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Proximity and knowledge sharing in coworking spaces: The case of São Paulo

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ABSTRACT

This paper studies proximity and knowledge creation and sharing in coworking spaces, which are currently abundant in large metropolitan areas. Physical and non-physical proximities can have a positive effect on knowledge sharing, as they facilitate communication and the creation of sense of community, but they can also have a detrimental effect as they might dimmish differences that can make knowledge exchange valuable. To investigate the effect of non-physical (or non-spatial) proximities on knowledge creation and sharing within coworking spaces, a questionnaire was applied to users of those spaces in São Paulo, Brazil, the largest metropolitan area in Latin America. Analysis of 45 responses indicates that users can be classified in three profiles according to their view on the effect of proximities on knowledge sharing, and that for some users, exchange is facilitated by social proximity, but it is actually hindered by cognitive proximity. Individuals that enjoy different points of view are also more available to contact and exchange, and thus, cognitive and social diversity actually favour knowledge sharing.

1. Introduction

Coworking spaces (CWS) are currently ubiquitous in urban areas across the world and the Covid-19 pandemic appears to have strengthened their presence, as companies are keeping hybrid work practices and relocating their infrastructure to such facilities, to offer flexibility to their employees and to cut costs (Howell, 2022). Sharing work infrastructure is not a new practice, but it has gained a renewed meaning since the early 2000s with CWS, which are not only providers of flexible workspace, but are also promoters of "community, collaboration, openness, diversity and sustainability" (Merkel, 2015, p. 124). Those spaces operate with different goals and business models: some aim to foster new businesses or support communities, others are infrastructure and specialized equipment lenders, while some act as platforms to promote connections between large corporations and start-ups. To cope with the multiplicity of goals, business propositions and organizational arrangements, scholars proposed different typologies based on, for example, collaboration (Spinuzzi, 2012), governance and innovation activities (Schmidt and Brinks, 2017), business models and access (Kojo and Nenonen, 2016), social and economic impact (Fiorentino, 2019) and goals and target audience (Orel and Bennis, 2021). Although many have departed from the original concept, coworking has become an "umbrella term" to designate workspace lenders that deliberately support social interaction and community building to some extent (Orel and Bennis, 2021), and thus, the term CWS is adopted in this paper.

While differing in several aspects, CWS primarily offer physical colocation to different parties, whether individuals, small businesses or large corporations. The advantages of physical proximity have been extensively discussed by the literature on industrial agglomerations, with significant advances in its understanding. Physical proximity between businesses can result in increased collective and individual efficiency, by allowing specialization and access to local resources (Becattini, 2002), stimulating innovation and new businesses (Porter, 1998) and facilitating knowledge production and exchange (Bathelt et al., 2004). In accordance with the literature on organizational knowledge that highlighted the importance of personal contact and relations (Nonaka and Konno, 1998; Nonaka and Toyama, 2003), and sense of community (Wenger, 1996) to support learning, industrial clusters have been considered privileged arrangements for knowledge creation and sharing (Arikan, 2009; Maskell, 2001). However, physical proximity has not been considered as neither "a necessary nor a sufficient condition for inter-organizational learning and innovation"

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(Broekel and Boschma, 2012, p. 2): social and cognitive similarities can play a more important role (Huber, 2012). To accommodate that notion, proximity has been conceptualized as a multidimensional concept, that interrelates spatial and network relations with knowledge and innovation (Menzel, 2015), encompassing physical, social and cognitive aspects (Torre and Rallet, 2005), which are particularly relevant in tacit knowledge transfer (Rallet and Torre, 1999).

In spite of differences in scale, both CWS and clusters allow physical proximity to their participants, and in that sense, the first can be considered as a micro version of the second, and thus, may offer similar advantages as their larger counterparts (Capdevila, 2013; Reuschke et al., 2021). The literature has already made several important contributions to our understanding about proximity and knowledge sharing in CWS. While colocation alone may not lead to increased relationships (Merkel, 2017), it can create a shared knowledge base (Bouncken and Aslam, 2019; Reuschke et al., 2021) and sense of community (Blagoev et al., 2019; Garrett et al., 2017), which can facilitate learning (Waters-Lynch and Potts, 2017). Those contributions explored different proximity dimensions and pointed to its benefits for creating communities and enhancing knowledge exchange (Mariotti and Akhavan, 2020).

However, the literature on industrial clusters has argued that proximity may not always have a positive effect, as it can reduce diversity and lead to innovation capability decrease (Broekel and Boschma, 2012): knowledge exchange can be impaired if parties are socially and cognitively similar, as there is not much to learn from each other, or they may become locked in "established ways of doing things" (Boschma and Frenken, 2010, p. 125). CWS have also been described as having an ambivalent nature related to users' behaviour: while some users look for, and benefit from, connections and community, others are more interested in business opportunities, and for those, community is not an important driver of participation (Reuschke et al., 2021), and thus, they are less interested in interaction and knowledge sharing. Hence, the literature has pointed to a mixed influence of proximity and community building within CWS: they can have either positive or negative effects on knowledge creation and sharing, depending on user profile and cognitive similarity. However, the extant literature has found mostly positive impacts of proximity on knowledge sharing (e.g. Bouncken and Aslam, 2019; Cabral and van Winden, 2016; Capdevila, 2013; Merkel, 2015). Whether proximity can be detrimental for knowledge exchange in CWS, and if so, under which conditions and for which users, can be further clarified. Therefore, this paper poses two questions: Is proximity always supportive of knowledge sharing in CWS? And if so, is that effect the same for all users?

