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***Individual's agency in workplace social networks  
Face-to-face communication behaviours***

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## Table of Contents

Acknowledgements .....	2
Introduction to the Dissertation.....	5
1. Ambidexterity Enacted. An RFID-based case study of an incubator.....	9
2. What do brokers do? A study of brokers' relational styles in daily working life.....	51
3. Homophilous behaviours in fleeting interactions. An RFID-based case study of an incubator .....	90
Appendix .....	131

## **Introduction to the dissertation**

“We live in an organisational world” (Pfeffer, 1997) and, as demonstrated by the emerging field of organisation studies, “structure, process, and culture are the outcome of the people in an organisation, not the cause of the behaviour of the organisation” (Schneider, Goldstein, and Smith, 1995: 751). The determinants of organisational behaviour are constituted by the attributes of people and not by “the nature of the external environment, or organisational technology, or organisational structure” (Schneider, 1987: 437). Hence, the importance claimed by organisation and innovation studies to understand which are the micro-foundations of organisational processes, by looking at the effects of individual’s characteristics and actions on organisations (Pfeffer, 1997: 4).

The present dissertation contributes to this debate by dealing with the investigation of individual agency and how actors, who are intentional agents (Nohria, 1992), purposively act in the organisational structures in which they are embedded. Despite the crucial role acknowledged to individuals in an organisational setting, there is scant evidence on how employees use the resources at their disposal to get the work done on a daily basis. Indeed, agency is a still overlooked topic in at least two main streams of research: ambidexterity and social network studies. In particular, literature on ambidexterity (e.g. Tushman & O’Reilly, 1996; Birkinshaw & Gibson, 2004) disregards the individual dimension implicitly assuming the presence of homogeneity of individual behaviours and, accordingly, neglecting the effect of employees’ action in achieving organisational ambidexterity (Chapter I). Conversely, in structural tradition of social networks (e.g. Burt, 1992, 2004; Granovetter, 1974; Podolny & Baron, 1997), social networks are conceived as latent structures linked to certain outcomes. By focusing on social networks as “something that individuals have”, extant research rarely observes the concrete behaviour of actors embedded in different workplace social networks (affective and instrumental social relationships); thereby failing “to connect the actions of individuals to their network positions” (Stevenson & Greenberg, 2000, p. 651; see also Obstfeld, 2005) and the mechanisms underlying network effects on outcomes (Chapter II). In addition, social network scholars did not contemplate an important aspect of today’s organisations: the ways through which people use their workplace social network to briefly channel information on a daily basis. In modern organisational contexts, employees also tend to carry out their tasks by shortly interacting with their colleagues. These under-explored

“fleeting” encounters among employees allow people to convey information and tacit knowledge necessary for creating innovation. Hence, the need to investigate the determinants of this particular communication behaviour (Chapter III).

The dissertation sheds light on the above-mentioned issue by investigating how employees engage in social interactions to perform their daily activities. The study aims at bringing the agency in two streams of literature by tackling three main questions:

- i) how organisational ambidexterity can be enacted by individual’s agency (Chapter I),
- ii) how brokers use the different types of social (affective and instrumental) relationships in which they are embedded in the workplace (Chapter II),
- iii) how types of similarity and space layout impact differently on a particular employee’s behaviours: the engagement in fleeting encounters among colleagues (Chapter III).

I address this issue by combining social network analysis and case study of a highly innovative private incubator and its 10 start-ups. In order to capture how employees enact the social structure in which s/he is embedded in a purposive way, I gather information on the employees’ engagement in interaction by using RFID (Radio-Frequency Identification) badges. These unobtrusive badges sense and log the face-to-face interactions (Stehlé, Charbonnier, Picard, Cattuto, & Barrat, 2013) occurring every day in the incubator. The use of RFID technology enables the collection of high-resolution information on interaction partners, frequency and amount of time people spend in close-range proximity (Cattuto *et al.*, 2010) in the workplace.

The rationale underlying the choice of examining individual behaviour by studying employees’ communication behaviour is twofold: social relations constitute crucial drivers of both exploration and exploitation (e.g. Jansen *et al.*; 2006 Weick, 1995; Turner & Lee-Kelley, 2013), and they represent the base upon which social structures are built. Communication explicates itself via interpersonal interactions and, thanks to interactions, people can channel information and knowledge (Miller, Zhao, & Calantone, 2006). Since knowledge has always a tacit dimension (Polanyi, 1962; Nonaka & Takeuchi, 1995) expressed in skillful actions, tacit knowledge has a critical role in knowledge transfer (Orlikowski, 2002). The medium through which people efficiently convey tacit and complex knowledge is represented by Face-to-Face (F2F) interaction (Bell & Zaheer, 2007). Indeed, although the presence of computer-based communication media, F2F still plays an irreplaceable role at the workplace (e.g. Nohria & Eccles, 1992) in feeding organisation social context (Nohria & Eccels, 1992) and solving problems (Hagardon & Sutton, 1997).

The dissertation mainly contributes to provide evidence on the need to take into consideration the role played by agency in organisational contexts. Once we consider the agential dimension, the picture we draw of our organisations seems to be richer and more complex than the one visible in the absence of individual's agency.

More specifically, when we look at the agential dimension role in organisational contexts facilitating ambidexterity, we acknowledge the presence of three individual ambidexterity orientations (exploitative, ambidextrous and explorative) that are differently combined at the organisational level. These results suggest that the ambidexterity enacted by individuals is more variegated, and articulate in precise time windows, than the one present at the organisational level. This evidence shows that we cannot always infer how exploitation and exploration are actually achieved by only looking at organisational level themes of structural and contextual ambidexterity, as the extant literature seems to do (Chapter I).

The introduction of the agential dimension on brokerage study in social network contributes to a much more nuanced theoretical perspective on broker's behaviour. If we capture the exact actions connecting to actors who occupy a broker's position by building a typology of *brokers' relational styles (RS)* - defined as *the patterns of actions through which brokers mobilise their affective and instrumental social relationships*, we are able to acknowledge that brokers (compared to non-brokers) perform their everyday tasks by differently engage with their informal workplace social network. From this perspective, the actual behaviour of brokers may vary depending on the content of the tie and the expectations embedded in different workplace contexts, because 'the cultural meaning attached to name generators such as friend, neighbour, drinking buddy, workmate, boss, acquaintance, etc. make a big difference' (Galaskiewicz, 2007:7). Thus, brokers may be expected to act and interact differently depending not only on the strength of the tie (Burt, 1997) but also on the content of the tie (affective vs. instrumental) Chapter II).

Chapter III brings agency in daily short interactions taking place among colleagues to cast light on the determinants of homophilous communications behaviours, in particular of fleeting interactions activated by employees to mobilise organisational resources in the same space in a short period of time. We test whether the existence of social and organisational similarity as well as space driver impact on homophilous employees' behaviours. The results show that in the workplace, friendship (Lincoln & Miller, 1979) and workplace layout are determinants of decisions and resource use that are closely related to work tasks. In addition, organisational similarity could act as a trigger of

potential interaction among colleagues whose relationships are already facilitated by friendship and spatial layout.

Finally, this dissertation yields a methodological contribution by using an original data collection approach. This work blends social network analysis (based on a free choice roster survey on workplace social networks), case study, and proximity-sensing electronic badges based on RFID technology. The use of RFID badges enables the detection of large-scale dynamical data on human behaviour (in terms of number and the duration of F2F interactions) with higher accuracy than obtainable by gathering data through survey, as standard research methods applied to measure human behaviour are often biased by subjectivity and memory effects.



## **ESSAY I**

### **Ambidexterity Enacted. An RFID-based case study of an incubator**

Mariachiara Barzotto

Anna Comacchio

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## ABSTRACT

*The paper addresses the emerging call for a micro-foundation in studies on organisation ambidexterity. This research aims at analysing how ambidexterity is achieved in practice at the micro-level, and how individual agency enacts organisational ambidexterity. Drawing on the conceptualisation of exploration and exploitation as learning behaviours and social network literature, we argue that exploitative and explorative individual learning are based on different communication behaviours: while individual exploitation is based on communication with others within the same organisational boundaries, exploration builds on bridging interactions. The empirical research is conducted on 91 employees of 10 start-ups in a high-tech incubator and their face-to-face interactions. By using proximity-sensing electronic badges based on Radio-Frequency Identification (RFID) technology and case study tools such as interviews, questionnaires and direct observations, fine-grained and innovative data are collected on how exploitative and explorative interactions are enacted and balanced at individual level. We analyse 7,799 everyday direct interactions over a period of 4 weeks. Main findings show that there is a difference in the features according to which individuals enact exploitative and explorative communication behaviours. Second, results suggest the presence of three individual ambidexterity orientations that are differently combined at organisational level. The paper advances this body of literature providing new insights on individual ambidexterity and explorative evidence on how organisation ambidexterity is enacted bottom-up by individual agency.*

**KEYWORDS:** *Ambidexterity, agency, direct communication behaviours, RFID technology.*

## INTRODUCTION

Companies are increasingly pushed to innovate as technological and scientific developments progress (e.g. Hotho & Champion, 2010; Quinn, Baruch, & Zein, 1997; Bilton & Cummings, 2010; Isaksen & Tidd, 2006). According to organisation theory and innovation management studies, long-term success is likely to be achieved by those organisations that are able to manage exploration of existing competencies and exploration of new opportunities in an equally effective way (March, 1991; Tushman & O'Reilly, 1997; Raisch *et al.*, 2009).

The ability to pursue both explorative and exploitative activities within organisations has been acknowledged as organisational ambidexterity (Tushman & O'Reilly, 1996). Since the seminal paper by March (1991), literature has provided theoretical contributions on how organisations are able to be ambidextrous by generating new radical ideas (exploration) while using and refining existing knowledge (exploitation), (Tushman & O'Reilly, 1996; Gibson & Birkinshaw, 2004; Turner, Swart, & Maylor, 2013). Moreover, empirical evidence shows that, under conditions of market and

technological uncertainty (Caspin-Wagner, Ellis, & Tishler, 2012), organisational ambidexterity (Raisch & Birkinshaw, 2008) positively impacts on a firm's performance (O'Reilly & Tushman, in press; Tarba *et al.*, in press; Masini, Zollo, & Wassenhove, 2004). On this regard, it has been demonstrated that organisational ambidexterity is associated with new product development (Katila & Ahujia, 2002) and growth in sales (He & Wong, 2004) and other performances such as market valuation as measured by Tobin's Q and firm survival (O'Reilly & Tushman, 2013). This positive relation has been observed in different settings (Turner, Swart, & Maylor, 2013), such as Canadian international new ventures (Han & Celly, 2008), high-tech firms in Taiwan (Li *et al.*, 2008) and German high-tech start-ups (Kuckertz *et al.*, 2010).

Notwithstanding the increasing research on ambidexterity and on its antecedents and outcomes, more recently scholars (e.g. Raisch & Birkinshaw, 2008) call for research providing "theorisation and empirical evidence [...] on how exploitation and exploration are achieved in practical" (Turner & Lee-Kelley, 2012: 180, Adler, Goldoftas, & Levine, 1999; Siggelkow & Levinthal, 2003; Bonesso, Gerli, & Scapolan, 2013).

As people are the source of action (Burt, Kilduff, & Tasselli, 2013) and, through their actions, they activate the organisational ambidexterity, we claim the need to fill this gap on how ambidexterity is achieved in practice. In order to do so, studies should focus on the micro-foundations of ambidexterity (Nosella, Cantarello, & Filippini, 2012), hence they should investigate individual behaviours, practices, interactions and dynamics (Turner & Lee-Kelley, 2012). Recent studies by Tushman and colleagues on how managers enable exploitation and exploration within their organisations (O'Reilly & Tushman, 2011; Tushman *et al.*, 2011) point to the "shifting from organisational to agential processes" in ambidexterity research (Turner & Lee-Kelley, 2012: 180). Moreover, notwithstanding the theoretical contribution of organisational-level studies of structural, contextual and temporal ambidexterity (Turner, Swart, & Maylor, 2013), this stream of research captures neither the reality of most organisations nor the multilevel nature of ambidexterity (Turner, Swart, & Maylor, 2013). Indeed the level of analysis according to which ambidexterity has been studied is a further open issue in the ambidexterity debate. On this aspect, scholars (Gupta, Smith, & Shalley, 2006; Raisch & Birkinshaw, 2008) claim the need to delineate "a more holistic, multi-level, understanding" (Turner, Swart, & Maylor, 2013: 328) of this phenomenon. Hence, the call for studies spanning between different levels of analysis (Rosing, Frese, & Bausch, 2011).

Thus the purpose of the present essay is to tackle the agency issue in ambidexterity

research by looking at the actions through which individuals enact exploitation and exploration on a daily basis. In this study we address the following research questions: how is ambidexterity achieved in practice at the micro-level and, how does individual agency enact organisational ambidexterity?

Drawing on the concept of exploration and exploitation as learning behaviours and drawing on social network literature, we argue that exploitative and explorative individual learning are based on different communication behaviours: while individual exploitation is based on communication with others within the same organisational boundaries, exploration builds on bridging interactions.

We conducted a field study in a high-tech incubator blending a qualitative and quantitative approach. The empirical research was carried out at high granularity level by using a proximity-sensing infrastructure based on *Radio-Frequency IDentification* (RFID) badges. On a sample of 91 workers, we analyse 7,799 encounters over a period of four weeks for a total amount of 19,129 minutes of observation. Moreover, a case study has been conducted analysing the 10 start-ups operating in the incubator and the incubator itself. Organisation, policies and employees' features have been analysed through interviews, questionnaires, archival data collection and direct observations.

This paper is organized as follows. The next section introduces the agency issue in ambidexterity theory, as well as the relation between ambidexterity at the organisational and exploitative and explorative behaviours undertaken by individuals. The method section illustrates the field study, and how we collected and analysed the data. Next, we present the empirical evidence on how individual enacted exploitation and exploration, and on how different individual's exploitative and explorative behaviours are combined at organisational level. Finally, results, implications, and directions for further research are discussed.

## **THEORETICAL BACKGROUND**

### **Agency in ambidextrous organisations**

In studies of adaptation, organisational learning, and technical innovation (e.g. Abernathy, 1978; Benner & Tushman, 2002, 2003; Katila & Ahuja, 2002; Levitt & March, 1988), the concepts of *exploration* and *exploitation* have been employed “broadly to

capture a wide array of firm actions and behaviors” (Beckman, 2000: 714). More specifically, drawing upon extant literature, Baum and colleagues (2000: 768) define exploitation as “learning [from own experience] gained via local search, experiential refinement, and selection and reuse of existing routines” whilst they circumscribe exploration as “learning [from others’ experience] gained through processes of concerted variation, planned experimentation, and play” (Baum, Li, & Usher, 2000: 768) via “broad search” (Beckman, 2000: 714; see also Gupta, Smith, & Shalley, 2006).

In their literature review, Gupta and his colleagues (2006) claim that there are two possible ways to orientate behaviours towards the orchestrating of a balanced learning: *structural ambidexterity* and *contextual ambidexterity*. Research on these two types has been conducted mainly at the organisational level of analysis, showing how organisations could achieve a balance either by creating organisational units differently devoted to exploration and exploitation or by building an organisational environment that enables individuals to divide their time between explorative and exploitative activities. By implicitly assuming that a top-down design of ambidexterity, either structural or contextual, will mold individual behaviours coherently, this body of literature neglects the effect that employees’ actions might have in achieving both types of organisational ambidexterity (Bonesso, Gerli, & Scapolan, 2013). Even the extant literature on contextual ambidexterity provides only scant evidence on the actual behaviours performed by ambidextrous individuals (Birkinshaw & Gibson, 2004) or by managers who are expected to fulfill ambidextrous roles (Bonesso, Gerli, & Scapolan, 2013).

The recent line of enquiry addressing the issue of ambidexterity at the individual level has emphasised managers’ “behavioural orientation toward combining exploration and exploitation related activities within a certain period of time” (Mom, Van den Bosch, & Volberda, 2009: 812). Other studies begin shedding light on the extent to which personal characteristics affect individual ambidexterity (e.g. Jasmand, Blazevic, & de Ruyter, 2012) integrating, for instance, studies on organisation managers with recent findings on the neuromodulation (Laureiro-Martínez, Brusoni, & Zollo, 2010). However these studies mainly focus on managers, neglecting other role behaviours and activities that could impact on organisational ambidexterity.

To fill these gaps we suggest that the investigation of micro-foundations of ambidexterity, looking at the employees’ behaviours, would help to understand in more depth how ambidexterity is achieved in practice on a daily basis.

## **Structural and contextual ambidexterity and individual behaviours**

Scholars have long debated whether the concepts of exploration and exploitation represented a continuum (the so-called dualism approach) or two orthogonal dimensions (the so-called duality approach) (Turner *et al.*, 2013). Researchers embracing the former approach claim that, in the case of lack of resources, exploration and exploitation are likely to be mutually exclusive as the use of a resource for one activity means giving up resource for the other (March, 1991). Conversely, those who adhere to the later approach endorse the thesis that - in absence of resource shortage - exploration and exploitation are two dimensions coexisting and not competing one with the other (Katila & Ahuja, 2002; see review by Gupta *et al.*, 2006). The issue of continuity or orthogonality of exploration and exploitation is not only linked to the level of resource shortage but also to the level of analysis. According to Gupta and colleagues' argument (2006), exploration and exploitation are generally mutually exclusive within a single domain (such as the individual, whilst they are generally orthogonal across different and loosely coupled domains such as individuals. As such, a unit or organisation is able to manage simultaneously exploitation and exploration easier than a single individual can do by her/his own.

In their literature review piece, Gupta and his colleagues (2006) claim that *structural ambidexterity* is pursued by loosely coupled and physically separated subunits achieving separately exploration and exploitation (Tushman & O'Reilly, 1996), while *contextual ambidexterity* is pursued by the employee's behavioural capacity to simultaneously balance exploitation and exploration across an entire business unit (Gibson & Birkinshaw, 2004). Accordingly Turner *et al.* (2013) interpret structural and contextual ambidexterity as two end-points of a continuum.

As far as individual behaviours are concerned these studies seem to build on the assumption that ambidexterity at the organisational level is supported by "mirroring" behaviours at individual levels. Structural ambidexterity is supposed to be enacted by the same correspondent separation of explorative and exploitative individuals, while contextual ambidexterity depends on how individuals simultaneously balance exploitation and exploration. More specifically, this correspondence (mirroring) between organisational and individual levels within a structural ambidextrous context can be captured in Tushman and O'Reilly's (1996) seminal work. Indeed, they describe that structural ambidexterity could be achieved by designing autonomous subunits, some devoted only to carry out

explorative and others only performing exploitative activities. Each subunit is asked to align people's competencies, incentive, structure, processes and cultures according to its own scope while, at the system level, the organisation enables the integration of these two different uses of resources as well as capabilities (e.g. Tushman & O'Reilly 1996; O'Reilly & Tushman, 2013; Nosella *et al.*, 2012). Conversely, in the case of contextual ambidexterity, the correspondence between organisational and individual levels is assumed by the fact the "ambidexterity of an organization as a whole derives from specific actions of individuals so that it is inextricably tied to a firm's efforts to manage human resources" (Kang & Snell, 2009). The context provides "a set of processes or systems that enable and encourage individuals to make their own judgments about how to divide their time between conflicting demands for alignment and adaptability" (Gibson & Birkinshaw, 2004: 210). According to the contextual ambidexterity framework, people are asked to reconcile "differentiated effort in both activities" (Wang & Rafiq, 2012) by "switch[ing] between different tasks in the course of a day's work and partition[ing] their activities to meet the conflicting dual demands (Bonesso *et al.*, 2013: 3).

According to this discussion and drawing on March's argument that exploration and exploitation balance occurs "at levels of a nested system - at the individual level, the organizational level, and the social system level" (March, 1991: 72), we suggest that the understanding of how ambidexterity is achieved in practice will benefit from a multilevel study.

### **Enabling interpersonal learning through direct communication behaviour**

Exploitation (exploration) has been defined as learning from own (others') experience gained via local (broad) search (Baum, Li, & Usher, 2000). The broad and local search are two distinct fundamental aspects of the process of interpersonal learning (Miller, Zhao, & Calantone, 2006) that reflect both March's work (e.g., Levinthal & March, 1981) and recent studies on organisational innovation (Katila & Ahuja, 2002; Rosenkopf & Nerkar, 2001; Stuart & Podolny, 1996). The local and broad search has been defined mainly in terms of alike in content, or context (Baum, Li, & Usher, 2000; Cyert & March, 1963; Nelson & Winter, 1982; Levitt & March, 1988). It has been recognised that individual learning plays a crucial role in reaching and maintaining a balance between exploration and exploitation (March, 1991; Miller, Zhao, & Calantone, 2006). In the extant

organisational learning literature, one of the ways through which scholars have studied how individuals actually undertake actions associated to explorative and exploitative activities is interpersonal communication behaviour (e.g. Weick, 1995; Lubatkin, Simsek, Ling, & Veiga, 2006; Turner & Lee-Kelley, 2013). In fact, as Jansen *et al.* (2006) state, social relations constitute crucial drivers of both exploration and exploitation. Accordingly, it is by examining communication that is possible to capture how ambidexterity is enacted by the individuals' agency.

In addition to the solo work, knowledge creation necessitates people who share “problem-solving processes and spend time together discussing, reflecting, observing, and interacting” (McFadyen & Cannella, 2004: 736; Seufert, von Krogh, & Bach, 1999). Communication behaviour among and within the internal structure of an organisation is crucial in innovative organisational contexts (i.e. IDEO case study by Hargadon & Sutton in 1997; Allen, 1997; Liu, 2009; Isaacson, 2012). Communication explicates itself via interpersonal interactions and, thanks to interactions, people can channel and transfer knowledge among each other (Miller, Zhao, & Calantone, 2006). As shown in previous studies, different networks of interactions facilitate both the exchange of new knowledge accessible via broad search (Mom, Van den Bosch, & Volberda, 2009; Subramaniam & Youndt, 2005) and the “sharing of experiences on how to implement improvements” (Bonesso, Gerli, & Scapolan, 2013: 3) via local search (Jansen *et al.*, 2006). More specifically, sparse and diversified communication channels increase the likelihood to detect and develop new rewarding opportunities while dense and closed communication channels increase the alignment allowing people to get better at what they already do (Burt, 1982; 2013). Recalling arguments developed by Burt (1992) and Granovetter (1973), Tiwana (2008) uses social ties to explain ambidexterity. He claims the importance of combining bridging ties (network rich in structural holes) and strong ties to improve a company's performance since “network of collaborators with strong ties has greater capacity to implement innovative ideas, but has inherently lower capacity to generate them” whilst network reach of bridging ties “has greater capacity to generate new ideas, but has a lower capacity to implement them” (Tiwana, 2008: 251–252).

According to organisational adaptation and learning studies, a further important aspect of communication is the tacit (non-codifiable) dimension of knowledge (Foss, 2003; Nightingale, 2003; Nonaka & Takeuchi, 1995) that is transferred through interpersonal relationships (Brown & Duguid, 1991; Polanyi, 1962) and that is expressed in skillful actions. Since knowledge always has a tacit dimension (Polanyi, 1962), tacit knowledge



plays a critical role in the knowledge transfer.

Given the importance of tacit knowledge in analysing interpersonal learning, F2F represents an opportunity to deepen our understanding on how exploitation and exploration is enacted by individuals. An attempt to recognise that F2F can be critical to knowledge transfer (Orlikowski, 2002) has been done by Miller and colleagues (2006) through the introduction of interpersonal learning in their agent-based simulation model. Indeed, F2F interaction is an important part of communication behaviours and vital for innovation (Nohria & Eccles, 1992). Notwithstanding the increasing use of such media (Rice, 1992), literature on communication has showed that F2F communication is essential to ensure the quality of a community as a whole (Flaherty *et al.*, 1998). Moreover F2F encounters at the workplace, conceived as a mutually meaningful communication experience in a common physical space (Nardi & Whittaker, 2002), not only support other mediated interactions; indeed, as literature on innovation suggests, they also have an irreplaceable role in individual knowledge sharing processes when content to be transferred is complex, implicit and embedded in a specific organisational context (Nohria & Eccles, 1992; Hallowell, 1999). The irreplaceability of impromptu and planned F2F interactions for knowledge sharing and innovation is mainly related to two key functions carried out by this rich communication medium (Treviño, Webster, & Stein, 2000). On the one side they allow rapid mutual feedback and the simultaneous communication of verbal and non-verbal cues (Suh, 1998) and enable the conveying of complex and tacit knowledge (Bell & Zaheer, 2007). On the other side, they help to develop trust-based relations (Nohria & Eccles, 1992) that, in turn, facilitate and speed up processes of knowledge transfer among employees, and might ease the use of other communication media (Burt, 2004; Johnson, Lorenz, & Lundvall, 2002). Both aspects are considered essential to boost knowledge sharing and innovation (Nonaka & Takeuchi, 1995; Conrath, 1973). Indeed, highly innovative and knowledge intensive organisations such as IDEO (Hagardon & Sutton, 1997) or Apple (Isaacson, 2012) and Google (Fortune, 2012) support impromptu and planned F2F encounters as a key means for innovation.

## **METHODS**

The empirical research is based on an integrated research approach, drawing on a qualitative study and quantitative analysis of RFID data. The research site is a set of 10

start-ups and an high-tech private incubator *Star (pseudonymous)* competing in the Internet and Digital Media sector. *Star* was established in 2005 in Italy and at the time of this study supported the ten start-ups under investigation by providing them with seed capital, granting the finance necessary for the early stage activities, as well as a bundle of services to speed up the business development (such as: general administration, press office, human resources, legal and financial consultancy and assistance in defining the commercial strategies, business plans, partnerships and exit strategies). Three years after the field-research project, *Star* incubates 47 start-ups, is a well-established at the international level, and run four subsidiaries in the United States, United Kingdom and India. Over its 8 years of activity, it has built a network of partnerships with innovative private organisations and prestigious academic institutions. Moreover, it has a certified collaboration with the Italian Ministry of Economic Development on start-up policies and law. Table 1 outlines the main characteristics of our case study.

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We selected *Star* and its incubatees as the setting of our field study for reasons of appropriateness. It represents a suited context where to analyse how individuals enact exploitation and exploration within and across organisational boundaries, respectively. An explanation for the choice is the fact that incubators provide a supportive organisational context, defined in terms of “performance management” and “social support” (Birkinshaw & Gibson, 2004), which has been associated with a higher level of ambidexterity since it shapes both individual and collective behaviours enabling contextual ambidexterity over time (Birkinshaw & Gibson, 2004). Indeed, by their own nature, incubators stimulate individuals to deliver high-quality results and make them accountable for their actions (performance management dimension) as well as create an environment in which people find security and latitude necessary to carry out innovative results (social support dimension). On social support factors, incubators represent a rich setting for investing relationships not only within but also across organisational boundaries, since their goal is start-ups’ growth by resource pooling (Tötterman & Sten, 2005; Lyons, 2002a, 2002b). One key resource is social capital and the incubator aims to facilitate networking among its residents. Indeed, the co-location provides start-ups with “a symbiotic environment”

(Tötterman & Sten, 2005: 489), which paves the way towards formal and informal (Lyons, 2002a) relationships across start-ups boundaries relationships (Sherman & Chappell, 1998; Duff, 1994). Location sharing provides the incubator's employees with knowledge transfer opportunities and experience exchange among them (Bergek & Norrman, 2008; Lewis, 2001). As previous studies state, incubators constitute effective means through which linking technology, capital and know-how to “leverage entrepreneurial talent, accelerate the development of new companies, and thus speed the exploitation of technology” (Grimaldi & Grandi, 2005: 111).

Besides this general reason, the decision on the setting for this study was driven by the fact that Star is an extremely fertile reality involved in building a high-performance context, since Star is an organisation that explicitly recognises the need to engage in both efficiency focused and new value creating innovation (Hoogstraten, 2005). In this incubator we find conditions that favour the constant stimulation of individuals to deliver high-quality results, as well as trust and support among its employees. On the first aspect, we observe the high presence of performance management factors not only in Star's overt exploration of the Internet frontiers to search for dynamic business models and new forms of communication, but also in Star's undertaking of geographical expansion to offer its residents a larger basin of business opportunities and potential clients to maximise their efficiency. On the second aspect, the prominent attention devoted by Star to its social and individual capital is exemplified by the presence of the human concept in its project name. Indeed, Star conceived its own environment in such a way that it could be useful to develop the expectations of skilled human resources. The existence of a diffused social support within the incubator can be captured by looking at friendship and trust social networks, with density of 11% and 7% respectively (Figures 1 and 2).

Finally, since we are analysing individual's behaviours by looking at people's use of direct communication, we highlight that Star is a highly innovative organisational context where people are encouraged to communicate via F2F as the key means for innovation. Indeed, as overtly stated by one of its CEOs, Star fosters direct interactions on a daily basis. It pursues this goal through the creation of space supporting impromptu and planned F2F encounters. Moreover, incubator regularly arranges brainstorming where employees present their projects and share ideas with colleagues.

To summarise, we chose Star because it represents a theoretically relevant case for analysing how incubator's employees enact exploitation and exploration on a daily basis given, first, the organisational context fostering and integrating ambidexterity that

characterises Star and, second, the existence of specific organisational boundaries typical of the nature of each incubator. The exploitation within organisational boundaries and the exploration across organisational boundaries is explained by the early-stage in which the incubatees are as they are raised via cross-pollination of financial and human resources provided in the incubator itself.

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Figures 1 and 2 about here  
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### **Data collection and data analysis**

This empirical research followed an integrated research approach, drawing quantitative analysis based on RFID<sup>1</sup> (e.g. Cattuto *et al.*, 2010; Isella *et al.*, 2011a; 2011b), enriched by a qualitative study of the incubator. We adopted multiple sources of evidence, primarily RFID-based data combined with semi-structured interviews, informal talks, formal presentations, survey, observation and archival search. Our data collection was carried out in June and July 2010, The Figure 3 outlines the data collection process.

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Figure 3 about here  
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*Semi-structured interviews with principal informants and informal talks.* Our principal informants for the interviews were the following subjects: the two incubator's CEOs, the two HR managers and the architect who completely created Star's working environment. The informants for the informal and impromptu conversation were employees.

We formally interviewed a reasonable set of principal informants since the talks were conducted with the aim of understanding the organisational climate and context. The second author interviewed the CEOs 3 times and conducted an interview with the architect. The interviews with the CEOs captured the mechanisms used within the incubator to

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<sup>1</sup> This study has been carried out with the collaboration with SocioPatterns. For detailed information on SocioPatterns and the use of this technology, see also: The SocioPatterns project. Available: <http://www.sociopatterns.org/>. Accessed 2013 November 2.

develop and maintain a supportive organisational context encouraging the balance between explorative and exploitative activities at Star. The interview with the architect aimed to ascertain the extent to which the workplace layout reflected and fostered the organisational ambidexterity claimed by the CEOs. Indeed, as it has been demonstrated on several studies in management, physical environment is not only a concrete construct related to a physical or geographical location but it also goes beyond the real dimension to assume an intrinsic meaning of originator. It affects social interaction patterns and is a promoter of values and norms of the context of which it is an integral part (e.g. among others, see: Hatch, 1987; Davis, 1984, Oldham & Rotchford, 1983; Schoenenberg, 2000). The first author conducted 3 interviews with the two incubator's HR managers to gathered information on start-ups' formal organisation as well as their employees' job titles. Each interview lasted on average 1.5 hour. During the interviews we took notes and we expanded these notes writing up what arose within 24 hours of each interview, following the 24-hour rule (Eisenhardt, 1989; Miles & Huberman, 1994).

Finally, during the time spent in the field, we had informal and impromptu conversations with Star's employees.

***Formal presentations.*** Before data collection began, a meeting was organised with all the incubator's employees to illustrate and share the aims of project and field research method in detail. Their willingness to participate was requested. The consent process ensured that employees voluntarily participated in the research, accepting to be observed during the analysis of office layout, to wear an RFID device for a month and to answer a survey on their social networks. A final meeting took place at the end of the field study to collect feedback from the participants and show them some preliminary results.

***Questionnaire.*** We administrated an online 15-item survey before the field study started. This questionnaire was composed of two sections: the first block of questions concerned individual socio-demographic attributes, the second part consisted of free choice roster questions on workplace social networks (such as: friendship, task advice, trust, social support, and acquaintance networks).

***Radio-Frequency IDentification Sensors of physical proximity.*** We captured fine-grained data on all the everyday F2F interactions among start-up employees over a period of four weeks by using RFID technology. The real time F2F interaction network was recorded by RIFD tag, an unobtrusive electronic wearable sensor consisting of a small chip and an antenna. It detects contacts during which participants, who wear it, are facing each other at a maximum distance of 1.50 metres. If such a configuration is sustained for longer

than one minute, then this indicates that some form of social interaction is taking place. The 1-minute parameter has been set to record only actual encounters, and not “spurious proximity such as two people walking past each other” (Ingram and Morris, 2007: 567). The RFID tag transmits information on interactions to the closest RFID reader (antenna), which records the encounters.

We decided to implement a data collection approach based on RFID badges because it helps to overcome limitations and respondents biases of data collection gathered by using both observation and survey methods. It provides a more accurate measure of the actual action undertaken by individuals (in terms of number and duration of F2F encounters) than the ones obtainable by survey.

Twelve RFID readers were placed all over the workplace (5 buildings), covering the incubator’s main indoor and outdoor areas (Figure 4), such as offices, meeting rooms, canteen and relax lounges. We monitored F2F interaction for 24 hours per day and 7 days per week over the 4-week observation period. Our analysis is based on 18 working days. We do not consider the first and the last days of observation because during these days we distributed and collected, respectively, RFID badges to employees and, while handling them, we recorded interactions that did not actually take place. We did not consider weekends since there is no interaction over those days. Employees had very flexible working hours. Their flexibility had an impact on the time window we analysed. We decided to consider a 12-hour time window interval (from 8.30 a.m. to 8.29 p.m.) due to the fact that these times are the average of, respectively, the first and last communication of each day.

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Figure 4 about here  
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The employees became acclimatised to the RFID-badge presence soon and, keen to know more about the incubator’s network, they asked to postpone the collection of the RFID-badges and allowed us (only for that week) to show the correspondence between employee’s name and RFID-tag number. The data collected over the fifth week has not been considered in this study.

**Observation.** Over two months, we spent 5 days in the field observing the work practices and gathering information on Star’s physical layout. We collected visual documentation of the physical environment and data on the desk position of each employee. At the time of our study, Star’s employees were allocated across 5 buildings, 10

floors and 13 wings (Figure 4). Star allocated all its employees in 10 open offices and 9 cellular offices. In a single wing it was possible to find the co-presence of different incubatees and/or different speciality communities (Figures 5 and 6). Contrary to previous studies (e.g. Allen, 1977; Liu, 2009), in our research the criticism on space-driven interaction is overcome since that location allotted for each incubatee is based on the space availability and not on specific organisational interdependences among start-ups.

