Markets, Globalization & Development Review

Volume 4
Number 2 *Design Thinking*

Article 2

2019

Spatial and Non-Spatial Drivers for Design Thinking in Knowledge Ecosystems

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Abstract

The concept of knowledge ecosystems is an emerging arena to reconsider the design thinking processes from a perspective which comprises different levels of knowledge interaction, and how those are regulated by different dimensions. The issue of design thinking is the most relevant for creative industries emerging around creativity and knowledge and providing innovation, change and impact through interaction, however, existing research inadequately connects design thinking both to physical and non-physical dimensions of knowledge ecosystems. Despite knowledge interaction is vastly regarded as a face-to-face communication for design thinking at micro-scale, it appears and be proficient as it involves non-spatial drivers at various scales. Therefore, this paper provides a more comprehensive and multi-disciplinary theoretical approach to this phenomenon, linking separate discourses revolve around different themes: spatiality of knowledge ecosystems, creative industries and design thinking. The paper aims to explore how different dimensions of knowledge ecosystems are influential on design thinking in terms of knowledge interaction and to investigate the key drivers for design thinking. The main evaluation suggests that a geographical proximity enables reduced cost, spontaneous knowledge exchange within ecosystems, however, proximity should not be described in only spatial terms as prior to the others. The findings reveal additional non-spatial drivers: social network, institutions, cognitive proximity and organizational proximity have essential contributions to design thinking processes in terms of knowledge interaction.

Keywords

Design Thinking, Knowledge Interaction, Creative Industries, Knowledge Ecosystem, Proximity.

Spatial And Non-Spatial Drivers For Design Thinking In Knowledge Ecosystems

Introduction

Design thinking that became the foundation for the Stanford School of Design, known as the d.school, as well as the guiding framework for design-driven companies like IDEO, IBM appears as a methodology, reconsiders the design process through large organizations, and combines the designer's toolkit with the problem-solving. The design thinking process is an iterative system, rather than linear, and comprises different levels of knowledge interaction regulated by different dimensions. In 2005, Design Council created a well-known process model called Double Diamond that consists of five distinct phases, namely empathize, define, ideate, prototype, and test, with the divergent and convergent stages of the design process. The unique nature of design thinking is employed in this paper to utilize it as a perspective to discuss the knowledge ecosystems that involve high level of interaction of knowledge and creativity in these phases, where participants have access to the inputs of others, internally and externally. The argument in this paper recognizes design thinking as a complex thinking process of conceiving new realities, expressing the introduction of design culture which brings transformation, evolution and innovation, to new forms of living and to new ways of managing business. It also acknowledges that design thinking is immensely influential in creative industries. Creative industries as a particular form of symbolic knowledge differs from the synthetic knowledge of engineering sectors as well as the analytic knowledge typical of more science-based industries. They are portrayed as a concept within new (creative) economy that entails knowledge and creativity flow (Montgomery and Potts 2009), co-creation, design thinking, design-led innovation (Fleischmann, Daniel and Welters 2017; Fleischmann, Hielscher and Merritt 2016) and co-design (Von Busch 2012). The knowledge in creative industries is created by a reliance on tacit knowledge and craft and know-how and is highly dependent on local buzz, face-to-face interactions (Asheim, Coenen, and Vang 2007; Storper and Venables 2004; Growe 2018). The term knowledge ecosystem is employed in this paper as a metaphorical approach to the creative industry clusters, and regarded as living organism, which enables research, development, and production of technology towards the development and growth of companies (Bogers et al. 2017; Clarysse et al. 2014). Very recently, Rissola et al. (2017) in their research report entitled 'Place-Based Innovation Ecosystems' supporting the strengthening and emergence of existing or new place-based innovation ecosystems and entrepreneurial universities in other EU regions and cities, define the emerging discourse on knowledge based ecosystems as "a way that stakeholders' tacit knowledge is mobilized and incorporated into decision making and priority selection; how embedded local networks work and how they are facilitated, including spatial aspects like proximity and an analysis of the most prominent nodes in the network" (p. 7). Moreover, Drake (2003) underlines some spatial attributes of knowledge enables to create form of visual materials/stimuli, as well as provide opportunities for creative local interaction and local buzz.

