrella, issues are addressed relating to the future structure and role of the Internet. More specifically, an ideal type vision is advocated in which the Internet is structured and designed such that it is able to provide meaning to all content on the web, allowing software to reason and understand (semantic = meaning). It is

subsequently envisioned that an Internet characterized by high degrees of semantic understanding is better able to respond to its users' needs, allowing society to truly progress into a knowledge society. Entrepreneurs active in the realm of the Internet and new media are regularly confronted with fundamentally new, technological developments adhering to this philosophy, enforcing the entrepreneur to take in a position. Differences in attitude or opinion towards developments related to the semantic web-debate or -movement imply a difference in world view or belief system. This difference or similarity characterizing a given ego-alter relationship is expressed by its degree of epistemic proximity.

The value of epistemic proximity in facilitating knowledge dynamics can take form in two ways. First, for interactive learning to be fruitful, it requires a certain base to build upon. Epistemic proximity can provide fruitful ground for interactive learning to take place, for it implies a strong mutual loyalty to a shared problem or goal (i.e. future desired state) (Amin and Roberts 2008). Given that the IT and new media world houses many different disciplines, implying cognitive friction and weak ties among them, epistemic proximity can form a crucial bridge in motivating people to engage in learning, despite possible cognitive or relational distance. Therefore, the following is suggested:

> *Hypothesis E1: the level of epistemic proximity between ego and alter is directly and positively related to the amount of interactive learning taking place in a given ego-alter relationship.*

Second, sharing a certain degree of epistemic proximity with a given alter can influence the ease of knowledge transfer between ego and alter, for negotiating a shared world view as a consequence of institutional and cultural differences is unnecessary. As such, ego and alter already share a similar understanding of reality, providing them with a similar context to discuss certain issues.

> *Hypothesis E2: higher epistemic proximity between ego and alter increases the ease with which knowledge is being transferred between ego and alter.*

Geographical proximity and interactive learning: Central to the ascribed importance of clusters to innovation and regional renewal lies the conviction that innovation stems from local interactions primarily (Oinas 1999). Put differently, "intellectual breakthroughs must cross hallways and streets more easily than oceans and continents" (Glaeser, Kallal, Scheinkman and Shleifer 1992: 1127). Closely linked actors are assumed to benefit from collective learning processes that are bound to a certain locality. The role of tacit knowledge, trust, and local institutions are stressed to have a significant effect on the process of accumulation of knowledge. As such, a high degree of geographical proximity among actors is, a priori, considered to stimulate and enhance mutual learning processes. Or, as Amin and Cohendet (2004: 90) assert, "learning and innovation are cast as regional properties, with spatial proximity and local belonging read as the vital economic asset for learning-based competitiveness." The role of geographical proximity in facilitating interactive learning and ease of knowledge transfer remains unclear, however, especially given the possible influence of other forms of proximity. As discussed above, other forms of proximity possibly act in relation with geographical proximity (Boschma 2005).

For analytical reasons, we define geographical proximity in a very confined manner. Geographical proximity refers to the physical distance among economic actors. Actors who are physically close, are assumed to benefit from knowledge externalities or spillover effects. Such claims are based on patent research primarily, showing that firms located in clusters or near knowledge sources are more innovative (Jaffe, Trajtenberg and Henderson 1993). Based on this research it is claimed that the larger the distance between ego and alter, "the less the intensity of these positive externalities, and the more difficult it becomes to transfer tacit knowledge" (Boschma 2005: 69).

However, in discussing the other forms of proximity, it has become clear that the value of clusters from a knowledge-based perspective might lie in strengthening these various forms of proximity, thus facilitating the interactive learning process indirectly. For instance, geographical proximity can facilitate the creation and maintenance of informal ties (Audretsch and Stephan 1996). In addition, geographical proximity can strengthen cognitive proximity by facilitating spillover effects (Malmberg and Maskell 2005). With respect to epistemic proximity, it is imaginable

that being part of the same cluster aids the creation of a shared view between ego and alter. Accordingly, geographical proximity might have an effect on the degree of epistemic proximity between ego and alter, which consequently affects the amount of interactive learning and ease of knowledge transfer (E1 and E2). This leads us to the following hypothesis:

Hypothesis G1: The degree of geographical proximity in a given ego-alter relationship positively effects the degree of relational, cognitive, and epistemic proximity of that relationship.

Taking the above into account, this leads to the theoretical model presented in figure 4.2.2.