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Figures 5 and 6 about here  
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**Archival data.** We collected information on the incubators through Star's website, press releases, media clippings, facebook page and internal documents.

### **The sample**

Our sample is composed of 164 employees. The participation was voluntary and privacy protection was guaranteed. During the research 138 (84.1% of the study population) employees wore the RFID badge on a daily basis. The response rate for the questionnaire was 59.14% as 97 employees filled the survey. Out of 97 employees, we analyse data on 91 subjects (55.5% of the study population) since 6 questionnaires were uncompleted.

Sixty per cent of the participants were male. The typical employee is 31 years of age (Std. Dev. = 4.76), has a bachelor's degree, and has been with the incubator for 25 months (Std. Dev. = 19.06). Start-up's average size is 8 employees, with a minimum of 2 employees and a maximum of 44 employees. Start-ups are flat organisations where, on average, there is one hierarchical level; the largest start-up is organised by three hierarchical levels.

Within the incubator, we identified the presence of a varied composition of expertise. We categorised them according to the definitions and the classification provided by Kellogg, Orlikowski and Yates (2006) in a study based on a setting similar to Star's one, considering that "members of the [...] communities perform[ed] distinct activities, engag[ed] unique areas of expertise, enact[ed] distinctive identities, were invest[ed] in particular sets of interests, and use[d] multiple artifacts" (Kellogg *et al.* 2006: 25). We

grouped Star's employees by the 6 speciality communities: guardians (start-ups' marketing and sales managers), planners (project managers), designers (creative), builders (technologists), leaders and clerks (administrative staff). Table 2 classifies and describes the 6 speciality community groups in Star's context and their distribution over the sample.

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Table 2 about here  
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As we considered 91 employees, the number of potential dyads was 4095. Out of 4095, 1233 (30%) dyads actually interacted over the 4 weeks. The overall number of encounters was 7799. The total dyadic engagement in interaction over the observation period was 19,129 minutes; in other words the incubator's employees spent 19,129 minutes (spells) in F2F interaction over the total amount of minutes of observation (12,960). The daily engagement in F2F interaction among the 91 employees consisted of 433 encounters on average (Std. Dev.  $\approx$  112.39) and a mean amount of time spent in interaction of 1062.72 minutes (about 18 hours) (Std. Dev.  $\approx$  301.30) (Table 3).

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Table 3 about here  
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A single F2F encounter lasted 2.45 minutes on average (Std. Dev.  $\approx$  4.1), with a maximum duration of 104 minutes. Members of each of the dyads that were conversing met each other 6.33 times on average (with maximum number of times equal to 191 encounters).

## Measures

The present work studies how individuals actually enact ambidexterity by looking at how employees express their agency on a daily basis. We tried to tackle the agency issue through the analysis of the number of encounters between two subjects and the cumulative



duration (in minutes) of the all the interactions occurring between two subjects over the 4-week observation period.

In order to capture whether there are differences in the ways in which employees explore and exploit, we group people working in the incubator according to their start-up membership. The decision to select start-up as organisational boundaries is due to the fact that people working in the same start-up have communalities that lead them to “be efficient and improve incrementally on existing processes or practices” (Beckman, 2006: 743) while working with people from different companies “encourage and facilitate exploration and innovation” (Beckman, 2006: 744). Indeed, individuals employed in the same organisation share language that suggests a common perspective and trustworthiness (Tsai & Ghoshal, 1998), vision which contribute to generate expectations about work (Nahapiet & Ghoshal, 1998), and narratives on the appropriate and inappropriate behaviours (Baron, Burton, & Hannan, 1996). Moreover employees who work together are more prompt to communicate because people tend to talk about what links them (Stasser, Taylor, & Hanna, 1989). For all these communalities, organisational specific shared knowledge “encourages local search because team members find discussion straightforward” (Beckman, 2006: 743). Conversely, the diversities among employees coming from different organisations are a source of heterogeneous new information and insights that stimulate creativity (Beckman, 2006, Amabile et al., 1996; Perry-Smith, & Shalley, 2003).

We operationalise *enacted exploitation* as the number and the cumulative duration (in minutes) of the all the interactions occurring between subjects belonging to the same start-up. Whilst we operationalise *enacted exploration* as the number and the cumulative duration (in minutes) of the all the interactions occurred between subjects belonging to two different start-ups.

To classify employees’ orientation, we develop a measure, labelled *exploitation index*, based on the cumulative duration of their interactions. This index is computed by dividing the cumulative duration of interactions undertaken by an individual with a conversation partner belonging to the same start-ups over the overall cumulative duration of interactions undertaken by an individual.

## **Analysis**

We performed two main analyses: t-test and cluster analysis. On the first test, we

assessed whether there is difference in the features of the enacted exploitation (captured by the interactions occurring within the same start-up) the enacted exploration (captured by the interactions occurring across start-ups). The unit of analysis is F2F interaction taking place between two employees. We carried out this analysis by using t-test. Indeed, the t-test allows us to assess the statistically significant difference between population means of these independent samples with unknown variances.

On the second test, we performed a cluster analysis using the data of exploitation index. This analysis was run to identify employees' orientations to enacted exploration and exploitation; that is, the ways according to which individual's enact exploitation and exploration in the workplace. To determine the appropriate number of clusters in our dataset, we relied on multiple criteria as suggested by Ketchen and Shook (1996): dendrogram and local depth analysis. Firstly, we visually inspected our data using a dendrogram: a graph of the order that observations join clusters and the similarity of observations joined (Ketchen & Shook 1996: 446). As dendrogram results should be cautiously interpreted (Aldenderfer & Blashfield, 1984), we used the local depth analysis (Agostinelli & Romanazzi, 2013; 2011) to assess the reliability of the results we obtained by verifying the appropriate number of clusters. Local depth is a generalisation of ordinary depth able to reveal local features of the probability distribution (Agostinelli & Romanazzi, 2011). Based on a non-parametric density estimation, local depth extends the usual depth definition so as to account for multimodal distributions and clustered data. It is usually used to identify partial centres of data sets, that is, modes and antimodes of probability distributions (Agostinelli & Romanazzi, 2013; 2011). We decided to employ this analysis to: firstly, check whether the distribution of the exploitation index is multimodal; secondly, in case the local depth exhibits a sequence of modes, to test whether these modes and their confidence intervals were localised in correspondence to the results obtained by the dendrogram visual investigation. Finally, we run a k-means clustering analysis to classify employees according their orientations to enact exploration and exploitation. This method aims at identifying similar groups on the basis of selected characteristic(s). Like other segmentation techniques, k-means clustering partitions the observations into a desired number of clusters defined by the analyst. We imputed the number of clusters according to dendrogram results. K-means clustering computes the distances of each individual value from the cluster centres and repeats the procedure until the distance between cluster centres is maximised. Individuals are, finally, assigned to the cluster with the nearest centre.

## FINDINGS

*T-test.* Table 4 reports the results of the t-test computed comparing number and cumulative duration of interactions occurring amongst employees working in the same start-ups with those working in different start-ups.

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Table 4 about here  
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This analysis is devoted to reaching a deeper understanding on how individuals enact exploitation and exploration. The results show that there are differences in the way individuals express their agency. Indeed, our findings show that interactions occurring among employees who belong to the same organisational boundary present different features compared to the ones occurring among employees who belong to different organisational boundaries, both in terms of the *number of interactions* and the *cumulative duration* of all interactions taking place between two employees within and across start-ups.

The results illustrate that F2F interactions in the incubator are mainly used to enact exploitation by consolidating the intra-organisational unit network, indeed 82% of the recorded interactions occur within start-up boundaries. The different impact of the two types of F2F ties on the whole system of daily interactions is confirmed by their different cumulative duration. The average cumulative duration of interactions within organisational boundaries is almost 5 times higher than those across organisational boundaries.

Figures 7-10 provide evidence of a different enactment of exploitation and exploration within the incubator. In particular, figures 9 and 10 analyse daily patterns of interaction disaggregated for enacted exploitation and exploration. Figures 11 and 12 represent how employees' agency is explicated in exploitative and explorative hour-by-hour. Our findings show a different activation of explorative and exploitative contacts on a daily basis. Indeed, we can highlight peaks of enacted exploration mostly during morning breaks (9.30-10.30) and lunch time (13.30-14.30), while enacted exploitation seems to follow a more constant pattern. Moreover our data show that the first part of the working day is an active temporal window (both in term of number of interaction and cumulative

duration) used mostly to enact explorative behaviours.

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Figures 7-10 about here  
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**Cluster.** The visual inspection of the dendrogram (Figure 11) suggests the presence of three clusters. The three-cluster solution is confirmed by the local depth analysis. In this analysis, we use local depth with tau equal to 0.107 (40% quantile order of the empirical distribution of distances between pairs of observations). Local depth exhibits 3 modes (the peaks in figure 12). This result provides us with evidence of the multimodal distribution of the exploitation index; this means that the exploitation index distribution is actually a mixture of 3 smaller distributions. An explanation of this result is that the exploitation index includes small clusters of observations corresponding to the 3 peaks. Local depth analysis enables us to estimate the locations of modes by looking at the position of the peaks and their confidence intervals (95% C.I.). Table 5 outlines the confidence intervals of each of three modes.

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Figure 11-12 and Table 5 about here  
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The k-means clustering analysis (Figure 13 and Table 6) enables us to identify the distribution of the three orientations of enacted exploitation and exploration (exploitative, ambidextrous and explorative orientation) as well as classify employees according to their own orientations.

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Figure 13 and Table 6 about here  
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**Distribution of ambidexterity orientation.** In order to investigate whether exploitation and exploration at individual level enact organisational ambidexterity, we studied the distribution of the three orientations per each start-up. Three possible “scenarios” emerge (Figure 14). Figure 15 outlines the distribution of individual

ambidexterity orientations per start-up. The engagement in exploitative and explorative activities of each employee mirrored the organisational ambidexterity only in one start-up (start-up 1). For the remainder, the organisational ambidexterity is explicated into two non-mirroring cases. In the first one, we identify the combination of employees who have an ambidextrous orientation with employees who are either exploitation- or exploration-oriented (start-up 3, 6, 9). Differently, in the second case, we observe the co-presence of each of the three orientations (incubator and start-up 2, 4, 7, 10).

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Figures 14 and 15 about here  
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To deeply explore the distribution of the ambidexterity orientations in Star, we compute how these three orientations are diffused per each speciality community (Figure 16). As reported in Figure 16, the three orientations are present in every speciality community, with the exception of the creatives' speciality community.

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Figure 16 about here  
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## **DISCUSSION**

Focusing on a fine-grained analysis of individuals' direct communication behaviours, our study contributes to the debate on organisational ambidexterity by shedding light on the agency dimension of ambidexterity and on how ambidextrous behaviours undertaken at the individual level enact ambidexterity at the organisational level. By collecting high-resolution RFID data on everyday interactions, we were able to detect the ways by which employees engage with their colleagues in exploitative and explorative activities on an hourly and daily basis.

Our research provides a deeper understanding on the extent to which employees enact exploitative and explorative behaviours respectively interacting within and across organisational boundaries. More specifically, from our analysis, we show that there is a

difference in the features of exploitative and explorative interactions. Employees under investigation tend to invest more effort in local search through encounters with colleagues belonging to the same start-up than in performing exploration by activating ties with colleagues of different start-ups. The prevailing engagement in exploitation activities is expressed both in terms of number and duration of interaction.

Moreover, the present study provides evidence on when the explorative and exploitative interactions occur on a daily basis. Findings on the time allocated to enact exploration and exploitation highlights the presence of two different patterns. Interactions within organisational boundaries (exploitative interactions) are constant on a daily basis and, if we look at one-hour time window, we observe that they range between 8% and 11% over the total amount of interactions occurring within the start-ups. Conversely, there are more explorative interactions during early morning and lunch breaks.

The paper advances the understanding of agency in ambidextrous organisational contexts, enriching the findings about dyadic interactions discussed previously with empirical evidence on how each individual allocates the overall time she/he spends in interacting with others. Research results show the presence of three ambidexterity orientations at the individual level. Indeed, there are employees who are more prone to spend time discussing with colleagues belonging to the same organisation, we name this behaviour *exploitative orientation*. Others spend most of their interaction time with colleagues belonging to another start-up, we label this choice as *explorative orientation*. Finally, others manage communication within and across start-up boundaries, allocating the total amount of time they spend in interactions equally between explorative and exploitative encounters. We name this behaviour *ambidextrous orientation*.

These findings empirically confirm Gupta and colleagues' arguments (2006) on the mutual exclusivity of exploitation and exploration at the individual level. Indeed, people have to decide to what extent they want to devote their time in communication either within or across start-ups.

This orchestration at individual level impacts differently at start-up level, being the ambidexterity emerging at the organisational level depends on the combination of individual ambidexterity orientations. It might be one of the following cases:

- i) *Combination of exploitation- and exploration-oriented employees*, in which case the enacted ambidexterity mirrors the structural organisational ambidexterity;

- ii) *Combination of individuals who divide their time between the conflicting demand of exploitation and exploration*, in which case the enacted ambidexterity mirrors the contextual organisational ambidexterity.
- iii) *Combination of the three orientations or a mix of exploitation- and exploration-oriented employees with ambidextrous ones*, in which case the enacted ambidexterity mirrors neither structural nor contextual organisational ambidexterity (non-mirroring cases).

The variety of ambidexterity orientations and their composition at the organisational level seem to suggest that the incentives described in previous literature on ambidexterity, both structural and contextual, should be reconsidered for non-mirroring cases. As Gupta *et al.* (2006:695) noted, the “mindsets and organizational routines needed for exploration are radically different from those needed for exploitation” so are those needed for balancing these two opposite activities. These non-mirroring cases of organisational ambidexterity achieved by the sum of the three orientations or a mix of exploitation- and exploration-oriented employees with ambidextrous ones need to be identified and better understood.

To summarise, the present work starts a reflection on the different organisational combinations (mirroring and non-mirroring) by acknowledging the presence of variegated ways through which exploitation and exploration can be enacted at the individual level. The picture of enacted ambidexterity seems to be more complex than the one visible at the organisational level. This evidence suggests that we cannot always infer how exploitation and exploration are actually achieved by looking at organisational ambidexterity. These findings open some implications for management practice.

***Implication for management practice in small enterprises.*** Our study casts new light on ambidexterity in new ventures, which is still overlooked as the extant research has mainly focused on ambidexterity in large companies. We build on previous evidence on the impact of ambidexterity on company’s innovation performance, not only in large established corporations, but also in technology oriented ventures (Kuckertz, Kohtamäki, & Droege gen. Körber, 2010), international new ventures (Han & Celly, 2008) and university start-up equity participation (Chang, Yang, & Chen, 2009). On this regard, the present work suggests that managers in small and innovative firms could build a *bottom-up ambidexterity* instead of a *top-down ambidexterity*, typical of larger organisations. Given the possible co-existence of three different ambidexterity orientations, small realities could examine the combination of employees’ orientations at their disposal to understand these

combinations. Incentives at the individual and organisational levels could be arranged according to the ambidexterity they want to pursue.

***Limitations and future lines of research.*** This work presents an issue of generalisability. The present study, indeed, is based on start-ups in the Internet and digital media sector supported by a private incubator. To firmly establish patterns of enacted exploitation and exploration as well as ambidexterity orientations, the same research should be carried out both in organisations belonging to different industries (e.g. manufacturing sector) and in organisations located in different cultural settings. The technology implemented in this work can be easily used in other setting, enabling the comparison of our findings in other contexts.

Limits of our study stimulate further research avenues. First, it would be useful to test the robustness of our findings on different types of individual behaviours, not only on direct communication behaviours. Second, future study should define a probabilistic model able to predict the likelihood of employee's orientations taking into account the interaction trajectory of each individual over time. Finally, it would be interesting to investigate how the workplace social network configuration affects employees' ambidextrous communication behaviours. Future research should also consider the extent to which personality traits impact on enacted ambidexterity.



## REFERENCES

- Adler, P. S., Goldoftas, B., & Levine, D. I. 1999. Flexibility versus efficiency: A case study of model changeovers in the Toyota production system. *Organization Science*, 10: 43-68.
- Abernathy, W. J. 1978. *The productivity dilemma*. Baltimore: Johns Hopkins Press.
- Aldenderfer, M. S. & Blashfield, R. K. 1984. *Cluster Analysis*. Sage, Newbury Park, CA.
- Allen, T. J. 1977. *Managing the flow of technology: Technology transfer and the dissemination of technological information with the R&D organization*. Cambridge, MA: MIT Press.
- Agostinelli, C., & Romanazzi, M. 2013. Asymptotics of stationary points of local simplicial depth in the univariate case. *Mathematical Methods of Statistics*, 22(1), 57-69.
- Agostinelli, C., & Romanazzi, M. (2011). Local depth. *Journal of Statistical Planning and Inference*, 141(2), 817-830.
- Amabile, T. M., Conti, R., Coon, H., Lazenby, J., & Herron, M. 1996. Assessing the work environment for creativity. *Academy of Management Journal*, 39: 1154–1184.
- Baron, J. N., Burton, M. D., & Hannan, M. T. 1996. The road taken: Origins and evolution of employment systems in emerging companies. *Industrial and Corporate Change*, 5: 239–275.
- Baum, J. A., Li, S. X., & Usher, J. M. 2000. Making the next move: How experiential and vicarious learning shape the locations of chains' acquisitions. *Administrative Science Quarterly*, 45(4), 766-801.
- Beckman, C. M. (2006). The influence of founding team company affiliations on firm behaviour. *Academy of Management Journal*, 49(4), 741-758.
- Bell, G. G. & Zaheer, A. 2007. Geography, Networks, and Knowledge Flow. *Organization Science*. 18(6): 955-972.
- Benner, M. J., & Tushman, M. 2002. Process management and technological innovation: A longitudinal study of the photography and paint industries. *Administrative Science Quarterly*, 47: 676–706.
- Benner, M. J., & Tushman, M. L. 2003. Exploitation, exploration, and process management: The productivity dilemma revisited. *Academy of Management Review*, 28: 238.
- Bergek, A., & Norrman, C. 2008. Incubator best practice: A framework. *Technovation*, 28(1), 20-28.
- Bilton, C. & Cummings, S. 2010. *Creative Strategy: Reconnecting Business and Innovation*. John Wiley and Sons, Chichester.

- Bonesso, S., Gerli, F. & Scapolan, A. 2013. The individual side of ambidexterity: Do individuals' perceptions match actual behaviors in reconciling the exploration and exploitation trade-off? *European Management Journal*.  
<http://dx.doi.org/10.1016/j.emj.2013.07.003>
- Brown, J. S., & Duguid, P. 1991. Organizational learning and communities-of-practice: Toward a unified view of working, learning, and innovation. *Organization Science*, 2: 40–57.
- Burt, R. S. 1982. *Toward a Structural Theory of Action*. New York: Academic Press.
- Burt, R. S. 2004. Structural Holes and Good Ideas. *The American Journal of Sociology*. 110(2) 349-399.
- Burt, R. S. 2005. *Brokerage and Closure: An Introduction to Social Capital*. Oxford University Press, Oxford, UK.
- Burt, R. S., Kilduff, M., & Tasselli, S. 2013. Social network analysis: Foundations and frontiers on advantage. *Annual review of psychology*, 64, 527-547.
- Caspin-Wagner, K. Shmuel, E. & Tishler, A. 2012. Balancing exploration and exploitation for firm's superior performance: The role of the environment. *Paper presented at the annual meetings of the Academy of Management*.
- Cattuto, C., Van den Broeck, W., Barrat, A., Colizza, V., Pinton, J-F & Vespignani, A. 2010. Dynamics of Person-to-Person Interactions from Distributed RFID Sensor Networks. *PLoS ONE*. 5(7): e11596. doi:10.1371/journal.pone.0011596
- Chang, Y. C., Yang, P. Y., & Chen, M. H. 2009. The determinants of academic research commercial performance: Towards an organizational ambidexterity perspective. *Research Policy*, 38(6), 936-946.
- Cyert, R. M., & March, J. 1963. A behavioral theory of the firm. University of Illinois at Urbana-Champaign's Academy for Entrepreneurial Leadership Historical Research Reference in Entrepreneurship.
- Conrath, D. W. 1973. Communications environment and its relationship to organizational structure. *Management Science*. 20(4): 586–603.
- Davis, T. 1984. The influence of the physical environment in offices. *Academy of Management Journal*, 9 (2), 271–283.
- Duff, A. 1994. *Best practice in business incubator management*. Booragoon, Australia: AUSTEP Strategic Partnering Pty.
- Eisenhardt, K. M. 1989. Building theories from case study research. *Academy of Management Review*, 14: 532–550.
- Emirbayer, M., & Mische, A. (1998). What Is Agency? *American journal of sociology*, 103(4), 962-1023.

- Flaherty, L. M., Pearce, K. J. & Rubinc, R. B. 1998. Internet and Face-to-Face Communication: Not Functional Alternatives. *Communication Quarterly*. 46(3).
- Fortune. 2012. *100 Best Companies to Work For 2012*. ULR: <http://money.cnn.com/magazines/fortune/best-companies/2012/snapshots/1.html>
- Foss, N. J. 2003. Bounded rationality and tacit knowledge in the organizational capabilities approach: An assessment and a re-evaluation. *Industrial and Corporate Change*, 12: 185–201.
- Gibson, C. B., & Birkinshaw, J. 2004. The antecedents, consequences, and mediating role of organizational ambidexterity. *Academy of management Journal*, 47(2), 209-226.
- Giddens, A. 1984. *The constitution of society: introduction of the theory of structuration*. Univ of California Press.
- Granovetter, M. 1973. The strength of weak ties. *American Journal of Sociology*, 78:1360–1380.
- Grimaldi, R., & Grandi, A. 2005. Business incubators and new venture creation: an assessment of incubating models. *Technovation*, 25(2), 111-121.
- Gupta, A. K., Smith, K. G., & Shalley, C. E. 2006. The interplay between exploration and exploitation. *Academy of Management Journal*, 49(4), 693-706.
- Hagardon, A. & Sutton, R. I. 1997. Technology brokering and innovation in a product development firm. *Administrative Science Quarterly*. 42: 716-749.
- Hallowell, E.M. 1999. The Human Moment at Work. *Harvard Business Review* (January-February).
- Hotho, S. & Champion, K. 2010. We Are Always After That Balance – Managing Innovation in the New Digital Media Industries. *Journal of Technology Management & Innovation*, 5(3).
- Han, M., & Celly, N. 2008. Strategic ambidexterity and performance in international new ventures. *Canadian Journal of Administrative Sciences/Revue Canadienne des Sciences de l'Administration*, 25(4), 335-349.
- Hatch, M. J. 1987. Physical barriers, task characteristics, and interaction activity in research and development firms. *Administrative Science Quarterly*, 32:387–399.
- He, Z., & Wong, P. K. 2004. Exploration vs. exploitation: an empirical test of the ambidexterity hypothesis. *Organization Science*, 15(4): 481–494.
- Hoogstraten, T. 2005. Difference in growth between successful, unsuccessful and non innovating SMEs , 2<sup>nd</sup> Twente Student Conference on IT, Enschede 21 January, 2005.
- Ingram, P. & Morris, M.W. 2007. Do People Mix at Mixers? Structure, Homophily, and the “Life of the Party. *Administrative Science Quarterly*. 52: 558–585.

- Isaacson, W. 2012. The Real Leadership Lessons of Steve Jobs. *Harvard Business Review*. 90(4): 92-102.
- Isaksen, S. & Tidd, J. 2006. *Meeting the Innovation Challenge: Leadership for Transformation and Growth*. John Wiley and Sons, Chichester.
- Isella, L., Romano, M., Barrat, A., Cattuto, C., Colizza, V., *et al.* 2011(a). Close encounters in a pediatric ward: measuring face-to-face proximity and mixing patterns with wearable sensors. *PLoS ONE*. 6(2): e17144.
- Isella, L., Stehlé, J., Barrat, A., Cattuto, C., Pinton, J.F., *et al.* 2011(b). What's in a crowd? Analysis of face-to-face behavioral networks. *Journal of Theoretical Biology*. 271: 166–180.
- Jansen, J. J. P., Van den Bosch, F. A. J., & Volberda, H. W. 2006. Exploratory innovation, exploitative innovation, and performance: Effects of organizational antecedents and environmental moderators. *Management Science*, 52(11):1661–1674.
- Jasmand, C., Blazevic, V., & de Ruyter, K. 2012. Generating sales while providing service: A study of customer service representatives' ambidextrous behavior. *Journal of Marketing*, 76(1), 20–37.
- Johnson, B., Lorenz, E. & Lundvall, B.A. Why all this fuss about codified and tacit knowledge? *Industrial and Corporate Change*. 11(2): 245-262.
- Kang, S. C., & Snell, S. A. 2000. Intellectual capital architectures and ambidextrous Learning: A framework for human resource management. *Journal of Management Studies*, 46(1), 65–92.
- Katila, R. and Ahuja, G. 2002. Something old, something new: A longitudinal study of search behavior and new product introduction. *Academy of Management Journal*, 45: 1183–1194.
- Kellogg, K., Orlikowski, W.j., & Yates, J 2006. Life in the trading zone: Structuring coordination across boundaries in post-bureaucratic organizations, *Organization Science*, 17(1): 22–44.
- Ketchen, D. J., & Shook, C. L. 1996. The application of cluster analysis in strategic management research: an analysis and critique. *Strategic Management Journal*, 17(6), 441-458.
- Kuckertz, A., Kohtamaki, M. and Droege gen. Korber, C. 2010. The fast eat the slow – the impact of strategy and innovation timing on the success of technology-oriented ventures. *International Journal of Technology Management*, 52:175–188.
- Laureiro-Martínez, D., Brusoni, S., & Zollo, M. 2010. The neuroscientific foundations of the exploration–exploitation dilemma. *Journal of Neuroscience, Psychology, and Economics*, 3(2), 95–115.
- Levinthal, D., & March, J. G. 1981. A model of adaptive organizational search. *Journal of Economic Behavior and Organization*, 2: 307–333.

Levitt, B., & March, J. G. 1988. *Organizational learning*. In W. R. Scott (Ed.), Annual review of sociology, vol. 14: 319–340. Palo Alto, CA: Annual Reviews.

Lewis, D.A., 2001. *Does technology incubation work? A critical review*. Reviews of Economic Development Literature and Practice, US Economic Development Administration, Department of Commerce, Washington, DC.

Li, C., Lin, C. and Chu, C. 2008. The nature of market orientation and the ambidexterity of innovations. *Management Decision*, 46:1002–1026.

Liu, C.C. 2011. *A spatial ecology of structural holes: Scientists and communication at a biotechnology firm*. DRUID Proceedings. DRUID, 2011.

Lyons, T. S. 2002a. *Building Social Capital for Sustainable Enterprise Development in Country Towns and Regions: Successful Practices from the United States*. In Conference on the Future of Australia's Country Towns. Bendigo: Australia. URL (October, 2001): <http://www.regional.org.au/au/countrytowns/keynote/lyons.htm>

Lyons, T. S. 2002b. Building Social Capital for Rural Enterprise Development: Three Case Studies in the United State. *Journal of Developmental Entrepreneurship*. 7(2): 193–216.

Lubatkin, M. H., Simsek, Z., Ling, Y. and Veiga, J. F. (2006). 'Ambidexterity and performance in small to medium-sized firms: the pivotal role of top management team behavioral integration'. *Journal of Management*, 32: 646–72.

March, J.G. 1991. Exploration and exploitation in organisational learning. *Organization Science*, 2(1):71-87.

Masini, A., Zollo, M. and van Wassenhove, L. 2004. Understanding exploration and exploitation in changing operating routines: The influence of industry and organizational traits. *London Business School Working Paper*, OTM 04-022.

McFadyen, M. A., & Cannella, A. A. 2004. Social capital and knowledge creation: Diminishing returns of the number and strength of exchange relationships. *Academy of Management Journal*, 47(5), 735-746.

Miles, M. B., & Huberman, A. M. 1994. *Qualitative data analysis: An expanded sourcebook*. (2nd ed.). Thousand Oaks, CA: Sage.

Miller, K. D., Zhao, M., & Calantone, R. J. 2006. Adding interpersonal learning and tacit knowledge to March's exploration-exploitation model. *Academy of Management Journal*, 49(4), 709-722.

Mom, T. J. M., Van den Bosch, F. A. J., & Volberda, H. W. 2007. Investigating managers' exploration and exploitation activities: the influence of top-down, bottom-up, and horizontal knowledge inflows. *Journal of Management Studies*, 44(6): 910–931.

Mom, T. J. M., Van den Bosch, F. A. J., & Volberda, H. W. 2009. Understanding variation in managers' ambidexterity: Investigating direct and interaction effects of formal structural and personal coordination mechanisms. *Organization Science*, 20(4): 812–828.

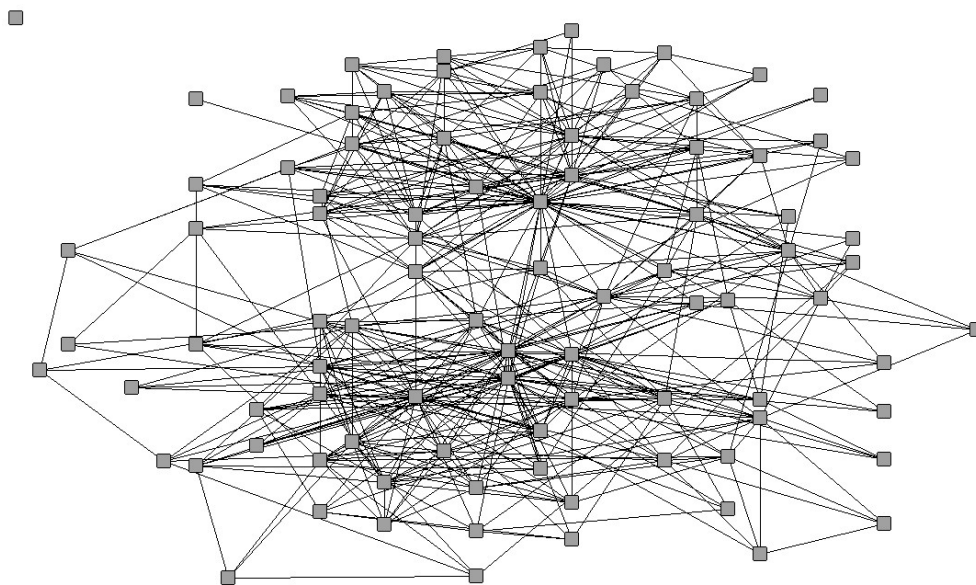
- Nahapiet, J., & Ghoshal, S. 1998. Social capital, intellectual capital, and the organizational advantage. *Academy of Management Review*, 23: 242–266.
- Nardi, B.A. & Whittaker, S. 2002. *The Place of Face-to-Face Communication in Distributed Work*. In Hinds, P.J. & Kiesler, S. (Eds.), *Distributed Work*. pp. 83-113. Cambridge: MIT Press.
- Nelson, R. R., & Winter, S.W. 1982. *An evolutionary theory of economic change*. Cambridge: Belknap.
- Nightingale, P. 2003. If Nelson and Winter are only half right about tacit knowledge, which half? A Searlean critique of “codification.” *Industrial and Corporate Change*, 12: 149–183.
- Nohria, N. 1992. *Is a network perspective a useful way of studying organizations?* In N. Nohria and R. G. Eccles (eds.), *Networks and Organizations: Structure, Form, and Action*: 1–22. Boston: Harvard Business School Press.
- Nohria, N. & Eccles, R. 1992. Face-to-face: Making network organizations work in Networks and Organizations. *Harvard Business School Press*.
- Nonaka, I., & Takeuchi, H. 1995. *The knowledge-creating company: How Japanese companies create the dynamics of innovation*. New York: Oxford University Press.
- Nosella, A., Cantarello, S., & Filippini, R. 2012. The intellectual structure of organizational ambidexterity: A bibliographic investigation into the state of the art. *Strategic Organization*, 10(4):450–465.
- Oldham, G. R. & Rotchford, N. L. 1983. Relationships between office characteristics and employee reactions: A study of the physical environment. *Administrative Science Quarterly*, 28: 542–556.
- O’Reilly, C. A. and Tushman M. L. 2013. *Organizational Ambidexterity: Past, Present and Future*, Research Paper No. 2130 Stanford – Graduate School of Business + *Academy of Management Perspectives*, in press.
- Orlikowski, W. J. 2002. Knowing in practice: Enacting a collective capability in distributed organization. *Organization Science*, 13: 249–273.
- Perry-Smith, J. E., & Shalley, C. E. 2003. The social side of creativity: A static and dynamic social network perspective. *Academy of Management Review*, 28: 89–106.
- Polanyi, M. 1962. *Personal knowledge: Toward a postcritical philosophy*. Chicago: University of Chicago Press.
- Quinn, J. B., Baruch, J. J., & Stein, K. A. 1997. *The Innovation Explosion*. Free Press, New York.
- Raisch, S., & Birkinshaw, J. 2008. Organizational ambidexterity: Antecedents, outcomes, and moderators. *Journal of Management*, 34(3), 375-409.

- Raisch, S., Birkinshaw, J., Probst, G., & Tushman, M.L. 2009. Organizational ambidexterity: balancing exploitation and exploration for sustained performance. *Organization Science*, 20(4): 685-695.
- Rice, R. E. 1992. Task analyzability, use of new media, and effectiveness: A multi-site exploration of media richness. *Organization Science*. 3(4): 475-500.
- Rosenkopf, L., & Nerkar, A. 2001. Beyond local search: Boundary-spanning, exploration, and impact in the optical disk industry. *Strategic Management Journal*, 22: 287–306.
- Rosing, K., Frese, M., & Bausch, A. (2011). Explaining the heterogeneity of the leadership-innovation relationship: Ambidextrous leadership. *The Leadership Quarterly*, 22(5), 956-974.
- Schoenenberg, E. 2000. *The management of time and space*. The oxford handbook of economic geography, Oxford: Oxford University Press.
- Seufert, A., vonKrogh, C, & Bach, A. 1999. Towards knowledge networking. *Journal of Knowledge Management*, 3(3): 180-190.
- Sherman, H. & Chappell, D. S. 1998. Methodological challenges in evaluating business incubator outcomes. *Economic Development Quarterly*, 12(4): 313–22.
- Siggelkow, N., & Levinthal, D. A. 2003. Temporarily divide to conquer: Centralized, decentralized, and reintegrated organizational approaches to exploration and adaptation. *Organization Science*, 14(6), 650-669.
- Stasser, G., Taylor, L. A., & Hanna, C. 1989. Information sampling in structured and unstructured discussions of three- and six-person groups. *Journal of Personality and Social Psychology*, 57: 67–78.
- Stehlé, J., Charbonnier, F., Picard, T., Cattuto, C., & Barrat, A. (2013). Gender homophily from spatial behavior in a primary school: a sociometric study. *Social Networks*, 35(4), 604-613.
- Stuart, T. E., & Podolny, J. M. 1996. Local search and the evolution of technological capabilities. *Strategic Management Journal*, 17: 21–38.
- Subramaniam, M., Youndt, M.A. 2005. The influence of intellectual capital on the types of innovative capabilities. *Academy of Management Journal*, 48(3):450–463.
- Suh, K. S. 1999. Impact of communication medium on task performance and satisfaction: an examination of media-richness theory, *Information & Management*. 35: 295-312.
- Tarba, Shlomo Y., Junni, Paulina, Sarala, Riikka M. and Taras, Vas 2013. Organizational Ambidexterity: A Meta-Analysis. *Academy of Management Perspectives (in press)*.
- Tiwana, A. 2008. Do bridging ties complement strong ties? An empirical examination of alliance ambidexterity. *Strategic Management Journal*, 29:251–272.