In order to answer these questions, a questionnaire asking about cognitive, social and organizational proximities, knowledge sharing and perceived results about using CWS was distributed to users from São Paulo, Brazil, the largest metropolitan area in Latin America, resulting in 45 valid responses. Small samples are useful for analytical discussion, they are used, for instance, at initial stages of health care studies, or when large samples are not feasible or available (Brunner and Langer, 2000; Shih et al., 2004). Results suggest that users of CWS can be classified into three profiles and that, while knowledge sharing is facilitated by social proximity, it can be hindered by cognitive proximity, which confirms its ambivalent effect and adds to the current discussion on CWS and knowledge creation and sharing. The literature on industrial clusters have already pointed out that knowledge flows require some level of dissimilarity, but in CWS, the dynamic and innovative environment is expected to be created by a culture of openness and tolerance towards participants, and this seems to be more important than shared background to sustain knowledge sharing. This, and other findings, are further explored in the remainder of this paper, which is structured as follows: in sections 2 and 3, a brief overview of the literature on coworking and proximity is offered. Section 4 describes data collection procedures and data analysis methods. Section 5 presents results, which are discussed in section 6. Section 7 offers conclusions and some suggestions for future research.

2. Coworking spaces and knowledge sharing

Business infrastructure providers are not a recent phenomenon, serviced offices offering workspace and services (Appel-Meulenbroek et al., 2019) exist since the 1960s. Incubators, organizations aimed at supporting entrepreneurship and new ventures, became popular in the 1980s offering primarily office space, to later expand their services to also supply business support services, specialized advice, and networking opportunities (Bruneel et al., 2012). More recently, some became known as accelerators, which started to offer mentoring programs and access to funding sources in order to speed up new ventures' growth (Pauwels et al., 2016). While incubators assist primarily small enterprises, from the early 2000s, coworking spaces started to serve autonomous professionals and freelancers (Gandini, 2015; Merkel, 2018; Spinuzzi, 2012), as their number increased due to a changing business context, in which knowledge work became project-based and labour relations, short-term. Those professionals joined an existing class of creative professionals, for whom temporary assignments have always been the norm. Due to the nature of their occupations, they often feel isolation, lack of community and encounter opportunities, feedback from peers and social support, and coworking spaces met their demand in that respect (Garrett et al., 2017; Reuschke et al., 2021; Spinuzzi et al., 2019).

As the serviced workspace market evolved, there has been a diversification of service offerings and business models, under several denominations: coworking spaces, incubators, accelerators, innovation hubs and creative hubs to name a few. To cope with the multiplicity, several typologies have been offered in the literature to classify these types of organisations. Some explored the community-building perspective, confronting opportunism and individualism with collaborative behaviour (Capdevila, 2013; Fiorentino, 2019; Spinuzzi et al., 2019). Others analyzed the service offering: office infrastructure and support services, prototyping machinery, and so on (Schmidt et al., 2015). Some researchers also proposed eclectic typologies that contemplate the nature of the sponsoring organization or clients, goals and the services offered (Kojo and Nenonen, 2016; Orel and Bennis, 2021; Schmidt and Brinks, 2017).

"Coworking" has become a popular term and has been proposed to designate the multiple forms of shared workspaces that currently coexist, as long as they provide workspace and offer some support for interaction at the individual and organizational levels. They can serve individuals (the original concept), corporate teams, start-ups, or support fabrication and creative production (Orel and Bennis, 2021). CWS can act as intermediaries between professionals, new ventures and established firms in urban innovation ecosystems, supporting communities and promoting knowledge creation and sharing. This role has been referred to as middleground (Cohendet et al., 2010), which connects informal businesses and autonomous professionals to firms, and ecosystem orchestrators, when they promote connections between start-ups and corporations (Giudici et al., 2018).

Community and knowledge sharing have been pointed as one of the positive outcomes from colocation in CWS. Building on the literature about industrial clusters, research has shown the benefits of physical proximity for knowledge creation and sharing. CWS bring together professionals from different backgrounds and can promote collaboration between them (Merkel, 2015). The shared understanding that results from social interaction build trust among participants (Capdevila, 2013), which leads to facilitated knowledge sharing. Spatial proximity also facilitates knowledge exchange because face to face contact is a powerful channel for tacit knowledge transfer (Bathelt et al., 2004; Storper and Venables, 2004). Hence, initiatives that stimulate interaction were found to enhance knowledge sharing: layout design that encourages contact (Bouncken and Aslam, 2019; Cabral and Van Winden, 2016), community managers that actively stimulate interaction (Brown, 2017), digital communication systems (Parrino, 2015) and mentoring and training sessions (Bouncken and Aslam, 2019). However, the

importance of physical proximity has been challenged during the Covid 19 pandemic, as social distancing measures prevented it, and digitally assisted interaction became the norm. Thus, the importance of the multidimensional nature of proximity has been stressed, and analyzing their effects has become even more important.

3. Proximity and knowledge sharing

Physical proximity facilitates knowledge creation and sharing, as it allows personal contact, informal conversations and non-verbal communication (Bathelt et al., 2004; Malmberg and Maskell, 2006; Storper and Venables, 2004), which are important for the exchange of tacit knowledge (Nonaka and Takeuchi, 1991). However, the effect of physical proximity can be also created by other means that facilitate and coordinate interaction; for instance, formal and informal professional rules and procedures that allow individuals to easily communicate and share knowledge (Rallet and Torre, 1999). Organizational arrangements can also support interaction, bridge physical distances, promote interactions, and ease knowledge sharing (Torre and Rallet, 2005). Those non-spatial aspects of proximity have been operationalized in four dimensions (Boschma, 2005): the degree of similarity between knowledge bases (cognitive proximity), the extent context and social environment are related (social and institutional proximities), and how close the degree of autonomy and structure are (organizational proximity). This classification of non-physical proximities is currently the most adopted in the literature (Micek, 2020), and is also applied in this paper.

Cognitive proximity refers to the extent organizations share a common knowledge base, and it influences learning because: (a) previous knowledge on a domain positively affects it (Cohen and Levinthal, 1990), and (b) communication and trust building are facilitated by shared behaviours and norms (Garnsey and Lawton Smith, 1998; Huber, 2012). Thus, a common knowledge domain and background facilitates knowledge exchange between organizations: the more they are similar, the more they share language and mindset, which helps communication and information acquisition (Boschma, 2005). Following the same reasoning, social proximity is related to a common social background, and it considers that business transactions happen within a social context that supports personal identification, connections and ultimately, trust building, which helps tacit knowledge transfer (Leonard and Sensiper, 1998; Zaheer et al., 1998). Institutional proximity also takes into account the social context and refers to a similar institutional environment: common formal and informal norms, i.e., laws, regulations, habits and informal rules that support transactions between actors (North, 1991). Both social and institutional proximities minimize opportunistic behaviour and, thus, lower uncertainty, which results in enhanced trust that facilitates information exchange. Finally, organizational proximity is a broad concept, which frequently encompasses the social aspect (Boschma, 2005), but it can be defined as the nature of the relationship between organizations, their autonomy to act independently, varying from an arm's length relation to a captive, hierarchical one. It refers to the extent organizations' share similar autonomy and structure.