Figure 4.2.2: Conceptual model
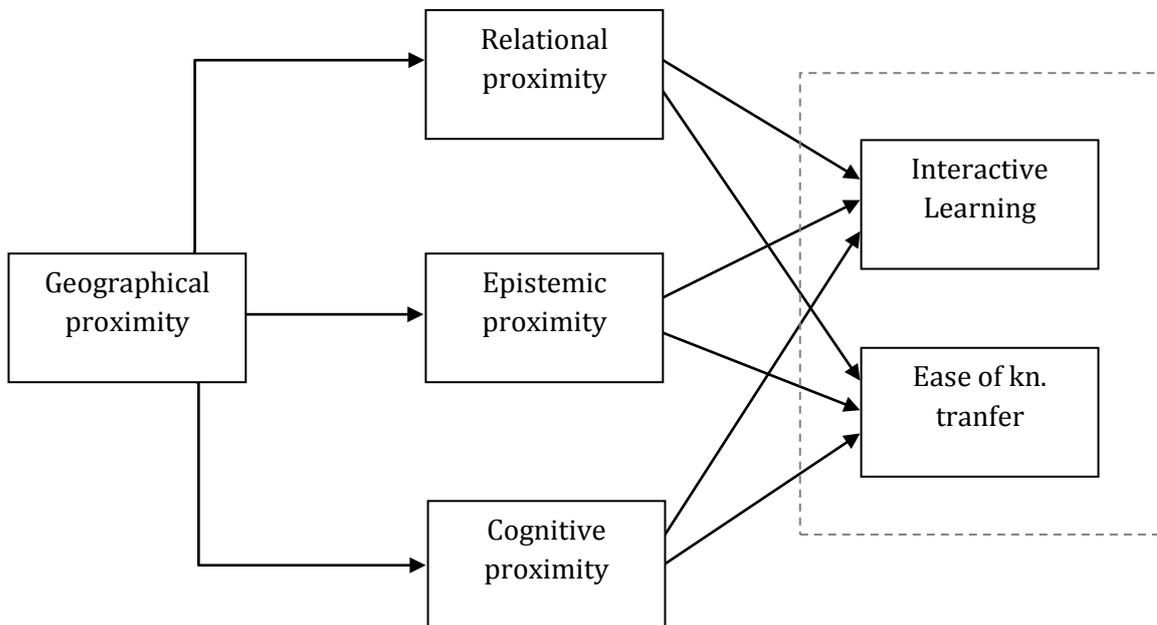
4.3 | Methods

This methods-section starts with discussing the research context in which this study was carried out. Subsequently, this section elaborates on the sample, data, and measures employed in this study.

4.3.1 The Amsterdam IT and new media-cluster

The stage for this study is the Amsterdam-based IT and new media-cluster, located in the greater Amsterdam area (the Netherlands). This cluster was identified by Leisink (2000) and the OECD (2002), and acknowledged as the region in the Netherlands with exceptionally high concentrations of IT, Internet, and new media related business activity. The Amsterdam IT and new-media cluster (henceforth AINM-cluster) is recognized for housing four interrelated activities: (1) multimedia enabling activities, (2) content distribution activities, (3) content provision activities, and (4) e-marketing/ advertising (Den Hertog, Brouwer, Maltha 2000). Fifteen percent of all jobs in the Dutch creative industries are located in the Amsterdam region (while the relative share of all Amsterdam-based jobs in the Dutch economy is 6,4 percent).

The AINM-cluster appears to be an ideal case for studying knowledge dynamics in the context of the local-global paradox. Whereas local policymakers stress the importance of the local context for innovation and regional economic renewal (echoing the works of Michael Porter and Richard Florida), Amsterdam-based entrepreneurs seem to stress the importance of tapping into the global buzz. To quote one entrepreneur on this issue with whom we had an interview prior to our quantitative study:

> "*(...) we have a global network through which we learn about numerous things that are going on globally, but that do not seem to be on the agenda in the Netherlands. (...) You have a network of people through which one learns of the developments that matter very quickly, and that allows you very quickly to find yourself in a context in which sensemaking takes place.*" (R3)

In addition, the AINM-cluster is affected by developments taking place at a larger scale. The production of culture, information, knowledge and innovations has changed dramatically over the course of the past two decades (Benkler 2006). Increasingly, it appears, the production of information, knowledge, and innovations is the domain of social production mechanisms irrespective of geographical boundaries and obstacles (*ibid*.). The development of the GNU/ Linux-operating system, with

more than one million registered users and contributors worldwide, serves as a successful example of the social production of innovations.[32]

Such developments imply a fundamental shift in the production and dissemination of knowledge, being "radically decentralized, collaborative, and nonproprietary" (Benkler 2006: 60). Important to note in this respect is that this development is of a highly ideological and pervasive nature, influencing all IT and Internet related disciplines and industries in a fundamental way (*ibid*.). Debates characterizing this development revolve around open-source software and the semantic web, and take place at an international level. Such debates contribute to the construction of shared world views, resulting in non-territorial structures of individuals with a shared collective interests (Elkjaer and Huysman 2008).