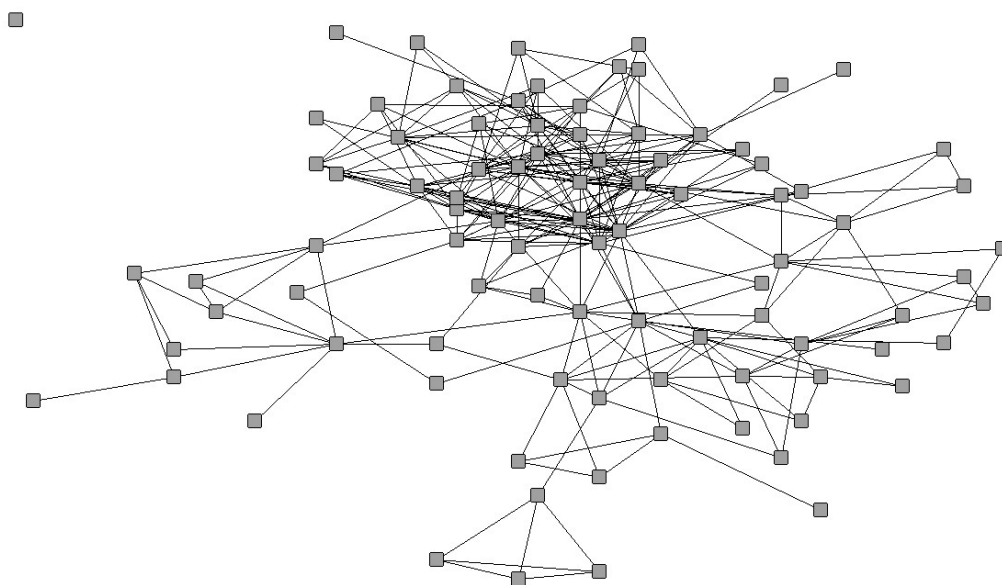
- Tsai, W., & Ghoshal, S. 1998. Social capital and value creation: The role of intrafirm networks. *Academy of Management Journal*, 41: 464–476.
- Tötterman, H. & Sten, J. 2005. Start-ups: Business Incubation and Social Capital. *International Small Business Journal*. 23: 487.
- Treviño, L.K., Webster, J. & Stein, E. W. 2000. Making connections: Complementary influences on communication media choices attitudes, and use. *Organization Science*. 11(2): 163–182
- Tushman, M.L., O'Reilly, C.A. 1996. The ambidextrous organization: managing evolutionary and revolutionary change. *California Management Review*, 38(4), 1-23.
- Turner, N. & Lee-Kelley, L. 2012. Unpacking the theory on ambidexterity: An illustrative case on the managerial architectures, mechanisms and dynamics. *Management Learning*, 44(2):179–196
- Turner, N., Swart, J., & Maylor, H. 2013. Mechanisms for managing ambidexterity: a review and research agenda. *International Journal of Management Reviews*. Vol. 15, 317–332
- Tushman M.L. & O'Reilly, C.A. 1996. Ambidextrous organizations: Managing evolutionary and revolutionary change. *California Management Review*, 38(4): 8–30.
- Tushman, M.L., Smith, W.K., & Binns, A. (2011). The ambidextrous CEO. *Harvard Business Review* 89(6): 74-80.
- Wang, C. L. & Rafiq, M. 2012. Ambidextrous Organizational Culture, Contextual Ambidexterity and New Product Innovation: A Comparative Study of UK and Chinese High-tech Firms. *British Journal of Management*. doi: 10.1111/j.1467-8551.2012.00832.x
- Whittington, R. 1992. Putting Giddens into action: social systems and managerial agency. *Journal of management studies*, 29(6): 693-712.



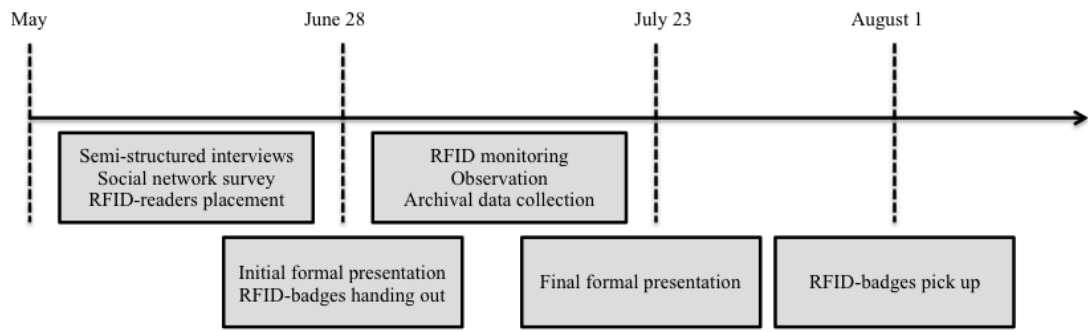
## FIGURES



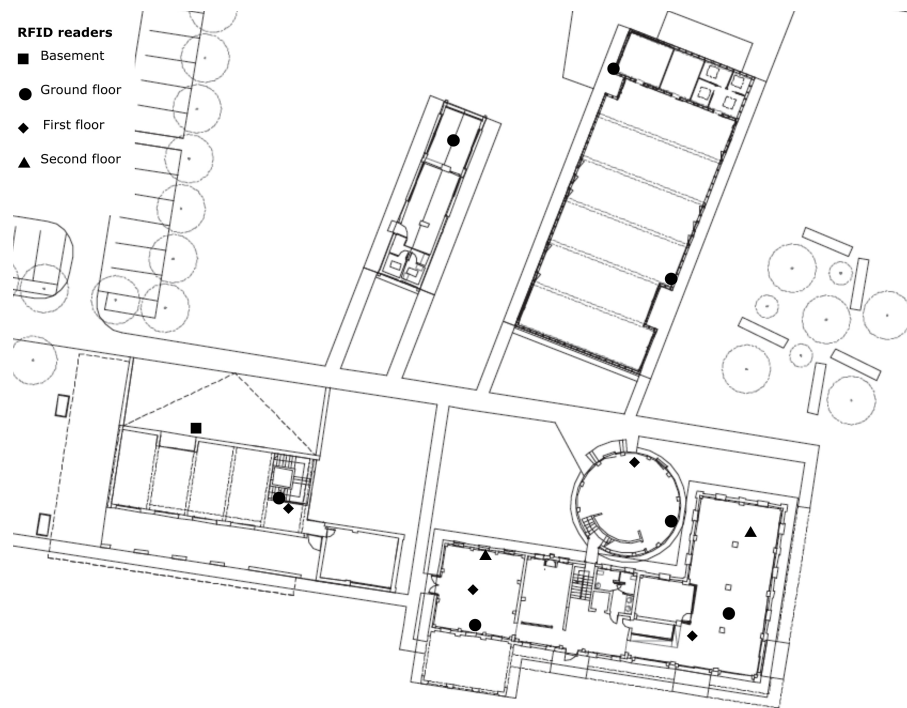
**Figure 1.** Star's Friendship Network (Density 11%, Number of Ties 902)



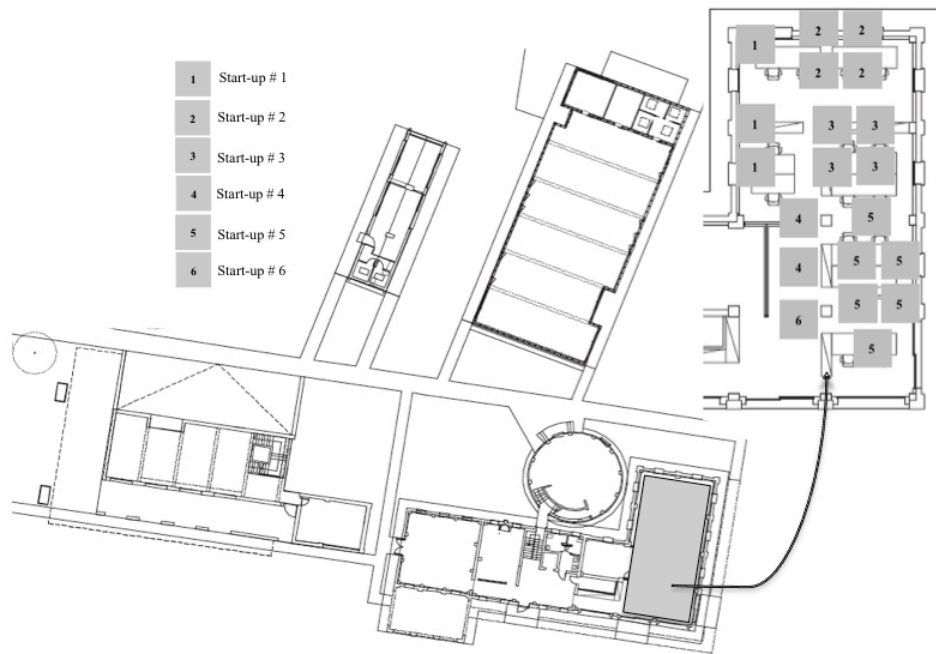
**Figure 2.** Star's Trust Network (Density 7%, Number of Ties 564)



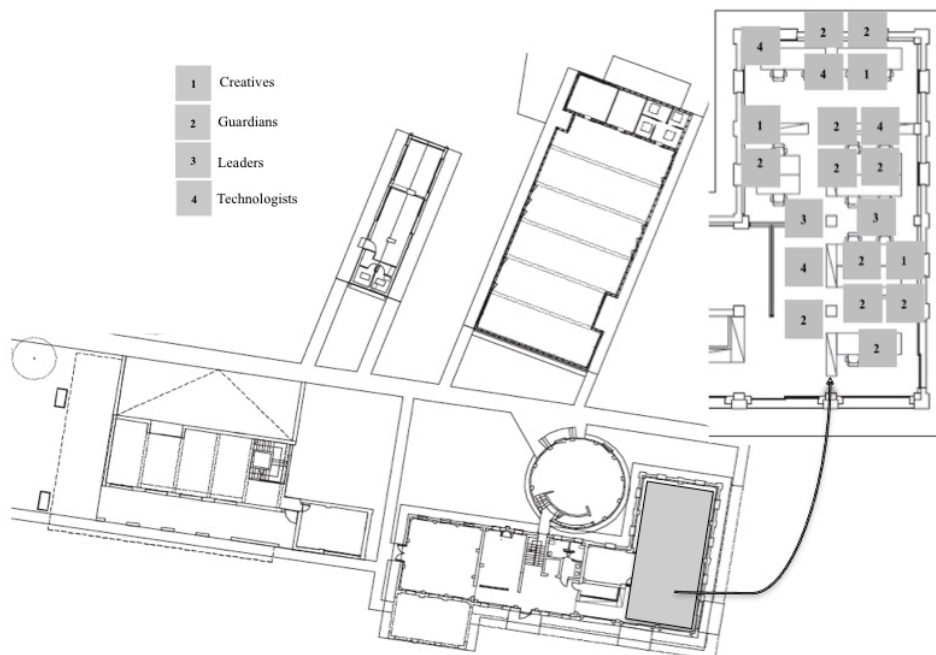
**Figure 3.** Data Collection Process



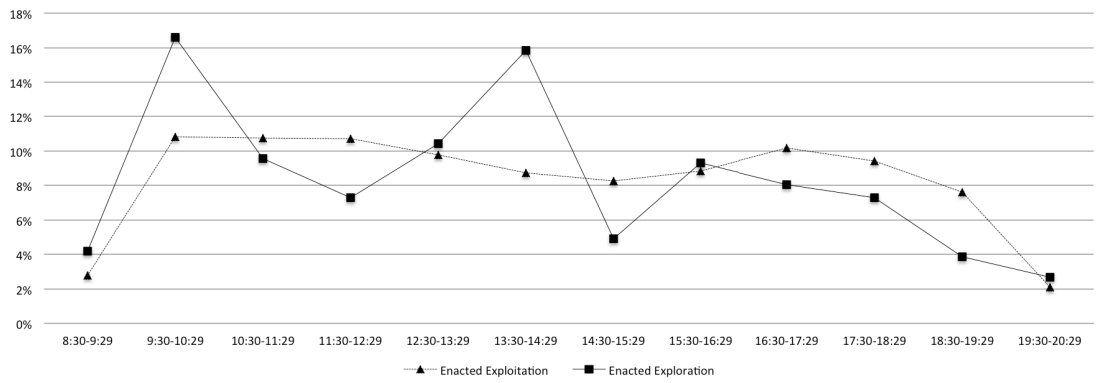
**Figure 4.** RFID-readers map



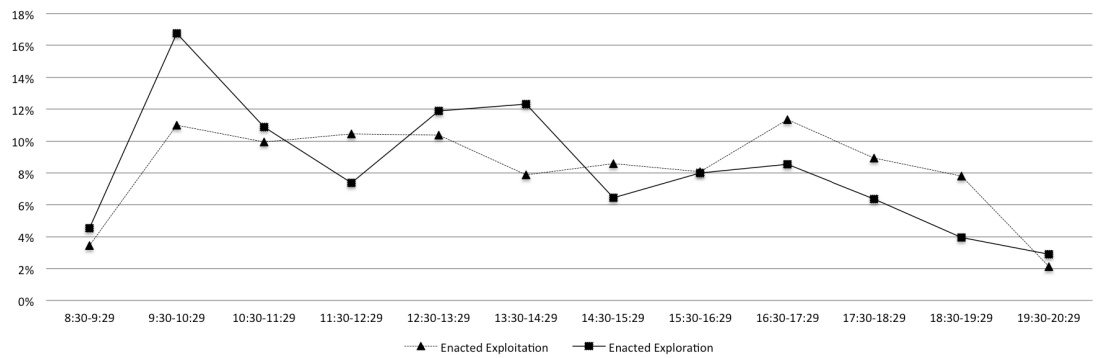
**Figure 5.** Example of Start-Ups Co-presence



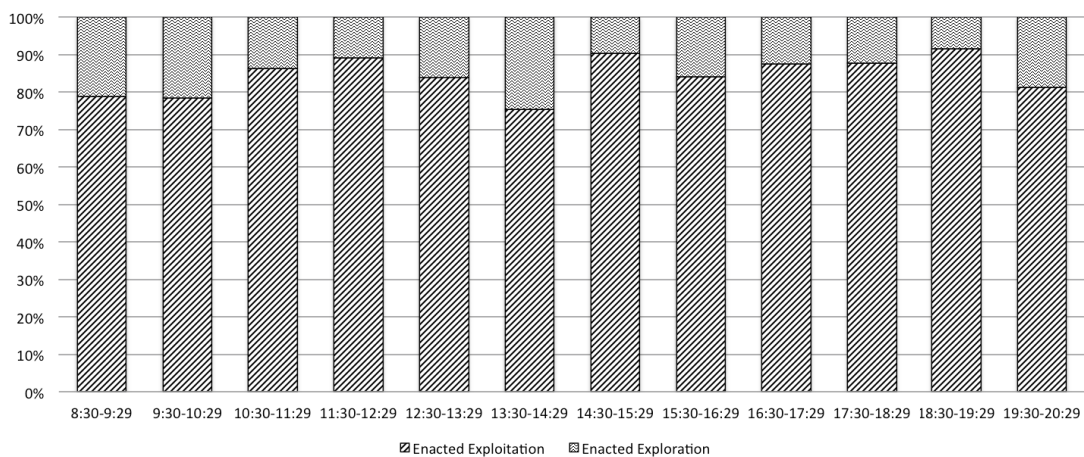
**Figure 6.** Example of Speciality Communities Co-presence



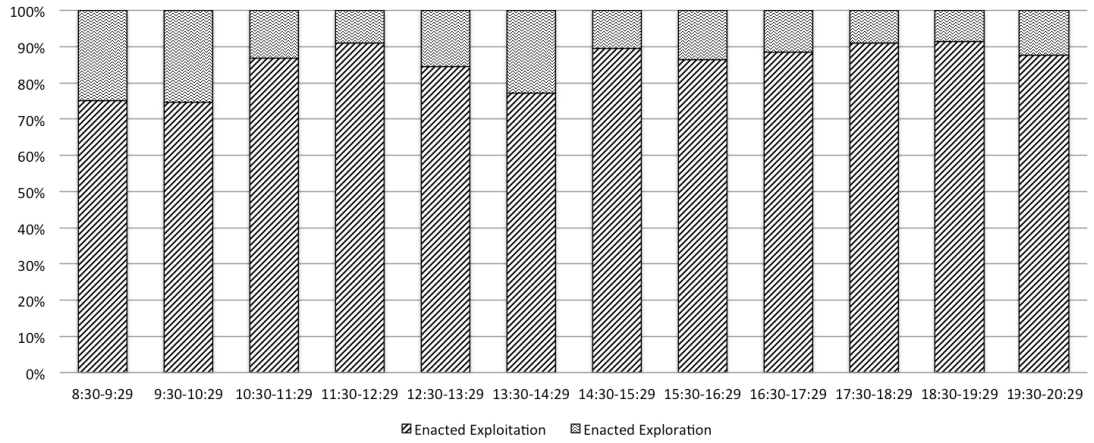
**Figure 7.** Daily Patterns of Enacted Exploitation and Enacted Exploration according to the Number of Interactions



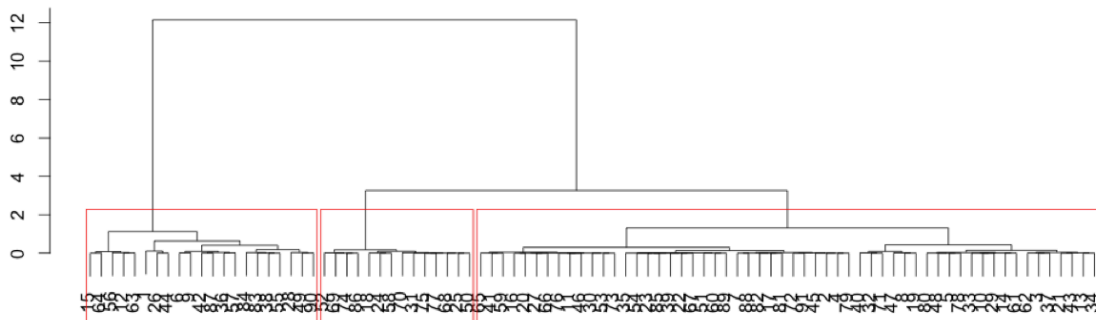
**Figure 8.** Daily Patterns of Enacted Exploitation and Enacted Exploration according to the Interaction Cumulative Duration



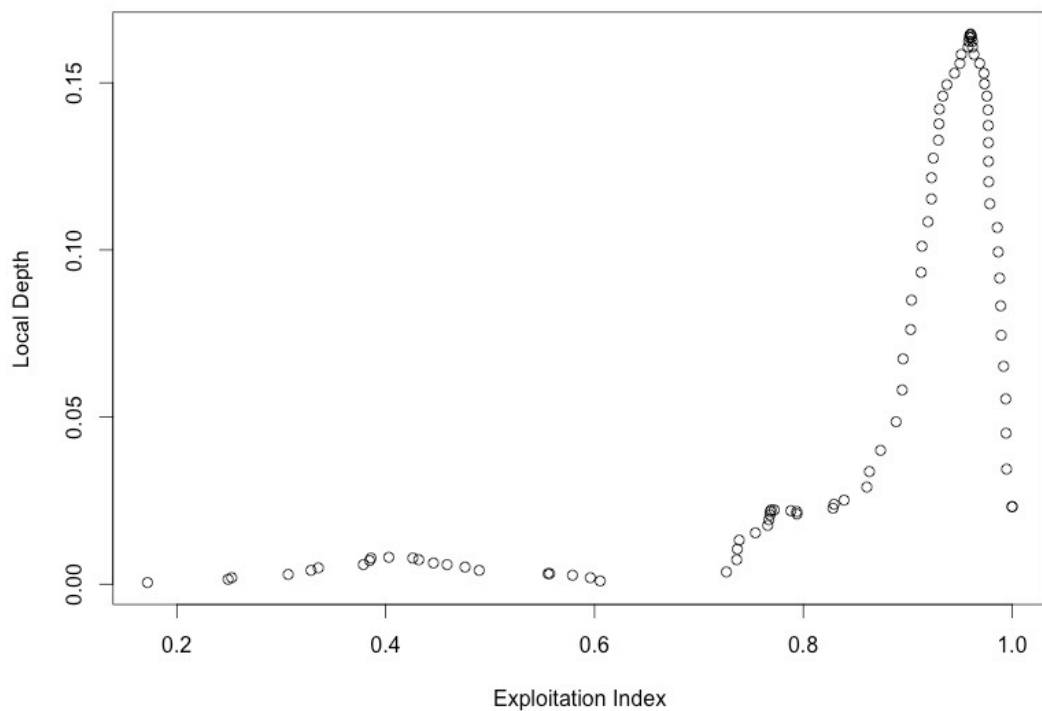
**Figure 9.** Hourly Patterns of Enacted Exploitation and Enacted Exploration according to the Number of Interactions



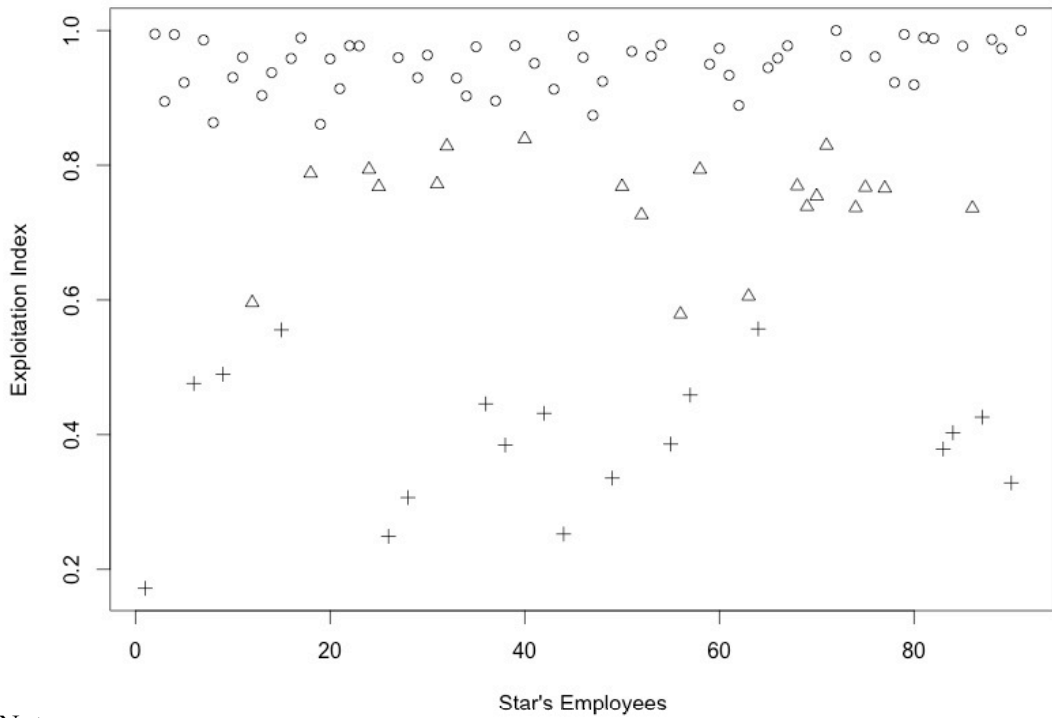
**Figure 10.** Hourly Patterns of Enacted Exploitation and Enacted Exploration according to the Interaction Cumulative Duration



**Figure 11.** Dendrogram of Exploitation Index

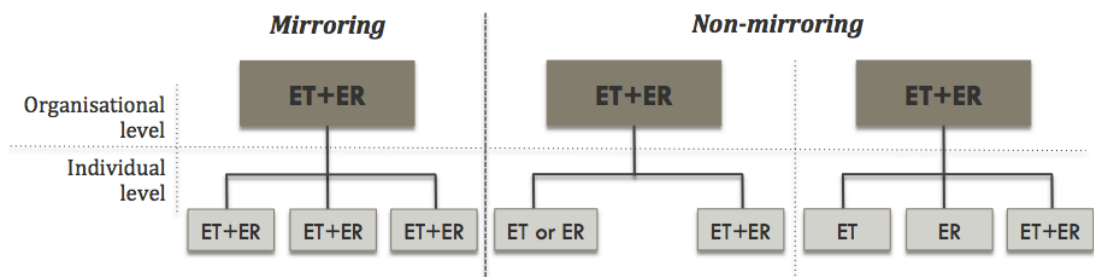


**Figure 12.** Local Depth ( $\alpha=0.04$ )

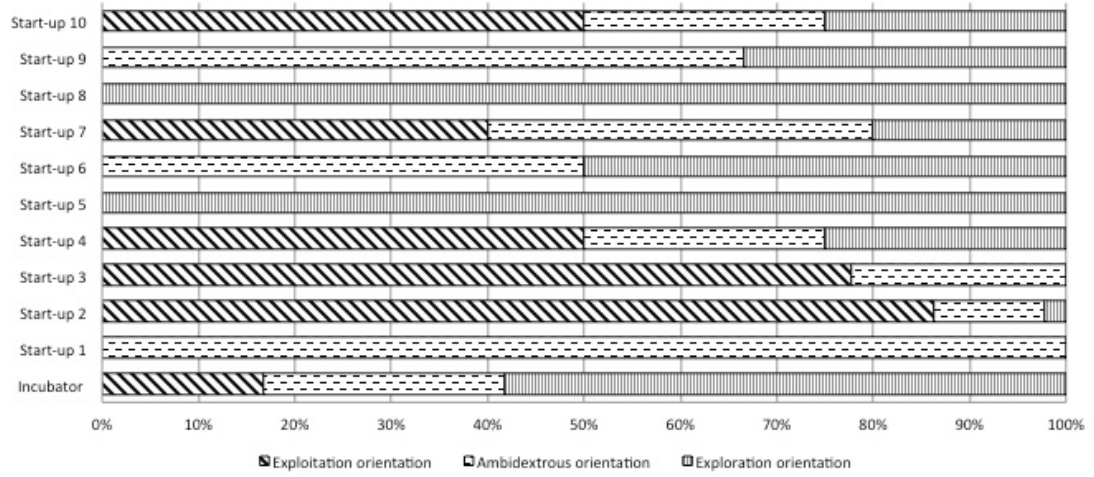


Note:  
 “o” represents exploitative orientation, “Δ” represents ambidextrous orientation,  
 “+” represents explorative orientation.

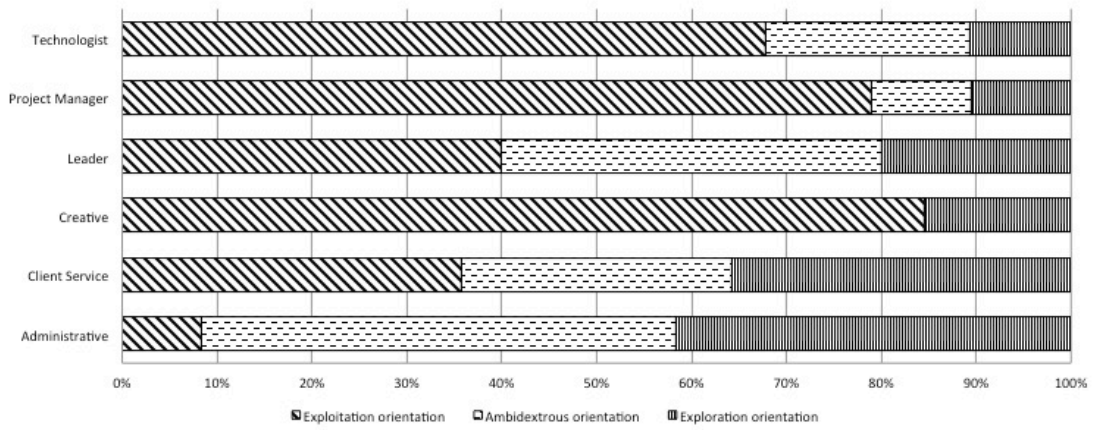
**Figure 13.** K-means clustering analysis



**Figure 14.** Ambidexterity at the organisational and individual levels (ET means Enacted Exploitation and ER means Enacted Exploration).



**Figure 15.** Distribution of Ambidexterity Orientations per Start-Up



**Figure 16.** Distribution of Ambidexterity Orientations per Speciality Communities

## TABLES

**Table 1.** Main Features of Star

Characteristics	
Location	Italy
Industry	Miscellaneous Financial Investment Activities (NAICS 2007 Code: 523999)*
Year of establishment	2005
Size (turnover)	2.4 million US Dollar in 2010 and 158 thousand US Dollar in 2012
Number of incubaties	11 start-ups incubated in 2010 and 47 start-ups incubated in 2012
Performance (average annual compound growth rate comuted on operating revenue)	Growth rate -74%
Number of professional families	6**
Number of buildings	5 buildings in 2010 and 14 cabins and 3 buildings***

Source:

\* ORBIS database

\*\* Star's HR managers

\*\*\* Star's blueprints

**Table 2.** Speciality Communities

Speciality Community	Client Services	Project Management	Creative	Technology	Leaders	Administration
<i>Identity</i>	Guardian	Planner	Designer	Builder	Leader	Clerk
<i>Expertise</i>	Building relationships	Managing projects	Designing websites	Building websites	Managing start-up(s) resources	Performing routine operational activities
<i>Interests</i>	Maintaining smooth relations with clients and increasing client revenues	Delivering products on time, on budget, and to specifications	Generating innovative, aesthetic, and breakthrough designs	Building robust, reliable, and scaleable websites	Increasing start-up(s) and incubator profitability	Supporting daily administration activities
<i>Activities</i>	Identifying and assessing client requirements over time, Developing client presentations and documentation, Maintaining client relationships	Creating project work plans, Developing milestones and measures, and monitoring them over time, Adjusting plans and schedules over time	Brainstorming ideas, Designing visual images, Generating graphic concepts and vocabulary, Creating Web process flows	Reusing, writing, revising, testing, and debugging program code, Interfacing with technology standards, technology, vendors, and client IT groups	Managing coordination of company(ies) activities, staff, and strategic and financial planning to achieve the goals of the organization(s).	Entering data, processing document, planning travel, purchasing office equipment operation, book-keeping
<i>Number of employees</i>	14	19	13	28	5	12

Personal elaboration of Kellogg *et al.* (2006).



**Table 3.** Main Features of Dyadic F2F Interactions at Star

Week #	Day #	Number of daily F2F encounters	Cumulative duration of daily F2F encounters	Number of weekly F2F encounters	Cumulative duration of weekly F2F encounters
1	1	537	1265	1917	4572
	2	509	1376		
	3	532	1170		
	4	339	761		
2	5	402	1012	2201	4787
	6	334	721		
	7	452	861		
	8	586	1122		
	9	427	1071		
3	10	396	967	1782	4987
	11	276	837		
	12	403	1034		
	13	270	692		
	14	437	1457		
4	15	296	735	1899	4783
	16	675	1802		
	17	542	1371		
	18	386	875		
Mean		433.28	1062.72	1949.75	4782.25
Std. Dev.		112.39	301.30	177.87	169.46

**Table 4.** T-test on Enacted Exploration and Exploitation in the Incubator

Dimension	Variable	P-value	Enacted Exploration	Enacted Exploitation
Start-Up	# Interactions	p<.001	Mean	2.45
			Std. Dev.	4.21
	Duration of Interactions	p<.001	Mean	5.06
			Std. Dev.	12.55
	# Dyads		Total	577
	# Interactions		Total	1413
		Total	656	
		Total	6386	

**Table 5.** Coverage of the confidence intervals for the three modes (tau is 40% and nominal level is 95%).

Mode	Zero	95% C.I.
Mode I (Exploitation orientation)	0.43	(0.23, 0.62)
Mode II (Ambidextrous orientation)	0.77	(0.36, 1.18)
Mode III (Explorative orientation)	0.96	(0.92, 1.00)

**Table 6.** K-means clustering analysis

Cluster	Size	Mean
Exploitative orientation	53	0.95
Ambidextrous orientation	20	0.75
Explorative orientation	18	0.39

## **ESSAY II**

### **What do brokers do? A study of brokers' relational styles in daily working life**

Mariachiara Barzotto

Santi Furnari

**Acknowledgement:** This essay is part of a research project led by the Institute for Scientific Interchange Foundation (Turin, Italy) and Ca' Foscari University. We gratefully acknowledge the support provided by the Institute for Scientific Interchange Foundation (Turin, Italy) in designing the original data collection project and in providing the RFID technology and platform to make it possible.

## ABSTRACT

*Despite the importance of network brokers in organisations, previous research has understudied how brokers concretely use different types of social relationships once they are located in their advantageous structural positions. In this essay, we address this question by building a typology of brokers' relational styles -i.e. the patterns of actions through which brokers mobilise their social networks- and by conducting an empirical study to detect the extent to which brokers use distinctive relational styles in their everyday interactions. We investigate a private incubator supporting 10 new digital media start-ups, employing 91 individuals, which wore a Radio-Frequency IDentification (RFID) badge every day for 4 consecutive weeks. We used these fine-grained RFID data on everyday interactions to detect the ways in which individuals mobilise their affective and instrumental workplace social relationships (e.g. task advice, daily communication, friendship and trust social networks). Results show that individuals occupying a broker's position in instrumental networks display different behaviours compared to brokers in affective networks. These findings contribute a more nuanced perspective on brokerage behaviour, highlighting that brokers can be expected to interact differently depending on the content of the tie (affective vs. instrumental).*

**KEYWORDS:** *social networks; brokers; tie content; action.*

## INTRODUCTION

Social network research has long focused on the relationship between the structural position of individuals in a social structure and a variety of positive outcomes, such as access to new information (e.g. Burt, 1992; 2004), career mobility and advancement (e.g. Granovetter, 1974; Podolny & Baron, 1997) and individual work performance (e.g. Mehra, Kilduff, & Brass, 2001). The position of brokers - actors who “mediate the flow of resources or information between two other actors who are not directly linked” (Fernandez & Gould, 1994:1475) - has attracted particular attention in the literature. In comparison to non-brokers, brokers have been shown to have better access to diverse information and new ideas (Burt, 2004; Hargadon & Sutton, 1997), achieve greater compensation (e.g. Burt, 2005) and exert greater influence on other actors (Fernandez & Gould, 1994; Gould, 1989; Padgett & Ansell, 1993). In short, brokers have been demonstrated to be crucially important for the achievement of fundamental outcomes in organisations and markets.