The literature has discussed proximity effects within CWS: Garrett et al. (2017) explored how it creates sense of community by the establishment of socially constructed processes and Blagoev et al. (2019) show how that sense emulates an organizational environment for independent professionals. Also, Mariotti and Akhavan (2020) analysed the perception of cognitive, social, institutional, and organizational proximities by users of CWS, and concluded that they support sense of community and communication, and Reuschke et al. (2021) found that professionals wish to become more efficient when engaging in community building initiatives. Regarding knowledge creation and sharing, Bouncken and Aslam (2019) found that colocation reduces boundaries between individuals and teams and stimulates knowledge flows and Parrino (2015) found that those flows are more intense and diverse when proximity is complemented with systems and processes that support users' contact.

What the aforementioned studies have in common revolves around the positive influence of physical and non-physical proximities on community building and, consequently, on knowledge sharing. However, non-physical proximities have been indicated not only as supportive but also as detrimental to knowledge sharing: when parties already share knowledge and possess common understanding, exchange may decline simply because there is not much to trade (Nooteboom et al., 2007). Thus, although sense of community and similar knowledge base can facilitate communication, they can also reduce learning in what has been called the "proximity paradox" where non-physical proximities can lead to decreased knowledge flows and insufficient variety and flexibility, which can result in, for instance, a lock-in effect and an inability to sense shifts in the wider business and technological landscape (Boschma and Frenken, 2010). That effect has been discussed in industrial clusters, and whether it can also affect the interaction between professionals in CWS is yet to be uncovered.

4. Method

A survey among CWS users was conducted to explore the impact of physical and non-physical proximity dimensions on knowledge creation and sharing, using a questionnaire about workspace quality, the perceived results of using CWS and cognitive, social and organizational proximities. Unlike physical proximity, for which there are direct measures (e.g. distance in kilometres), the measurement of non-physical proximities can be more difficult. In this study, each non-spatial proximity, social, cognitive and organizational, were operationalised in four qualitative questions, based on Boschma (2005) definitions, using five-point Likert scales (other non-physical proximity measures, a review about them and their limitations can be found in Capello and Caragliu (2018); Santos (2017); Santos et al. (2021)). Institutional proximity was not included because the concept addresses the nation level as opposed to the sub-regional level (Knoben and Oerlemans, 2006), and it was assumed that respondents live in the same area (Southern Brazil), and thus, all were subjected to the same institutional context. Questions are detailed in Table 1.

The questionnaire was pre-tested with 5 CWS users during a workshop in January 2020, and then uploaded in an online survey platform, and distributed to users of 13 public and private CWS located in São Paulo. The city is the tenth largest metropolitan area in the world (OCDE, 2020), and one of the most important global business hubs, alongside cities such as Los Angeles, Chicago, Toronto, Sydney, Amsterdam, Milan and Frankfurt (GaWC, 2023). It ranks 10th place among the megacities in the world for human capital, due to attraction and retention of talent, high proportion of third level graduates among its population and the easiness to find skilled employees (FDi Intelligence, 2021), which makes it a good city to study CWS.

There were 1497 CWS in Brazil and 388 in São Paulo in 2019, the highest concentration in the country, four times more than the second city, Rio de Janeiro, and equal to the sum of the eight following cities. São Paulo presents a balance between technology and creative businesses: health care, biotechnology, finance, audio-visual and videogames, and a vibrant startup scene. CWS in São Paulo are mostly private, for profit and multidisciplinary spaces, with an average of 39 resident users (Coworking Brasil, 2019). A deliberate sample of CWS was selected, adopting two of the typologies discussed in section 2: profit and non-profit spaces (following Kojo and Nenonen, 2016), to have different users profiles. Non-profit spaces are São Paulo City and São Paulo State government initiatives, they do not charge for their offering, and three out of four in the sample are located in peripheral areas of the city, while the for-profit ones charge fees for their services and are located in central business districts. Also, individual, group and start-up focused CWS were selected, as they usually offer different conditions: individual focused ones are usually small venues that favour social interaction, while group and startup ones have usually large facilities and are more

Table 1
Dimensions and Questions.

Dimension	Code	Question
Knowledge creation and sharing (KCS)	Q15_1	The workspace design enhances my ability to have new ideas
	Q15_2	Informal chats lead me to unanticipated, but relevant, ideas and actions
	Q15_3	It is important that I share my thoughts with other users
	Q15_4	I try to share knowledge with my co-workers whenever possible
Cognitive Proximity (CP)	Q15_5	The diversity of users' knowledge helps me to better understand the world
	Q15_6	The diversity of projects and activities within the workspace changed my worldview
	Q15_7	Interacting with people from different industries helps me think outside the box
	Q15_8	Work routines benefit my knowledge base
Social Proximity (SP)	Q15_9	Mutual trust among users helps me to finish my tasks
	Q15_10	Shared spaces and social events help me to broaden my network
	Q15_11	A larger social network is useful both professionally and personally
	Q15_12	Getting involved with the community surrounding the workspace help me to perform my tasks
Organisational Proximity (OP)	Q29_1	Support from a multidisciplinary team help me to perform my tasks
	Q29_2	A clear hierarchy of the workspace management helps me to perform my tasks
	Q29_3	Formal workspace rules help me to perform my tasks
	Q29_4	Informal rules and norms in the workspace enhance my personal results
Perceived Results (PR)	Q29_5	Using a shared workspace positively influence my creativity
	Q29_6	Using a shared workspace positively influenced my business
	Q29_7	Distractions from the shared workspace do not negatively affect my ability to complete my tasks
	Q29_8	Socializing with my fellow workspace users makes me happier
	Q29_9	Working together with my fellow shared space users makes more productive
	Q29_10	Social events in the workspace make me a more effective professional
	Q29_11	Working in shared spaces increases the quality of my work
	Q29_12	Working in shared spaces reduces the time it takes for me to finish my tasks