This makes the AINM-cluster an interesting case to study the influence of geographical, relational, cognitive, and epistemic proximity on knowledge dynamics among entrepreneurs. First of all, it offers the possibility to assess the relative impact of both local and non-local ties on knowledge dynamics among entrepreneurs. In addition, the pervasiveness of the open-source model, the free software movement, and the semantic web development creates a strong impetus for critically approaching the geography of learning-discourse (Maskell and Malmberg 2005). Our focus on the AINM-cluster also implies a shift away from so-called science-based clusters or regions (like biotechnology), which are involved in the development of technical knowledge primarily (Tallman and Phene 2007; Owen-Smith and Powell 2004). We suggest that our considerations with respect to the AINM-cluster are to be perceived in the context of professional services-based clusters instead, to which industries such as IT consulting and design, advertising, marketing, software development, media production, et cetera, are allocated (Von Nordenflycht 2010). It is generally acknowledged that such innovative services "require high levels of expertise and awareness of the latest dynamics of the marketplace served" (Faulconbridge 2007: 970), implying that the benefits that accrue from interactive learning and knowledge transfer are potentially of great value to the firms involved.

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[32] The development of the GNU/Linux-operating system serves as an example of free software development through peer production. Other examples might include Wikipedia.org, the clickworkers-experiment by NASA, or the SETI@home-project (Benkler 2006).

4.3.2 Sample and data

To test the hypotheses, we collected ego-network data among fifty entrepreneurs active in the AINM-cluster from May – August 2009. Preceding the data generation phase, a list of 339 entrepreneurs was created. In constructing the list of entrepreneurs, we made use of membership-databases of two Amsterdam-based network clubs, known for having many entrepreneurs among their members. The list was completed by adding names generated through LinkedIn, a popular social network-tool among Amsterdam-based IT and new media-entrepreneurs. We undertook this last step to certify that all disciplines active in the AINM-cluster were represented in this list, assuring a good representation of the Amsterdam AINM-cluster and preventing a sample bias; the list consisted out of entrepreneurs active in various fields, ranging from IT, Internet, gaming, e-marketing and advertising, new media, software, et cetera.

4.3.3 Questionnaire design

The questionnaire was designed to generate relational data. We randomly requested entrepreneurs to participate in our research by putting the entrepreneurs' names in random order and administer the questionnaire to every third entrepreneur on the list. This was done until we had generated fifty fully filled-in questionnaires. These fifty ego-networks resulted in 418 dyadic relationships (i.e. ego-alter relationships) that form the unit of analysis for this chapter (i.e. N = 418).

 The questionnaire consisted of name generator questions, relationship interpretation questions and similarity measures. Table 1 provides a detailed account of the content and range of this questionnaire. The questionnaire was pretested among seven academic colleagues as well as three entrepreneurs active in IT, Internet, and/or new media. The pretesting resulted in adjusting some of the wording of particular survey-items, as well as some slight adjustments to some of the answer-categories.

 The questionnaire starts with four so-called name generator questions. This type of question serves the purpose of eliciting names of people (alters) relevant to the respondent (ego). The goal of the name generator questions was to elicit alters who are important to ego from a knowledge-based perspective. Thus, ego was asked to

recall alters who are specifically important to him or her with respect to generating information and knowledge. The first two name generator questions (NG1 and 2, table 4.4.1, appendix section) were specifically designed to elicit relatively strong alters from ego. The final two name generator questions (NG3 and 4, table 4.4.1) were aimed at probing for weak ties as well. Important to note is that the name generators were specifically designed to capture non-codified or tacit knowledge, for the notion of tacit knowledge is of central importance to the knowledge-based theory of clusters (Broekel and Binder 2007). As such, this design moves away from capturing articulated technology flows, as would be the case when focusing on patents (Tallman and Phene 2007).

  The questionnaire applied a so-called *free recall* design, allowing egos to freely generate a set of alters based on the name generator questions that were being administered to them. In addition, egos were allowed to mention as little or as many alters as they considered appropriate (i.e. *free choice* design). No fixed amount of alters was specified in advance.