Furthermore, Sunley et al. (2008) in their research on the connection between sites and creativity at several levels and scales, emphases the importance of understanding innovation as a product of interactions between sites and a form of organizational creativity. Their research emphasizes the importance of place as "a catalyst may have been exaggerated as design firms show ambivalent responses to the suggestion of a direct link between place and creativity" (p. 678). For co-location in relation to innovation, Wylant (2008)'s research on the geographic concentration reveals that the location enables "access to capabilities, information, expertise, and ideas", and allows "members to quickly recognize and identify new opportunities far more readily than those residing outside the cluster" (p. 3). Regarding these claims, location appears as an important driver for ecosystems of creative industries, since design innovation emerges from the particular character of particular sites and the density and form of interactions between different knowledge. Therefore, geographical proximity can be explained by the argument that knowledge, and tacit knowledge in particular, is context-based as having a spatial dimension.

Despite the fact that majority of the previous studies has argued mainly the place-based attributes of knowledge and innovation, there are still some studies providing different insights that are important for us to understand the knowledge interaction processes beyond place. Specifically, neo-regionalist approaches (Grabher 2002; Bathelt, Malmberg and Maskell 2004; Boschma 2005; Torre and Rallet 2005; Asheim and Gertler 2005; Gertler 2008; Storper and Scott 2009; Shearmur 2011; Mattes 2012) have predominantly concentrated on how spatial proximity should be approached from a wider perspective. According to neo-regionalists' arguments, spatial entities are loosely defined in regard to meeting requirements for proximity indicating knowledge and creativity exchange, collaboration, cooperation and so forth. Regarding these competing, yet complimentary arguments, on spatiality of knowledge in ecosystems, is the knowledge interaction only limited to the geographical and/or physical, namely, spatial proximity? Can we also contribute to the design thinking methodologies through knowledge interactions via non-spatial drivers?

This paper aims to explore how different dimensions of knowledge ecosystems are influential on design thinking in terms of knowledge interaction. More specifically, it investigates the key drivers for design thinking through the spatial and non-spatial approaches to knowledge ecosystems. In following sections, the paper presents knowledge ecosystems as an organizational metaphor of the operations of creative industry clusters and, looks into how individuals play a major role in construction of knowledge through interaction, network and collaboration. Literature review as a methodology informs us to amalgamate the literature of geography and business management to describe specific environments of knowledge and creativity in creative industries interpreted as ecosystems. Hence, multiple approaches taken by the literature are analyzed to describe the roles of proximity for knowledge-based activities in concentration differing by the degree of spatial and non-spatial dimensions. The present study recognizes knowledge interaction as one of the essential components of such ecosystems, both internally and externally, and then, it explores the major features of knowledge interactions related to the design thinking: core fundamentals, goals, actors and scales. In the evaluation, regarding the predominant approaches in the literature, spatial and non-spatial

dimensions of knowledge ecosystems are reconsidered in terms of knowledge interaction, and some key drivers for design thinking are identified and categorized. The findings contribute to how we should understand spatial and non-spatial dimensions of knowledge ecosystems in terms of knowledge interaction, and how different types of approaches become crucial for engagement of design thinking in such environments.

Knowledge Ecosystems and Knowledge Management

The concept of ecosystem was first introduced by Moore (1993) to the business studies. Moore (1993) describes the concept of business ecosystem as an economic community indicating many industries operating cooperatively and competitively in production, customer service and creation, and notes that:

> "An economic community supported by a foundation of interacting organizations and individuals--the organisms of the business world. This economic community produces goods and services of value to customers, who are themselves members of the ecosystem. The member organizations also include suppliers, lead producers, competitors, and other stakeholders. Over time, they coevolve their capabilities and roles, and tend to align themselves with the directions set by one or more central companies. Those companies holding leadership roles may change over time, but the function of ecosystem leader is valued by the community because it enables members to move toward shared visions to align their investments and to find mutually supportive roles" (p. 26).