business-oriented. Sampling took advantage of contacts made during two research projects on CWS, which identified key players in the city. From the geographic perspective, the sample includes CWS in the periphery and in central business districts, from the ownership and governance perspective, stand-alone, Brazilian owned CWS and units of international networks, and from the industry perspective, multi-sector as well as sector-specific CWS. Individual CWS in the sample have between 120 and 500 m^2, and can host 30 to 150 people, while large CWS have about 20.000 m^2 and are located in dedicated multi-storey buildings. Table 2 details CWS characteristics, including whether CWS are sponsored by the government or by a company, and whether there are anchor companies. In the first case, public sponsored CWS may not need to have financial return, which can influence participants profile, and in the second, the presence of anchor companies, usually conglomerates, often indicates a more business-oriented mindset. Table 3 depicts the 13 CWS according to Kojo and Nenonen and Orel and Bennis dimensions.

Response rate was low and, as this action was taken at the end of 2020 and beginning of 2021, when strong social distancing measures were in place, it is likely most of the users were overwhelmed by online information and requests. To increase response numbers, the questionnaire was also posted in entrepreneurship groups on social networks, and in the final phase of data collection, as sanitary conditions improved in mid-2021, some workspaces were visited, and whenever there were users present, they were asked to answer the questionnaire. This action resulted in a high response rate, but the presence of users in CWS was still low. In total, 54 responses were collected, and after incomplete questionnaires were removed, the final dataset was composed of 45 respondents, a number higher than the average CWS attendance in São Paulo in 2019. Small samples can point to valid results, they are often used, for instance, in life sciences pilot studies to validate further testing (Shih et al., 2004), and thus, although results may not have statistical generalisability, they can point to useful insights. Given the research questions aim to explore whether proximity is supportive for knowledge sharing in CWS, and if different users feel that effect in the same way, a small sample can be sufficient to answer them and expand our knowledge on the effect of proximities on knowledge sharing.

Data was analysed as follows. There are four questions related to each Proximity dimension (cognitive, social and organizational) and Knowledge creation and sharing, and eight questions for Perceived

Table 3
Sample according to selected dimensions.

	Profit	Non profit
Individual	CW1	CW4, CW5, CW6
Group	CW3, CW7, CW9, CW13	
Start-up	CW2, CW10, CW11, CW12	CW8

Table 2
CWS characteristics.

			Sponsor	Anchor companies	Multi unit	Total Area (m^2)	Total capacity (people)
CW1	profit	Individual	No	No	No	970	240
CW2	profit	Startup	Yes	No	Yes	2600	600
CW3	profit	Group	No	No	No	2600	600
CW4	non profit	Individual	Yes	No	Yes	120	30
CW5	non profit	Individual	Yes	No	Yes	500*	50
CW6	non profit	Individual	Yes	No	Yes	400**	40
CW7	profit	Group	No	Yes	Yes	4000	970
CW8	non profit	Startup	Yes	No	No	1500	100
CW9	profit	Group	No	Yes	No	150	80
CW10	profit	Startup	Yes	Yes	No	22,000	1500
CW11	profit	Startup	Yes	Yes	No	20,000	1500
CW12	profit	Startup	No	Yes	No	20,000	1500
CW13	profit	Group	No	No	Yes	***	***

* including a conference room.
** including a sewing workshop.
*** multiple locations in the city.

Results, using five-point Likert scales. Responses for each dimension were added, giving a score that was used for data analysis, unless otherwise stated. In order to assess whether users have similar perception about proximities, cognitive proximity (CP), social proximity (SP), and organizational proximity (OP) scores were used to run a hierarchical cluster analysis, using Euclidian distance and the Ward method, to reach high group homogeneity. As a descriptive technique, cluster analysis can be applied to small samples, resulting in the best possible grouping with the available data. To test if there is significant difference of responses between the identified groups, a Kruskal-Wallis test for independent samples was used. This non-parametric test was chosen due to the sample size and the impossibility to consider that populations are normally distributed. The results are discussed in the next section.

5. Results

Respondents made use of 34 different workspaces, and 19 among them (42%) were users of more than one place. 53% of them use CWS for at least three years, and the effect of social distancing measures is evident in the low number of those who started using them in 2020 (Fig. 1). The majority (75%) live in São Paulo, and 11% live in Campinas, 100 km of São Paulo (Fig. 2), 11% in Curitiba and 2% in Rio de Janeiro, both about 450 km from São Paulo. Thus, the assumption of same institutional environment is supported. There is a split between heavy users and part timers: 45% use them for more than 30 h/week, while 42,5% use them up to 15 h/week (Fig. 3).

The cluster analysis resulted in three clearly distinct groups, as depicted in the dendogram in Fig. 4: G1 (15 individuals), G2 (21 individuals) and G3 (9 individuals), and Kruskal-Wallis test results indicate responses from clusters are different both for the aggregate dimension scores and for each question (see Table 4).

Questions asked whether respondents were in agreement with statements related to CP, SP and OP. To analyse and compare clusters, the responses "I fully agree" and "I partially agree" for each question were added and the ratio over the total number of responses was calculated. A higher ratio indicates higher agreement with the statement, and thus, more homogeneity in opinions regarding CP, SP and OP within each cluster. Results are depicted in Fig. 5, and shows a pattern: Cluster G3 (yellow line) has the highest level of agreement about the three proximities, G2 (gray line) has intermediary agreement in CP and SP, and lower in OP, and G1 has the lowest agreement on CP and OP, and intermediary in OP.