4.3.4 Descriptive information sample and data

As an introduction to this section, table 4.3.4a provides an overview of some descriptive information concerning the fifty ego-respondents from which the 418 ego-alter relationships were solicited. The apparent overrepresentation of male entrepreneurs (as opposed to female entrepreneurs) can be explained by the research domain, i.e. the AINM-cluster. Reviewing member lists from local network associations, we found a similar overrepresentation male entrepreneurs.

Table 4.3.4a: Descriptive information ego respondents

Sex		Years in business with present company					Entrepreneurial experience (years)				Number of employees				
M	F	< -1	1-4	5-8	9-12	13+	<-2	3 -5	6 -10	11+	0	1 -5	6 -10	11 -15	16-21
47	3	0	26	16	5	3	7	14	20	9	6	17	10	10	7

  The entrepreneurs representing our sample are all situated in the Amsterdam IT and new media-cluster. In generating this sample, effort was put in having

representatives of different geographical sections of the Amsterdam IT and new media-cluster. Table 4.3.4b shows the geographical origin/ distribution of the entrepreneurs in the sample. The geographical locations in the sample show that, although not all cities are represented in the selection, a good representation of the most relevant parts of the cluster was achieved.

Table 4.3.4b: Geographical and functional dispersion of sample

Geographical location entrepreneurs in sample	Amount	Discipline	Amount
Amsterdam	35	NM&E	8
Haarlem	2	CBS	6
Utrecht	5	IT	36
Amersfoort	2	IT content	14
Nieuwegein	1	IT services	16
Hilversum	5	IT hardware	6

Besides a good geographical fit, the sample was to provide a proper representation of most of the disciplines/ activities carried out in the Amsterdam IT and new media-cluster. Table 1.3.2 (chapter 1) was to serve as point of reference in this matter. Table 4.3.4b shows the extent to which each discipline is represented in the sample applied for this study.

Given our interest in local and non-local entrepreneurial behavior, entrepreneurs were requested to estimate the relative share of international customers and competitors. This was done to get a feel for their international orientation. Table 4.3.4c provides an indication of the international orientation of the entrepreneurs included in the sample.

Table 4.3.4c: International orientation entrepreneurs sample

| 5-items Likert scale	Customers abroad		Competion abroad	
	Freq	%	Freq	%
None	11	22	10	20
Significantly less than half	27	54	21	42
About 50%	7	14	2	4
Significantly more than half	5	10	12	24
All	0	0	5	10

Interestingly, most entrepreneurs indicate that they have customers abroad (78%), albeit to varying degrees. However, based on the distribution of the answers, the share of international customers is rather limited. The relative share of international competitors portraits a rather different picture. Again, about 20% of the respondents indicate not having or experiencing any competition from abroad. However, 80% does experience competition from abroad. A significant share of entrepreneurs (48%) even indicate that at least half of their competitors are situated abroad. From the interview (see previous chapters), we know that a significant part of this competition has its origin in the Anglo-Saxon world (United Kingdom and United States primarily), and to a lesser extent from mainland Europe (see table 4.3.4c).

4.4 | Measures

4.4.1 Independent variables

The four types of proximity introduced above represent the independent variables for this study. *Geographical proximity* was measured by having the respondent (i.e. ego) indicate his/her own physical business location as well as the (business) location of each of his/her contacts (alters). This information was categorized afterwards into three types: 1) ego-alter relations crossing cluster boundaries as well as national