The characteristics presented with the research by Pirot, Meynell, and Elder (2000) make emphasis on interrelation and interaction that create the structure and function of ecosystem. In addition, Iansiti and Levien (2004b) suggest that each loosely interconnected participant is specialized in a specific activity and, that is the collective efforts shown by many participants that constitute knowledge. Networks within the ecosystem contain both cooperation and competition link firms across products, services, and technologies. For Iansiti and Levien (2004a), key feature is to create a base, such as services, tools, or technologies, which is available others in the ecosystems to enhance their own performances. For innovation, ecosystems, on one hand, operate on the exploration capacity of its internal members in order to learn about new knowledge, processes and skills (Yalcinkaya, Calantone and Griffith 2007), and on the other, develop networks, which is considered as an external resource, by increasing the number and the quality of connections with other firms (Coombs, Deeds and Duane 2009). Baregheh, Rowley and Sambrook (2009) defines ecosystems as "the multi-stage process whereby organizations transform ideas into new/improved products, service or processes, in order to advance, compete and differentiate themselves successfully in their marketplace" (p.1339). All knowledge, regardless internal or external, is dependent on the actors and their nature of the interaction, regarding the design thinking. Connection between individuals or groups is not stable in ecosystems; rather, it evolves over time, and with the diversity, density, intensity and quality of interactions (Comunian 2011; Comunian, Chapain and Clifton 2010). According to Cross (2011), thinking in multiple perspectives about future

possibilities is difficult to conduct by purely internal mental processes; the designer needs to interact with an external representation (Cross, 2011).

Knowledge has always been an integral part of the vast literature on new economy literature (Murphy and Redmond 2009; Musterd and Gritsai 2010; Yigitcanlar 2010; Gospodini 2006). The spatial nature of knowledge has been previously examined by scholars in the field of knowledge management (Brown and Duguid 2002), innovation studies (Von Hippel 1994) and geography (Asheim, Coenen and Vang 2007; Asheim and Isaksen 2002; Maskell 2014; Linder 2014). From a geographical point of view, the Michael E Porter first describes geographic concentrations of knowledge as clusters that enables producing a particular product or service (Porter 1990) and later, as a "critical masses -in one place- of unusual competitive success in particular fields" or "geographic concentrations of interconnected companies and institutions in a particular field" (p. 78). Furthermore, Porter (2000) reconsiders clusters as "a geographically proximate group of inter-connected companies and associated institutions in a particular field, linked by commonalities and complementarities" (p. 254). Porter's arguments are based on the idea that clusters bring innovation opportunities due to proximity to buyers and suppliers, continuous interaction with other firms in the industry and; new business formation driven by the accessible information about opportunities and resources. However, Porter's definitions have vastly been debated as being mainly spatial so that some other authors have proposed new definitions that include interactions and relationship between firms as specific type of relation linking a set of people and space. In this regard, Rosenfeld (1997) stresses the importance of the interaction and cooperation, defining the cluster as "a geographically bounded concentration of similar, related or complementary businesses, with active channels for business transactions, communications and dialogue, that share specialized infrastructure, labor markets and services, and that are faced with common opportunities and threats" (p. 10). From the management perspective, networking becomes crucial in where cluster as a localized network of specialized activities through which goods, services and knowledge are exchanged. Similarly, Bathelt, Malmberg, and Maskell (2004) underline a role for competition in spurring innovation and learning within a localized agglomeration. Besides, Montgomery (2003) emphasizes the relation between interaction and competition as "a grouping of industries linked together through customer, supplier and other relationships, which enhance competitive advantage" (p. 298). Thus, interaction emerges as a key component in the process of gaining access to, acquire, and develop creativity and new knowledge for the stimulation of knowledge in ecosystems.