Questions were related to the perceived effect of each proximity on respondents activities, personal results, relationships and knowledge base. Those associated to CP asked whether diversity (of knowledge, activities, industries) is perceived as beneficial, and thus, a higher agreement with statements indicates that respondents think knowledge diversity, i.e., less CP, is beneficial. Questions related to SP and asked whether respondents understand trust, social contact, and community engagement are beneficial, and those related to OP, if rules, norms and hierarchy are helpful, i.e., higher agreement on those questions means higher SP and OP. Answers are analysed below and are summarised in Table 5.

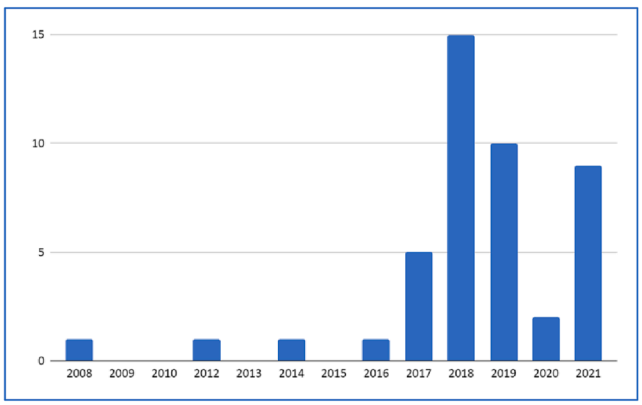

Fig. 1. Start year in SWS.

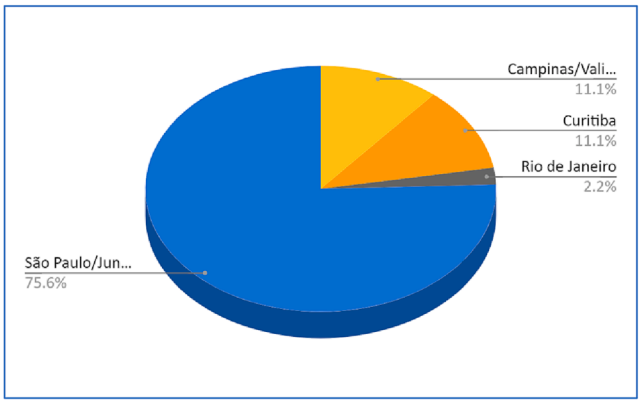

Fig. 2. City of Residence.

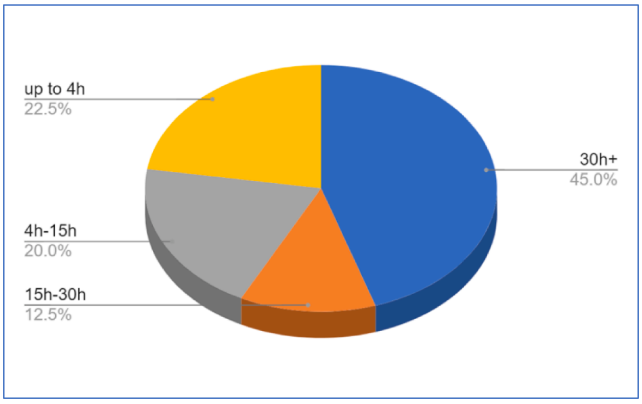

Fig. 3. Hours per week in SWS.

Cognitive Proximity (CP) – Cluster G1 does not agree diversity of knowledge, and especially activities and projects, are productive, and thus, they do agree CP helps their work. On the opposite end, cluster G3 perceives diversity as highly beneficial, hence, individuals in this cluster do not understand CP as advantageous. Cluster G2 has also a high level of agreement, although slightly below G3, indicating they also do not understand CP as beneficial.

Social Proximity (SP) – Cluster G1 shows low level of agreement, especially related to gains from trust and community involvement, but it does understand social network as very important. The overall assessment of the benefits of SP of cluster G1 is the lowest among groups. Again, on the opposite end, cluster G3 understands trust, social contact, networking and community engagement as important, and therefore, SP is relevant to this group. Cluster G2 shows a similar pattern with G1, trust and community engagement are not very important, but they have higher agreement regarding the benefit of social events and networking.

Organizational Proximity (OP) – Cluster G3 has higher level of agreement regarding the benefits of rules and hierarchy. There is an inversion on the assessment of this proximity: Cluster G2 has the lowest level of agreement, and Cluster G1 is intermediary, about half of individuals understand rules and hierarchy as beneficial. Interestingly, all clusters understand multidisciplinary teams as important.