Figure 4.4.1: Diagram on left: absolute frequency of type 1, 2, and 3 dyads in sample
Diagram on right: specification geographical dispersion type 1 dyads
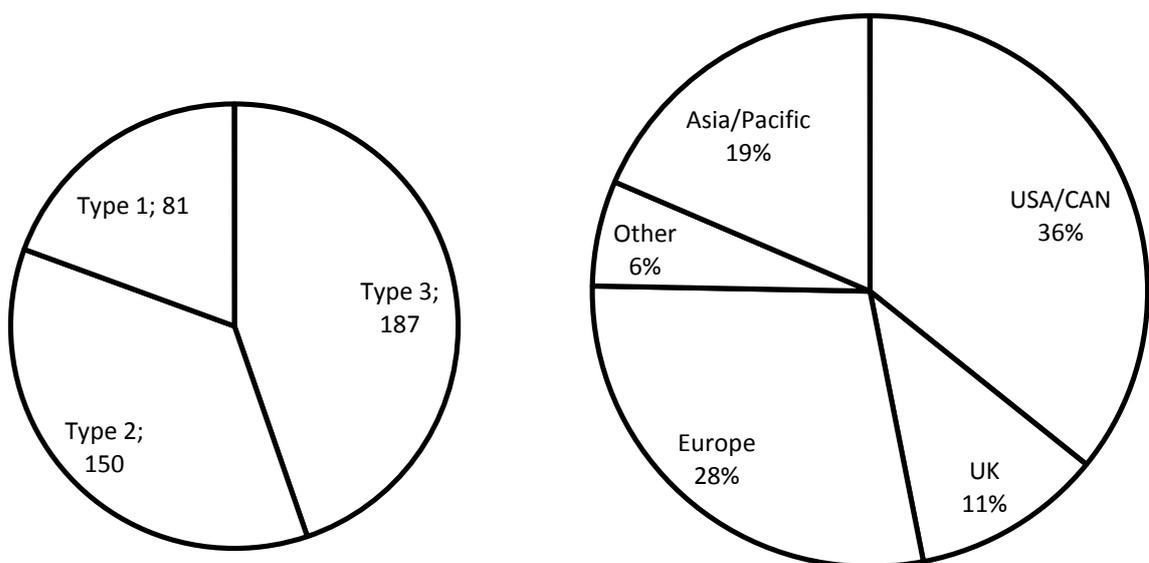
boundaries, 2) ego-alter relations crossing cluster boundaries yet confined by national boundaries, and 3) ego-alter relations confined to cluster boundaries (similar to Tallman and Phene 2007). Figure 4.4.1 shows the number of dyads of each type generated through the research sample.

   Relational proximity was measured by having the respondent indicate the duration of contact with each of his/her alters as well as the degree of emotional closeness characterizing each relationship. In line with Burt (1997) and Perry-Smith (2006), both items were measured using a four item scale. *Cognitive proximity* was measured by having the ego indicate the extent to which he/she shared similar work-related knowledge with each of his/her alters. The phrase work-related knowledge was used to capture knowledge dynamics relevant to the process of doing and running a business. *Epistemic proximity* was measured by having the ego indicate to what extent his/her attitude towards fundamental developments in his/her field was similar or different to each of his/her contacts. These two similarity-measures both consist of a one-item scale (see table 4.4.1, appendix section). Reason for this is the time-constraint. Taking a social network questionnaire can be a time-consuming endeavor for the respondent involved.[33] For both items we initially adopted Rodan and Galunic's (2004) item scales. Pretesting the scales, however, suggested adding a fifth answer-category for the epistemic proximity question, namely 'don't know.'

4.4.2 Dependent variables

This study incorporates two dependent variables: interactive learning and ease of knowledge transfer. *Interactive learning* was measured using a three items scale. First, the respondent was asked to indicate the frequency of knowledge and information exchange between him-/ herself and each of his/her alters. In order to establish this, respondent was requested to answer two questions: 1) how frequent respondent approached each of his/her alters with a knowledge or information request, and 2) how often each of his/her alters approached respondent with a knowledge or information request. This was done in order to capture the degree of interaction between ego and alter. The interactive learning-variable was

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[33] It is not unusual in social network-research to apply 1 or 2-item scales. See for instance Rodan and Galunic 2004 or Borgatti and Cross 2003.

complemented by having respondent indicate the significance or value of each interaction involved. A reliability-analysis revealed a Cronbach's alpha of .69.

The second dependent variable, *ease of knowledge transfer*, was measured using a one-item scale. This item requested the respondent to indicate how easy he/she considered it to explain a key concept or idea from his discipline to each of his/her alters (see table 4.4.1, appendix section).

4.4.3 Accounting for the clustering of the survey design

Although the data-analysis takes place at the level of the dyad, the actual data were generated at the ego-level. The fifty ego's consulted for this study therefore must be considered the primary sampling units (PSU), meaning that the dyadic data are, in fact clustered at the ego-level. Cluster sampling typically results in larger sample-to-sample variability compared to sampling individuals (or dyads in this case) directly. This increase in variability must be taken into account in standard error estimates, hypothesis testing, and other forms of inferences. This was done through a cluster procedure available in Stata11.

4.5 | Results

Table 4.5a exhibits the means, standard deviations, and correlations for the variables employed in this study. The conceptual model (see figure 1) was tested using Stata11 in order to account for the clustering of the data at the PSU-level. Figure 4.5b shows the empirical model containing the results of the regression analyses.