Analysis of Different Dimensions of Knowledge Ecosystems

Spatial Dimension

The earlier approaches to clusters are heavily depended on the spatial concentration of economic activity emerging to reduce the transaction costs and develop more intense inter-firm relations. Initially, Scott and Scott (1988)'s claim on the transaction cost became influential in terms of spatial proximity. In this view, costs for obtaining the relevant information are reduced and, flow of knowledge and exchange of information are increased. The study by Storper (2000) contributes that with his claims on how firms engaged in the same industries tend to locate to guarantee access to the latest ideas about the

product and market changes and shifts. Gordon and McCann (2000) take the second approach and distinguish two spatial models: pure agglomerations and industrial complex. The classic model of pure agglomeration focuses on the external economies of scale or scope driven by the other firms locating in the same area. In the model of pure agglomeration, inter-firm relations are described rather short-lived, and the sizes of firms inherently atomistic. Such environments are portrayed by frequent face-to-face communication through particular spatial proximity as a fundamental for promoting growth and innovation (Feldmann 2000). The third approach is known as industrial complex presented by Gordon and McCann (2000) and Iammarino and McCann (2006). For co-location, firms have complex and highly organized input–output supply chain production and consumption hierarchy in the area in which they operate. Firms locate in close proximity in order to ease interaction and minimize the costs of communication. However, some factors, such as, shared services, a specialized labor pool and spontaneous information exchange remains comparatively insignificant in this approach. Such high industry concentration tends to have distrust and low entry possibilities (Iammarino and McCann 2006). The following table (Table 1) summarizes the spatial dimension of knowledge ecosystems.

Table 1. Spatial dimension of knowledge ecosystems

Transaction *(Storper 2000; Scott and Scott 1988)*	***Pure Agglomeration*** *(Gordon and McCann 2000; Feldmann 2000; Iammarino and McCann 2006)*	***Industrial Complex*** *(Iammarino and McCann 2006; Gordon and McCann 2000)*
• Transaction-based goods, capital and knowledge • Disregarded social interaction	• Atomistic firm size • Openness to others • Economies of scale and localization (internal & external) • Knowledge mutation • Knowledge crossover • Diversity	• Relatively larger firms • Stable and frequent retailing • Local and regional scale • Specialization • Lack of spontaneous knowledge pool • Lack of external information exchange • Enclosed

Non-Spatial Dimension

As mentioned by Mattes (2012), the concept of spatial proximity merely falls short to explore the interactions of partners in distant locations (Gertler 2008). Additionally, social networks are regarded as a complementary driver towards purely geographical approaches. Scott (2000), Iammarino and McCann (2006) and Gordon and McCann (2000) propose a further approach based on the social network where active collaborations between firms and other actors emerge to stimulate knowledge and long-term relationships. Another approach suggested by Bassett et al. (2002) emphasizes the existence of embedded routines, norms, and habits that are rooted in inter-firm relations and interdependencies, interaction collaborations and collective identity created by the network of supporting institutions and organizations such as financial