Although these theories of network brokerage have greatly contributed to our understanding of the structural advantages of a broker position, they are characterised by two fundamental limitations. First, extant research rarely observed the concrete behaviour of brokers once they are located in their advantageous structural positions, thereby failing

‘to connect the actions of [these] individuals to their network positions’ (Stevenson & Greenberg, 2000: 651; cf. Obstfeld, 2005). This gap in the brokerage literature reflects a more general limitation in social network theory, which often conceptualises social networks as “latent structures that are correlated with certain outcomes” (Galaszkiewicz, 2007: 6) on the basis of specific assumptions on the relationship between social structure and actual behaviour (Salancik, 1995).

Second, existing research on network brokerage has typically analysed one type of social network at a time, without taking into consideration that in the real world an individual broker is embedded in *multiple* social networks simultaneously. By focusing on only one type of network at a time, existing research has mostly overlooked the role of *tie content* –i.e. how the different types of social network ties in which a broker is embedded can differently affect her/his behaviour. The problem of tie content is particularly important to enhance our understanding of brokerage behaviour in different social contexts. In fact, despite many brokerage theories have implicitly assumed that brokers are all equal and brokers are all “self-interested, rational actors [...] universally motivated to maintain their brokerage positions” (Sasovova, Mehra, Borgatti, & Schippers, 2010:640, see also Ryall & Sorenson, 2007; Buskens & van de Rijt, 2008; Burt, 2010), other studies have demonstrated that brokers’ behaviour does actually change due to the type of social relationships in which a broker is embedded (e.g. Fernandez & Gould, 1994; Stevenson & Greenberg, 2000; Obstfeld, 2005).

Despite these studies generally acknowledge the importance of different types of ties, the exact processes through which different types of social ties can be mobilised into action by brokers have remained poorly understood (cf. Soda & Zaheer, 2012).

Juxtaposing these two limitations of existing literature, the following research question emerges as an interesting and relevant yet under-studied question: *how do brokers use the different types of social relationships in which they are embedded in the workplace?*

In this essay, we address this question in two ways. First, we build a typology of *brokers’ relational styles* (RS) –defined as *the patterns of actions through which brokers mobilise their existing social relationships* (e.g. see also Lin, 1999; Vissa, 2010). By developing the concept of brokers’ relational styles, we contend that the same social network can be used by a broker in different ways by adopting a different relational style. The concept of relational styles focuses attention on how individuals –embedded in social networks- actually engage in interaction among each other, allowing to identify the

different patterns (i.e. styles) by which people use their social networks in concrete situations of interaction. In particular, we investigate how brokers (as compared to non-brokers) choose, on a daily basis, which social ties to activate and how much time and effort they decide to spend in interacting with others (cf. Bensaou et al., 2013). Thus, to capture the actual behaviour of brokers, we consider two aspects of their relational styles: 1) *relational breadth*: the number of individuals with which they decide to interact; 2) *relational effort*: the time spent in interactions with others. Based on these two conceptual dimensions, we identify four distinctive broker's relational styles, which identify four specific ways through which brokers can use their pre-existing social relationships. Second, we address our research question by conducting a field study of the daily face-to-face (F2F) interactions through which individuals concretely mobilised their social relationships in a knowledge-intensive organization –i.e. a private incubator supporting 10 small start-ups in new digital media sector.

To directly observe the ways in which individuals occupying broker positions concretely use their different workplace social ties for purposive action, we collected two main types of data: 1) social network data on the affective and instrumental relations connecting people at work; 2) every-day work interactions among the incubator's employees. First, we gathered information on social network data through a survey administrated before the field study began. Particularly, we collected data on six different types of informal relationships (Podolny & Baron, 1997); three types of affective social networks (friendship, social support and trust); and three types of instrumental social networks (daily communication, weekly information exchange, task advice). Second, we collected fine-grained RFID (Radio-Frequency IDentification) data on the everyday minute-by-minute interactions among 91 employees working in this incubator, which wore RFID badges for four consecutive weeks. These unobtrusive badges sense and log the face-to-face interactions occurring every day in the incubator (Stehlé, Charbonnier, Picard, Cattuto, & Barrat, 2013). The use of RFID technology enables us to gather high-resolution information on the employees' engagement in interaction, in terms of interaction partners, frequency and amount of time people spend in close-range proximity (Cattuto *et al.*, 2010).

The essay is organised as follows. First, we describe the action problem in the network brokerage literature, defining four possible types of relational styles according to which employees actually use different social networks. Second, we delineate the impact of different types of workplace social networks on actions. Second, we illustrate our field study research and how we collected and analysed the data. Finally, results are discussed

and theoretical and practical implications on how actors can approach social networks are drawn.

## **THEORETICAL BACKGROUND**

### **The Action Problem in Broker's Positions**

With his 1992's book *Structural Holes: The Social Structure of Competition*, Ronald Burt established a powerful baseline model to explain how an actor's social structural position impacts on the opportunities and rewards to which the actor has access. Burt's argument is simple yet powerful: unique ties to other individuals or firms provide superior access to information and greater opportunities to exercise control. Burt's theory is mostly concerned with explaining the benefits of one particular type of network structure: network rich in structural holes. Thus, structural holes theory shares with most resource-dependence, exchange-driven, accounts of networks (e.g. Marsden, 1982) a focus on the advantages accruing to actors once they are located into network structure, leaving unexplored the questions of how these advantages are concretely obtained through the actions and behaviours of embedded actors (e.g. Galaskiewicz, 2007)

Burt himself has recently raised the action issue by recognizing that the network advantage that a person could derive from her/his position can remain unexploited unless the actor acts on it in specific ways (Burt, 2010: 221). He has also acknowledged that there is scant empirical evidence on how brokers' advantages, such as generation of novel combinations or recombination of ideas, are actually obtained and led to the successful implementation of those ideas (Burt 2004; see also Tiwana, 2008; Tortoriello & Krackhardt, 2010). In fact, by and large Burt (1992)'s structural holes theory does not fully take into account that the implementation of novel ideas requires particular effort in "transferring, integrating, and leveraging the heterogeneous inputs" (Tortoriello & Krackhardt, 2010:167) coming from dispersed, unconnected people (Argote, 1999; Carlile, 2004; Dougherty, 1992) who tend to be characterised by different interests, perspectives and communicate with different languages (Obstfeld, 2005). As a result, direct empirical evidence is surprisingly scarce on the mechanisms and processes underlying the mobilisation of resources by actors who occupy a broker's position (e.g. Bensaou, Galunic & Jonczyk-Sédès, 2013). Hence, we know little about "purposive actors who display

creativity and choice in social action, which should include strategies for networking” (Bensaou, Galunic & Jonczyk-Sédès, 2013:1) such as the exact relational effort and choices undertaken by actors who occupy a broker’s position.

This specific gap in the literature is part of a larger problem in network research. Indeed, several recent studies have lamented the failure of network research to connect the actions of individuals to their network positions (Emirbayer & Goodwin, 1994; Galaskiewicz, 1985; Obstfeld, 2005; Stevenson & Greenberg, 2000). This problem is particularly relevant for the study of network brokerage because brokerage positions are likely to be inherently unstable and actor's brokerage position are not necessarily associated with actual brokerage behaviour (Fernandez & Gould, 1994). For example, Fernandez and Gould (1994) demonstrated that a broker is more or less likely to lose his advantageous structural position depending on his overt behaviour in the eye of the disconnected parties. Indeed, in cases in which “occupants of brokerage positions support particular policies, actors who do not support these policies may choose not to rely on them as brokers for fear that they will not mediate communication impartially” (Fernandez and Gould, 1994: 1461). In this perspective, the actions of the broker enter at the centre of the picture: the reliance of the disconnected parties on the broker as mediator will depend on the behaviour of the broker. Moreover, Stevenson and Greenberg (2000) used social movement concepts to explain the success and failure of actors in a network of relationships trying to influence policies on environmental issues in a small city. They identified three different networking tactics: direct contact, broker, and coalition, whose effectiveness varies depending on the presence of opposition, the structure of political opportunity and the actor's position in the network. Obstfeld (2005) discovered that actions consistent with a *tertius iungens* strategy - e.g. a behavioural orientation toward connecting people in their social network - are an important network mechanism underlying the combination of novel ideas found in innovative efforts. Hence, the “*tertius iungens* orientation and social knowledge constitute a set of agency-related factors that complement social structure (e.g. social networks) as predictors of social action” (Obstfeld, 2005: 125).

Taken together, these studies suggest that structural positions define only potential for action (Emirbayer & Goodwin, 1994). The present essay inserts and tries to advance this stream of research that aims to bring the agentic dimension back in. It does it by capturing the exact action connecting to actors who occupy a broker’s position.



## **Brokers' Relational Styles: A Typology of Broker's Actions**

Previous research has demonstrated that occupying a broker position is beneficial, as bridging people who are not directly connected one with the other increases the likelihood of detecting new rewarding opportunities (Burt, .1992; 2013). Despite the fact that we can assume because of the benefits accruing to brokers, “there is a strong incentive for becoming a broker” (Sasovova *et al.*, 2010:640), not every employee has the motivation or ability to link otherwise unconnected actors (Sasovova *et al.*, 2010) as building bridges requires particular effort, costs to be maintained, and they are vulnerable (Burt, 2002; Kossinets & Watts, 2006; Ryall & Sorenson, 2007). Being a broker means to “mediate the flow of resources or information between two other actors who are not directly linked” (Fernandez & Gould, 1994:1475). In order to mediate, brokers have to take actions within networks for mobilising resources present in those networks.

To capture the actions taken by brokers to use their networks, we draw on a growing field of research on strategic action and agency in networks. This field looks at individuals' purposive actions - instead of personal network structure - as driver of formation and management of their workplace social ties. Accordingly, this perspective perceives networks as “plastic” (Davis 2008) in the sense that people forge distinctively different patterns of social ties in the workplace (Mehra *et al.*, 2001:141; Gibbons, 2004; Bensaou *et al.*, 2013). The above-mentioned research is characterised into two streams. The first stream addresses the exchange partner choice by investigating the symbolic management strategies (Zott & Huy, 2007) and the negotiating strategies applied by executives to efficiently initiate relationships (Hallen & Eisenhardt, 2012). These process-oriented works define a rich model of inter-organisational tie formation without tackling how individuals use their existing interpersonal contacts or the relationship between forming new interpersonal relationships and managing existing ones (Vissa, 2012:494). The second stream attempts to fill these gaps by shedding light on the actors' active use of their social ties. Vissa (2012) inductively conceptualises two constructs describing entrepreneurs' behavioural repertoires in forming new ties (*network-broadening actions*) and maintaining existing one (*network-deepening actions*), and demonstrates that these two networking actions affect the way through which the entrepreneur looks (i.e. reliance on referrals) for exchange partners to form new ventures. A related research (Bensaou *et al.*, 2013) focuses on the configuration of relational choices and activities that amount to a

social networking strategy. Bensaou and colleagues explore the role played by personal choices and acquired cultural categories (i.e. schemas, beliefs, values) in the construction of networking strategies. They found three networking strategies: *devoted player*, *selective player* and *purist*, which differ mainly in terms of target of their relational activities and energy spent on new and existing social relations.

This field of research explores the sequence of actor's actions, interactions between and among group members (Strauss, 1993), to pursue a more fine-grained understanding of the fluidity of network relations. Coherently with these works, we decided to investigate how employees occupying broker - compared to non-broker - positions actually engage with and practice their social networks (Figure 1) in terms of relational breadth and effort spent in interacting. We employed these two dimensions to define a typology of patterns of actions undertaken by employees to mobilise their workplace ties on a daily basis. *Ceteris paribus*, the larger the individual's number of interaction partners (broad relational breath) the higher the likelihood s/he comes across diversified types of information, as well as satisfies her/his own interests against others (Burt, 2010). In social network literature, the effort devoted to communications has been used to capture the intensity according to which a subject is exposed to individuals (Burt, 2010); hence, the higher the interactions effort the higher the actor's engagement in using her/his workplace social. By considering these two dimensions, we identify the following four relational styles (Figure 2). We employ the relational style construct to explore the extent to which being brokers (compared to non-brokers) explains variance in the focal individual engagement in interactions implemented by employees to perform their daily work.

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Figures 1 and 2 about here  
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### *1. Catalyst Relational Style*

An actor is following a catalyst relational style when s/he puts a lot of effort in interacting with a large number of interaction partners (broad relational breath). The presence of dense ego-social networks in terms of a large number of interaction partners, and the extensive investment in conversation, should allow the channelling of 'norms of cooperation, and more effective exchange of complex knowledge, all of which are crucial to the coordinated action necessary for sustained innovation efforts' (Obstfeld, 2005:106).

## *2. Cliquish Relational Style*

We label cliquish relational style the pattern of interactions undertaken by an individual who invests a considerable amount of effort in conversation with a small number of individuals (narrow relational breadth). The presence of a consistent investment in conversation enables actors to build working relationships as well as channels complex knowledge flows, since the more time people spend together the more they deepen their tacit knowledge and nuances emerge.

## *3. Nomadic Relational Style*

The nomadic relational style describes the pattern of interactions of actors who can count on a large number of interaction partners (broad relational breadth) and spend a limited effort in interacting with whom s/he is linked. Conversely to the cliquish relational style, the individuals who use this RS are able to draw from a large pool of resources but the limited amount of time invested in conversation inhibits the channelling of complex knowledge. Even if nomadic individuals do not spend lot of time in engaging in conversations, they could take advantage of being well-connected actors by acting according to the *tertius iungens orientation*; that is, ‘a behavioural orientation toward connecting people in one's social network by either introducing disconnected individuals or facilitating new coordination between connected individuals’ (Obstfeld, 2005: 102). For instance, in the case in which nomadic actors see an opportunity but they do not have time or energy to devote, they could pass it to one of her/his network node (Burt, 2010).

## *4. Sporadic Relational Style*

We call sporadic the relational style carried out by individuals who both devote little effort in interaction and exchange information with an inner circle of interaction partners. The absence of dense ego-social networks in terms of a small number of interaction partners (narrow relational breadth), and the missed investment in conversations, reduces the possibility for people with sporadic relational style to create norms of cooperation and exchange complex knowledge effectively. As we stated above, the presence of norms of cooperation and the exchange of complex knowledge are two crucial elements to foster innovation.

## The Tie Content Problem in Broker's Positions

Since “patterns of informal network interactions play an important role in facilitating the achievement of desired individual and organisational outcomes” (Ibarra, 1992: 165, Kanter, 1983, 1989; Kotter, 1982, 1895), scholars have been calling for a better understanding of the mechanisms underlying network effects on outcomes. They suggest that a relevant line of inquiry to explore is the extent to which network content (e.g. Soda & Zaheer, 2012) affects who occupies a broker's position (among others, Podolny & Baron, 1997; Obstfeld, 2005). Regarding this, Podolny and Baron (1997) underline that different types of social relationships (e.g. formal vs. informal, affective vs. instrumental) co-exist in the same organisational setting (e.g. Lincoln & Miller, 1979) and each workplace social network can enable as well as inhibit individual action, leading to different outcomes. Indeed, in an organisation, employees “navigate multi-dimensional context” (Hite, 2008; 134); they interact daily with their colleagues to discuss work-related matters, exchange personal information as well as building friendship and trust-based relationships. Network researchers (e.g. Gibbons, 2004; Tichy, Tushman & Fombrun, 1979) conventionally group the different types of ties in two sets: *instrumental* ties and the *affective* ones. Instrumental ties are centred on formal positions and reflect job interdependencies (e.g. Podolny & Baron, 1997), they arise in the course of performing assigned work roles and channel task-related information and resource. The information and resource “that ego can provide and that ego needs is largely determined by formal position, and the alters best situated to provide ego with task advice also depend on ego's formal role” (Podolny & Baron, 1997: 677). Instrumental ties are mainly related to organisation power (Brass, 1992; Ibarra & Andrews, 1993) and they are activated when individuals at work look for information, advice or opportunities to solve their problems by asking the people with whom they collaborate. This kind of tie enables the coordination among activities and subjects as well as boosting the organisational norms (Gibbons, 2004). Conversely, affective ties involve the personal sphere: they are centred on persons, are more discretionary than instrumental ties and are mainly expressions of interpersonal attraction and trust (Podolny & Baron, 1997). The emotional attachment that these types of links convey is higher than the one channelled by the instrumental ties as they channel “a person's generalized positive or negative feelings toward a co-worker” (Casciaro & Lobo, 2008: 656).

Compared to affective ties, instrumental one are less driven by the homophily principle (Soda & Zaheer, 2012), the tendency of individuals to spend time with those who are similar to themselves (e.g. McPherson & Smith-Lovin, 1987; Lazarsfeld & Merton, 1954; Ingram & Morris, 2007). It has been demonstrated that employees are more likely to interact with colleagues who experience similar lives since they tend to share mutual interests and concerns (Soda & Zaheer, 2012). Work settings, however, “restrict the freedom of individuals to withdraw from one set of ties and position themselves in another, so that individual preferences for "homophily" exercise little influence on network form. [...] Friendship networks in organisations are not merely sets of linked friends. They are systems for making decisions, mobilizing resources, concealing or transmitting information, and performing other functions closely allied with work behaviour and interaction” (Lincoln & Miller, 1979: 196). Contrarily to instrumental networks that are built following a logic of cost and efficiency (Casciaro & Lobo, 2008), friendship usually starts with attraction toward a person but it develops over time by interacting, sharing experiences and increasing affection (Carley, 1991; Krackhardt, 1992). At work friendship (Jehn & Shah, 1996) and, in general, affective ties favour cooperation among colleagues. As Casciaro & Lobo proved (2008: 667) “positive affect for someone enhanced the impact of his or her task competence on the likelihood of seeking him or her out for task-related interaction”. Indeed, friendship ties among work groups smooth status differences present in advice network, serving as a bridge supporting both advice and co-workers’ goodwill networks (Lazenga & Pattison, 1999). The intimacy presents in friendship (Gibbons, 2004), in trust as well as in social support ties, enables shared understandings, clear communication and exploration of new professional ideas without threatening the relationship. Indeed, employees tend to support friends’ new ideas since they expect that those “come with good intentions, and the stability of the relationship provides a safe venue for mutually exploring unproven thoughts”. (Gibbons, 2004: 241). People are likely to mobilise the friendship network to promote professional values, as such friendship networks can be seen as a “catalyst for change” whilst advice networks are seen as a “stabilizer of professional values” (Gibbons, 2004:257).

Relationships are costly, as people have to spend time and energy for building and maintaining them (e.g. McFadyen & Cannella, 2004). Employees are asked to handle interpersonal exchanges within different workplace social networks in a given amount of daily working hours. Yet, instrumental and affective networks not only channel different flows but are also an expression of different (sometimes conflicting) tacit and codified

rules. Affective relationships, for instance, bond tighter and require more psychological attention than instrumental type of ties. Indeed, people are more prompt to preserve a friendly image when they act their affective relationships. Conversely, because of the absence of social content, individuals do not expect and are not expected to be generous within instrumental networks. These differences underlying the tie content should lead employees to mobilise them in a heterogeneous manner, both in terms of relational breadth and effort spent in interactions. Previous studies acknowledge the simultaneous presence, the interweaving of multiple workplace social structures, and the fact that actors may occupy distinct positions in each of those structures. Notwithstanding, they tend to combine all networks in one and evaluate them as dichotomous factor (Hite, 2008). In so doing, extant research overlooks the impact of the tie content on enabling or inhibiting individual actions. Yet, the exact pattern of relational behaviour use for each of these content ties used by people occupying a broker position in different social structures is still unexplored, leaving the call by Galasckiewicz (2007) for an investigation of the structural holes theory in affective networks still open. Understanding the use of the exchanges systems (Lazenga & Pattison, 1999) is important since the mobilisation of different tie contents leads to different outcomes; for instance the effect of the presence of structural holes on mobility has been shown to be positive for ties that convey resources and information while negative for those that transmit identity and expectations (Podolny & Baron, 1997: 689).

## **METHODS**

### **Setting and data**

The present essay builds on a joint research project of the Institute for Scientific Interchange Foundation (Turin) and Ca' Foscari University of Venice. The field research was carried out in a private international incubator, called *Star* (pseudonym). At the time this study was conducted, the incubator hosted 10 start-ups in the new digital media sector. *Star* provides its incubates with seed capital, granting the finance necessary for the early stage activities, as well as a bundle of services to speed up the business development (such as: general administration, press office, human resources, legal and financial consultancy and assistance in defining the commercial strategies, business plans, partnerships and exit

strategies). Table 1 outlines the main characteristics of our case study.

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Table 1 about here  
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The breadth of setting the study in this particular private incubator was driven by reasons of appropriateness. Incubators generally represent a unique setting to analyse because they are organisational structures created, among other reasons, to boost the creation and the development of social capital within the incubatees. Indeed, as Tötterman and Sten (2005) stated, incubators together with their internal networks facilitate resource pooling by allowing start-ups to share resources (Lyons, 2002a,b) and networking among the tenants' companies. The resource pooling can be facilitated also by the co-location of the incubator residents; indeed, the fact that start-ups are physically close to each other in a well-defined area, provides start-ups with "a symbiotic environment" (Tötterman & Sten, 2005\_ 489), which paves the way towards formal and informal (Lyons, 2002a) relationships among incubatees themselves (Duff, 1994; Sherman & Chappell, 1998). Besides these general reasons, the breadth of Star was determined by the fact that this specific incubator represents an extremely fertile reality for several points of views. On the one hand, Star is known as a highly innovative setting in the sector in which it is inserted and its competitiveness has been recognised at the national level. On the other hand, from an organisational point of view, the co-presence of several incubatees and the rich composition of employees' expertise that are present in Star allow us to draw reflections on the employees' use of the incubator's resources. Star overtly supports and encourages interaction among its employees; the workplace environment was purposively thought and built to increase both impromptu and planned encounters among incubator's residents.

**Data collection.** The present 4-week field research, carried out in 2010, is mainly built on a quantitative analysis based on RFID<sup>2</sup> (e.g. Cattuto *et al.*, 2010; Isella *et al.*, 2011a; 2011b) data and a social network survey. In order to explain and share the research goals and methods with Star's employees, several meetings with Star's CEO and the CEO's main collaborators as well as all the incubator's employees took place before starting the data collection. The willingness to volunteer for this research project was asked

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<sup>2</sup> This study has been carried out with the collaboration with SocioPatterns. For detailed information on SocioPatterns and the use of this technology, see also: The SocioPatterns project. Available: <http://www.sociopatterns.org/>. Accessed 2013 Decembre 2.

of each of Star's employees. Their privacy protection was guaranteed. At the end of the field study we organised a meeting during which we presented some preliminary results to Star's employees. The Figure 3 outlines the data collection process.

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Figure 3 about here  
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We administrated a 15-item online survey to all the incubator's employees before we started gathering data on F2F interaction by using RFID technology. The questionnaire consisted of two sections: the first block of questions was composed of individual socio-demographic attributes, the second part of free breadth roster questions on workplace social networks (see Appendix 1 for a complete view of the survey).

We captured data on all minute-by-minute F2F interactions amongst the incubator's employees through RFID<sup>3</sup> technology; that is, subjects who decided to participate in this research field had to wear a RFID tag, an unobtrusive electronic device consisting of a small chip and an antenna, put inside a badge. The RFID tag was able to detect contacts where individuals wearing it were facing each other at a maximum distance of 1.50 metres. If two people did closely face each other within a distance of 1.50 metres for a period longer than one minute, then this means that some form of social interaction was taking place between them. We decided to record encounters that lasted more than one minute in order to capture only actual interactions, and not 'spurious proximity such as two people walking past each other' (Ingram & Morris, 2007: 567). The RFID tag transmits information on interactions to the closest RFID reader (antenna), which records the encounters. Twelve RFID readers were placed all over the workplace environment, covering the incubator's main indoor and outdoor area. Over the 4-week observation period, we monitored F2F encounters for 24 hours per day and 7 days per week. We based our study on 18 working days. The reasons why we considered 18 working days are the following: first, we did not analyse weekends because no interaction occurred over those

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<sup>3</sup> This device is a powerful tool to collect F2F interaction as shown by recent studies that apply this technology in several different settings, such as: primary schools (Stehlé *et al.*, 2011(a)), scientific conferences (Cattuto *et al.*, 2010; Alani *et al.*, 2009; Van den Broeck *et al.*, 2010; Stehlé *et al.*, 2011(b); Isella *et al.*, 2011(b)); pediatric hospitals (Isella *et al.*, 2011(a)) and museums (Isella *et al.*, 2011(b)). Indeed, wearable sensors allow the gathering of social sensing infrastructure (Barrat & Cattuto, 2013) by capturing the strength (analysed by number and average duration) of F2F human interactions with high accuracy. The accuracy is given by the fact that the device provides the "finest resolution of F2F proximity" (Barrat & Cattuto, 2013:1). According to the study in which Choudhury and Pentland (2003) employed IR sensors, it has been shown that performance accuracy of sociometer badges in capturing F2F conversations is 87,5% for conversations greater or equal to one minute (the duration we are considering in the present work).



days; second, we dropped the first day (which was a Monday) and the last day (which was a Friday) of the field study because during these two days we were delivering RFID badges to the participants and withdrawing them, respectively. While handling the RFID badges during these two days, we recorded interactions that did not actually occur. Star's employees had flexible working hours, this is partially due to the incubator's organisational culture. Given this flexibility, we decided to capture interactions that took place during a 12-hour time window interval (from 8.30 a.m. to 8.29 p.m.). This time window was defined according to the hour in which the first and last communication of each day occurred on average. Moreover, the 12-hour interval enabled us to keep track of interactions taking place not only during the working hours but also during the lunch break.

*The sample.* Our sample consists of 164 employees. Sixty per cent of the participants were male. The typical employee working for Star's incubator is 31 years of age (Std. Dev. = 4.76), has a bachelor's degree, and has been with the incubator for 25 months (Std. Dev. = 19.06).

Looking at the overall formal organisation chart, which includes both incubator and incubatees, we identified 5 hierarchical levels (Figure 4). Figure 5 and 6 illustrate the sample distribution of the employees' education attainment and seniority, respectively.

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Figures 4-6 about here  
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84.1% of the study population (138 employees) decided to participate in the field study by consenting to wear the RFID badges during their working hours. 59.14% (97 subjects) was the response rate of the survey distributed among the incubator's employees. Out of 97 employees, we analyse data on 91 subjects (55.5% of the study population) since 6 questionnaires were uncompleted. Over the 4-week observation period, 30% (1233 dyads) of the potential dyads have had at least one F2F contact. We recorded 7799 F2F encounters for a total amount of 19,129 minutes spent in direct interaction among people working for Star. The daily engagement in F2F interaction among the 91 employees consists of 433 encounters on average (Std. Dev.  $\approx$  112.39) and a mean amount of time spent in interaction of 1062.72 minutes (about 18 hours) (Std. Dev.  $\approx$  301.30) (Table 2 and Figures 7 and 8).

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Table 2 and Figures 7 and 8 about here  
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On average a single F2F encounter lasted 2.45 minutes (Std. Dev.  $\approx$  4.1), with a maximum duration of 104 minutes. On average, each employee interacted with about 27 people (Std. Dev.  $\approx$  11.8), which represents almost one third of our sample. Members of each of the dyads that conversed met each other 6.33 times on average (with maximum number of times equal to 191 encounters). The density<sup>4</sup> of the F2F engagement network is 0.30 (Std. Dev.  $\approx$  0.46) whilst the densities<sup>5</sup> of the affective and instrumental social networks are, respectively, almost equal to 0.15 (Std. Dev.  $\approx$  0.36) and almost equal to 0.17 (Std. Dev.  $\approx$  0.37). Star's employees activated (through at least a F2F contact) 68% of the affective ties and 72% of the instrumental ties over the 4-week observation period. Figures 9 represents the F2F network, which has been computed by using the binary matrix indicating the presence/absence of the occurrence of at least one F2F encounter over the observation period.

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Figure 9 about here  
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## Measures

***Workplace social networks.*** In order to allow the comparison with previous network research (e.g. Burt, 1992; Casciaro & Lobo 2008; Lincoln & McBride, 1985; Podolny & Baron, 1997) we decided to analyse six workplace social networks. We consider the following social networks as instrumental ties: daily communication, weekly information exchange and task advice networks. Conversely, we examine the following social networks as affective ties: friendship, trust and social support social networks. The *daily communication network* captures the nodes and the links involved in the information sharing during the working hours on a daily basis. The *weekly information exchange*

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<sup>4</sup> We computed (using UCINET VI) the density of F2F network using the binary matrix indicating the presence/absence of the occurrence of at least one F2F interaction over the observation period.

<sup>5</sup> We computed (using UCINET VI) the density of the affective and instrumental networks using the binary adjacency matrix.

*network* collects the network of the information exchange during the working hours on a weekly basis. The *task advice network* gathers data on who a person asks for advice when s/he faces a new problematic situation which is strictly related to her/his job. Among the affective networks, the *friendship* one captures who is friends with whom inside the organisation; the *trust network* collects data on people a person trusts the most in the context of her/his work activity; and, finally, the *social support network* defines the network of who an actor asks for advice when s/he faces a new problematic situation which is related to her/his interpersonal relationships at work (such as a conflict).

Figures 10 and 11 represent, respectively, affective and instrumentals networks. The affective network has been computed by using the binary matrix indicating the presence/absence of at least one tie in the multiplex matrix containing friendship, trust and social support networks. The instrumental network has been computed by using the binary matrix indicating the presence/absence of at least one tie in the multiplex matrix containing daily communication, weekly information exchange and task advice networks.

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Figures 10-11 about here  
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Following Laumann and Pappi (1976: 137), we include all reported ties disregarding their direction and whether they are reciprocated or not (Lincoln & Miller, 1979: 187). Although some relationships are not symmetrical in the sense as measured by breadths reciprocated (Lincoln & Miller, 1979), building on previous studies (e.g. Granovetter, 1973: 1364), we claim that such types of tie are typical within organisations and play a crucial role in conveying information and transferring knowledge. Moreover, we consider instrumental and affective ties stable channels “through which messages may travel in two directions” (Lincoln & Miller, 1979: 187). The questions we asked imply a symmetric link; that is, “if A reports a work contact with B, it follows that B has also had a contact with A even if B fails to report it” (Lincoln & Miller, 1979: 187; see also Blau, 1962). For these reasons we claim that either A or B are sufficiently informant to acknowledge the presence or absence of a tie between them. This breadth is coherent with the undirected F2F data we collected as we captured interaction among employees without knowing the direction of the communication.

***Action variables: relational styles.*** This essay examines the concrete actions that

actors occupying broker and non-broker positions actually undertake to use their social relationships, both affective and instrumental, in order to get the work done. In their working life, employees deal with the daily challenges by interacting with each other and exchanging information and knowledge within the organisation. Hence, everyday interactions could be interpreted as a way by which these individuals in a workplace use the social relationships in order to share information and knowledge. This transmission of information and knowledge can be accomplished either through a direct communication medium, such as F2F interaction, or through a mediated communication medium (for instance: phone, instant messaging, videoconference and e-mail).

We used the RFID data on F2F interactions to capture the actions through which employees activate their social relationships, which have been detected through the network survey as aforementioned, to execute their tasks at work. We decided to look at F2F interactions because, although the use of mediated communication media for transferring information and knowledge has become more and more widespread (Flanagin & Metzger, 2001; Rice, 1992), scholars on innovation and knowledge management have demonstrated the still irreplaceable role of F2F encounters at the workplace (e.g. Hallowell, 1999; Nohria & Eccles, 1992). One of the main reasons why *impromptu* and planned F2F interaction is a critical communication (Weeks & Fayard, 2011) channel is that, by using it, individuals can efficiently convey complex and tacit knowledge (Bell & Zaheer, 2007; Johnson, Lorenz & Lundvall, 2002) as well as build trust-based relationships (Nohria & Eccles, 1992). These are aspects considered essential in the production process of creative ideas (Conrath, 1973; Nonaka & Takeuchi, 1995) within organisations.

We focus on two main dimensions by which individuals can directly engage with their social networks: broker's (compared to non-broker) relational breadth and effort (e.g. Bensaou *et al.*, 2013). We operationalise relational breadth as the total *number of alters* with whom an actor occupying broker and non-broker positions has interacted, which is the number of contacts that an actor has in a network. We operationalise relational effort as the *cumulative duration* (in minutes) of the overall amount of interaction of a given actor. We decide to look at these two dimensions because they are reasonable and fine-grained measures of the investment done by these individuals in activating their networks. Moreover, the use of RFID technology allows us to detect accurately the duration of single episodes and the actors involved in the interaction.

We classify an actor with a *broad* relational breadth when the number of her/his conversation partners are equal or higher than the alters' mean number of incubator

employees (which is 27 individuals). Conversely, we classify an actor with a *narrow* relational breadth when the number of her/his conversation partners are less than the alters' mean number of incubator employees. Moreover, the actor's effort in using the social relationships in which s/he is embedded is defined as *high* when s/he has spent, in conversing, an amount of time equal or superior to the cumulative duration spent on average by all incubator employees (which is  $\approx 420$  minutes). Whilst, the actor's effort in using the social relationships in which s/he is embedded is defined as *low* when s/he has spent, in conversing, an amount of time inferior to the cumulative duration spent on average by all incubator employees.

The combination of these two dimensions, namely the number of alters and cumulative duration, generates the aforementioned four RSs. In particular, we labelled as:

1. *Catalyst Relational Style* the relational style in which the actor interacts with a number of alters equal or superior to the average number of conversation partners for an amount of time equal or superior to the average cumulative duration.
2. *Cliquish Relational Style* the relational style in which the actor interacts with a number of alters inferior to the average number of conversation partners for an amount of time equal or superior to the average cumulative duration.
3. *Nomadic Relational Style* the relational style in which the actor interacts with a number of alters equal or superior to the average number of conversation partners for an amount of time inferior to the average cumulative duration.
4. *Sporadic Relational Networking Style* the relational style in which the actor interacts with a number of alters inferior to the average number of conversation partners for an amount of time inferior to the average cumulative duration.

**Structural variables.** Among the independent variables we consider broker position in affective and instrumental networks and three demographic variables: gender, educational attainment and seniority.

To identify the individuals occupying a broker's position in affective and instrumental social networks, we employed the Burt's (1992) measure of constraint. The network constraint captures the extent to which a subject depends on others within her/his own network and the extent to which s/he accesses new and non-redundant information (Burt, 1992, 2008, 2010; Obstfeld, 2005). Network constraint is the reverse of structural holes; this means that high constraint corresponds to a low number of structural holes, whilst low constraint corresponds to a high number of structural holes. The constraint is a summary index, which is computed as follows (equation (1)):

$$C_i = \sum_j c_{ij} \quad i \neq j \quad (1)$$

where  $C_i$  is network constraint on actor  $i$  and  $c_{ij}$  represents a measure of the  $i$ 's dependence on contact  $j$  (equation (2)):

$$c_{ij} = (p_{ij} + \sum_q p_{iq}p_{qj})^2, \quad q \neq i \neq j \quad (2)$$

where:  $p_{ij}$  is the proportion of actor  $i$ 's network time and energy spent on contact  $j$  ( $p_{ij} = z_{ij}/\sum_q z_{iq}$ ). The variable  $z_{ij}$  is the strength of connection between contacts  $i$  and  $j$ .  $c_{ij}$ , which represents the contact-specific constraint, ranges from 0 to 1 according to the network time and energy directly ( $p_{ij}$ ) and indirectly ( $\sum_q p_{iq}p_{qj}$ ) spent by the subject  $i$  on the alter  $j$  (Burt, 1992; 2008; 2010, p. 294).