Tabel 4.5a: Means, standard deviations, and correlations

	Mean	S.D.	1	2	3	4	5	6
1. Relational proximity	3.515	1,98	1.000					
2. Epistemic proximity	3.09	.871	-.132**	1.000				
3. Cognitive proximity	2.75	.922	-.010	.324**	1.000			
4. Geographic proximity	2.25	.76	.151**	-.012	.063	1.000		
5. Ease of knowledge transfer	3.22	.79	.038	.529**	.341**	.007	1.000	
6. Interactive learning	6.65	5.64	.610**	-.095	.036	.061	.096	1.000

N = 418 (N=403 for epistemic proximity due to missing values)
** correlation is significant at the 0.01-level

Figure 4.5b: Empirical model

<div align="right">
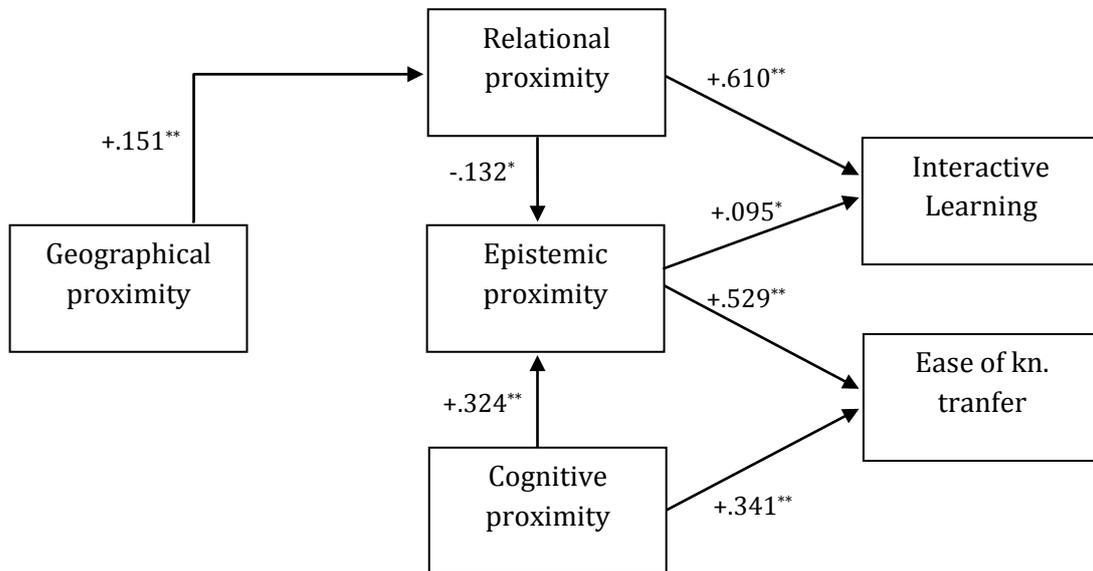
N= 418

* p < 0.1 | ** p < 0.01

All values corrected for clustering at PSU-level

</div>

Our present regression analysis assumes linearity among the variables, whereas hypothesis C1 proposed a non-linear relationship between the amount of learning and the level of cognitive proximity in a relationship. We checked for the hypothesized inverted U-shape relation by dividing the interactive learning variable in two sets, expecting to find a positive linear relationship for low levels of cognitive proximity and a negative linear relationship for high levels of cognitive proximity. Based on this analysis, we were not able to substantiate an inverted U-shape relation in this matter (nor a linear one). With respect to the effect of geographical proximity on interactive learning and ease of knowledge transfer, we additionally checked for a direct relation. No direct effect was found between geographical proximity and both dependent variables, suggesting that the effect of geographical proximity on interactive learning is mediated by relational proximity as exhibited by the empirical model (figure 4.5b). Table 4.5 summarizes what these results imply with respect to the hypotheses.

Table 4.5: Overview of hypotheses, tests, and results

Hypothesis	Support
R1: higher relational proximity between ego and alter increases the amount of interactive learning taking place in that relationship.	Full
R2: higher relational proximity between ego and alter increases the ease with which knowledge is being transferred between ego and alter.	No
C1: the amount of interactive learning taking place in a given ego-alter relationship has an inverted U-shaped relation with the level of cognitive proximity between ego and alter.	No
C2: higher cognitive proximity between ego and alter increases the ease with which knowledge is being transferred between ego and alter.	Full
E1: the level of epistemic proximity between ego and alter is directly and positively related to the amount of interactive learning taking place in a given ego-alter relationship.	Full
E2: higher epistemic proximity between ego and alter increases the ease with which knowledge is being transferred between ego and alter.	Full
G1: The degree of geographical proximity in a given ego-alter relationship positively effects the degree of relational, cognitive, and epistemic proximity of that relationship.	Partial, only relational proximity

4.6 | Conclusion and discussion

The findings strongly suggest to reconsider the role of geographical proximity in facilitating interactive learning and ease of knowledge transfer among actors. The model presented in figure 4.5b clearly shows that interactive learning and ease of knowledge transfer are mainly facilitated by relational, cognitive, and epistemic proximity. Geographical proximity plays a limited, yet clear role by facilitating relational proximity.