Cluster G1 (15 individuals) has the lowest agreement regarding SP,

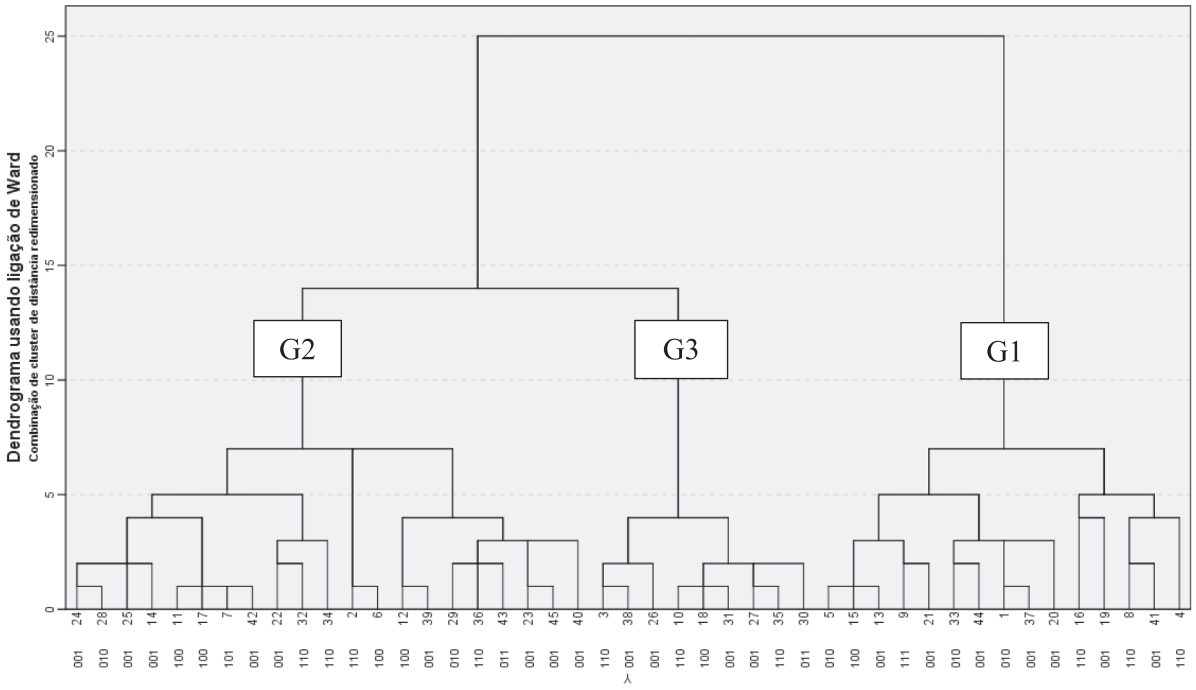

Fig. 4. Clusters' Dendogram.

Table 4
Kruskal-Wallis Test results.

		Significance at 0,05 level
1	Cognitive proximity score	0,000
2	Social proximity score	0,000
3	Organizational proximity score	0,000
4	Question Q15_1	0,003
5	Question Q15_2	0,001
6	Question Q15_3	0,037
7	Question Q15_4	0,010
8	Question Q15_5	0,000
9	Question Q15_6	0,000
10	Question Q15_7	0,005
11	Question Q15_8	0,014
12	Question Q15_9	0,000
13	Question Q15_10	0,004
14	Question Q15_11	0,013
15	Question Q15_12	0,000
16	Question Q29_1	0,003
17	Question Q29_2	0,001
18	Question Q29_3	0,038
19	Question Q29_4	0,013
20	Question Q29_5	0,000
21	Question Q29_6	0,000
22	Question Q29_7	0,004
23	Question Q29_8	0,050
24	Question Q29_9	0,033
25	Question Q29_10	0,012
26	Question Q29_11	0,000
27	Question Q29_12	0,000

only networking scores high concordance, which can be viewed as an opportunistic behaviour: social interaction is viewed as important if resulting in business contacts. Cognitive proximity scores the highest agreement among clusters, indicating they are more comfortable among people with a similar background. Cluster G2 (21 individuals) scores the lowest level of agreement on OP, only multidisciplinary teams are regarded as helpful, but formal and informal rules, and hierarchy are not viewed as beneficial, i.e., they seem to disregard structure and formality. They have an intermediate assessment about the importance of CP and SP, but they value knowledge diversity, social events and social networks. Cluster G3 (9 individuals) shows the highest agreement about the importance of SP, including community interaction, and regards CP as less favourable, almost all individuals understand knowledge and peer background diversities are beneficial. Interestingly, not all individuals think access to new knowledge through projects and activities is important, which suggests an emphasis on social contact.

Regarding perceived results of using CWS (Fig. 7), G3 understands CWS as having positive impact on both their business activities and on their well-being. They also value socialisation, but understand distractions are detrimental to their productivity. G2 assesses results closely to G3 but has more negative perception on distractions and their detrimental effect on their results. G1 displays a mixed perception: while being very critical on the effect of CWS on their efficiency and quality of their work, they understand socialization is important for their well-being.

Responses regarding knowledge creation and sharing, are depicted in Fig. 6. G3 thinks knowledge sharing is very important, and that the CWS supports it. G2 has also a similar, but less favourable, assessment on the benefits of CWS on knowledge creation and sharing, but they do not evaluate space design as equally important as the previous group. On the lower side, G1 regards knowledge sharing and participation in CWS as contributing less to their activities.

6. Discussion

Physical and non-physical proximities (CP, SP and OP) have been found to have positive effects on knowledge creation and sharing in CWS, as it facilitates personal contact and communication, trust and sense of community (Bouncken and Aslam, 2019; Garrett et al., 2017; Mariotti and Akhavan, 2020; Parrino, 2015). However, our results show a nuanced picture: those who understand CWS contribute to knowledge creation and sharing, while acknowledging the benefits of SP, are not so sure about gains from CP and OP. G3 considers SP and OP as adding to their work, but thinks a diverse peer group, i.e., not cognitively close (less CP), are more favourable. G2, while enjoying SP, also understands diversity as good, and does not think OP is valuable. G1 is the only group that thinks knowledge diversity, i.e., lack of CP, is not beneficial to knowledge sharing, while also having a negative assessment of the effect

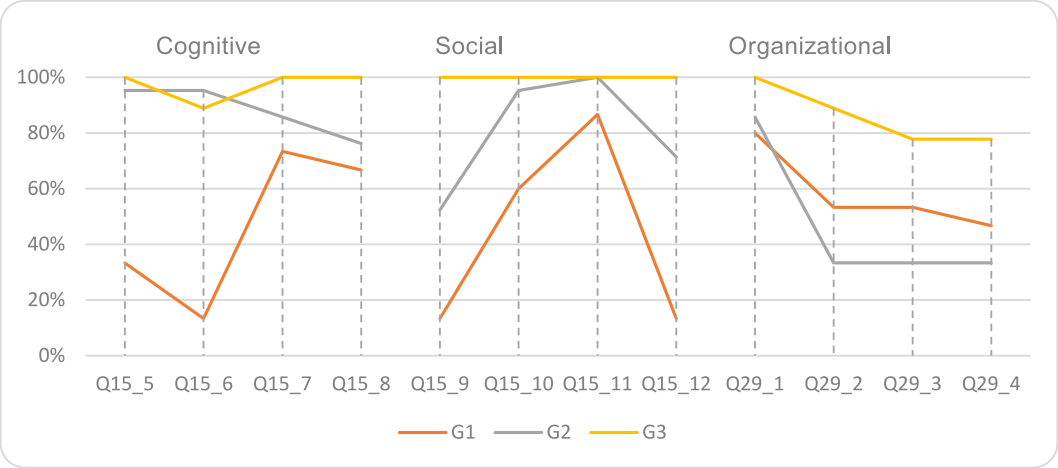

Fig. 5. Agreement ratio *per* Cluster.