institutions, trade associations, training organizations, local authorities, and their infrastructure (Bassett, Griffiths, and Smith (2002). Furthermore, Boschma (2005) identifies four further dimensions of proximity: cognitive proximity (sharing a common vocabulary and conceptual framework), organizational proximity (capacity to coordinate and exchange knowledge), social proximity (micro-level social ties of friendliness and trust), and institutional proximity (macro-level routines, rules and regulations). Firstly, cognitive proximity refers to that proximity means more than just creation and learning dependent on geographical location. In general, related actors need a certain cognitive proximity in order to communicate, absorb and process new information. For Mattes (2012), if the cognitive distance is excessive, the actors involved may misunderstand each other, and have difficulty exchanging and interpreting each other's knowledge. Similarly, if too small, access to new knowledge or creativity cannot be guaranteed so that there should be an optimal level of cognitive distance. Secondly, organizational proximity is defined as the extent to which relations are shared in an organizational arrangement. In this view, a single coordination controls all the relevant activities, and all the related tasks being carried out within a single organization. Yet, this mechanism not only coordinates, but also acts as a driver that enables transfer and exchange of information and knowledge between different actors. Thirdly, social proximity brings about the result of micro-level shared personality characteristics, personal interaction and a sense of familiarity between individual actors (Mattes 2012). Lastly, institutional proximity comprises many factors, from laws to social norms, values and routines rules, which combined the socio-cultural, economic and political framework in which the actors are involved. The following table (Table 2) summarizes the non-spatial dimension of knowledge ecosystems.

Table 2. Non-spatial dimension of knowledge ecosystems

Networks *(Scott 2000; Iammarino and McCann 2006; Gordon and McCann 2000)*	***Institutional Approach*** *(Bassett, Griffiths and Smith 2002)*	***Different Proximities*** *(Boschma 2005; Mattes 2012; Shearmur 2011)*
• Diverse firm scales • Partially open to others • Collaboration opportunities • Large and uncertain	• Involvement of institutions and organizations • Existence of embedded inter-firm relations	• Capacity to coordinate and exchange knowledge • Micro-level social ties of friendliness and trust • Macro-level routines, rules and regulations • Distant knowledge and creativity systems

Design Thinking and Knowledge Interaction

The term and concept of design thinking has earned considerable interest in recent years, especially after being reformulated by the design consultancy IDEO as a particular design methodology. Nigel Cross introduced design thinking as a 'designerly ways of thinking' of studying designers and engineers in action (Cross 2001; 2004; 2011). In early 2000s, the use of the design

thinking concept was widespread, and it was recognized and employed by theorists and practitioners in design, organizational science, and management beyond product and design management. Since then, the concept of design thinking has been employed to achieve innovative solutions to wicked problems through designerly methods, tools, and processes in various areas, which involves designers with particular knowledge, creativity and skills, but also experts from other knowledge areas working together on projects (Thoring and Müller 2011b). However, design thinking process including the process, collaborative team and work environment, particular knowledge and know-how, and brainstorming techniques is different than the design process in terms of knowledge interaction. Thoring and Müller (2011a) distinguish the design thinking process from the typical design process in terms of the actors and processes. Unlike the typical creative design process, which is usually an intuitive and individual process that is performed by well-trained designers, design thinking is usually carried out by multi-disciplinary teams. It consists of "a flexible sequence of process steps and iteration loops, each including several tools and resulting in different artifacts" (p.493).

A fundamental characteristic of design thinking has always been its collaborative nature in participatory methods of co-creation, and the user centered approach in engagement of communities in the whole design process, from problem identification to ideation, prototyping to evaluation (Brown and Katz 2009). Design thinking utilizes empathy, collaboration and experimentation through a user-centered approach with multi-disciplinary teams. Participants require exchanging ideas, expressing feelings and sharing information to enable linkages, foster open communication, and build trust as well as to form a self-organization that occurs at every level when enough individual elements interact. In that respect, knowledge interaction is crucial in every level of the design thinking phases to understand the business, customer, employee, and the collaborative processes. Interactions are regarded the essence of effective design thinking processes since they involve individuals in multiple aspects comprising creativity and knowledge exchange with a range of operations and process so that the actors are simultaneously influenced by their internal capabilities and by their complex interactions in knowledge ecosystems (Iansiti and Levien 2004b). Knowledge interaction as one of the major of creative and knowledge ecosystems is the utmost influential dynamic for design thinking where processes of knowledge creation are marked by spatial and non-spatial interactions. They enable the team to grasp creativity and knowledge from internal and external parties more effectively, and enable to produce new goods and services. The face-to-face interaction is also needed for the diffusion of tacit knowledge that adds a geographical dimension to parts of design knowledge and practice (Linder 2014).