We computed the constraint measure (Burt, 1992) on the affective and instrumental matrices for each individual using UCINET VI (Borgatti, Everett, & Freeman, 2002). To capture affective and instrumental networks, we generated two matrices; each of them aggregates the three person-centred matrices (friendship, social support and trust) and the three position-centred ones (daily communication, weekly information exchange and task advice). To divide the sample into subsets of individuals occupying broker and non-broker positions in affective and instrumental social network, we used the average constraint of the two types of informal networks as cut off. Hence, we define actors occupying broker positions in affective and instrumental ties those who show a constraint level equal or less than the mean constraint level of the affective and instrumental social network, respectively. Conversely, we define actors occupying non-broker positions in affective and instrumental ties those who show a constraint level greater than the mean constraint level of the affective and instrumental social network, respectively.

***Social demographic variables.*** We check whether there exists a causal relationship between three individual demographic variables: gender, educational attainment and seniority, and the RSs employed by a subject. To examine whether gender impacts on the RS adopted by a person, we generate the *gender* dichotomous variable. We test whether the level of general knowledge possessed by a person (Liu, 2009) affects the networking behaviour of an employee. To capture the level of general knowledge that a person has, we use her/his highest educational degree as proxy. In order to assess its impact on RSs, we create the *educational attainment* variable composed by the following items: middle school

diploma, high school diploma, bachelor's degree, and master's degree. Finally, to evaluate if the number of months that an employee has been working for Star impacts on her/his RS, we define the *seniority* variable. This variable consists of three intervals: 0-12 months, 13-24 months and more than 25 months.

## **Analysis**

The unit of analysis is the individual: the incubator's employee. We use cross-tabulation to explore whether the RSs are affected by the aforementioned variables, namely: actors who occupy broker (compared to non-broker) positions in affective and instrumental networks, gender, educational attainment and seniority. Cross-tabulation is a technique among the more commonly used analytic methods in the social sciences. It represents a joint frequency distribution of cases displayed on the basis of the two or more categorical variables. In order to investigate whether the variables under analysis are statistically independent or – conversely - they are linked by a causal relationship, we analysed the joint frequency distribution by computing the Fisher's exact test for count data. We decided to apply Fisher's exact test for two main reasons: first, because of the small size of our sample; second, because the large expected frequencies assumptions<sup>6</sup> for running the chi-square test were not satisfied.

## **RESULTS**

In tables 3-7, we report the cross-tabulations discussed above.

***RS within instrumental vs affective workplace relationships.*** Tables 2 and 3 explore whether there is a relationship between occupying a broker (compared to non-broker) position in instrumental/affective networks and the RSs that individuals undertake. Our findings show that brokers and non-brokers may differently engage with the informal workplace social networks in which they are embedded according to the networks (affective and instrumental ones) we take into consideration.

From our analysis, it emerges that there exists a direct relationship between occupying broker (compared to non-broker) positions in instrumental networks and the RSs ( $p$ -value = 0.001). This means that there are statistically significant differences on how

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<sup>6</sup> The chi-square test works best in the case in which the expected frequencies are no less than 1 and no more than 20% of them should be less than 5.

brokers, compared to non-brokers, interact with the ties whose relationships are centred on formal positions and reflecting job interdependencies. *Catalyst* or *nomadic* RSs are networking behaviours privileged by brokers within instrumental networks to mobilise their contacts. Conversely, *cliquish* and *sporadic* RSs are networking behaviours mainly employed by non-brokers to use their instrumental social networks (Table 3).

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Table 3 about here

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Table 4 analyses whether there is a contingency between occupying broker (compared to non-broker) positions in affective networks and the RSs. Looking at the joint frequency distribution of cases in which relationships are centred on persons and reflecting interpersonal attraction and trust, we find that - contrary to the previous case - there is no significant differences on how brokers (compared to non-brokers) interact with the ties within their affective workplace social networks (p-value > 0.1).

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Table 4 about here

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***RSs and demographic variables.*** We controlled for the relationship between the RSs and three individual variables: gender, educational attainment and seniority. Results on Tables 5, 6 and 7 show that RSs are independent of gender, level of education and seniority respectively (p-value > 0.1).

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Tables 5-7 about here

## **DISCUSSION AND CONCLUSIONS**

To fully capture the role of individuals in the process by which network structure constitutes social capital (Burt, 2010) we cannot neglect this agentic dimension. This essay contributes to an agent-centric perspective in social network theory by examining the relational actions through which actors occupying broker and non-broker positions



concretely use their affective and instrumental social relationships. In particular, we focus on a specific way to mobilise the social networks for exchanging resources at work: the engagement in F2F interaction within the organisation. The use of direct interaction, indeed, plays a pivotal role in defining relational behaviours and allows us to discriminate between potential (those who structurally occupy a broker position *but* do not behave as such) and actual brokers (those who structurally occupy a broker position *and* behave as such). By giving a picture of the individual's use of her/his affective and instrumental social networks through F2F interaction, the present work provides insights on the mechanisms underlying network effects on outcomes.

From a theoretical point of view, we contribute to the understanding of how occupying a broker (compared to non-broker) position in affective and instrumental ties allows actors to engage differently with their informal workplace social networks in performing their everyday tasks. Findings and data analysis represent an attempt to define the extent to which individual demographic variables and structural position, such as people occupying a broker (compared to the non-broker) position, in instrumental as well as affective networks explain variance in the focal RSs. Our results suggest that individuals occupying a broker position in instrumental networks display different behaviours compared to ones occupying a broker position in affective networks. The use of affective relationships requires more psychological attention as affective ties entail emotional bonds (McAllister, 1995) that go beyond professional obligations. These findings contribute to a much more nuanced theoretical perspective on brokerage behaviour. More specifically, the findings contribute to defining a more contingent, cultural-specific, theory of brokerage behaviour (e.g. Galaskiewicz, 2007; Burt, 1997). From this perspective, the actual behaviour of brokers may vary depending on the content of the tie and the expectations embedded in different workplace contexts, because 'the cultural meaning attached to name generators such as friend, neighbor, drinking buddy, workmate, boss, acquaintance, etc. make a big difference' (Galaskiewicz, 2007:7). Thus, brokers may be expected to act and interact differently depending not only on the strength of the tie (Burt, 1997) but also on the content of the tie (affective vs. instrumental). Workplace relationships are driven by different sources and characterised by different discretionary levels, affect-intensive ties in the workplace are relatively more discretionary (Sasovova *et al.*, 2010: 641, 663) than instrumental ones. For these reasons, employees are more likely to strategically act when they use instrumental networks instead of affective-based relationships (Sasovova *et al.*, 2010: 663).

## **Limitations and future research**

As any other study, this essay has a number of limitations. We did not have the possibility to control the impact of employee's personality traits on direct interactions. It would be interesting to look at whether and how the direct communication flow changes according to the individual propensity to sociability (Hatch, 1987), stimulus screening capacity, inhibitory ability, and perceived privacy (Maher & von Hippel, 2005). Our investigation can be extended in other directions. First, future research should investigate if there exists a relationship between the interplay of the structural positions that an employee occupies in different social networks and her/his relational style. Second, it would be useful to capture relational styles of actors occupying broker and non-broker positions in affective and instrumental networks by looking at individual's relational trajectories on a daily basis.

This work presents limits of generalisability. Indeed, the study is based on an incubator supporting start-ups working in the new media sector located in Italy. To firmly establish the relationship between occupying a broker (compared to non-broker) position in affective and instrumental workplace relationships and RSs, the research field should be carried out both in organisations belonging to different industries (e.g. manufacturing sector) and in organisations located in different cultural settings.

## REFERENCES

- Alani, H., Szomsor, M., Cattuto, C., Van den Broeck, W., Correndo, G. & Barrat, A. 2009. Live Social Semantics. *8th International Semantic Web Conference ISWC 2009*, Lecture Notes in Computer Science 5823. 698-714, [http://dx.doi.org/10.1007/978-3-642-04930-9\\_44](http://dx.doi.org/10.1007/978-3-642-04930-9_44)
- Argote, L. (1999). *Organizational learning: Creating, retaining, and transferring knowledge*. Boston: Kluwer Academic.
- Barrat, A., & Cattuto, C. 2013. Temporal networks of face-to-face human interactions. In *Temporal Networks*: 191-216. Springer Berlin Heidelberg.
- Bell, G. G. & Zaheer, A. (2007). Geography, Networks, and Knowledge Flow. *Organization Science*. 18(6): 955-972.
- Bensaou, B.M., Galunic, C. & Jonczyk-Sédès, C. (2013). Players and Purists: Networking Strategies and Agency of Service Professionals, *Organization Science*. Articles in Advance, pp. 1–28.
- Blau, P. M. (1962). Patterns of choice in interpersonal relations. *American Sociological Review*, 27: 41-55.
- Borgatti, S. P., Everett, M. G. & Freeman, L. C. (2002). *Ucinet for Windows: Software for social network analysis*. Harvard, MA: Analytic Technologies.
- Brass, D J. (1992). Power in organizations. A social network perspective. In G. Moore and J. A. Whitt (eds), *Research in Politics and Society*. 295-323. Greenwich, CT JAI Press.
- Burt, R.S. (1992). *Structural holes: The Social Structure of Competition*. Cambridge, Mass: Harvard University Press.
- Burt, R. S. (1997). A note on social capital and network content. *Social Networks*, 19:355-373.
- Burt, R. S. (2002). Bridge decay. *Social Networks*, 24: 333–363.
- Burt, R.S. (2004). Structural holes and good ideas. *The American Journal of Sociology*. 110(2): 349-399.
- Burt, R. S. (2005). *Brokerage and closure*. Oxford. Oxford University Press.
- Burt, R. S. (2008). Industry performance and indirect access to structural holes. *Advances in Strategic Management*, 25: 315-360.
- Burt, R. S. (2010). *Neighbor networks: Competitive advantage local and personal*. Oxford: Oxford University Press.
- Buskens, V., & van de Rijt, A. (2008). Dynamics of networks if everyone strives for structural holes. *American Journal of Sociology*, 114: 371-407.

- Carley, K. M. (1991). A theory of group stability. *American Sociological Review*, 56: 331-354.
- Carlile, P. R. (2004). Transferring, translating and transforming: An integrative and relational approach to sharing and assessing knowledge across boundaries. *Organization Science*, 15: 555–568.
- Casciaro, T. & Lobo, M.S. (2008). When competence is irrelevant: The role of interpersonal affect in task-related ties. *Administrative Science Quarterly*, 53: 655-684.
- Cattuto, C., Van den Broeck, W., Barrat, A., Colizza, V., Pinton, J-F, *et al.* 2010. Dynamics of Person-to-Person Interactions from Distributed RFID Sensor Networks. *PLoS ONE*. 5(7): e11596. doi:10.1371/journal.pone.0011596
- Choudhury, T. & Pentland, A. (2003). *Sensing and modeling human networks using the sociometer*. Proceedings of the Seventh IEEE International Symposium on Wearable Computers (ISWC).
- Conrath, D. W. (1973). Communications environment and its relationship to organizational structure. *Management Science*, 20(4): 586–603.
- Dougherty, D. (1992). Interpretive barriers to successful product innovation in large firms. *Organization Science*, 3(2): 179–202.
- Duff, A. (1994). *Best Practice in Business Incubator Management*. Booragoon, Australia: AUSTEP Strategic Partnering Pty.
- Emirbayer, M. & Goodwin, J. (1994). Network analysis, culture, and the problem of agency. *American Journal of Sociology*, 99(6): 1411-54.
- Emirbayer, M. & Mische, A. (1998). What Is Agency? *American Journal of Sociology*, 103(4): 962-1023.
- Flanagin, A.J. & Metzger, M. J. (2001). Internet use in the contemporary media environment. *Human communication research*, 27(1): 153-181.
- Fernandez, R.M. & Gould, R.V. (1994). A dilemma of state power: Brokerage and influence in the national health policy domain. *American Journal of Sociology*, 99(6).
- Galaskiewicz, J. (2007). Has a network theory of organizational behaviour lived up to its promises? *Management and Organization Review*, 3(1): 1-18.
- Gibbons, D. E. (2004). Friendship and advice networks in the context of changing professional values. *Administrative Science Quarterly*, 49: 238–262.
- Gould, R.V. (1989). Power and social structure in community elites. *Social Forces*, 68(2): 531-552.
- Granovetter, M. S. (1974). *Getting a job: A study of contacts and careers*. Cambridge, Mass.: Harvard University Press.

- Lazarsfeld, P. F. & Merton, R. K. 1954. Friendship as a social process: A substantive and methodological analysis. In *Freedom and control in modern society*, edited by Monroe Berger, Theodore Abel, and Charles H. Page. New York: Van Nostrand: 18–66.
- Hallen, B. L., & Eisenhardt, K. M. (2012). Catalyzing strategies and efficient tie formation: how entrepreneurial firms obtain investment ties. *Academy of Management Journal*, 55(1), 35-70.
- Hallowell, E.M. (1999). The Human Moment at Work. *Harvard Business Review* (January-February).
- Hargadon, A. & Sutton, R.I. (1997). Technology brokering and innovation in a product development firm. *Administrative Science Quarterly*, 42: 716–749.
- Hatch, M. J. (1987). Physical barriers, task characteristics, and interaction activity in research and development firms. *Administrative Science Quarterly*, 32: 387–399.
- Hite, J. M. (2008). The role of dyadic multi-dimensionality in the evolution of strategic network ties. *Advances in Strategic Management*, 25, 133-170.
- Ibarra, H. (1992). Structural alignments, individual strategies, and managerial action: Elements toward a network theory of getting things done. In N. Nohria & R. G. Eccles (Eds.), *Networks and organizations: Structure, form and action*: 165-188. Boston: Harvard Business School Press.
- Ibarra, H. & Andrews, S. B. (1993). Power, social influence, and sense making. Effects of network centrality and proximity on employee perceptions. *Administrative Science Quarterly*, 38:277-303.
- Ingram, P. & Morris, M.W. (2007). Do People Mix at Mixers? Structure, Homophily, and the “Life of the Party”. *Administrative Science Quarterly*. 52: 558–585.
- Isella, L., Romano, M., Barrat, A., Cattuto, C., Colizza, V., *et al.* 2011(a). Close encounters in a pediatric ward: measuring face-to-face proximity and mixing patterns with wearable sensors. *PLoS ONE*. 6(2): e17144.
- Isella, L., Stehlé, J., Barrat, A., Cattuto, C., Pinton, J.F., *et al.* 2011(b). What’s in a crowd? Analysis of face-to-face behavioral networks. *Journal of Theoretical Biology*. 271: 166–180.
- Jehn, K. A., & Shah, P. P. (1996). Interpersonal relationships and task performance. An examination of mediating processes in friendship and acquaintance groups. *Academy of Management Proceedings*: 279-283.
- Johnson, B., Lorenz, E. & Lundvall, B.A. (2002). Why all this fuss about codified and tacit knowledge? *Industrial and Corporate Change*. 11(2): 245-262.
- Kanter, R.M. (1983). *The change masters*, New York: Simons & Schuster.
- Kanter, R.M. (1989). The new managerial work. *Harvard Business Review*, 6:85-92.

- Kossinets, G., & Watts, D. J. (2006). Empirical analysis of an evolving social network. *Science*, 311: 88–90.
- Kotter, J.P. (1982). *The general managers*. New York: Free press.
- Kotter, J.P. (1985). *Power and influence: Beyond formal authority*. New York: Free press.
- Krackhardt, D. (1992). The strength of strong ties. The importance of philos in organizations. In N. Nohria and R. G Eccles (eds ), *Networks and Organizations Structure, Form, and Action*. 216-240 Boston: Harvard Business School Press.
- Laumann, E. O., & Pappi, F. U. (1976). *Networks of collective action: A perspective on community influence systems*. New York: Academic Press.
- Lazega, E., & Pattison, P. E. (1999). Multiplexity, generalized exchange and cooperation in organizations: a case study. *Social networks*, 21(1), 67-90.
- Lin, N. (1999). Building a Network Theory of Social Capital. *Connections*. 22(1): 28-51.
- Lincoln, J. R. & McBride, K. (1995) Resources, homophily, and dependence: Attributes and asymmetric ties in human service networks. *Social Science Research*, 14: 1–30.
- Lincoln, J.R. & Miller, J. (1979). Work and friendship ties in organizations: A comparative analysis of relation networks. *Administrative Science Quarterly*, 24(2):181-199.
- Liu, C.C. (2009). *A Spatial Ecology of Structural Holes: Scientists and Communication at a Biotechnology Firm*. Doctoral Dissertation. DRUID
- Lyons, T. S. 2002a. *Building Social Capital for Sustainable Enterprise Development in Country Towns and Regions: Successful Practices from the United States*. In Conference on the Future of Australia's Country Towns. Bendigo: Australia. URL (October, 2001): <http://www.regional.org.au/au/countrytowns/keynote/lyons.htm>
- Lyons, T. S. 2002b. Building Social Capital for Rural Enterprise Development: Three Case Studies in the United State. *Journal of Developmental Entrepreneurship*. 7(2): 193–216.
- Maher, A. & von Hippel, C. (2005). Individual differences in employee reactions to open-plan offices. *Journal of Environmental Psychology*. 25: 219–229.
- Marsden, P. V. (1982). Brokerage behavior in restricted exchange networks. *Social structure and network analysis*, 7(4): 341-410.
- McAllister, D.J. (1995). Affect- and Cognition-Based Trust as Foundations for Interpersonal Cooperation in Organizations. *Academy of Management Journal*, 38(1): 24-59.
- McFadyen, M. A., & Cannella, A. A. (2004). Social capital and knowledge creation: Diminishing returns of the number and strength of exchange relationships. *Academy of Management Journal*, 47(5), 735-746.
- McPherson, J. M. & L. Smith-Lovin. 1987. Homophily in voluntary organizations: Status

distance and the composition of face-to-face groups. *American Sociological Review*, 52: 370–79.

Mehra, A., Kilduff, M. & Brass, D.J. (2001). The social networks of high and low self-monitors: Implications for workplace performance. *Administrative Science Quarterly*, 46(1): 121-146.

Nohria, N. & Eccles, R. (1992). *Face-to-face: Making network organizations work in Networks and Organizations*. Harvard Business School Press.

Nonaka, I., & Takeuchi, H. (1995). *The knowledge creating company*. Oxford University Press, Oxford.

Obstfeld, D. (2005). Social Networks, the tertius iungens Orientation, and involvement in Innovation. *Administrative Science Quarterly*, 50: 100-130.

Padgett, J.F. & Ansell, C.K. (1993). Robust action and the rise of the Medici, 1400-1434. *American Journal of Sociology*. 98(6):1259-1319.

Poldony, J.M. & Baron, J.N. (1997). Resources and relationships: Social networks and mobility in the workplace. *American Sociological Review*, 62(5): 673-693.

Rice, R. E. (1992). Task analyzability, use of new media, and effectiveness: A multi-site exploration of mediarichness. *Organization Science*. 3(4): 475-500.

Ryall, M. D., & Sorenson, O. (2007). Brokers and competitive advantage. *Management Science*, 53: 566–583.

Salancik, G.R. (1995). Review: WANTED: A good network theory of organization. *Administrative Science Quarterly*, 40(2): 345-349.

Sasovova, Z., Mehra, A., Borgatti, S. P., & Schippers, M. C. (2010). Network churn: The effects of self-monitoring personality on brokerage dynamics. *Administrative Science Quarterly*, 55(4), 639-670.

Sherman, H. & Chappell, D. S. (1998). Methodological Challenges in Evaluating Business Incubator Outcomes. *Economic Development Quarterly*, 12(4): 313–22.

Simmel, G. (1950). *The sociology of Georg Simmel* (KH Wolff, Trans.). Glencoe, IL: Free.

Soda, G. & Zaheer, A. (2012). A network perspective on organizational architecture: Performance effects of the interplay of formal and informal organization. *Strategic Management Journal*, 33(6): 751-771.

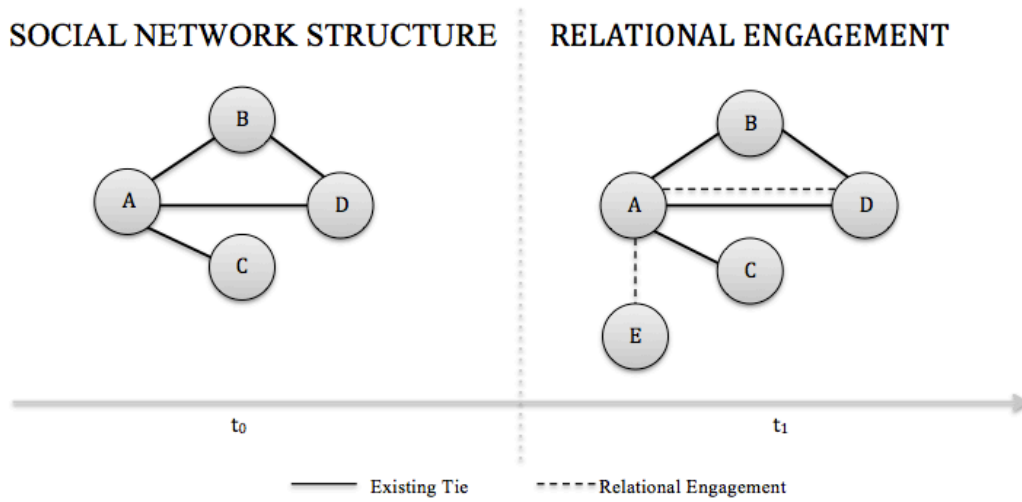
Stehlé, J., Voirin, N., Barrat, A., Cattuto, C., Isella, L., *et al.* 2011 (a). High-Resolution Measurements of Face-to-Face Contact Patterns in a Primary School. *PLoS ONE*. 6(8): e23176. doi:10.1371/journal.pone.0023176

Stehlé, J., Voirin, N., Barrat, A., Cattuto, C., Colizza, V., Isella, L. *et al.* 2011 (b). Simulation of a SEIR infectious disease model on the dynamic contact network of conference attendees. *BMC Medicine*. 9:87

- Stevenson, W.B. & Greenberg, D. (2000). Agency and social networks: Strategies of action in a social structure of position, opposition, and opportunity. *Administrative Science Quarterly*, 45: 651-678.
- Strauss, A.L. (1993). *Continual permutations of action*. Walter de Gruyter, Inc., New York.
- Tichy, N. M., Tushman, M. L. & Fombrun C. (1979). Social Network Analysis for Organizations. *The Academy of Management Review*, 4(4):507-519.
- Tiwana, A. (2008). Do bridging ties complement strong ties? An empirical examination of alliance ambidexterity. *Strategic Management Journal*, 29: 251–272.
- Tortoriello, M., & Krackhardt, D. (2010). Activating cross-boundary knowledge: the role of Simmelian ties in the generation of innovations. *Academy of Management Journal*, 53(1), 167-181.
- Tötterman, H. & Sten, J. (2005). Start-ups: Business Incubation and Social Capital. *International Small Business Journal*. 23: 487.
- Vissa, B. (2012). Agency in Action: Entrepreneurs' networking style and initiation of economic exchange. *Organization Science*, 23(2): 492–510.
- Weeks, J., Fayard, A.L. (2011). Blurring Face-to-Face and Virtual Encounters. *Harvard Business Review*, *HBR Blog Network*.
- Van den Broeck, W., Cattuto, C., Barrat, A., Szomsor, M., Correndo, G. & Alani, H. 2010. The Live Social Semantics application: a platform for integrating face-to-face presence with on-line social networking, *First International Workshop on Communication, Collaboration and Social Networking in Pervasive Computing Environments (PerCol 2010)*, Proceedings of the 8th Annual IEEE International Conference on Pervasive Computing and Communications, Mannheim, Germany (2010) 226-231.
- Zott, C., & Huy, Q. N. (2007). How entrepreneurs use symbolic management to acquire resources. *Administrative Science Quarterly*, 52(1): 70–105.



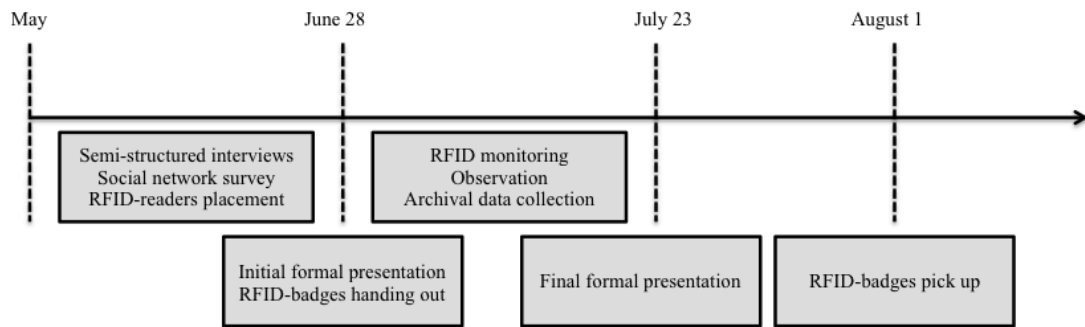
**FIGURES**



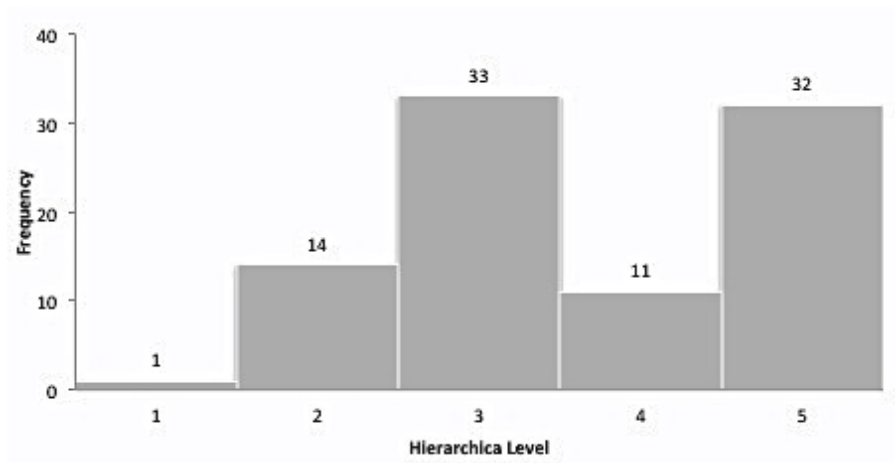
**Figure 1.** Example of Social Network Structure and Relational Engagement

		<b>Relational Breadth</b> (Number of interaction partners)	
		<i>Broad</i>	<i>Narrow</i>
<b>Relational Effort</b> (Duration of interaction)	<i>High</i>	Catalyst	Cliquish
	<i>Low</i>	Nomadic	Sporadic

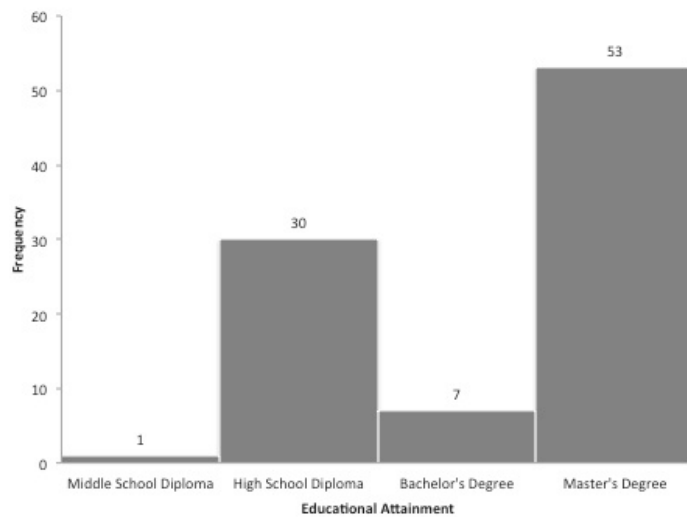
**Figure 2.** Relational Styles



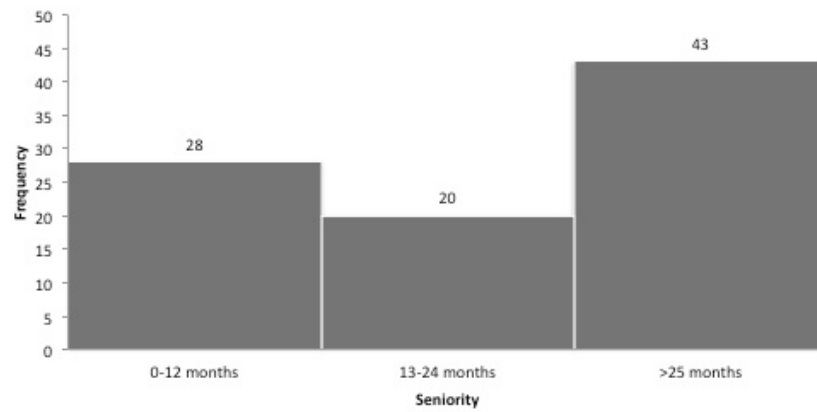
**Figure 3.** Data Collection Process



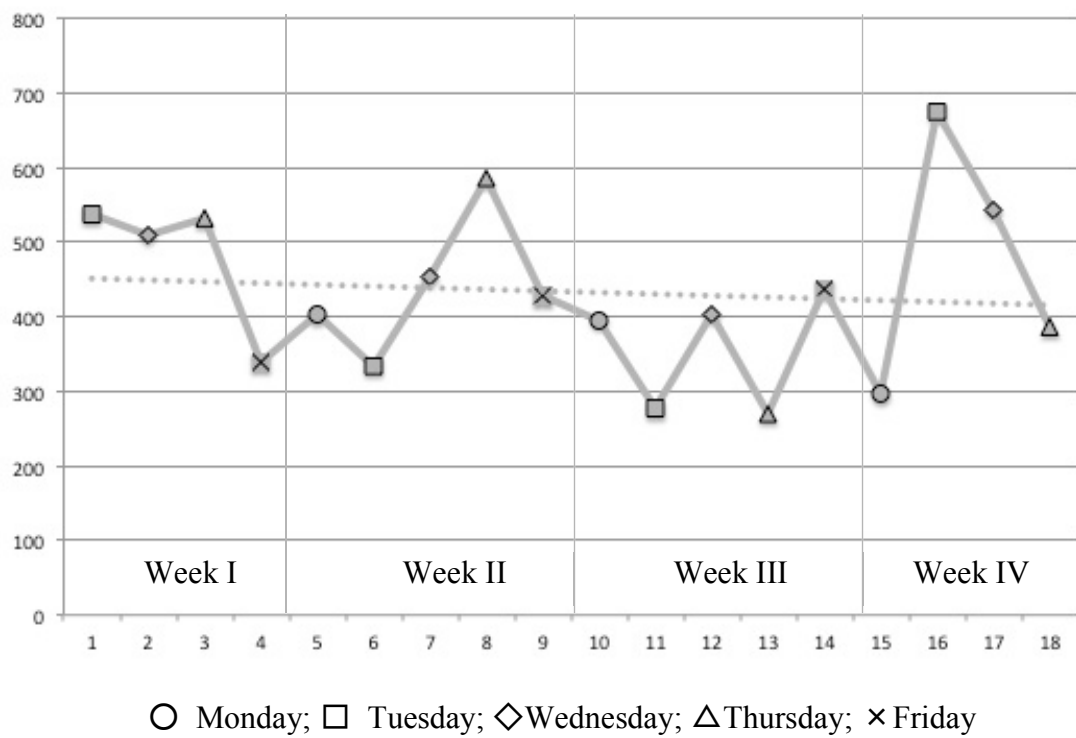
**Figure 4.** Hierarchical Level Sample Distribution



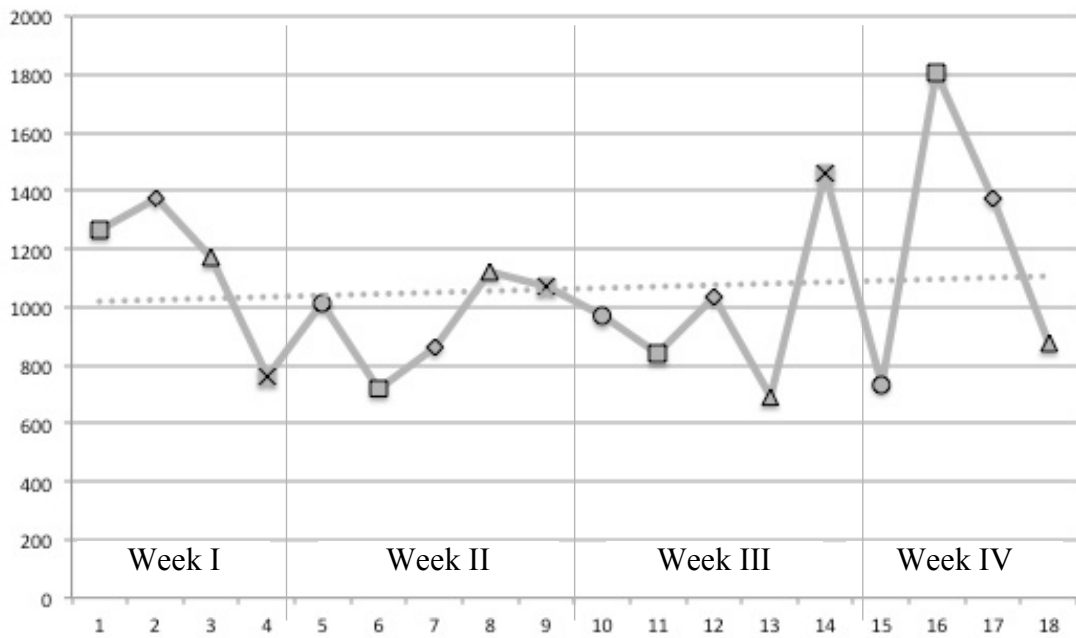
**Figure 5** Educational Attainment Sample Distribution