Table 5
Comparative agreement on Proximities.

Cluster	Cognitive Proximity (CP)	Social Proximity (SP)	Organisational Proximity (OP)
G1	High	Low	Intermediary
G2	Intermediary	Intermediary	Low
G3	Low	High	High

of SP. Thus, G3 and G2 do not understand CP as important to the same extent G1 does, but the first two groups value and actively seek knowledge exchange more intensely than the third one. While the proximity literature asserts that CP supports knowledge sharing, results suggest contrarily: those who do not think CP is beneficial are more engaged in knowledge exchange.

The industrial cluster literature considers that knowledge exchange is facilitated when teams share a common knowledge base, because language and mindset are similar, and thus, despite idiosyncrasies of each organization, communication and mutual understanding are facilitated. However, at the individual level, communication is easier for those more inclined to exchange and willing to interact with others, regardless of their background. Those individuals enjoy diversity and are open for interpersonal contact, they like to exchange ideas and to listen to others and believe that a heterogeneous group will provide them a richer experience. Therefore, as they look for contact with that diverse party, they interact and exchange knowledge more intensely. Thus, our results do not suggest the inverted U-shaped relationship between cognitive proximity and knowledge sharing, the so-called proximity paradox (Broekel and Boschma, 2012). Instead of an inverted U-shaped relationship, knowledge sharing in CWS can have a negative relationship to cognitive proximity, at least to some user profiles: lower similarity supports higher exchange, which decreases as similarity grows. CWS have been created around an ethos based on diversity of ideas and free exchange of experiences, where heterogeneity is considered an asset for innovation, as it can lead to fresh perspectives and new ideas (Jakonen et al., 2017). CWS users that adhere to that ethos look for diversity in order to get different points of view, and CWS are reference locations for such interactions (Waters-Lynch and Potts, 2017). Thus, our results show that there are some users who do look for diversity, and value knowledge sharing, while others are not so interested in exchange. The later seem to adopt an opportunistic behaviour, which is confirmed in the next findings.

Regarding SP, while G3 assesses it as important, G1 does not regard it as important, except for establishing social networks, while G2 values it, but trust is not understood as beneficial. Those results suggest two behaviours: in the first, represented by G3, social proximity is highly regarded: being closer and interacting with peers and the community are perceived as beneficial, both professionally and personally. The second, from G1 and G2, is more opportunistic and business-oriented, openness to others may not be high, but networking is important for personal development, which requires interacting with others. Thus, the group that considers SP important also actively engages in knowledge sharing,

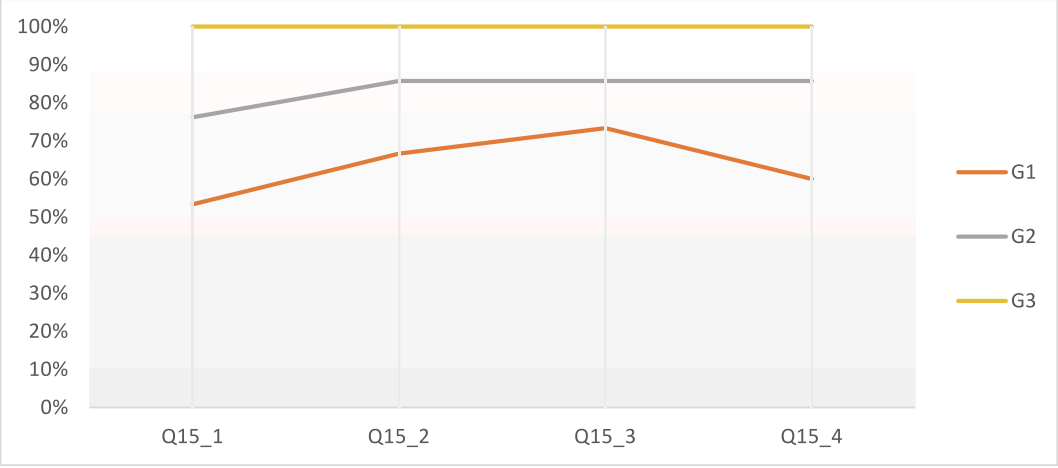

Fig. 6. Groups assessment on Knowledge creation and sharing.

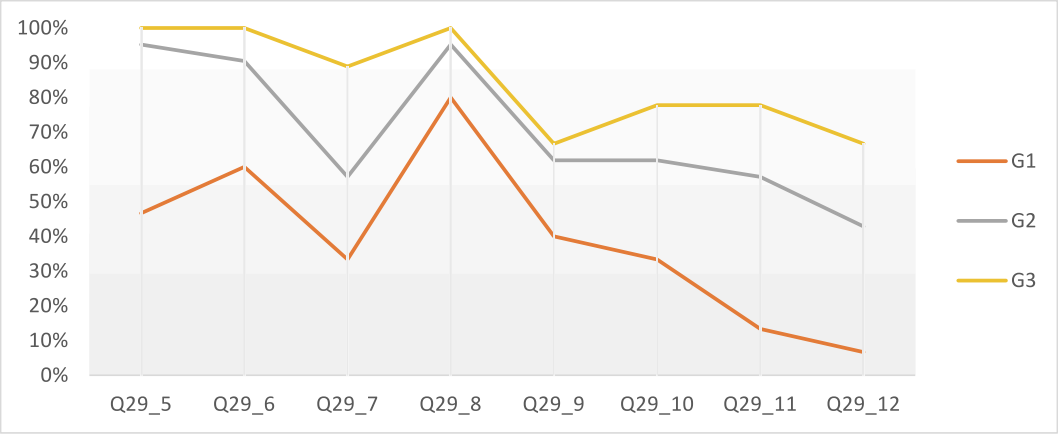

Fig. 7. Groups assessment of Perceived Results.

while those that adopt a more opportunistic stance do exchange ideas, but less intensely.