Creativity occurs in the intersections between individuals, cultural or symbolic domains and social fields (Csikszentmihalyi 1999). The role of creativity as an analyzing framework for the evolution of ideas and theories in the design thinking process is determined by three main aspects: generating ideas, selection of ideas, and retention of ideas is more than just idea generation for design thinking (Thoring and Miller 2011b). Thoring and Miller (2011a) in their research on an educational context reveal that three aspects of creativity that explain the effectiveness of interaction. According to their findings, the design thinking process is determined by alternating phases of

generation and selection where teams are able to recombine their respective expertise, and the overall working culture and environment encourage mutation of ideas. Design thinking supports the creative process from different angles, some by stimulating interaction within the team and teambuilding activities. Furthermore, Bettiol et al. 2012 investigate knowledge management in services by exploring the relationship between standardization and creativity, and find that "creatives were forced to use discipline in their work and to codify what they were doing, they did not use database or past projects as an inspiration for their creativity and instead relied on social interaction and tacit knowledge" (p. 558). From the same viewpoint, it can be said that creativity is not the result of actions by isolated individuals but a collective process that depends upon existing social norms. It is rather produced by the interactions of flows of knowledge in different 'domains' (Sunley et al. 2008).

The interactions as a part of the fundamentals of local everyday practices in industrial agglomerations produce knowledge that contributes to the design thinking processes. Particularly for creative industry clusters as ecosystems, face-to-face interaction is a major mean of communication among the workers through particular physical proximity. These environments establish personal relationships, enable linkages, foster open communication, and build trust. However, the form of interactions can be seen internal and external. Lichtenthaler and Lichtenthaler (2009) argue different form of interaction in relation to knowledge and note that:

> Internal knowledge exploration refers to generating new knowledge inside a firm, e.g. inventions resulting from research; external knowledge exploration describes the acquisition of knowledge from external sources; internal knowledge exploitation describes internal innovation, i.e. knowledge application to a firm's own products; external knowledge exploitation refers to outward knowledge transfer, e.g. by means of technology alliances or technology licensing; internal knowledge retention is a result of the need to maintain knowledge over time; external knowledge retention refers to knowledge that is maintained in a firm's inter-organizational relationships (p. 1317).

Studies on knowledge management (Bathelt, Malmberg and Maskell 2004; Bettiol, Di Maria and Grandinetti 2012; Gertler 2003; Lam 2000; Narayanan and O'Connor 2015; Nowacki and Bachnik 2016; b and Müller 2011) have addressed knowledge interaction as a process able to increase the efficiency in design thinking and to enable knowledge transfer not only across individuals and firms but also space. Internal interaction refers to the communities where population shares information within the ecosystem. Internal interaction between populations allows information, creativity and knowledge to be shared among different populations in the same organization. The positive effects of internal communication arise from co-location. Observation and intensive interaction, through spatial proximity, enable the exchange and creation of tacit knowledge, trust and conflict resolution (Gertler 1995; Nilsson and Mattes 2015; Rutten 2017). On the other hand, external interaction occurs when population communicates with other populations outside the organization. This is a common practice and allows creativity and knowledge to be introduced into an organization from outside sources. For

external interaction, networks are ideal information resource for the information flow mechanisms. The following table (Table 3) presents the major features of knowledge interactions in relation to design thinking.