By identifying the effects of each dimension of proximity on interactive learning and ease of knowledge transfer, we are now able to isolate and assess the relative impact of geographical proximity in this matter. From the analysis it appears that the bounded region metaphor, to which Thrift and Olds (1996) refer, is in need of re-conceptualization indeed. It is reasonable to question the proclaimed role of geography in the geography of learning-discourse (Boschma, 2005). Geographical

proximity does not directly influence interactive learning and ease of knowledge transfer, nor does it play a dominant role by strengthening other forms of proximity, as suggested by Boschma (2005), with the exception of relational proximity.

The data, as presented by the empirical model (figure 4.5b), suggest an interesting and significant role for the concept of epistemic proximity. At the very least, the concept of epistemic proximity should become a part of the vocabulary of the knowledge-based theory of clusters, for it clearly influences both ease of knowledge transfer and interactive learning. The logic behind the role of epistemic proximity relates to the concept of organizing visions; having similar ideological representations of the future invokes the sharing of resources of various kinds, including knowledge and information. A high level of epistemic proximity possibly motivates actors to share knowledge (though not measured in this study) and eases the process of sharing knowledge, for ego and alter do not necessarily need to negotiate a shared world view.

Epistemic proximity, by definition, is not bounded by geographical borders. Rather, it is bounded by "the limits of effective communication" (Shibutani 1955: 566). This implies that in today's world, where sophisticated communication technologies have become ubiquitous, geographical distance should not necessarily represent an

> *Epistemic proximity should become a part of the vocabulary of the knowledge-based theory of clusters*

obstacle in the process of interactive learning. The amount of interactive learning is dependent on other aspects of the relationship involved, suggesting that previous explaining models of local learning are too much inward looking (Oinas 1999).

The role of epistemic proximity also has implications for the concept of local buzz (Bathelt *et al.* 2004). This concept basically involves "specific information and continuous updates of this information, intended and unanticipated learning processes in organised and accidental meetings, the application of the same interpretative schemes and mutual understanding of new knowledge and technologies, as well as shared cultural traditions and habits within a particular technology field, which stimulate the establishment of conventions and other institutional arrangements" (*ibid*.: 38). This concept has been put forward to

differentiate between local and non-local knowledge flows (i.e. the pipeline thesis), arguing that local buzz is a form of exchange predominantly reserved to cluster based entrepreneurs and firms. However, the data suggest that learning processes, whether intended or not, cross cluster boundaries fairly easy, suggesting that the concept of local buzz has a global or inter-local equivalent: global buzz.

A number of relationships appear in the empirical model (figure 4.5b) that are not hypothesized in the conceptual model (figure 4.2.2). Specifically, a negative linear relationship was found between relational proximity and epistemic proximity (b = -.132; p < 0.1), and a positive linear relationship was found between cognitive proximity and epistemic proximity (b = .324; p < .01). To our knowledge, there is no theoretical explanation available for any of these relationships at present.

The negative relationship between relational and epistemic proximity (b = -.132; p < 0.1) is an intriguing one, especially since it feels counterintuitive. The negative relationship found for these two variables implies that the stronger the tie between any given ego and alter, the greater the epistemic distance and, thus, the more likely they are to differ in their opinion about web2.0 related issues. A logical, yet speculative, explanation might be that the better ego and alter are acquainted the better ego and alter are equipped to register subtle yet critical differences in world view. On the one hand, this could possibly hamper the ease of knowledge transfer and learning for ego and alter are likely to debate epistemic details, meaning that epistemic proximity can play a negative role in facilitating knowledge dynamics through strong ties. On the other hand, it also implies that epistemic proximity can play a positive role in facilitating knowledge dynamics across distant ties, both relationally and geographically. However, this remains speculation.

The positive relationship between cognitive and epistemic proximity appears more logical (b = .324; p < .01). Intuitively, it is more likely that two individuals sharing a similar knowledge background on, in this case, Internet, IT and new media, share similar convictions on its use, practicality, and value. It enables both to comprehend and discuss small and grand developments in their respective disciplines, allowing them to reach consensus on an epistemic level. However, again, this remains speculative.