The literature has pointed to a divide between two coworking models: a corporate, commodified model and a resilient, bottom-up one (Gandini and Cossu, 2021; Merkel, 2018; Reuschke et al., 2021). In the first, CWS are infrastructure providers where community is foremostly for creating business networking opportunities, while in the second, they are places that enable mutual support and social relations as their prime goal. Our results support that divide, not at the place but at the individual level: there are users that engage in opportunistic behaviour, for whom working in a shared space is primarily to build professional connections, while others understand it is a chance to belong to a community and to build trust-based relations with peers. This provides a demand-based argument to the coworking phase model presented by Gandini and Cossu (2021), the resurgence of the original CWS concept is not only a strategy designed by the workspaces, but also a response to an existing demand from users who do not perceive corporate CWS as their ideal place to work.

OP is not well regarded by G2, members do not enjoy rules and hierarchy, while G3 understands them as valuable, which suggests members require a more controlled work environment. G1′s members are divided in their opinion, half understand rules and hierarchy are good, the others do not think they contribute to their activities. Thus, organizational rules and control support knowledge sharing only for some users. This is backed by early findings that observed that organizational practices assist community building and sharing (Parrino, 2015), but in a shaded perspective: they are helpful only for some users, who enjoy a more controlled environment.

Results suggest that although CWS could be conceptualized as micro-clusters (Capdevila, 2013), they do not present the same knowledge dynamics as their larger counterparts: while CP in industrial clusters is considered to facilitate communication and innovation to a certain level, in CWS it can be viewed as detrimental. Although both are agglomerations of businesses, scale makes difference: industrial clusters are collections of firms, and CWS, a mix of autonomous professionals, entrepreneurs, small ventures, medium and large companies. Due to that fact, the impact of non-physical proximities in CWS are a result of differences related to individual traits: among user groups, some seem to have a lower threshold for proximity, while others a higher one, they are more open to diversity in knowledge and thinking.

The literature has already proposed user typologies. (Spinuzzi, 2012) found two coworking configurations: the good-neighbours, where CWS are places in which users share space but conduct activities independently, and the good-partners, where users make contact and develop joint projects. Orel and Bennis (2021) suggest the first are more appropriate for seasoned professionals, who have already developed business connections, while the second meet the needs of up-and-coming ones. While this classification sheds light on the degree of collaboration between users and where it was first engendered, it is very coarse-grained and does not cover all user profiles. Brown (2017) developed an eclectic typology with four coworking user profiles: mentees, who value sharing ideas and learning from others, networkers that look for business contacts and professional networks, motivators, business-oriented users that enjoy the collegial work atmosphere, and reluctant soloists who, despite enjoying social contact, understand CWS as places to work alone. While illustrating different user profiles, it presents, as the author herself recognizes, overlap between user groups. Our findings suggest the distinction between user groups can be related to three main aspects: knowledge diversity (the opposite of CP), community (SP) and rules and norms (OP). Appreciation of knowledge diversity and community is related to knowledge sharing, suggesting a monotonic relationship, and not an inverted-U as suggested by the literature on industrial clusters (Broekel and Boschma, 2012). It should be noted that our results come from a small sample, sourced from one city, and thus, it does not have statistical generalizability. However, findings can be useful as they shed light on a different relationship that should be further explored.

7. Conclusion

Proximity, as a multidimensional concept, plays an important role on knowledge creation and sharing, and although technology facilitates contact, physical encounters cannot always be substituted by remote ones, as the recent years have shown. Also, similarities that promote social identification and lead to trust are facilitators for knowledge sharing. However, the results discussed here suggest that, although proximities do play an important role on knowledge sharing in CWS, their effects vary according to the level of analysis. At the group level, cognitive, social and organizational proximities do support knowledge exchange, as they create common language and mindset which facilitate communication and make tacit knowledge transmission easier. For knowledge exchange between organizations, in which complex information must be transmitted quickly and precisely, higher proximities simplify the task of overcoming cognitive barriers and organizational or professional idiosyncrasies. But, at the individual level, there is less noise coming from dissimilar backgrounds, and personal traits seem to play a more prominent part: individuals that enjoy different points of view and are more open to others, are also more available to contact and exchange. For them, cognitive and social diversities are more valuable than closeness, different perspectives enrich discussion, bring new ideas and clear different pathways to solutions. Thus, proximities matter less. In fact, the shared workspace ethos is based on that idea: being in an environment that values diversity, where different perspectives are present, leads to innovation, and many individuals that make use of

those places do share this point of view. This answers our two research questions: non-physical proximities are not always beneficial for knowledge sharing, particularly at the individual level, and their effect varies according to users. For some, less proximity means more opportunities to share and exchange, they are open to overcome cognitive barriers in order to get different perspectives. Others will be more oriented to fast and precise exchange and will enjoy more cognitive and social proximities.

Results contribute to practice as they highlight different CWS users' profiles, which can support managers to plan activities and resources to support different demands. It can be used in business strategy definition: a CWS can choose to focus on a specific user profile, by selecting a set of resources and activities to offer. While some users demand a busy social activity schedule, others do not have the same need. Thus, instead of providing a broad range of services and activities to cater for all tastes and may end up not pleasing anyone, a CWS can attract more users from a specific profile by tailoring its service offering.

This study has limitations: it is based on a small dataset, and although analytical methods were chosen to prevent inadequate discussion, more research is needed. Also, all respondents were from São Paulo, and although it is the largest metropolitan area in South America that features a strong business and innovation ecosystem, this limitation may have introduced bias on results, studies in other cultural settings will also be useful. Also, even though measures of proximities were based on the literature, and the questionnaire was pre-tested, results may be subject to biases from the interpretation of respondents. The small sample, sourced from only one city do not allow results statistically generalization of results, however they can be the starting point for future research. How CWS users value knowledge sharing and perceive proximities can be explored in cities from different countries and cultures, both using quantitative or qualitative methods. Also, more data from users of individual, group and startup CWS can add to our results, and allow comparative analysis.

CRediT authorship contribution statement

Davi Nakano: Conceptualization, Methodology, Writing – original draft, Project administration, Funding acquisition. **Emerson Gomes dos Santos:** Methodology, Formal analysis. **Ely Mota Lima:** Investigation. **Tarek Virani:** Conceptualization, Writing – original draft.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

The authors do not have permission to share data.

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