Table 3. Knowledge interaction in design thinking

Core Fundamentals for Design Thinking *(Camillus 2008; Richard 1992; Rylander 2009; Cross 2011; Linder 2014).*	***Means for Interaction*** *(Brown and Katz 2009).*	***Actors Involved (***Thoring and Müller 2011b)	***Scales of Interaction*** *(*Gertler 1995; Nilsson and Mattes 2015; Rutten 2017)
• Tacit knowledge • Creativity • Expertise • Skills • Know-how	• Co-creation • Human-centered design process • Innovation • Transformation • Problem solving • Management	• Individuals • Communities • Designers • Businesses • NGO's • Governmental bodies	• Internal • External

Evaluation: Spatial and Non-spatial Drivers of Knowledge Interaction for Design Thinking

The production of creative content today is increasingly concentrated in a series of co-locations and networks of knowledge in different proximities. Multiple approaches taken by the literature describe the proximity for knowledge-based activities in concentration differing by the degree of spatial and non-spatial drivers of knowledge interactions. From an ecosystem perspective, interaction takes place in forms of exchange of ideas, expression of feelings and sharing information that are essential as a natural process to form self-organization occurring at various scales, as enough individual elements exist to interact. Therefore, internal and external knowledge interactions are need to reconsidered for design thinking with respect to the spatial and non-spatial dimensions of knowledge ecosystems. In following table (Table 4), predominant approaches in terms of different dimensions of knowledge ecosystems previously mentioned in the literature are summarized, and scales of interaction and key drivers for design thinking are presented.

Table 4: Framing the spatial and non-spatial drivers

Dimensions of Knowledge Ecosystems		***Scales of Interaction***	***Key Drivers for Design Thinking***
SPATIAL	***Geographical Proximity***	• Internal to Firms • Hubs • Districts • Precincts • Regions	• Improved transportation possibilities for systems, services and products

		• Cities	• Access to creative workforce and physical infrastructures • Reduced travel and communication costs • Co-located actors • Relatively frequent physical / internal interaction • Specialized labor pool and spontaneous information exchange • Diffusion of information in space • Knowledge mutation & spillovers • Face-to-face contacts • High absorptive capacity • Long-term interests and commitment • Local-buzz • Community attachment • Gravity
NON-SPATIAL	***Social Network***	• Organizational & Individual • National & International	• Relatively higher level of diversity • Heterogeneous collaboration • Openness • Trust and endorsement • Information and pools of technology • Interpersonal sources for knowledge interaction • Social integration and social ties
	Institutions	• Co-located in the same ecosystem (internal) • Located in different ecosystem (external)	• Imposed or encouraged distant collaborations • Formal laws, structured norms and values • Common framework of incentives and constraints

			• Shared regulations, norms and ways of knowing • Enhanced regional disparities and spatial obstacles • Local and Non-local actors • Governmental, academic and industrial partners
	Cognitive proximity	• Similar knowledge • Different knowledge	• Collective knowledge ground • Common goals and shared culture • Meaningful communication • Interactive learning • Membership of the community • The tacit, localized and cumulative nature of knowledge
	Organizational proximity	• Intra-ecosystem • Inter-ecosystem	• Access to actors from a similar background • Shared acknowledgment of control and coordination • Trust-based relations between agents • Strategic alliances, joint ventures, agreements • Hierarchical dependences • Relationship of economic or financial dependency

According to the above table (Table 4), spatial dimension via geographical proximity appears as the first key driver that facilitates more frequent interaction and provide a more cost-efficient design thinking process with a lower cost access to specialized inputs. In terms of the knowledge interaction, firms can access to the accumulated knowledge and knowledge flow, as well as to the experts within the ecosystem at very low cost through frequent physical interaction. Such proximity also brings a pool of technology, know-how and local-buzz, and some of the marketing and sourcing advantages where the collective benefits taken by design thinking actors. Due to repeated