**Figure 6.** Seniority Sample Distribution

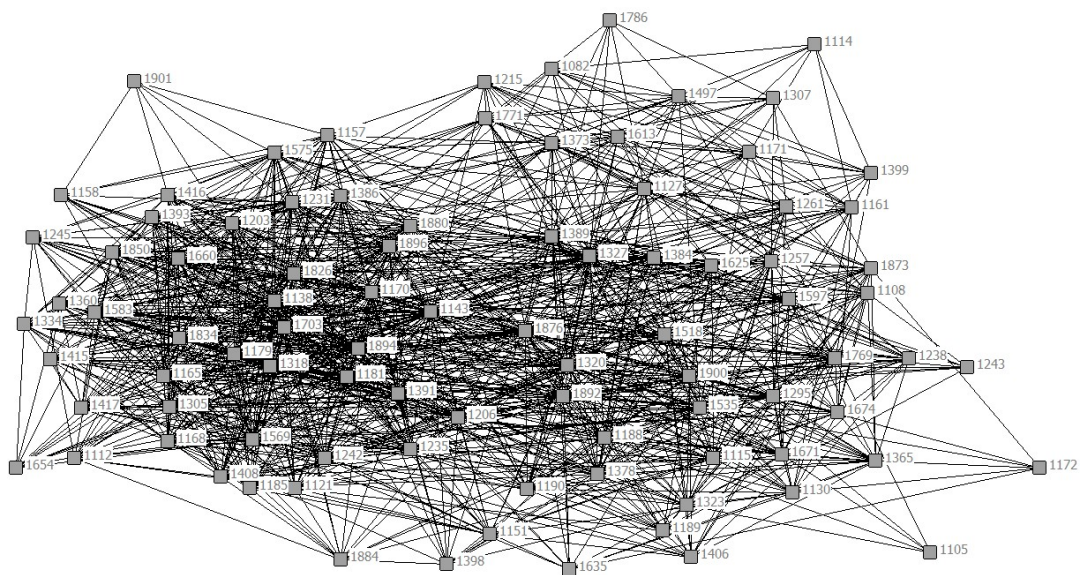


**Figure 7.** Number of Daily F2F Interactions

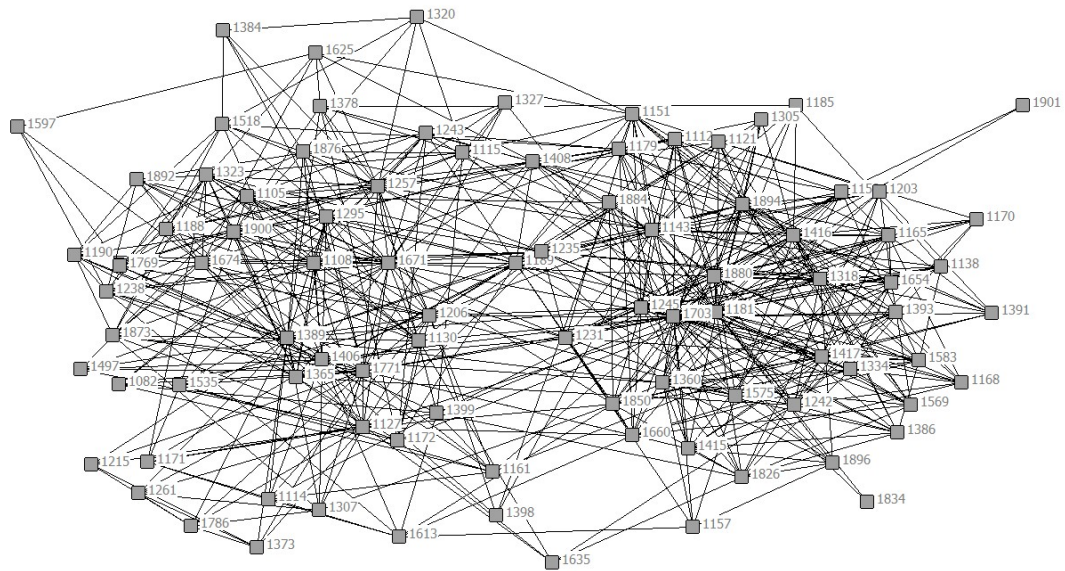


○ Monday; □ Tuesday; ◇ Wednesday; △ Thursday; × Friday

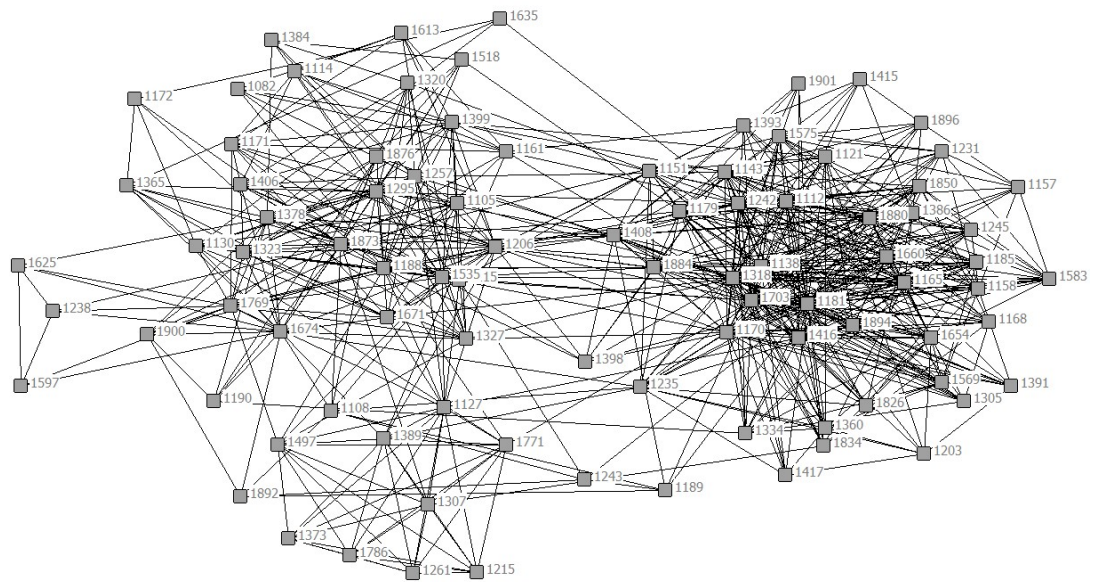
**Figure 6.** Cumulative Duration (in minutes) of Daily F2F Interaction



**Figure 9.** F2F Social Network



**Figure 10.** Affective Social Network



**Figure 11.** Instrumental Social Network

## TABLES

**Table 1.** Main Features of Star

Characteristics	
Location	Italy
Industry	Miscellaneous Financial Investment Activities (NAICS 2007 Code: 523999)*
Year of establishment	2005
Size (turnover)	2.4 million US Dollar in 2010 and 158 thousand US Dollar in 2012
Number of incubaties	11 start-ups incubated in 2010 and 47 start-ups incubated in 2012
Performance (average annual compound growth rate comuted on operating revenue)	Growth rate -74%

Source: \* ORBIS database

**Table 2.** Main Features of Dyadic F2F Interactions at Star

Week #	Day #	Number of daily F2F interactions	Cumulative duration of daily F2F interactions	Number of weekly F2F interactions	Cumulative duration of weekly F2F interactions
1	1	537	1265	1917	4572
	2	509	1376		
	3	532	1170		
	4	339	761		
2	5	402	1012	2201	4787
	6	334	721		
	7	452	861		
	8	586	1122		
	9	427	1071		
3	10	396	967	1782	4987
	11	276	837		
	12	403	1034		
	13	270	692		
4	14	437	1457	1899	4783
	15	296	735		
	16	675	1802		
	17	542	1371		
	18	386	875		
Mean		433.28	1062.72	1949.75	4782.25
Std. Dev.		112.39	301.30	177.87	169.46

**Table 3.** Cross-tabulation: Broker (compared to Non-Broker) position in Instrumental Social Networks and RS

			Instrumental Social Networks		
			Non-Brokers	Brokers	Row Total
RSs	Cliquish	N	1.00	0.00	1.00
		Expected N	0.37	0.63	
		N/Row Total	1.00	0.00	0.01
		N/Column Total	0.03	0.00	
		N/Table Total	0.01	0.00	
	Sporadic	N	25.00	21.00	46.00
		Expected N	17.19	28.81	
		N/Row Total	0.54	0.46	0.50
		N/Column Total	0.73	0.37	
		N/Table Total	0.28	0.23	
	Catalyst	N	6.00	23.00	29.00
		Expected N	10.84	18.17	
		N/Row Total	0.21	0.79	0.32
		N/Column Total	0.18	0.40	
		N/Table Total	0.07	0.25	
	Nomadic	N	2.00	13.00	15.00
		Expected N	5.60	9.40	
		N/Row Total	0.13	0.87	0.17
		N/Column Total	0.06	0.23	
		N/Table Total	0.02	0.14	
Column Total	N	34.00	57.00	91.00	
	N/Table Total	0.37	0.63		

Note: Fisher's Exact Test for Count Data (Alternative hypothesis: two sided), p-value= 0.001.

**Table 4.** Cross-tabulation: Broker (compared to Non-Broker) position in Affective Social Networks and RSs

			Affective Social Networks		
			Non-Brokers	Brokers	Row Total
RSs	Cliquish	N	1.00	0.00	1.00
		Expected N	0.35	0.65	
		N/Row Total	1.00	0.00	0.01
		N/Column Total	0.03	0.00	
		N/Table Total	0.01	0.00	
	Sporadic	N	17.00	29.00	46.00
		Expected N	16.18	29.82	
		N/Row Total	0.37	0.63	0.50
		N/Column Total	0.53	0.49	
		N/Table Total	0.18	0.32	
	Catalyst	N	9.00	20.00	29.00
		Expected N	10.20	18.80	
		N/Row Total	0.31	0.69	0.32
		N/Column Total	0.28	0.34	
		N/Table Total	0.10	0.22	
	Nomadic	N	5.00	10.00	15.00
		Expected N	5.28	9.73	
		N/Row Total	0.33	0.67	0.17
		N/Column Total	0.16	0.17	
		N/Table Total	0.05	0.11	
Column Total	N	32.00	59.00	91.00	
	N/Table Total	0.35	0.65		

Note: Fisher's Exact Test for Count Data (Alternative hypothesis: two sided), p-value= 0.62.

**Table 5.** Cross-tabulation: Gender and RSs

			Gender		
			Female	Male	Row Total
RSs	Cliquish	N	0.00	1.00	1.00
		Expected N	0.40	0.60	
		N/Row Total	0.00	1.00	0.01
		N/Column Total	0.00	0.02	
		N/Table Total	0.00	0.01	
	Sporadic	N	19.00	27.00	46.00
		Expected N	18.20	27.80	
		N/Row Total	0.41	0.59	0.50
		N/Column Total	0.53	0.49	
		N/Table Total	0.21	0.29	
	Catalyst	N	10.00	19.00	29.00
		Expected N	11.47	17.53	
		N/Row Total	0.35	0.65	0.32
		N/Column Total	0.28	0.34	
		N/Table Total	0.11	0.21	
	Nomadic	N	7.00	8.00	15.00
		Expected N	5.93	9.07	
		N/Row Total	0.47	0.53	0.17
		N/Column Total	0.19	0.15	
		N/Table Total	0.08	0.09	
Column Total	N	36.00	55.00	91.00	
	N/Table Total	0.40	0.60		

Note: Fisher's Exact Test for Count Data (Alternative hypothesis: two sided), p-value= 0.80.

**Table 6.** Cross-tabulation: Educational Attainment and RSs

			Educational Attainment				Row Total
			Middle School Diploma	High School Diploma	Bachelor's Degree	Master's Degree	
RSs	Cliquish	N	0.00	0.00	0.00	1.00	1.00
		Expected N	0.01	0.33	0.08	0.58	
		N/Row Total	0.00	0.00	0.00	1.00	0.01
		N/Column Total	0.00	0.00	0.00	0.02	
		N/Table Total	0.00	0.00	0.00	0.01	
	Sporadic	N	1.00	13.00	4.00	28.00	46.00
		Expected N	0.51	15.17	3.54	26.79	
		N/Row Total	0.02	0.28	0.09	0.61	0.50
		N/Column Total	1.00	0.43	0.57	0.53	
		N/Table Total	0.01	0.14	0.04	0.31	
	Catalyst	N	0.00	9.00	1.00	19.00	29.00
		Expected N	0.32	9.56	2.23	16.89	
		N/Row Total	0.00	0.31	0.03	0.66	0.32
		N/Column Total	0.00	0.30	0.14	0.36	
		N/Table Total	0.00	0.10	0.01	0.21	
	Nomadic	N	0.00	8.00	2.00	5.00	15.00
		Expected N	0.17	4.95	1.15	8.74	
		N/Row Total	0.00	0.54	0.13	0.33	0.17
		N/Column Total	0.00	0.27	0.29	0.09	
		N/Table Total	0.00	0.09	0.02	0.06	
Column Total	N	1.00	30.00	7.00	53.00	91.00	
	N/Table Total	0.01	0.33	0.08	0.58		

Note: Fisher's Exact Test for Count Data (Alternative hypothesis: two sided), p-value= 0.39.



**Table 7.** Cross-tabulation: Seniority and RSs

		Seniority			Row Total	
		0-12 months	13-24 months	>25 months		
RSs	Cliquish	N	0.00	1.00	0.00	1.00
		Expected N	0.31	0.22	0.47	
		N/Row Total	0.00	1.00	0.00	0.01
		N/Column Total	0.00	0.05	0.00	
		N/Table Total	0.00	0.01	0.00	
	Sporadic	N	17.00	10.00	19.00	46.00
		Expected N	14.15	10.11	21.74	
		N/Row Total	0.37	0.22	0.41	0.50
		N/Column Total	0.61	0.50	0.44	
		N/Table Total	0.18	0.11	0.21	
	Catalyst	N	9.00	4.00	16.00	29.00
		Expected N	8.92	6.37	13.70	
		N/Row Total	0.31	0.14	0.55	0.32
		N/Column Total	0.32	0.20	0.37	
		N/Table Total	0.10	0.04	0.18	
	Nomadic	N	2.00	5.00	8.00	15.00
		Expected N	4.61	3.30	7.09	
		N/Row Total	0.13	0.33	0.54	0.17
		N/Column Total	0.07	0.25	0.19	
		N/Table Total	0.02	0.06	0.09	
Column Total	N	28.00	20.00	43.00	91.00	
	N/Table Total	0.31	0.22	0.47		

Note: Fisher's Exact Test for Count Data (Alternative hypothesis: two sided), p-value= 0.24.

## **ESSAY III**

### **Homophilous behaviours in fleeting interactions. An RFID-based case study of an incubator**

Mariachiara Barzotto

**Acknowledgement:** This essay is part of a research project led by the Institute for Scientific Interchange Foundation (Turin, Italy) and Ca' Foscari University. We gratefully acknowledge the support provided by the Institute for Scientific Interchange Foundation (Turin, Italy) in designing the original data collection project and in providing the RFID technology and platform to make it possible.

## ABSTRACT

*Individual face-to-face (F2F) encounters within organisations still are an essential driver for creativity and innovation. In organisations where flexibility, quick response and knowledge exchange through networks are prominent features for competitiveness, short F2F encounters might play an irreplaceable role in nurturing social relations, channelling timely information, and sharing knowledge. Notwithstanding the large use of fleeting interactions in organisations, there is scant evidence on their features and their determinants. The aim of the study is to provide a deeper understanding of the antecedents driving the employees' decision to briefly meet a colleague. Bridging different explanations, I investigate three different antecedents: social and organisational similarities, as well as office layout. The data analysed consisted of 5,908 dyadic fleeting F2F interactions among 91 employees of a private incubator. By using Radio-Frequency Identification (RFID) badges, I recorded the dyadic engagement in fleeting interactions over a 4-week observation period. This study extends research on F2F encounters in two ways. It casts new light on Granovetter's weak tie theory by identifying the determinants of fleeting interactions and showing that considering a determinant independently of the other ones can be potentially misleading in understanding workplace interpersonal connections. Moreover, it provides rich and grounded evidence on fleeting encounters by using an original research method. Implications on patterns of fleeting interactions at the organisational level are discussed.*

**KEYWORDS:** *Fleeting Face-to-Face Interaction, Similarity Forms, Workplace Layout, RFID (Radio-Frequency Identification) Badges.*

## INTRODUCTION

Information transfer and knowledge sharing among employees are key drivers of innovation and they play an indispensable role in affecting company performance (e.g. Hansen, 1999; Nonaka & Takeuchi, 1995). The transfer of information and knowledge may occur by using a direct type of communication (such as: F2F interaction) or a mediated communication (such as: phone, instant messaging, and e-mail). In spite of the increasing use of mediated communication - especially internet-based systems such as videoconference, social network and e-mail (Flanagin & Metzger, 2001; Rice, 1992) - as medium of knowledge sharing within and across organisations, literature on innovation and knowledge management has recognised the still irreplaceable role of F2F encounters in the workplace (e.g. Hallowell, 1999; Olson & Olson, 2001). Recent works assess the positive effect of the use of F2F communication on individual and team performance (e.g. Ancona, 1990; Ancona & Caldwell, 1992; Salter & Gann, 2003; Toker & Gray, 2007) in today's organisations. Among these studies, I highlight an MIT research quoted by

Pentland (2009) showing that the productivity of employees with the most cohesive F2F networks is 30% higher than their colleagues. In management literature there are many examples in which dynamic and highly innovative organisations (e.g. IDEO case studied by Hargadon and Sutton in 1997) support impromptu and planned F2F encounters. Such a support has been raised even by companies such as Apple (Isaacson, 2012) and Google (Fortune, 2012), which have largely contributed to create mediated-communication media. The latter, however, are profusely used to facilitate the continuance of relationships previously created through F2F communication (Brass, Galaskiewicz, Greve, & Tsai, 2004).

Research along this line has pointed out that individuals use this communication medium for fleeting interactions within organisations (e.g. Isaacs, Whittaker, Frohlich, & O’Conaill, 1997). According to these works, the average time that employees spent in a direct interpersonal communication is brief as individuals rapidly switch to another interaction (Su, Mark, & Sutton, 2007) and/or another activity. The engagement in short encounters on a daily basis seems to underline activation of “weak ties” (Granovetter, 1974) among an employees’ communication network. Despite the acknowledgement of the presence of this synchronous type of interaction, not enough attention has been devoted to studying the use and the antecedents of fleeting F2F encounters. Hence, the interest in, as well as the necessity of, shedding light on short encounters, which are common within organisations but different from the stable interactions usually captured by social network studies.

Social network literature has mainly explained the interaction among people, such as the engagement in F2F encounter, by looking at the actors' attributes (e.g. Lazerfeld & Merton, 1954; McPherson & Smith-Lovin, 1987) and the network structure in which individuals are embedded (e.g. Zahn, 1991). Specifically, this stream of research refers to the tendency of people to form ties with those whom they share similar characteristics. This stream of literature has devoted marginal attention to the impact of office layout on interaction, although literature on management and architecture shows the influence of the overall workplace configuration on organisational communication (e.g. Allen, 1977; Rashid, Kampschroer, Wineman, & Zimring, 2006; Rashid, Wineman, & Zimring, 2009).

Yet, there has been no empirical evidence that the aforementioned drivers might explain fleeting interactions, and there has been no systematic research integrating these determinants. Thus, the aim of the present work is to investigate which are the antecedents driving an employee’s efforts of briefly meet a colleague in order to understand her/his

relational behaviour. I will explore how social and organisational similarities affect the employee's decision to engage in fleeting F2F encounters, and shed light on how space interacts with social and organisational drivers. I will investigate the antecedents' impact on the amount of fleeting F2F encounters. Thus, my research questions are the following: Do different types of similarity and space layout impact differently on fleeting encounters frequency? How does space interact with combinations of similarities in fleeting F2F encounters between two employees?

I answer these questions investigating two forms of similarity and how they, independently or jointly taken, impact on employee's fleeting F2F behaviour, and how the spatial layout could affect encounters of employees who are similar, at the dyadic level of analysis. The focus of this work is not to analyse *what* people communicate but *why* and *how* employees shortly interact in the social environment in which they are embedded. I analyse why and how individuals engage in fleeting F2F interaction by testing whether social and organisational similarity as well as space translate into communication "behavioural homophily" (Stehlé, Charbonnier, Picard, Cattuto, & Barrat, 2013). I propose to enrich extant literature on interaction by exploring the use of fleeting F2F encounters in an organisational context in which knowledge sharing is a key driver of innovation.

I empirically investigate this issue through an original field study, conducted in a private incubator of the Internet and digital industry. The data collection lasted 4 weeks, during this period I monitored minute-by-minute dyadic F2F interactions on a daily basis among 91 employees who wore RFID devices. These unobtrusive badges enable us to gather data on the employees' engagement in fleeting F2F through which I was able to build a behavioural network where nodes represent employees and a link between two nodes implies that those employees have spent time facing each other (Stehlé, Charbonnier, Picard, Cattuto, & Barrat, 2013). This method allows us to examine properties of weak ties, which are difficult to capture using diaries, questionnaires and observations.

The next section provides a discussion of the three above-mentioned different antecedents of fleeting F2F encounters in everyday working life. This is followed by a section on the methodological approach and the presentation of the findings. Finally, results are discussed and both theoretical and managerial implications on patterns of fleeting interaction in organisations are drawn.

## **THEORETICAL BACKGROUND: ANTECEDENTS OF ENGAGEMENT IN FLEETING F2F INTERACTION**

F2F interaction has been defined as a synchronous speech among two or more people engaged in any reciprocal exchanges in close physical proximity (Oldham & Rotchford, 1983; Zalesny & Farace, 1987; Warkentin, Sayeed, & Hightower, 1997). The occurrence of a F2F interaction entails the intentional effort of two or more individuals to align their activities in a short time period and in the same space. The logic of efficiency driving private organisations and the fixed amount of working hours at employees' disposal lead individuals to judge how much time to devote to interaction and with whom to interact. This means that employees have to cope with a crucial trade-off between time invested in this type of interaction and other organisational activities. Hence, the choice of sharing a "mutually meaningful experience in a common physical space" (Nardi & Whittaker, 2002) is expression of the fact that employees consider F2F the most efficient medium to use for executing their daily tasks. Hence, the importance of understanding what might explain employees' efforts of sharing time and space for fleeting interacting with colleagues.

The efficiency of F2F in channelling resources among individuals is mostly linked to the richness of this communication medium (Treviño, Webster, & Stein, 2000) both in terms of availability and ability to transmit effective components of interaction (O'Kane & Hargie, 2007). Due to F2F richness, people who meet during either *impromptu* or planned encounter are able to convey complex and tacit knowledge (Bell & Zaheer, 2007) as well as develop trust (Nohria & Eccles, 1992; Rocco, 1998) more easily. The possibility to rely on trust-based relations, in turn, facilitates the sharing of tacit and strategically crucial information among employees (Johnson, Lorenz, & Lundvall, 2002). These are both aspects considered essential in the production process of creative ideas (Conrath, 1973; Nonaka & Takeuchi, 1995) within organisations. Furthermore, scholars acknowledge that, within organisations, individuals use direct communication to accomplish fundamental functions, such as: problem solving, complex coordination and social learning (Isaacs, Walendowski, Whittaker, Schiano, & Kamm, 2002; Kraut, Fish, Root, & Chalfonte, 1990).

Different types of tie could explain how employees use fleeting F2F interaction during their working hours. According to previous literature I group these ties into three sets: social, organisational and spatial. In the following sections, I focus on examining how the presence/absence of one or more kinds of similarity and the possibility to share the

same working space, may contribute to a deeper understanding of the engagement in fleeting direct encounters between two employees.

### **Friendship as a Social Focus of Fleeting Direct Communication**

A long tradition of studies shows the tendency of people to form ties with others whom they share similar characteristics, that is the so-called homophily principle (e.g. McPherson & Smith-Lovin, 1987). Previous research has mainly focused on two types of homophily: “status homophily” based on individual socio-demographic dimensions and “value homophily” based on individual values, attitudes, and beliefs (Lazarsfeld & Merton, 1954). This principle defines network ties of every type; one of these networks is friendship (McPherson, Smith-Lovin & Cook, 2001), which represents an important part of the informal organisational network (e.g. Casciaro & Lobo, 2008; Gibbons, 2004; Krackhardt, 1992).

Generally, a node’s friendship network does not represent a random sample of the population under study (Easley & Kleinberg, 2010) since friends are similar along different dimensions; both status and value ones. Sharing characteristics of different nature with friends explains people’s desire to spend time in interacting (Ingram & Morris, 2007; Soda & Zaheer, 2012) with them. Ties centred on formal positions and reflecting job interdependencies (Podolny & Baron, 1997) are built on logic of cost and efficiency (Casciaro & Lobo, 2008). Conversely, friendship ties are costly as people are expected to spend time and energy to build and maintain that type of relationship (e.g. McFadyen & Cannella, 2004). Affective ties bond tighter and require more psychological attention than instrumental types of ties. Accordingly, people are more likely to preserve a friendly image when they act on their affective relationships.

Since people like spending time with friends, and friendship requires that individuals make an effort to foster the growth of this affective tie, I hypothesise that employees are likely to invest energy to meet a colleague even for short F2F interaction. The brief meeting might help maintain the friendship. Thus, I posit the following hypothesis.

*Hypothesis 1. The number of fleeting encounters between two employees increases if they are friends.*

## **Organisational Links as Driver of Fleeting F2F Interaction**

Interactions within companies are not only voluntary and affective-based (mainly driven by friendship links) but they are also spurred by the organisational structure itself. Formal boundaries group employees together, make them share the same tasks and responsibilities, learn the same specific communication code and unit culture, increasing their similarity and enabling knowledge and information exchange among them (Brass *et al.* 2004; Zahn, 1991). Employees use direct communication to provide and/or be provided with resource depending on the formal roles covered by individual within the organisation. These types of ties are activated following logic of cost and efficiency (Casciaro & Lobo, 2008). Due to the absence of social content, employees do not expect and are not expected to be generous when they look for information, advice or opportunities to solve their problems in the workplace.

Inside a company, labour is mainly divided and coordinated according to three dimensions: organisation units in which individuals work, employees' jobs and hierarchical positions covered by them. In the next sections, I will investigate the impact of these three dimensions on fleeting F2F encounters.

***Fleeting F2F engagement and unit membership.*** The design of organisational unit boundaries is mainly determined by the identification of all those activities whose separation leads to diseconomies. Several elements contribute to the specification of which activities should be included in a given unit, such as: formal workflow relations (both sequential and reciprocal interdependences - e.g. Thompson, 1967), "member's goal orientation, member's time orientations and member's interpersonal orientations" (Lawrence & Lorsch, 1967:1).

Sharing interdependences and orientations should smooth communication processes among people working in the same organisational unit, facilitating the occurrence of fleeting F2F encounters. I expect that brief synchronous interactions ease those communications that Allen (1986) defines as communications for accomplishing coordination among tasks and activities, and communications for providing information about product development. For these reasons and because of the absence of expectation of social content in the communication, I infer that belonging to the same unit membership positively affects fleeting F2F interaction among employees. Thus, I hypothesise:



*Hypothesis 2a. The number of fleeting encounters between two employees increases if they work in the same organisational unit.*

***Fleeting F2F engagement and speciality community.*** Knowledge sharing and information transfer within organisations might be influenced by speciality community (Kellogg, Orlikowski & Yates, 2006) membership. In other words, the professional family to which employees belong should affect fleeting communication flows within organisations. Employees might consider it easier to briefly converse with colleagues having similar job tasks; such ease can be determined by the fact that being employed in similar tasks often means sharing interests (Kellogg *et al.*, 2006) and using common lexicons (Carlile, 2004), or adopting standard operating procedures (Nelson & Winter 1982). The constructivism, a sociological approach developed by Carley (1991), is based on the assumption that people having the same knowledge are more likely to interact. The possibility of availing of a colleague facing similar problems and conveying the message using a common language should smooth communication processes thanks to a quick understanding of the counterpart's needs. Thus I expect that fleeting F2F interactions among colleagues of the same speciality community are eased, despite the organisational unit to which they belong. I therefore hypothesise:

*Hypothesis 2b. The number of fleeting encounters between two employees increases if they belong to the same speciality community.*

***Fleeting F2F engagement and hierarchical level.*** In the coordination theory (Crowston, 1997) hierarchy is one mechanism influencing communication. There are two ways by which this mechanism affects interaction patterns: one vertical underlying superior-subordinate relationship and one horizontal underlying peer relationship (Whitbred *et al.*, 2011). As Hurwitz, Zander and Hymovitch (1960) showed, the choice of the exchange information partner might be determined by the employee's position in the hierarchical level. For instance, in the case of advice communication flow, people tend to seek advice among colleagues with whom they share status homophily (Lazega *et al.*, 2010). The choice of conversing with peers instead of superiors could be driven by the fact that lower status employees prefer not to show their superiors what they do not know. At the same time, higher status employees prefer not to seek advice from people below them in the hierarchy in order to not lose their status. The lower status recognition needed

back in a peer relationship decreases the cost of advice from similar people (Lazega *et al.*, 2010). Communications among employees sharing the same hierarchical level should require less formality compared to the ones involving a superior-subordinate relationship. For all these reasons, an employee might be more prone to briefly interact with a colleague positioned at the same hierarchical level. Thus, I expect that the presence of status hierarchy impacts on communication flow, enhancing the frequency of fleeting interactions within hierarchical status groups, and inhibiting the frequency of fleeting interactions across hierarchical status groups.

*Hypothesis 2c. The number of fleeting encounters between two employees increases if they belong to the same hierarchical level.*

### **Office Layout as Facilitator and Obstacle to Fleeting F2F Interaction**

Since the engagement in fleeting F2F interaction is a behaviour occurring in a given location, the analysis of the space in which short encounters occur is fundamental to understanding how employees use this communication medium in the workplace.

Previous literature has studied space as one of the factors affecting F2F communication the most (Oldham & Brass, 1979; Oldham, Cummings, & Zhou, 1995; Oldham & Rotchford, 1983; Rafii, 1995). Space is a behaviour conditioner since, according to the effect of walls and furniture on creating the chance of interaction, it can be considered a F2F opportunity generator as well as a barrier (Boutellier, Ullman, Schreiber, & Naef, 2008; Stryker, 2005). Space is a non self-evident meaning and abstract concept (Bengtsson, Müllern, Soderholm, & Wahlin, 2007). Schoenberg (2000) describes it as a mix of physical and abstract attributes constructed through social processes. Indeed, space is not only a concrete construct related to a physical or geographical location; it also goes beyond the real dimension to assume an intrinsic meaning of originator and promoter of values and norms of the context of which it is an integral part. In the '70s-'80s, organisation theory and architecture literature devoted particular attention to study the impact of a set of space variables on organisational communication and social interaction patterns (e.g. Allen & Fusfeld, 1974; Oldham & Rotchford, 1983; Sundstrom, 1986). Despite previous findings highlighted both the importance of F2F interaction within organisations and the relationship between office layout and employees' communication,

starting from the '90s the analysis of workspace seems to be neglected in organisational literature.

In the present essay I evaluate the relationship between space and the engagement in fleeting F2F in the light of studies on the new “physical, social and virtual work environments” (Nenonen, 2004). In particular, I focus on examining how sharing the same office space affects fleeting interactions among employees by looking at two spatial variables: the closeness of working stations (co-location) and the possibility for employees to see colleagues from their desks (visibility).

***Fleeting F2F engagement and co-location.*** Among communication media, F2F interaction is most influenced by physical location (e.g. Allen, 1997; Treviño *et al.*, 2000; Van den Bulte & Moenaert, 1998). Indeed, distance can be considered a contextual constraint to F2F meeting (Reinsch & Beswick, 1990). Previous studies claim that a worker’s willingness to move to meet a colleague is inversely proportional to the distance s/he has to cover (e.g. Allen & Fusfeld, 1974; Hatch, 1987). Proximity increases the chance of impromptu encounters in which workers can share knowledge and transfer information (Davis, 1984). Allen and Fusfeld (1974) find that the probability of weekly communication shows a low asymptotic communication level within the first 25 or 30 metres. Not only impromptu encounters are affected by the physical proximity but also planned ones. Indeed, planning a meeting becomes more difficult as distance between offices rises (Van den Bulte & Moenaert, 1998). Monge, Rothman, Eisenberg, Miller and Kirste (1985) provide a social psychological interpretation of the positive relationship between location and F2F interaction. They state that people may perceive physical proximity with co-workers not only as an opportunity but also an obligation for informal interactions, such as greetings.

Although the use of computer-based communication media (i.e. Skype and e-mail) has increased over time even over short distances, I expect that the positive effect of co-location on the frequency of F2F communication works especially in the case of brief direct encounters enabling the arranging of planned meetings and the incurring of impromptu encounters.

*Hypothesis 3a. The number of fleeting encounters between two employees increases if they work in the same physical area.*

***Fleeting F2F engagement and visibility.*** Studies (Hall, 1966; Rashid *et al.*, 2006) provide evidence that visible co-presence (people seeing each other reciprocally) positively

affects F2F interaction, because a worker is more inclined to move and talk with a colleague if s/he can see the interlocutor from her/his own desk (Parsons, 1976). F2F interaction increases in workplaces where visibility is high, such as the ones located close to atriums or hallway areas (Stryker, 2005). Comparing offices with different visibility and accessibility levels, Rashid *et al.* (2009) report that the number of F2F interactions per workspace increases significantly in the presence of better visibility even though individual workspaces remain the place where interactions occur the most. The possibility to see co-workers from the individual's own desk has positive effects on carrying out tasks as it makes people aware of what other colleagues are doing and to whom they relate. In the case of problematic occurrence, the visible co-presence allows employees to provide unquestioned help in order to solve the issue (Appel-Meulenbroek, 2010) because employees see what the other person is doing. Moreover visibility should help to align activities and movements, facilitating a planned fleeting encounter. Two employees can choose the right moment to briefly meet, when simply monitoring each other at sight, they detect that the other is free from other tasks and available for a fleeting encounter. Hence, I test the following hypothesis:

*Hypothesis 3b. The number of fleeting encounters between two employees increases if they can see each other from their own desks.*

### **The Interplay of Similarity Dimensions on Fleeting F2F Interaction**

Although according to the homophily principle, people are inclined to stay with those whom they share common aspects, the interrelation of different similarity foci has been overlooked (McPherson *et al.*, 2001). Indeed, we do not know how the dyadic F2F encounter and, in particular, the fleeting F2F encounter might be influenced by the interplay of social and organisational similarity as well as space. The present essay aims at studying this interplay by looking at two combinations of different kinds of similarity linking employees and the office configuration in which they work.