To recapitulate, this chapter set out to explore the relative importance of geographical proximity in facilitating interactive learning and ease of knowledge transfer, by taking into account other forms of proximity. This allowed for a critical approach of the knowledge-based theory of clusters, which holds clusters as valuable and exclusive domains of knowledge. From this perspective, geographical proximity is considered to be a main facilitator of local knowledge dynamics and is regarded a key issue in the field of economic geography.

Other forms of proximity have been suggested to play a distinct part in facilitating interactive learning

The theory claims that geographical proximity increases the frequency with which actors communicate as well as the effectiveness of the knowledge that is being transferred (Arikan 2009; Bathelt *et al.* 2004). The theory fails, however, to specify precisely the role of other forms of proximity in facilitating interactive learning and knowledge transfer, and thereby the exact role of geographical proximity in this matter (Boschma 2005). In addition, the knowledge-based theory of clusters fails to explain or account for successful knowledge interactions crossing cluster boundaries (Owen-Smith and Powell 2004; Saxenian 2006).

Lately, it has been suggested that the role of the local spatial context (i.e. geographical proximity) in facilitating interactive learning and ease of knowledge transfer is overstated (Oinas 1999; Malmberg and Maskell 2005). Other forms of proximity have been suggested to play a distinct part in facilitating interactive learning (Boschma 2005). In this chapter we looked at the role of relational, cognitive, and epistemic proximity in addition to geographical proximity. The main contribution of this chapter, thus, is an empirically falsified model that provides a detailed understanding of how these forms of proximity interact in facilitating interactive learning and ease of knowledge transfer among entrepreneurs.

Introducing and measuring the concept of epistemic proximity is the second main contribution of this study. The concept of epistemic proximity not only provides us with a better understanding of the process by which interactive learning is enhanced and facilitated, but also directs our attention beyond the cluster concept in

understanding knowledge dynamics and innovation. Thus, the concept of epistemic proximity is central in our critical approach of the knowledge-based theory of clusters.

This study does have limitations. First, part of the knowledge-based logic of the existence and value of cluster relies on the notion of competition monitoring and local labor market dynamics (see introduction chapter for an elaboration). These aspects are not taken into account in this study, meaning that clusters might still be of value in this respect (Malmberg and Maskell 2005). Second, a cluster can aid in the development of other forms of proximity not taken into account in this study, such as organizational or institutional proximity (Boschma 2005). Third, the present model does not distinguish between different forms or categories of knowledge. It would for instance be interesting to observe whether learning interactions involving new ideas differ from learning interactions involving advice or buzz. Fourth, this study is cross-sectional, and does not assesses the effect of geographical proximity on the other forms of proximity over time. Finally, as explained above, the results reported in this study might not be applicable to other types of clusters, most notably science-based clusters (Owen-Smith and Powell 2004).

These limitations, on the other hand, offer interesting and possibly fruitful venues for future research. At present, it remains unclear to what extent the concept of epistemic proximity is applicable to industries and disciplines other than IT, Internet, and new media. It is conceivable that other industries or

It is conceivable that other industries or disciplines are less ideologically inclined

disciplines are less ideologically inclined and, thus, subject to other combinations of proximity in relation to knowledge dynamics. Such subtle differences between clusters can possibly serve as explanations for different research outcomes in the matter of (local) knowledge dynamics. In relation to this, the interaction among the different forms of proximity is, in our view, a promising future research venue as well. To our knowledge, literature explaining interactions among various forms of proximity is in short supply.

In addition, as suggested above, we regard it necessary to distinguish more precisely between different forms of knowledge or learning interactions. Thus, we propose to move away from the present crude distinction between codified and non-codified knowledge interactions, and adopt a different, more precise, vocabulary in researching knowledge and learning processes (see for instance Amin and Roberts 2008).

Finally, other forms of proximity possibly play a role in facilitating local and inter-local learning and knowledge dynamics, but were not taken into account in this study for reasons explained above. In our opinion, the concept of institutional proximity has promising explanatory value with respect to understanding local and inter-local knowledge dynamics, and thus might shed a different light on the role of geographical proximity. At present, however, we regard the concept of institutional proximity as one that lacks conceptual clarity to be successfully tested quantitatively, and call for more work on this issue.

Notwithstanding these limitations and associated future research venues, we strongly believe that this study touches upon a number of fundamental concerns related to the knowledge-based theory of clusters, thus providing a basis for further theorizing on this matter. At the very least, this study calls upon future research to look beyond the boundary of the cluster in the course of understanding innovation and learning.

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