interactions, diffusion of information and reputation, and aspiration for standing in the ecosystem are more useful for long-term interests. Through design thinking, spontaneously shared information enables firms to continuously merge and blend similar and non-similar resources to reach new ideas or better solutions. Additionally, social network with higher level of diversity of actors occurring at organizational and/or individual levels or at national and/or international levels offers a heterogeneous nature of collaboration, openness, trust, and integration. Furthermore, institutions co-located in the same ecosystem or located in different ecosystem, enact and encourage distant collaborations, and establish formal laws, structured norms and values within common framework of incentives and constraints. At the same time, there are shared regulations, norms and ways of knowing associated with various institutions. The involvement of institutions provides opportunities to access to local and non-local actors, governmental, academic and industrial partners. Moreover, cognitive proximity involves both similar and different knowledge in design thinking processes. It offers common goals and shared culture, meaningful communication, interactive learning through the use of a common codebook. Actors with such proximity bring the tacit, localized and cumulative knowledge to the process. Lastly, organizational proximity allows access to others from a similar background inside and/or outside the ecosystem. It encompasses shared control and coordination, and accordingly trust-based relations between agents who come together with strategic alliances, joint ventures, and agreements. Such proximity also entails economic and hierarchical dependences of organizations.

Conclusion

The article explains the spatial and non-spatial approach of knowledge ecosystems and the knowledge interaction both in micro and macro perspectives. It argues that the design Thinking mindset can influence individuals and communities in creative industries. Design thinking mindset can have a potential in knowledge interaction to create solutions and new working models so that it is crucial to frame the main drivers for design thinking in knowledge interaction. The theoretical framework in this paper not only discusses the nature of knowledge interaction, but also introduces the spatial and non-spatial dimensions of knowledge interaction to be engaged in different organizations, firms and individuals, as well as design thinking methodologies and practice. Knowledge interaction that stimulates a dynamic and innovative atmosphere in ecosystems has influential where, when, and how creativity and knowledge are generated, transferred and exchanged through spatial and non-spatial proximities since various forms of creativity and knowledge occur within the design thinking processes. Therefore, a spatial perspective taken from business and urban studies on clusters provides the most relevant insights for the contemporary issues in design thinking. In this paper, we argue that creative industry clusters involve a complex blending of many different dimensions of knowledge ecosystems that are influential on design thinking, so that it requires us to understand a set of key drivers for effective knowledge interaction in their ecosystems.

Findings suggests five key drivers for design thinking as relevant, namely geographical proximity as a spatial driver, social network, institutional proximity, cognitive proximity and organizational proximity as non-spatial

drivers. On the basis of the findings, five major inter-related reflections are suggested:

1. Geographical proximity provides a physical concentration within particular ecosystems, and provides more rapid problem solving, innovation and impact opportunities. It entails reduced cost of transportation and mobilization, relatively frequent physical interaction between specialized actors. It creates knowledge mutation and spillovers among these actors and provides face-to-face contacts and attachment to the design thinking processes.
2. Social networks bring higher level of diversity, heterogeneity, openness, integration, trust and endorsement of new knowledge for interaction. It brings social integration and social ties beyond the ecosystem boundaries. Fundamentally, networks facilitate rapid information transfer through horizontal and vertical links of ecosystems, and they enable diffusion of creativity and knowledge.
3. Institutions provide formal and informal sources of incentives and constraints for various actors involved in the design thinking process. Formal laws, structured norms and values regulate this process inside and/or outside the knowledge ecosystem.
4. Cognitive proximity stands for the degree to which actors have a shared knowledge ground that allows effective learning. It eliminates the limitations of pure market relationships and short-term contracts and enables greater level of social integration through common goals and shared culture.
5. Organizational proximity suggests shared acknowledgment of control and coordination in knowledge ecosystems and, creates opportunities for strategic collaborations and joint ventures with relatively more hierarchical dependences both at the intra-ecosystems and inter-ecosystem levels.

Spatial perception is changing by the micro and macro dynamics, and affects the forms of knowledge interaction. Therefore, place-based innovation ecosystems consider knowledge mobility and search for new collaborative working models. These findings provide a better understanding of knowledge interaction in knowledge ecosystems, and reconsider the proximity mechanisms on design thinking processes.

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