***Fleeting F2F engagement and social and organisational similarity.*** As Reagans and McEvily stated, “individuals who have a strong emotional attachment are more likely to share knowledge than those who are not emotionally attached” (2003: 244). At work friendship (Jehn & Shah, 1996) favours cooperation among colleagues. Indeed, the presence of a multiplex tie built on co-work and friendship relationships facilitates the

creation of advice ties (Lazega & Pattison, 1999). Friendship ties among work groups smooth status differences present in advice network serving as a bridge supporting both advice and co-workers' goodwill networks (Lazega & Pattison, 1999). For instance in supportive relationships among employees, work-related information and knowledge exchange among employees is enabled by the presence of trust, empathy and reciprocity (Bacharach, Bamberger, & Vashdi, 2005; Uzzi, 1996), which are elements that characterise this kind of workplace tie. The intimacy present in friendship (Gibbons, 2004) enables shared understandings, clear communication and exploration of new professional ideas without threatening the relationship. Indeed, employees tend to support friends' new ideas since they expect that those "come with good intentions, and the stability of the relationship provides a safe venue for mutually exploring unproven thoughts". Such a relationship has positive consequences not only on employees' wellbeing (e.g. Fried & Tiegs, 1993; Thomas, 1993) but also on performance at the individual level (Ibarra, 1997) as well as at the company one (Shah & Jehn, 1993). "Positive interpersonal affect increases a person's reliance on competence as a criterion for choosing task partners, facilitating access to organisational resources relevant to the task" (Casciaro & Lobo, 2008: 655); hence, positive feelings underlying friendship relationships should promote engagement in fleeting F2F interaction among friendly colleagues. Therefore, I expect that the existence of friendship ties and organisational ties positively affect the number of fleeting co-present communications. I suppose that this positive effect on fleeting F2F interaction might be found even if two employees are not located in the same area and/or have no possibility to see each other from their own workstations.

*Hypothesis 4. The co-presence of social and organisational similarity increases the number of fleeting encounters between two employees who do not work in the same area and/or in visible co-presence.*

***Fleeting F2F engagement and social similarity with space impact.*** Conversely to instrumental ties that channel work-related information, friendship is a relationship that costs time and energy to be maintained. People enjoy spending time with friends but they are expected to demonstrate feelings of attachment (Mayer, Davis, & Schoorman, 1995; McAllister, 1995) to those whom they consider a friend in order to nurture this tie. As mentioned above, by showing attachments to friendly colleagues, fleeting F2F interaction could be considered a channel through which friendships are nurtured. Working close to friends, and/or having the possibility to see them from their own desk, are elements that

should facilitate the carrying out of those activities necessary to maintain friendship ties. As consequence, it should increase the volume of fleeting interaction even in the case where the two friends are not liked by any organisational similarities.

*Hypothesis 5. In the absence of organisational similarity, the number of fleeting encounters increases if two friendly employees work in the same area and/or in visible co-presence.*

## **METHODS**

### **Setting and Data**

**Field research and setting.** The present essay aims at analysing the dynamics of fleeting F2F interactions in a highly innovative organisation. The project involves an innovative organisation: a private international incubator called *Star* (pseudonym). *Star* was established in Italy 2005 and competes in the Web, Digital and New Media sector. This incubator has an international presence with four subsidiaries in the United States, United Kingdom and India. At the time this study was conducted, *Star* supported 10 start-ups of the Internet and Digital Media sector by providing them with seed capital, granting the finance necessary for the early stage activities, as well as a bundle of services to speed up the business development: general administration, press office, human resources, legal and financial consultancy and assistance in defining the commercial strategies, business plans, partnerships and exit strategies.

Incubators represent a unique setting to analyse, as the purpose for which such organisational structures are created, among others, is to foster social capital building within companies supported by incubators themselves. An incubator and its internal networks facilitate resource pooling (Tötterman & Sten, 2005) by allowing start-ups to share resources (Lyons, 2002a, 2002b) and networking among the incubator residents. The co-location of the tenants' companies provides start-ups with "a symbiotic environment" (Tötterman & Sten, 2005: 489), which paves the way towards formal and informal (Lyons, 2002a) relationships among incubatees (Sherman & Chappell, 1998; Duff, 1994).

Besides these general reasons, the choice of *Star* is determined by the fact that this incubator is an extremely fertile reality for different points of views. First, it allows us to study a highly innovative setting given the sector in which it competes. Second, from an

architectural point of view, the variety of office layouts offered by Star enables us to explore the impact of the workplace environment either in promoting or inhibiting fleeting encounters among employees. Third, from an organisational point of view, the co-presence of several incubatees and the rich composition of employees' expertise present in Star allow us to draw reflections on the employees' use of the incubator's resources.

**Data collection.** The empirical research is based on an integrated research approach, drawing on a qualitative study of the incubator's organisation and quantitative analysis of RFID<sup>7</sup> (e.g. Cattuto *et al.*, 2010; Isella *et al.*, 2011a; 2011b) data. Four primary sources were used in a 4-week field study carried out in June and July 2010: RFID-based data combined with semi-structured interviews, observation, and survey. Before data collection began, a meeting was organised with all the incubator's employees to illustrate and share the aims of project and field research method in detail. At this meeting, their willingness to participate was requested. The consent process ensured that employees voluntarily participated in the research, accepting to be observed during the analysis of office layout, to wear an RFID device for a month and to answer a survey on their social networks.

I gathered information on formal organisation charts as well as employees' job titles by semi-structured interviews with the two human resource managers. The author conducted 3 interviews with the two incubator's HR managers to gather information on start-ups' formal organisation as well as their employees' job titles. During these interviews, blueprints of 5 buildings were collected. HR managers provided information about the desk assignment of each employee. The architect was interviewed with the aim of ascertaining to what extent the workplace layout was built to enable both impromptu and planned social interaction. Each interview lasted on average 1.5 hour. Since I was not allowed to record the interviews, notes were taken during the interviews, writing up and expanding these within 24 hours of each interview, following the 24-hour rule (Eisenhardt, 1989; Miles & Huberman, 1994).

In order to accurately keep track of the incubator's workplace environment, I spent five days in the field observing the work practices and gathering information on Star's physical layout. Around 600 pictures of office layouts were taken.

Before the field study began, an online 15-item survey was administered. This questionnaire was composed of two sections: the first block of questions concerned

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<sup>7</sup> This study has been carried out with the collaboration with SocioPatterns. For detailed information on SocioPatterns and the use of this technology, see also: The SocioPatterns project. Available: <http://www.sociopatterns.org/>. Accessed 2013 November 2.

individual socio-demographic attributes, the second part consisted of free choice roster questions on workplace social networks (such as: friendship, task advice, trust, social support, and acquaintance networks).

Finally, I captured fine-grained data on all the everyday F2F interactions among employees by using RFID technology. This technology allowed us to gather data on behavioural network based on individuals' time-varying proximity (Stehlé *et al.*, 2013). The real time F2F interaction network was recorded by RFID tag, an unobtrusive electronic device consisting of a small chip and an antenna. The tag uses bidirectional low-power radio communication and it detects contacts during which participants who wear it are facing each other at a maximum distance of 1.50 metres. If such a configuration is sustained for longer than one minute, then this indicates that some form of social interaction is taking place. The 1-minute parameter was chosen so as to record only actual encounters, and not "spurious proximity such as two people walking past each other" (Ingram & Morris, 2007: 567). The RFID tag transmits information on interactions to the closest RFID reader (receiving station), which records the encounters. Twelve RFID readers were placed all over the workplace environment, covering the incubator's main indoor and outdoor areas (Figure 1). I monitored F2F interaction for 24 hours per day and 7 days per week over the 4-week observation period. The analysis is based on 18 working days. I did not consider the first and the last days of observation because during these days RFID badges were distributed and collected, respectively, to employees and, while handling them, interactions that did not actually take place were recorded. I did not consider weekends since there was no interaction over those days. Employees had very flexible working hours. Their flexibility had an impact on the time window I analysed. I decided to consider a 12-hour time window interval (from 8.30 a.m. to 8.29 p.m.) due to the fact that these times are the average of, respectively, the first and last communication of each day.

I chose to implement a data collection approach based on RFID badges because it helps to overcome limitations and respondents biases of data collection gathered by using both observation and survey methods. This technology provides a more accurate measure number and duration of F2F encounters than the ones obtainable via survey and observation. It does not suffer from individual's recall biases and, as it is unsupervised, it imposes less constraint in terms population size (Stehlé *et al.*, 2013). This device is a powerful tool to collect F2F interaction as shown by recent studies that apply this technology in several different settings, such as: primary schools (Stehlé *et al.*, 2011(a)),



scientific conferences (Cattuto *et al.*, 2010; Alani *et al.*, 2009; Van den Broeck *et al.*, 2010; Stehlé *et al.*, 2011(b); Isella *et al.*, 2011(b)); pediatric hospitals (Isella *et al.*, 2011(a)) and museums (Isella *et al.*, 2011(b)). Indeed, wearable sensors allow the gathering of social sensing infrastructure (Barrat & Cattuto, 2013) by capturing the strength (analysed by number and average duration) of F2F human interactions with high accuracy. The accuracy is given by the fact that the device provides the “finest resolution of F2F proximity” (Barrat & Cattuto, 2013:1). According to the study in which Choudhury and Pentland (2003) employed IR sensors, it has been shown that performance accuracy of sociometer badges in capturing F2F conversations is 87,5% for conversations greater or equal to one minute (the duration I are considering in the present work).

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Figure 1 about here  
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**The sample.** The sample is composed of 164 employees. The participation was voluntary and privacy protection was guaranteed. Sixty per cent of the participants were male. The typical employee is 31 years of age (Std. Dev. = 4.76), has a bachelor’s degree, and has been with the incubator for 25 months (Std. Dev. = 19.06). Within the incubator, it was possible to identify a varied composition of expertise: people who “perform distinct activities, engage unique areas of expertise, enact distinctive identities, invest in particular sets of interests, and use multiple artifacts” (Kellogg *et al.*, 2006: 25). According to this definition and the classification provided by Kellogg and colleague (2006) in a study based in a setting similar to Star’s one, I distinguished the following 6 speciality communities: guardians (start-ups’ marketing and sales managers), planners (project managers), designers (creative), builders (technologists), leaders and clerks (administrative staff). Table 1 classifies and describes the 6 speciality community groups in Star’s context and their distribution over the sample.

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Table 1 about here  
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The formal organisation chart, which includes both incubator and incubatees, consists of 5 hierarchical levels (Figure 2). Figure 3 and 4 illustrate the sample distribution of the employees' education attainment and seniority, respectively.

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Figures 2-4 about here  
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Star's employees are allocated across 5 buildings (10 floors total). Contrary to previous studies (e.g. Allen, 1977; Liu, 2011), I can assume that an employee's desk location is randomly assigned at the start-up level. That is, the space allotted for each incubatee is based on the space availability and not on the presence of specific organisational interdependences with other start-ups. Out of 11 incubator residents, desk positions of employees working for the incubator and those working for another start-up have been assigned in different floors and/or building. For the remainder, the desks of individuals who belong to the same start-up have been co-located on the same building-wing. Star allocated all its employees in 10 open offices and 9 cellular offices. In a single office it is possible to find the co-presence of different incubatees and/or different speciality communities (Figures 5 and 6).

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Figures 5 and 6 about here  
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138 (84.1% of the study population) employees wore the RFID badge on a daily basis. The response rate for the questionnaire was 59.14% as 97 employees filled the survey. Out of 97 employees, I analysed data on 91 subjects (55.5% of the study population) since 6 questionnaires were uncompleted. As I considered 91 employees, the number of potential dyads was 4095. Out of 4095, 1233 (30%) dyads were actually interacting over the 4 weeks. The overall number of fleeting encounters was 5,907. The 46% of the overall social and organisational ties were activated through at least one fleeting F2F contact. The daily engagement in brief F2F interaction among the 91 employees consisted of 328 encounters on average (Std. Dev. = 88.28) (Table 2).

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Table 2 about here  
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## Measures

***Dependent variables.*** The present work studies the employees' engagement in fleeting F2F interaction; that is, the effort put in by people to join others in brief F2F interaction. The engagement in fleeting F2F interaction is observed by using information gathered through RFID badges worn by Star's employees. As previously mentioned, this method avoids informant biases such as the limited recall of individuals about their fleeting contacts, and allows us to collect "large-scale, high-resolution dynamical data on human behaviour in a reproducible manner" (Stehlé *et al.*, 2013: 612).

I capture the employees' engagement in fleeting F2F interaction by looking at a well-established property of social behaviour: the *number of fleeting encounters* between two people. Following Stehlé and colleagues (2013:606) the classification of observed weak ties (in terms of fleeting encounters) is purely behavioural and it depends on an arbitrarily chosen threshold of a quantitative strength. I consider as fleeting interaction every encounter that lasted up to 2 minutes. The rationale that led us to apply a 2-minute cut off is two-fold: first, it is the average duration of all interactions that occurred over the observation period (2.45 minutes); second, it is in line with the average duration of interaction recorded by previous studies (e.g. Su *et al.*, 2007; Isaacs *et al.*, 1997).

***Independent variables.*** *Social similarity:* I use the friendship tie between two employees as proxy of the social similarities linking them. I record the friendship network present in the incubator by asking an individual who is his/her friend among the list of Star's employees provided in the questionnaire. Following Laumann and Pappi (1976: 137), I include all reported ties irrespective of their direction and whether they are reciprocated or not (Lincoln & Miller, 1979: 187). Although some relationships are not symmetrical in the sense as measured by choices reciprocated, building on previous studies (e.g. Granovetter, 1973: 1364), I consider affective ties stable channels "through which messages may travel in two directions" (Lincoln & Miller, 1979: 187). Given the emotional inclination involved in friendship relations, the question I asked implies a symmetric link; that is, if A reports to be friend of B, it follows that also B is friend of A

even if B fails to report it (Lincoln & Miller, 1979: 187; see also Blau, 1962). For these reasons I claim that either A or B are sufficiently informant to acknowledge the presence or absence of a friendship tie between them. This choice is coherent with the undirected F2F data I collected as I captured direct interaction among employees without knowing the direction of the communication. On the basis of this assumption, I construct a dichotomous symmetrized adjacency matrix in which each cell can have either value 1 or 0. Value 1 means that at least one employee stated to be a friend of the other member of the dyad and value 0 if no member of the dyad declared to be a friend of his/her counterpart.

*Organisational similarity*: unit membership similarity, speciality community similarity and hierarchical level similarity. I operationalise *unit membership similarity* as a binary variable; it assumes a value of 1 if two employees belong to the same start-up, a value of 0 otherwise. I code *speciality community similarity* as a binary variable attaching a value of 1 if two employees belong to the same professional family, 0 otherwise. As with previous variables, *hierarchical level similarity* is a binary variable; I attach a value of 1 if two employees belong to the same hierarchical level within the overall incubator's chart, 0 otherwise.

*Office layout*: The first spatial variable I analyse is *co-location*. Following the logic used for the previous independent variables, I treat co-location as a binary variable having a value of 1 if two employees work in the same wing, 0 otherwise. By wing I mean the area covered by each RFID reader. The RFID reader is able to detect the signal emitted by the RFID badge within an area varying from 10 to 30 metres. Such a space interval is a proxy of physical closeness between two individuals' desks, which is consistent with Allen's (1977) findings. Indeed, according to him the first 30 metres represent the separation threshold to the probability of weekly interaction among employees. The second variable I consider is *visibility*. It represents the possibility for the actors forming a dyad to be able to see each other's presence without moving from their own workstation. I operationalise visibility as a dichotomous variable (1 if two employees see each other from their desks, 0 otherwise).

*Control variables*. In all models, I include four categorical control variables to account for socio-demographic dyadic attributes: same age, same gender, same educational attainment, and same seniority. To acknowledge the influence of being the *same age interval* (22-26, 27-30, 31-34, 35-38 and 39-43 years old) has on how two employees briefly F2F interact, I introduce the same-age binary variable. It assumes a value of 1 if the dyad is the same age, 0 otherwise. To reflect any impact that sharing the *same gender*

(Reagans, 2010) produces on the way people engage in fleeting F2F interaction, I generate a dichotomous variable (1 if the dyad is composed by people of the same gender, 0 otherwise). To include the level of general knowledge (Liu, 2011) linking the dyad, I control for the effect that sharing the highest educational degree (such as: middle school diploma, high school diploma, bachelor's degree, and master's degree) might have on fleeting F2F interaction. I create a binary variable, where a value of 1 corresponds to the *same educational attainment* reached by the members of the dyad and 0 implies they obtained a different educational level. Finally, to contemplate the impact on fleeting F2F encounters caused by having been working for Star for an equal number of years, I include the same-seniority dichotomous variable. I code a value of 1 if the dyad has the *same seniority*, 0 otherwise.

## **Analysis**

The unit of analysis is the dyad. The rationale behind this choice is two-fold. First, similarity is a “relational concept” (Brass *et al.*, 2004); that is, a person can only be similar to a subject and dissimilar to another one. Second, the behavioural network captured by the RFID technology is reciprocal by construction.

I compute correlations among the above-mentioned variables and test my hypotheses by using the bootstrapped Quadratic Assignment Procedure (QAP) correlations and regressions (Baker & Hubert, 1981) available in UCINET VI (Borgatti, Everett, & Freeman, 2002). I cannot assess both the Pearson correlations and the effect of different types of similarity and office space on F2F interaction running Ordinary Least Squares (OLS) regressions since the statistical assumptions of independence underlying them are systematically violated. Indeed, subjects embedded in networks are linked one to another; furthermore, the non-independence of observations is due to the fact that dyads located in the same row or column of the matrices share the same actors as endpoints (Borgatti & Feld, 1994).

The QAP correlation calculates Pearson's correlation coefficient between corresponding cells of the two data matrices; one matrix is the observed network and the other is an expected network, generated according to the null hypothesis of no relationship between the matrices (Borgatti & Feld, 1994). The QAP procedure randomly permutes rows and columns (together) of one matrix to then correlate the permuted matrix with the

other input matrix. The permutation takes place hundreds of times to count the proportion of times that a random measure is larger than or equal to the observed correlation. A low proportion ( $p < 0.05$ ) indicates it is unlikely that a strong relationship between the matrices has occurred by chance (Borgatti *et al.*, 2002).

I run a QAP regression according to the Double-Dekker Semi Partialling MRQAP procedure available in UCINET VI. The algorithm works in two steps. The first step consists of a standard multiple regression across corresponding cells of the dependent and independent variables. The second step randomly permutes rows and columns (synchronously) of the matrices and re-computes the regressions hundreds of times. The proportion of all random permutations, that yields a coefficient as extreme as the one originally observed, is counted by the algorithm for each coefficient. The effect of any collinearity amongst the independent variables is partially removed by running a double regression, first on the residuals and the independent variables and then on the all variables and residuals (Borgatti *et al.*, 2002).

## **RESULTS**

In table 2 the descriptive statistics and correlations among the above-mentioned variables are reported.

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Table 3 about here  
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### **Similarities and Office Configurations that Bond at Work**

Antecedents were introduced in blocks. The control variables were introduced in Model I. The first hypothesis is tested in Model II. The second hypothesis is tested in Model III. The third hypothesis is tested in Model IV. The first three hypotheses are tested in Model V. Hypotheses 4 and 5 are tested in Model VI and VII, respectively.

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Table 4 about here  
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Model II in Table 4 explores the effect of social similarity on the number of fleeting F2F encounters between a dyad, it includes controls variables and social similarity (which I have defined as friendship). As predicted in hypothesis 1, social similarity makes the brief encounters between two employees significantly more likely. Indeed, being linked by a friendship tie positively affects (beta  $\approx$  0.33,  $p < 0.001$ ) the number of fleeting encounters involving two employees.

Model III examines the presence of homophilous behaviour in the engagement in fleeting F2F interactions among employees due to organisational similarities linking them. The positive relationship between unit membership similarity and the number of fleeting interactions predicted in hypothesis 2a is supported since the number of brief direct communications is higher among people belonging to the same organisational unit. Speciality community similarity has a positive and statistically significant coefficient; it demonstrates that sharing the same speciality community increases the number of fleeting encounters within the speciality community itself, as predicted in hypothesis 2b. I do not find support for hypothesis 2c as the hierarchical level similarity coefficient is not significant. Hence, the number of times that two employees briefly meet is not affected by belonging to the same hierarchical level within the overall incubator's organisational chart.

Model IV tests the effort performed by individuals in briefly F2F interacting according to their workstation positions. My results are consistent with previous studies on the effect of proximity on communication (e.g. Allen & Fuschel, 1975; Allen, 1977), the positive relationship between co-location and interaction has been present even when people meet each other for short encounters (hypothesis 3a). Indeed, sharing the same working area increases the number of fleeting interactions among employees whose desks are located in that area. The positive and statistically significant coefficient for visibility provides support for hypothesis 3b. Hence, the possibility for the members of a dyad to see the counterpart from their own desks while working positively affects the frequency of fleeting F2F interaction among them.

Model V tests the first three hypotheses. This model provides support to hypotheses 1 and 3 and marginal support to the hypotheses on organisational similarity. I assess the same positive statistically significant relationships between unit membership similarity and number of fleeting encounters. Contrary to Model III, community and hierarchical level similarities show a negative statistically significant impact on the number of fleeting encounters,  $p < 0.6$  and  $p < 0.3$  respectively.

As I predicted (hypothesis 4), Model V shows that the number of fleeting encounters among employees who do not work physically close and/or in visible co-presence increases if they share social and organisational similarities. Conversely, I found that in the absence of organisational similarity the number of fleeting F2F is not affected by the co-presence of social and spatial dimensions (hypothesis 5).

The effects of control variables are fairly consistent across models. Sharing the same education and having been working for the incubator for an equal number of years do not affect fleeting F2F engagement. Being of the same age produces (Model I, III, IV, VI, and VII) a positive, even if marginal ( $p < 0.1$ ), impact on the number of fleeting F2F encounters. Finally, the amount of brief interaction is statistically significantly higher when the subjects involved in the communication are either both female or both male.

I also performed some robustness checks. In particular I controlled for the consistency of the results across different time lengths of short encounters. I computed the regression including all the interactions occurring during the observation period, the ones that lasted more than two minutes and those that lasted at least five-time spells. Results do not change, there are only two slight increases of statistical significance: one related to speciality community driver ( $p < 0.04$ ) in Model V; and, one related to the interplay of social similarity with space in the absence of organisational similarity ( $p < 0.09$ ) in Model VII. Every model run with interactions lasted at least five minutes as dependent variable shows Chi-squares lower than the models with at least two-minute interactions.

## **DISCUSSION AND CONCLUSIONS**

The present work provides insights on the use of fleeting direct interaction in a natural setting such as private organisations. Notwithstanding the valuable impact of F2F interactions on performance (Waber, Olguin Olguin, Taemie, & Pentland, 2010; Wu, Waber, Aral, Bryniolfsson, & Pentland, 2008), the comprehension of the use of fleeting interaction has been limited mainly due to the lack of techniques able to monitor F2F at high granularity levels. This essay analyses the antecedents (expressed in terms of social, organisational and spatial dimensions) driving the intentional effort of two individuals to align their activities in a short time period and in the same space during their working hours.

Although people massively use mediated communication media, organisation



researchers claim the irreplaceability of F2F interaction within organisations and encourage its adoption at the workplace (e.g. Nohria & Eccles, 1992). Regular doses of F2F interaction (Olson & Olson, 2001) nourish work-based relationships (Nardi & Whittaker, 2002) and channel specific forms of knowledge and information considered essential in the production process of creative ideas (e.g. Nonaka & Takeuchi, 1995). The importance of F2F interaction has been especially recognised by those organisations that are highly devoted to innovation and use new computer-communication media intensively (e.g. Apple, IDEO and Google). These organisational contexts promote the use of F2F among employees contrarily to efficiency-oriented organisations. The latest, indeed, try to obstacle co-present communication (in particular *impromptu* encounters), since they are seen as time subtracted from the production process. In previous studies, the type of F2F interaction that emerges as being used within organisations is a short encounter among employees, whose features have hitherto been under-examined in the existing literature.

Given my focus on the role played by fleeting F2F interaction in innovation-oriented organisations, I decided to set the study in an incubator working in the Internet and digital media sector. From direct observation and interviews with Star's architect, it emerges that the incubator and start-ups encourage planned and *impromptu* encounters among employees as they represent channels that promote the "cross-pollination" (Hargadon & Sutton, 1997) of ideas. Such attention to foster direct interaction is even more critical if I consider that the incubator's business focus is the development of web technologies and, as I observed, its employees heavily use computer-mediated communication media (such as: e-mails, Skype, Twitter and Facebook).

## **Contributions**

The study yields several contributions: methodological, empirical and theoretical ones. From a methodological point of view, this study moved beyond the classical research methods on networks (which are mainly based on survey) by using an original data collection approach. The use of RFID badges enables the detection of large-scale dynamical data on human behaviour (in terms of number and the duration of F2F interactions) with higher accuracy than obtainable by gathering data through survey, as standard research methods applied to measure human behaviour are often biased by subjectivity and memory effects (Mohan, Ara, Pentland, Olguin, Waber, & Taemie, 2009).

In a study employing IR sensors, Choudhury and Pentland (2003) show that performance accuracy of sociometer badges in capturing F2F conversations is 87,5% for conversations greater or equal to one minute (equivalent to the one I consider in the present work). This technology enables us to test whether there is a correspondence between behavioural homophily and social, organisational and spatial similarity.

From an empirical point of view, the possibility of having an accurate picture of the fleeting F2F investment done by employees enables a deeper comprehension of the employees' behaviour in the workplace. The elevated granularity of the data collected allows us to quantify the volume of fleeting F2F interactions over 4 weeks. Although the extensive use of computer-mediated communication media observed during the field study, my results show that the investment done by employees on fleeting F2F encounters is not marginal. Indeed, over the 1-month observation period, 46% of the incubator's social and organisational network has been activated by at least one interaction lasting up to 2 minutes. From the analysis, a constant trend emerges in the volume of fleeting direct communications occurring on a daily and weekly basis. Indeed, within a given range of  $\pm 88.28$  fleeting interactions/day, there is no possibility to identify a definite interaction pattern over the week.

The richness of the present setting is twofold: first, the variety of different organisations, speciality communities and office layouts present at Star; second, the distribution in different locations of start-ups and speciality communities within the incubator's spaces. Such a variety and distribution allows us to examine the impact of different drivers on fleeting F2F engagement among employees and draw theoretical implications on the use of this communication medium. From a theoretical point of view, the present work advances the body of literature on social network in the workplace in three main ways. First, it investigates a phenomenon (the fleeting interaction) that, although it is present in today's organisation, there is scant evidence on its use. Second, it reflects the complexity of the working environment by complementing the analysis of interaction at work by adding the spatial dimension to the well-established social and organisational ones. Third, it focuses on how these three dimensions impact on the fleeting F2F engagement among employees when jointly taken. On the second theoretical contribution, I suggest that the fleeting communication flow in an organisation setting is determined not only by social and organisational variables but also by spatial ones. Despite the importance of the office layout in affecting interaction claimed by organisation and architecture researchers, the analysis of the office arrangement has been overlooked in

social network theory. I provide evidence that social network analysts should devote more attention to the environment where ties are formed and managed. The results show that sharing spatial attributes (in terms of working in the same area of another employee and/or being able to monitor his/her presence without moving from their own desk) positively affects fleeting F2F interaction when these variables are taken into consideration independently to organisational and social ties. On the third theoretical contribution, this study tries to test the role played by the interrelation of two different types of similarity and working environment. It shows that the effect of the engagement in conversation might change when we consider different kinds of similarity linking two people and the office layout in which they work. Results provide evidence on how friendship and space (in terms of co-location and/or visibility) promote the communication exchange at the workplace but, in the absence of organisational similarity, the role played by them is not strong enough to enable a robust impact on the number of fleeting encounters. Work setting, indeed, seems to “restrict the freedom of individuals to withdraw from one set of ties and position themselves in another (Lincoln & Miller, 1979: 196). This finding might imply that organisational similarity, particularly driven by unit membership similarity, could act as a trigger of potential interaction among colleagues whose relationships are already facilitated by friendship and spatial layout. Hence, I can conclude that, in the workplace, friendship (Lincoln & Miller, 1979) and workplace layout are determinants of decisions and resource mobilisation that are closely related to work tasks.

### **Limitations and Future Research Directions**

There are different directions in which the present study can be extended. This work represents a first attempt to provide a systematic analysis of how different types of similarity and space, both independently and jointly taken, affect fleeting F2F communication flow within organisations. I do not capture how past history of fleeting encounters influences the dyad’s future behaviour in engaging in brief F2F interaction. The present work should be advanced by dynamic modelling of fleeting F2F conversations, it would allow the study of the presence of path dependence in the way in which employees briefly converse and predict their fleeting communication volume over a finite future time interval.

I decided to examine the dyad as it represents the “fundamental unit of encounter” (Ingram & Morris, 2007: 565); every network structure, indeed, can always be split in

several dyads. A further extension would be to focus on fleeting interaction behaviour at the level of more complex network structures (such as triads or clusters), since employees are not only embedded in dyadic relations but also in triadic or even larger ones. For this reason, future research should advance the present study showing the role played by these similarities and space on the dynamics of fleeting interaction involving structures of three or more groups of employees.

This work presents an issue of generalisability. The present study, indeed, is based on an incubator supporting start-ups working in the Internet and digital media sector. To firmly establish the presence of specific patterns of fleeting F2F interaction due to the three above-analysed dimensions, the same research should be carried out both in organisations belonging to different industries (e.g. manufacturing sector) and in organisations located in different cultural settings. The technology implemented in this work can be easily used in other setting, enabling the comparison of these findings on individuals' homophilous behaviours in other contexts.

## REFERENCES

- Alani, H., Szomsor, M., Cattuto, C., Van den Broeck, W., Correndo, G. & Barrat, A. 2009. Live Social Semantics. *8th International Semantic Web Conference ISWC 2009*, Lecture Notes in Computer Science 5823. 698-714, [http://dx.doi.org/10.1007/978-3-642-04930-9\\_44](http://dx.doi.org/10.1007/978-3-642-04930-9_44)
- Allen, T. J. 1977. *Managing the flow of technology: Technology transfer and the dissemination of technological information with the R&D organization*. Cambridge, MA: MIT Press.
- Allen, T. J. 1986. Organizational structure, information technology and R&D productivity. *IEEE Transaction on Engineering Management*. pp. 212–217.
- Allen, T. J. & Fusfeld, A. R. 1974. *Research laboratory architecture and the structuring of communications*. Working Paper No. 692-74, MIT.
- Ancona, D.G., 1990. Outward bound: strategies for team survival in an organization. *Academy of Management Journal*. 33: 334–365
- Ancona, D.G. & Caldwell, D.F. 1992. Bridging the boundary: external activity and performance in organizational teams. *Administrative Science Quarterly*. 37: 634–665.
- Appel-Meulenbroek, R. 2010. Knowledge sharing through co-presence: added value of facilities. *Facilities*, 28(3/4): 189–205.
- Bacharach, S. B., Bamberger, P. A. & Vashdi, D. 2005. Diversity and homophily at work: Supportive relations among white and African-American peers. *Academy of Management Journal*, 48(4): 619–644.
- Baker, F. B. & Lawrence J. H. 1981. The analysis of social interaction data: A nonparametric technique. *Sociological Methods and Research*, 9: 339-6.
- Barrat, A., & Cattuto, C. 2013. Temporal networks of face-to-face human interactions. In *Temporal Networks*: 191-216. Springer Berlin Heidelberg.
- Bell, G. G. & Zaheer, A. 2007. Geography, networks, and knowledge flow. *Organization Science*, 18(6): 955-972.
- Bengtsson, M., Müllern, T., Soderholm, A. & Wahlin, N. 2007. *A grammar of organizing*. Edward Elgar Publishing.
- Blau, P. M. (1962). Patterns of choice in interpersonal relations. *American Sociological Review*, 27: 41-55.
- Borgatti, S. P., Everett, M. G. & Freeman, L. C. 2002. *Ucinet for Windows: Software for social network analysis*. Harvard, MA: Analytic Technologies.
- Borgatti, S. P. & Feld, S.L. 1994. How to test the strength of weak ties theory. *Connections*, 17(1): 45-46.
- Boutellier, R., Ullman, F., Schreiber, J., & Naef, R. 2008. Impact of office layout on

- communication in a science-driven business. *R&D Management*, 38(4): 372–91.
- Brass, D. J., Galaskiewicz, J., Greve, H. R. & Tsai, W. 2004. Taking stock of networks and organizations: A multilevel perspective. *Academy of Management Journal*, 47(6): 795–817.
- Carley, K. 1991. A Theory of group stability. *American Sociological Review*, 56(3): 331–354.
- Carlile, P. R. 2004. Transferring, translating, and transforming: An integrative framework for managing knowledge across boundaries. *Organization Science*, 15(5): 555–568.
- Casciaro, T. & Lobo, M.S. 2008. When competence is irrelevant: The role of interpersonal affect in task-related ties. *Administrative Science Quarterly*, 53: 655–684.
- Cattuto, C., Van den Broeck, W., Barrat, A., Colizza, V., Pinton, J-F, *et al.* 2010. Dynamics of Person-to-Person Interactions from Distributed RFID Sensor Networks. *PLoS ONE*. 5(7): e11596. doi:10.1371/journal.pone.0011596
- Choudhury, T. & Pentland, A. 2003. *Sensing and modeling human networks using the sociometer*. Proceedings of the seventh IEEE international symposium on wearable computers (ISWC).
- Conrath, D. W. 1973. Communications environment and its relationship to organizational structure. *Management Science*, 20(4): 586–603.
- Crowston, K. 1997. A coordination theory approach to organizational process design. *Organization Science*, 8: 157–175.
- Davis, T. 1984. The influence of the physical environment in offices. *Academy of Management Journal*, 9(2): 271–283.
- Duff, A. 1994. *Best practice in business incubator management*. Booragoon, Australia: AUSTEP Strategic Partnering Pty.
- Eisenhardt, K. M. 1989. Building theories from case study research. *Academy of Management Review*, 14: 532–550.
- Easley, D. & Kleinberg, J. 2010. *Networks, crowds, and markets*. Cambridge Univ. Press.
- Flanagin, A.J. & Metzger, M. J. 2001. Internet use in the contemporary media environment. *Human Communication Research*, 27(1): 153–181.
- Fortune. 2012. *100 Best Companies to Work For 2012*. ULR: <http://money.cnn.com/magazines/fortune/best-companies/2012/snapshots/1.html>
- Fried, Y. & Tiegs, R. B. 1993. The main effect model versus buffering model of shop steward social support: A study of rank-and-file auto workers in the U.S.A. *Journal of Organizational Behavior*, 14(5): 481–493.

- Gibbons, D. E. 2004. Friendship and advice networks in the context of changing professional values. *Administrative Science Quarterly*, 49(2): 238-262.
- Granovetter, M. S. (1974). *Getting a job: A study of contacts and careers*. Cambridge, Mass.: Harvard University Press.
- Hall, E. T. 1966. *The hidden dimension*. Doubleday, New York.
- Hallowell, E.M. 1999. The human moment at work. *Harvard Business Review* (January-February).
- Hansen, M. T. 1999. The search-transfer problem: The role of weak ties in sharing knowledge across organization subunits. *Administrative Science Quarterly*, 44: 82-111.
- Hargadon, A. & Sutton, R. I. 1997. Technology brokering and innovation in a product development firm. *Administrative Science Quarterly*, 42: 716-749.
- Hatch, M. J. 1987. Physical barriers, task characteristics, and interaction activity in research and development firms. *Administrative Science Quarterly*, 32: 387-399.
- Hurwitz, J., A. Zander & Hymovitch, B. 1960. Some effects of power on the relations among group members. In D. Cartwright & Zander, A. (eds.), *Group dynamics*, 2nd ed. New York: Harper & Row.
- Ibarra, H. 1997. Paving an alternative route: Gender differences in managerial networks. *Social Psychology Quarterly*, 60(1): 91-102.
- Ingram, P. & Morris, M.W. 2007. Do people mix at mixers? Structure, homophily, and the "life of the party. *Administrative Science Quarterly*. 52: 558-585.
- Isaacs, E., Walendowski, A., Whittaker, S., Schiano, D. J. & Kamm, C. 2002. *The character, functions, and styles of instant messaging in the workplace*. CSCW '02, November 16-20, 2002, New Orleans, Louisiana, USA.
- Isaacs, E.A., Whittaker, S., Frohlich, D., & O'Conaill, B. 1997. Informal communication re-examined: New functions for video in supporting opportunistic encounters. In Finn, K.E., Sellen, A.J., & Wilbur, S.B. (Eds.), *Video-mediated communication*, New Jersey: Lawrence Erlbaum, pp. 459-485.
- Isaacson, W. 2012. The real leadership lessons of Steve Jobs. *Harvard Business Review*, 90(4): 92-102.
- Isella, L., Romano, M., Barrat, A., Cattuto, C., Colizza, V., et al. 2011(a). Close encounters in a pediatric ward: measuring face-to-face proximity and mixing patterns with wearable sensors. *PLoS ONE*. 6(2): e17144.
- Isella, L., Stehlé, J., Barrat, A., Cattuto, C., Pinton, J.F., et al. 2011(b). What's in a crowd? Analysis of face-to-face behavioral networks. *Journal of Theoretical Biology*. 271: 166-180.
- Johnson, B., Lorenz, E. and Lundvall, B.A. Why all this fuss about codified and tacit

knowledge? *Industrial and Corporate Change*, 11(2): 245-262.

Kraut, R.E., Fish, R.S., Root, R.W. & Chalfonte, B.L. 1990. Informal communication in organizations: Form, function, and technology. In S. Oskamp & S. Spacapan (Eds.), *People's reactions to technology*, Newbury Park: Sage, 145-199.

Kellogg, K., Orlikowski, W.j., & Yates, J. 2006. Life in the trading zone: Structuring coordination across boundaries in post-bureaucratic organizations, *Organization Science*, 17(1): 22–44.

Krackhardt, D. 1992. The strength of strong ties: The importance of philos in organizations. In N. Nohria & R. G. Eccles (Eds.), *Networks and organizations: Structure, form and action*: 216–239. Cambridge, MA: Harvard Business School Press.

Laumann, E. O., & Pappi, F. U. (1976). *Networks of collective action: A perspective on community influence systems*. New York: Academic Press.

Lawrence, P. R., & Lorsch, J. W. 1967. Differentiation and integration in complex organizations. *Administrative Science Quarterly*, 12(1): 1-47

Lazega, E., Mounier, L., Snijders, T. & Tubaro, P. 2010. Norms, status and the dynamics of advice networks: A case study. *Social Network*. doi:10.1016/j.socnet.2009.12.001

Lazega, E. & Pattison, P., 1999. Multiplexity, generalized exchange and cooperation in organizations. *Social Networks*, 21: 67–90.

Lazarsfeld, P. F. & Merton, R. K. 1954. Friendship as a social process: A substantive and methodological analysis. In *Freedom and control in modern society*, edited by Monroe Berger, Theodore Abel, and Charles H. Page. New York: Van Nostrand: 18–66.

Lincoln, J.R. & Miller, J. (1979). Work and friendship ties in organizations: A comparative analysis of relation networks. *Administrative Science Quarterly*, 24(2):181-199.

Liu, C.C. 2011. *A spatial ecology of structural holes: Scientists and communication at a biotechnology firm*. *DRUID Proceedings*. DRUID, 2011.

Lyons, T. S. 2002a. *Building social capital for sustainable enterprise development in country towns and regions: Successful practices from the United States*. In Conference on the Future of Australia's Country Towns. Bendigo: Australia. URL (October, 2001): <http://www.regional.org.au/au/countrytowns/keynote/lyons.htm>

Lyons, T. S. 2002b. Building social capital for rural enterprise development: Three case studies in the United State. *Journal of Developmental Entrepreneurship*. 7(2): 193–216.

Mayer, R.C., Davis, J.H. & Schoorman, F.D. 1995. An integrative model of organizational trust. *Academy of Management Review*, 20(3): 709-734.

McAllister, D.J. 1995. Affect- and cognition-based trust as foundations for interpersonal cooperation in organizations. *Academy of Management Journal*, 38(1): 24-59.

McFadyen, M. A., & Cannella, A. A. (2004). Social capital and knowledge creation:



- Diminishing returns of the number and strength of exchange relationships. *Academy of Management Journal*, 47(5), 735-746.
- McPherson, J. M. & L. Smith-Lovin. 1987. Homophily in voluntary organizations: Status distance and the composition of face-to-face groups. *American Sociological Review*, 52: 370–79.
- McPherson, J. M., L. Smith-Lovin, & J. M. Cook. 2001. Birds of a feather: Homophily in social networks. *Annual Review of Sociology*, 27: 415–44.
- Miles, M. B., & Huberman, A. M. 1994. *Qualitative data analysis: An expanded sourcebook*. (2nd ed.). Thousand Oaks, CA: Sage.
- Monge, P. R., Rothman, L.W., Eisenberg, E. M., Miller, K. I., & Kirste, K. K. 1985. The dynamics of organizational proximity. *Management Science*, 31: 1129–1141.
- Mohan, A., Ara, K., Pentland, A., Olguin, D.O., Waber, B.N. & Taemie, K. 2009. *Sensible organizations: Technology and methodology for automatically measuring organizational behavior*. Systems, man, and cybernetics, Part B: Cybernetics, IEEE Transactions On 39.1: 43-55.
- Nardi, B.A. & Whittaker, S. 2002. The place of face-to-face communication in distributed work. In Hinds, P.J. & Kiesler, S. (Eds.), *Distributed work*. pp. 83-113. Cambridge: MIT Press.
- Nelson, R. & Winter, S. 1982. *An evolutionary theory of economic change*. Cambridge, MA: Harvard University Press.
- Nenonen, S. 2004. Analysing the intangible benefits of work space. *Facilities*. 22(9/19): 233–239.
- Nohria, N., & Eccles, R. G. 1992. Face-to-face: Making network organizations work. In N. Nohria and R. G. Eccles (Eds.), *Networks and organizations: Structure, form and action*. Boston: 288-308. Harvard Business School Press.
- Nonaka, I. & Takeuchi, H. 1995. *The knowledge creating company*. Oxford University Press, Oxford.
- O’Kane, P. & Hargie, O. 2007. Intentional and unintentional consequences of substituting face-to-face interaction with e-mail: An employee-based perspective. *Interacting with Computers*, 19: 20–31.
- Oldham, G. R. & Brass, D. J. 1979. Employee reactions to an open-plan office: A naturally occurring quasi-experiment. *Administrative Science Quarterly*, 24: 267–284.
- Oldham, G. R., Cummings, A. & Zhou, J. 1995. The spatial configuration of organizations: a review of the literature and some new research directions. *Personnel and Human Resources Management*, 13: 1–37.
- Oldham, G. R. & Rotchford, N. L. 1983. Relationships between office characteristics and employee reactions: A study of the physical environment. *Administrative Science Quarterly*, 28: 542–556.

- Olson, G. & Olson, J.S. 2001. Distance matters. *Human-Computer Interaction*, 15: 139–178.
- Pentland, A. 2009. How social networks network best. *Harvard business review*. February.
- Parsons, H. M. 1976. Work environments. *Human behavior and environment: Advances in theory and research*, 1: 163–556.
- Poldony, J.M. & Baron, J.N. (1997). Resources and relationships: Social networks and mobility in the workplace. *American Sociological Review*, 62(5): 673-693.
- Rafii, F. 1995. How important is physical collocation to product development success? *Business Horizons*, 38:78–84.
- Rashid, M., Kampschroer, K., Wineman, J. & Zimring, C. 2006. Spatial layout and face-to-face interaction in offices? A study of the mechanisms of spatial effects on face-to-face interaction. *Environment and Planning B: Planning and Design*, 36(3): 825– 844.
- Rashid, M., Wineman, J. & Zimring, C. 2009. Space, behavior, and environmental perception in open-plan offices: a prospective study. *Environment and Planning B: Planning and Design*, 36(3): 432–449.
- Reagans, R. 2010. Close Encounters: Analyzing How Social Similarity and Proximity Contribute to Strong Network Connections, *Organization Science*. 22(4): 835-849.
- Reagans, R. & McEvily, B. 2003. Network structure and knowledge transfer: The effects of cohesion and range. *Administrative Science Quarterly*, 48(2): 240-267.
- Reinsch, N. & Beswick, J. R. 1990. Voice-mail versus conventional channels: A cost minimization analysis of individuals' preferences. *Academy of Management Journal*, 4: 801–816.
- Rice, R. E. 1992. Task analyzability, use of new media, and effectiveness: A multi-site exploration of mediarichness. *Organization Science*, 3(4): 475-500.
- Rocco, E. editor. 1998. *Trust breaks down in electronic contexts but can be repaired by some initial face-to-face contact*. CHI, Proceedings of the SIGCHI conference on Human factors in computing systems.
- Salter, A. & Gann, D., 2003. Sources of ideas for innovation in engineering design. *Research Policy*. 32: 1309–1324.
- Schoenenberg, E. 2000. *The management of time and space*. The oxford handbook of economic geography, Oxford: Oxford University Press.
- Shah, P. P, & Jehn, K. A. 1993. Do friends perform better than acquaintances? The interaction of friendship, conflict and task. *Group Decision and Negotiation*, 2: 149–165.
- Sherman, H. & Chappell, D. S. 1998. Methodological challenges in evaluating business incubator outcomes. *Economic Development Quarterly*, 12(4): 313–22.

- Soda, G. & Zaheer, A. (2012). A network perspective on organizational architecture: Performance effects of the interplay of formal and informal organization. *Strategic Management Journal*, 33(6): 751-771.
- Stehlé, J., Charbonnier, F., Picard, T., Cattuto, C., & Barrat, A. (2013). Gender homophily from spatial behavior in a primary school: a sociometric study. *Social Networks*, 35(4), 604-613.
- Stehlé, J., Voirin, N., Barrat, A., Cattuto, C., Isella, L., *et al.* 2011 (a). High-Resolution Measurements of Face-to-Face Contact Patterns in a Primary School. *PLoS ONE*. 6(8): e23176. doi:10.1371/journal.pone.0023176
- Stehlé, J., Voirin, N., Barrat, A., Cattuto, C., Colizza, V., Isella, L. *et al.* 2011 (b). Simulation of a SEIR infectious disease model on the dynamic contact network of conference attendees. *BMC Medicine*. 9:87
- Stryker, J. 2005. *Designing the workplace to promote communication: The effect of collaboration opportunity on face-to-face communication in R&D project teams*. Newark, Rutgers, The State University of New Jersey, The State University of New Jersey.
- Su, N.M., Mark, G. & Sutton, S.A. 2007. Workplace connectors as facilitators for work. In Steinfield, C., Pentland, B. T., Ackerman, M., & Contractor, N. (eds.), *Communities and technologies 2007: Proceedings of the third communities and technologies conference*, Michigan State University, 2007, London: Springer, 131-150.
- Sundstrom, E. 1986. *Work places*. Cambridge University Press, Cambridge.
- Thomas, D. A. 1993. The dynamics of managing racial diversity in developmental relationships. *Administrative Science Quarterly*, 38: 169–194.
- Thompson, J.D. 1967. *Organizations in action*. New York: McGraw Hill.
- Treviño, L.K., Webster, J. & Stein, E. W. 2000. Making connections: Complementary influences on communication media choices attitudes, and use. *Organization Science*, 11(2): 163–182.
- Toker, U. & Gray, D.O. 2008. Innovation spaces: Workspace planning and innovation in U.S. university research centers. *Research Policy*. 37: 309–329
- Tötterman, H. & Sten, J. 2005. Start-ups: business incubation and social capital. *International Small Business Journal*, 23: 487.
- Uzzi, B. 1996. The sources and consequences of embeddedness for the economic performance of organizations: The network effect. *American Sociological Review*, 61: 674–698.
- Van den Broeck, W., Cattuto, C., Barrat, A., Szomsor, M., Correndo, G. & Alani, H. 2010. The Live Social Semantics application: a platform for integrating face-to-face presence with on-line social networking, *First International Workshop on Communication, Collaboration and Social Networking in Pervasive Computing Environments* (PerCol

- 2010), Proceedings of the 8th Annual IEEE International Conference on Pervasive Computing and Communications, Mannheim, Germany (2010) 226-231.
- Van den Bulte, C. & Moenaert, R. 1998. The effects of R&D team co-location on communication patterns among R&D, marketing, and manufacturing. *Management Science*, 44(11).
- Waber, B. N., Olguin Olguin, D., Taemie, K. & Pentland, A. 2010. *Productivity through coffee breaks: Changing social networks by changing break structure*. Available at SSRN: <http://ssrn.com/abstract=1586375> or <http://dx.doi.org/10.2139/ssrn.1586375>
- Warkentin, M. E., Sayeed, L. & Hightower, R. 1997. Virtual teams versus face-to-face teams: An exploratory study of a web-based conference system. *Decision Sciences*, 28(4).
- Whitbred, R., Fonti, F., Steglich, C. & Contractor, N. 2011. From microactions to macrostructure and back: A structural approach to the evolution of organizational networks. *Human Communication Research*, 37: 404–433.
- Wu, L., Waber, B., Aral, S., Bryniolfsson, E., & Pentland, A. 2008. *Mining face-to-face interaction networks using sociometric badges: Predicting productivity in an IT configuration task*. In Proceedings of International Conference on Information Systems, Paris, France.
- Zahn, L. G. 1991. Face-to-face communication in an office setting: The effects of position, proximity and exposure. *Communication Research*, 18: 737–754.
- Zalesny, M. D. & Farace, R. V. 1987. Traditional versus open offices: A comparison of sociotechnical, social relations, and symbolic meaning perspectives. *Academy of Management Journal*, 30(2): 240–259.

## FIGURES

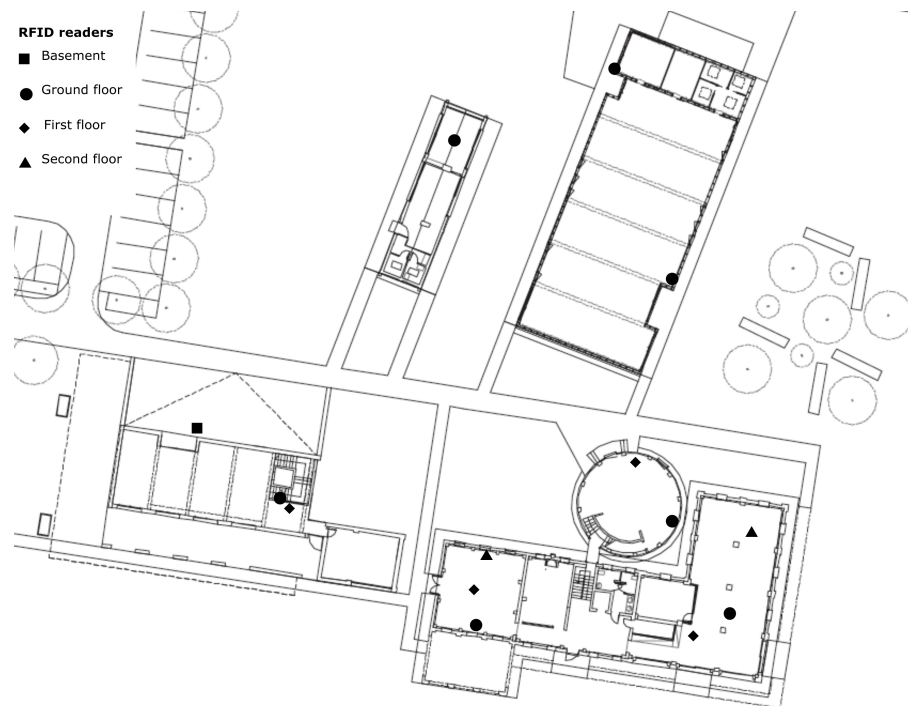


Figure 1. RFID-readers map

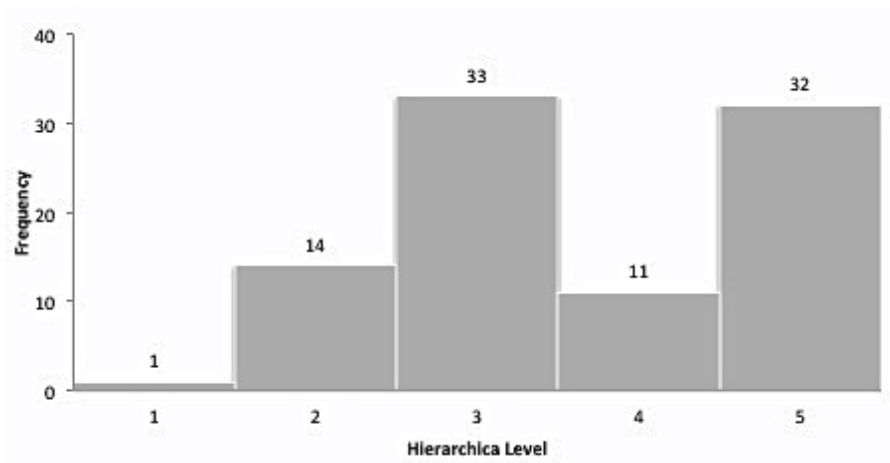
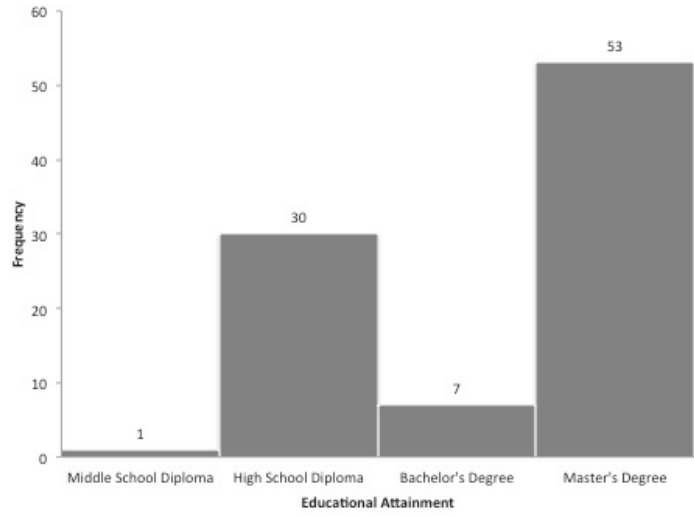
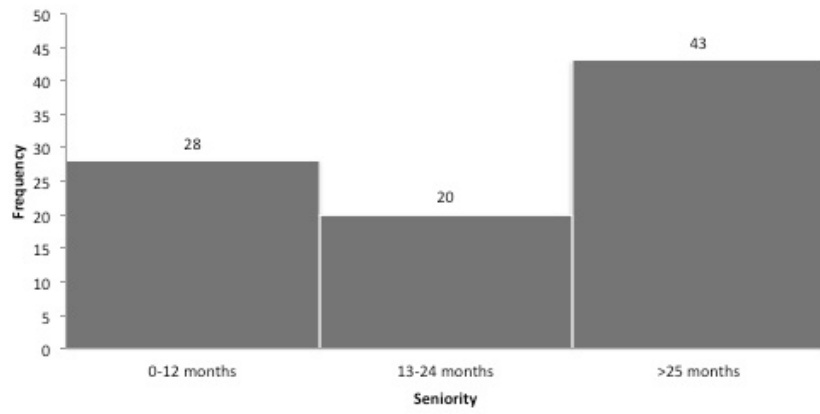


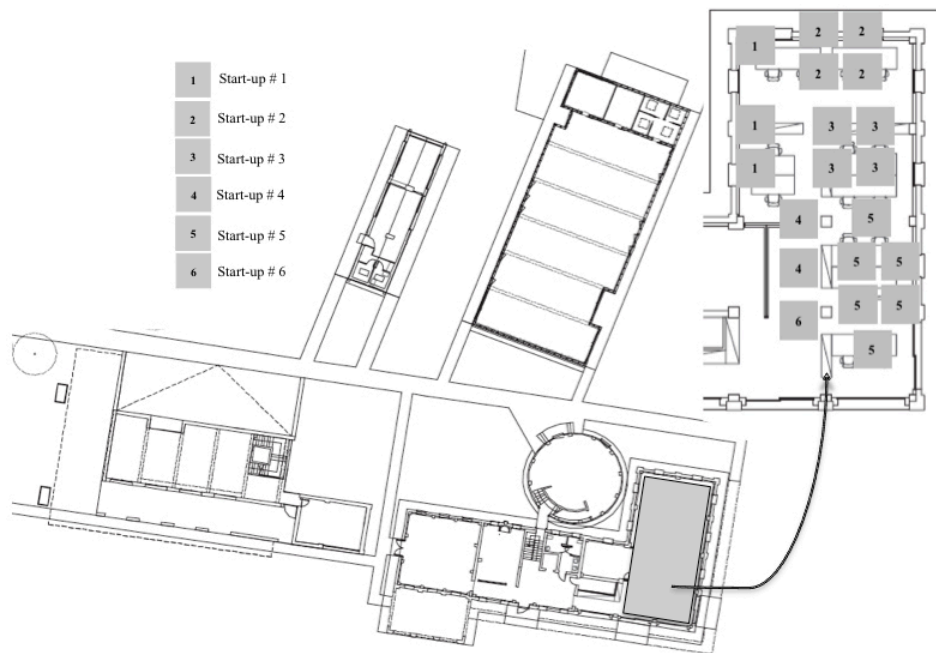
Figure 2. Hierarchical level sample distribution



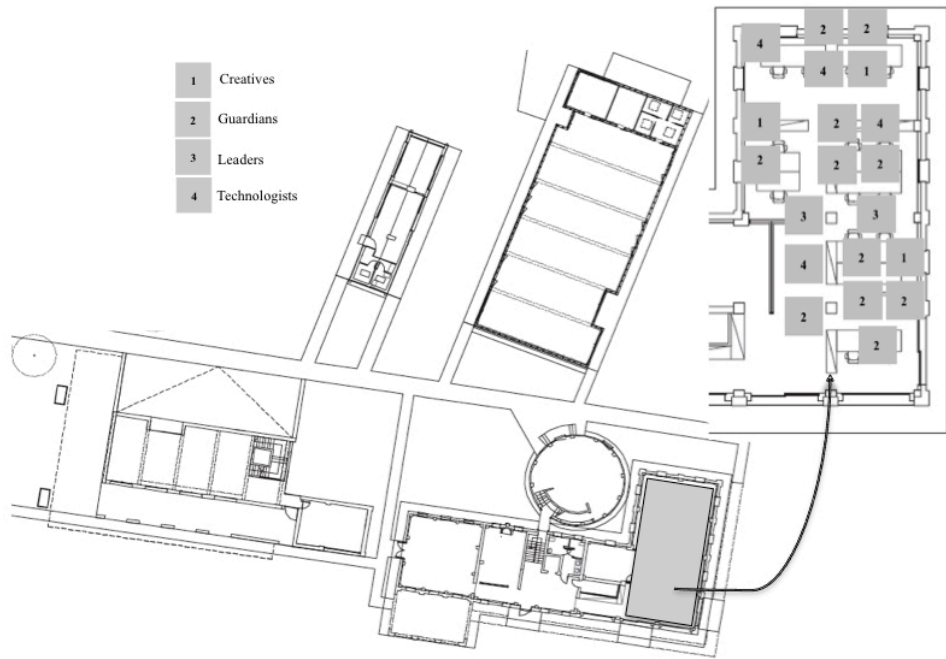
**Figure 3.** Educational attainment sample distribution



**Figure 4.** Seniority sample distribution



**Figure 5.** Example of start-ups co-presence



**Figure 6.** Example of speciality communities co-presence

## TABLES

**Table 1.** Speciality Communities

Speciality Community	Client Services	Project Management	Creative	Technology	Leaders	Administration
<i>Identity</i>	Guardian	Planner	Designer	Builder	Leader	Clerk
<i>Expertise</i>	Building relationships	Managing projects	Designing websites	Building websites	Managing start-up(s) resources	Performing routine operational activities
<i>Interests</i>	Maintaining smooth relations with clients and increasing client revenues	Delivering products on time, on budget, and to specifications	Generating innovative, aesthetic, and breakthrough designs	Building robust, reliable, and scaleable websites	Increasing start-up(s) and incubator profitability	Supporting daily administration activities
<i>Activities</i>	Identifying and assessing client requirements over time, Developing client presentations and documentation, Maintaining client relationships	Creating project work plans, Developing milestones and measures, and monitoring them over time, Adjusting plans and schedules over time	Brainstorming ideas, Designing visual images, Generating graphic concepts and vocabulary, Creating Web process flows	Reusing, writing, revising, testing, and debugging program code, Interfacing with technology standards, technology, vendors, and client IT groups	Managing coordination of company(ies) activities, staff, and strategic and financial planning to achieve the goals of the organization(s).	Entering data, processing document, planning travel, purchasing office equipment operation, book-keeping
<i>Number of employees</i>	14	19	13	28	5	12

Personal elaboration of Kellogg *et al.* (2006).

**Table 2.** Main features of dyadic fleeting F2F interactions at Star

Week Number	Day Number	Number of Daily Fleeting F2F Interactions	Number of Weekly Fleeting F2F Interactions
1	1	402	1,445
	2	370	
	3	408	
	4	265	
2	5	295	1,716
	6	263	
	7	362	
	8	468	
	9	328	
3	10	316	1,231
	11	217	
	12	307	
	13	183	
4	14	298	1,425
	15	209	
	16	507	
	17	411	
	18	298	
	Mean	328.17	1,476.75
	Std. Dev.	88.28	168.51



**Table 3.** Descriptive statistics and QAP Pearson correlation coefficients<sup>a</sup>

Variables	Minimum	Maximum	Mean	s.d.	1	2	3	4	5	6	7	8	9	10
1. Number of Fleeting F2F Interactions	0	98	1.44	5.36										
2. Social Similarity	0	1	0.11	0.31	.33***									
3. Unit Membership Similarity	0	1	0.17	0.38	.45***	.30***								
4. Speciality Community Similarity	0	1	0.19	0.40	.11***	.13**	.13***							
5. Hierarchical Level Similarity	0	1	0.29	0.45	.15***	.19***	.30***	.10**						
6. Co-location	0	1	0.18	0.38	.39***	.24***	.58***	.15***	.28***					
7. Visibility	0	1	0.08	0.28	.43***	.25***	.48***	.26***	.23***	.65***				
8. Same Age <sup>b</sup>	0	1	0.23	0.42	.02 <sup>+</sup>	.06**	.01	.00	.04*	.01	.00			
9. Same Educational Attainment	0	1	0.45	0.50	.01	-.04 <sup>+</sup>	.02	.03 <sup>+</sup>	.01	.03	.02	.00		
10. Same Gender	0	1	0.52	0.50	.06**	.04*	.07**	.14***	.00	.06*	.08**	-.01	.01	
11. Same Seniority <sup>c</sup>	0	1	0.22	0.41	.00	.03*	-.01	.01	.02	-.01	-.01	.02	.03 <sup>+</sup>	-.01

<sup>a</sup> 5000 random permutations were calculated. Two-tailed tests.

<sup>b</sup> Given the distribution of the age in our sample, we classified same age variable in 5 intervals: 22-26, 27-30, 31-34, 35-38, and 39-43.

<sup>c</sup> We grouped seniority variable in 5 1-year intervals.

<sup>+</sup> p<.10, \*p<.05, \*\*p<.01, \*\*\*p<.001

**Table 4.** QAP regressions on number of fleeting F2F interactions<sup>a</sup>

Variable	Model I	Model II	Model III	Model IV	Model V	Model VI	Model VII
Same Age	0.02 <sup>+</sup>	0.00	0.02 <sup>+</sup>	0.02 <sup>+</sup>	0.01	0.02 <sup>+</sup>	0.02 <sup>+</sup>
Same Gender	0.06**	0.05**	0.02 <sup>+</sup>	0.03*	0.02	0.06**	0.06**
Same Educational Attainment	0.01	0.02	0.00	0.00	0.01	0.01	0.01
Same Seniority	0.00	-0.01	0.01	0.01	0.00	0.00	0.00
Social Similarity (SS)		0.33***			0.19***		
Unit Membership Similarity (UMS)			0.44***		0.26***		
Speciality Community Similarity (SCS)			0.04**		-0.02 <sup>+</sup>		
Hierarchical Level Similarity (HLS)			0.02		-0.03*		
Co-location (C)				0.19***	0.05*		
Visibility (V)				0.31***	0.24***		
SS * (UMS + SCS + HLS) - (C + V) <sup>b</sup>						0.04**	
SS * (C + V) - (UMS + SCS + HLS) <sup>c</sup>							0.02
R <sup>2</sup>	.01**	.11***	.21***	.21***	.30***	.01***	.01***
# Observations	8190	8190	8190	8190	8190	8190	8190

<sup>a</sup> The network regression procedure is implemented in UCINET VI. 5000 random permutations were calculated. UCINET does not provide standard errors for coefficients. Standard coefficients are reported.

<sup>b</sup> In this model, we test if the number of fleeting encounters increases between two employees who do *not* work in the same area (C) and/or in visible co-presence (V) *but* who are linked by social similarity (SS) *and* organisational similarities (UMS, SCS and HLS).

<sup>c</sup> In this model, we test if the number of fleeting encounters increases between two employees who are liked by social similarity (SS) *and* work in the same area (C) and/or in visible co-presence (V) *but* who are *not* linked by organisational similarities (UMS, SCS and HLS).

<sup>+</sup>p<.10, \*p<.05, \*\*p<.01, \*\*\*p<.001

## Appendix

The survey that we administrated was composed by two sections: the first block of questions regarded individual socio-demographic attributes, the second part consisted of a free choice roster questions on workplace social networks. The survey we handled was drawn in Italian.

### Section 1: Personal attributes

The first block of the questionnaire was on: name, age, start-up for which actor works, residence, educational attainment, latest work experience, seniority, previous work experience inside the incubator.

### Section 2: Workplace social networks

A free choice roster approach (listing every employees working in the incubator) has been used to define different workplace social network inside the incubator. The subject was asked to answer the following twelve questions:

#### *Routine information network*

1. With whom do you exchange information during the working hours on a daily base?
2. With whom do you exchange information during the working hours on a weekly base?

#### *Task advice network*

3. Who did you ask a piece of advice when you face a new problematic situation which is strictly related to your job task?
4. Is any other person who asked professional advice while facing the same situation?

#### *Social support network*

5. Who did you ask a piece of advice when you face a new problematic situation which is related to your interpersonal relationships at work, such as a conflict?
6. Is any other person who you asked professional advice while facing the same situation?

#### *Friendship network*

7. Who is your friend?

#### *Transactive memory network*

8. Of which people do you know the professional skills (such as: programming languages he/she knows, which problems he/she is able to solve or which are his/her managerial abilities)?

#### *Trust network*

9. Who do you trust the most in the context of your work activity?

#### *“Task Popularity” network*

10. In your opinion, who receives requests of advice in case of a problematic situation which is task related?

#### *Acquaintance network*

11. Who did you already know before being hired at Star?

#### *Job Substitution network*

12. If you have to stay away from work for a couple of months, who might substitute you at best?

Most of these questions is based on the work by Podolny and Baron (1997).

## Estratto per riassunto della tesi di dottorato

*Studente: Mariachiara Barzotto*

*Matricola: 955695*

*Dottorato: Economia Aziendale*

*Ciclo: 25*

*Titolo della tesi: Individual's Agency in Workplace Social Networks. Face-to-Face Communication Behaviours*

*Estratto:*

La tesi approfondisce il tema delle azioni intraprese dagli individui per attivare le strutture organizzative nelle quali sono inseriti. Il presente studio sostiene la necessità di investigare i comportamenti degli individui all'interno delle organizzazioni per una maggiore comprensione delle micro-fondazioni dei processi organizzativi. La tesi unisce la metodologia dell'analisi delle reti sociali con quella del caso di studio, con oggetto un incubatore privato e 10 *start-up* supportate dall'incubatore. Sono, inoltre, stati utilizzati *badge* RFID (Radio-Frequency IDentification) al fine di catturare le modalità attraverso le quali i lavoratori usano le risorse a disposizione all'interno dell'organizzazione. L'utilizzo della tecnologia RFID ha permesso di monitorare, con elevata risoluzione, lo sforzo in termini di interazione faccia a faccia di una rete composta da 91 soggetti. Il primo capitolo affronta il tema di *ambidexterity* individuale dimostrando la presenza di 3 orientamenti di *ambidexterity* individuali e le loro possibili combinazioni a livello organizzativo. Il secondo capitolo analizza gli stili relazionali utilizzati dai *brokers* (comparati ai non *brokers*) nell'attivazione delle reti lavorative di tipo strumentale e affettivo. Si dimostra che il comportamento dei *brokers* varia sulla base del tipo di relazione (strumentale vs. affettiva) in cui il soggetto è inserito. Infine, il terzo capitolo analizza l'uso delle interazioni faccia a faccia di breve durata tra lavoratori e le determinanti di questo specifico comportamento comunicativo, importante nell'attivare le risorse organizzative. I risultati suggeriscono che determinanti di tipo sociale, organizzativo e spaziale influenzano la frequenza di questo tipo di interazioni. In particolare, la presenza di similarità organizzativa sembra giocare un ruolo chiave nel attivare incontri di breve durata tra soggetti legati da similarità sociale e dalla condivisione di un spazio lavorativo contrassegnato da specifiche caratteristiche di prossimità e visibilità.

*Abstract:*

The thesis focuses on the actions undertaken by individuals to activate the organisational structures in which they are embedded. The present study upholds the need to investigate individual's behaviours within organisations for a deeper understanding of organisational processes micro-foundations. The dissertation blends social network analysis and case study methods, with a private incubator and its 10 start-ups as a research setting. RFID (Radio-Frequency IDentification) badges were used to capture the ways through which employees mobilise the resources at their disposal within the organisation. The use of RFID technology has enabled the monitoring, with high-resolution, of the effort in terms of face-to-face interaction undertaken by a 91-subject network. Essay I deals with individual ambidexterity showing the presence of 3 individual ambidexterity orientations and their possible combinations at the organisational level. Essay II focuses on the relational styles used by brokers (compared to non-brokers) to activate workplace social networks, both instrumental and affective ones. Findings show that brokers differently engage with their informal workplace social networks depending on the content of the relationship (instrumental vs. affective) in which s/he is embedded. Finally, Essay III analyses the use of "fleeting" face-to-face interactions among employees and the determinants of this communication behaviour, important in activating organisational resources. Results suggest that social, organisational and spatial determinants impact on the frequency of this kind of interactions. More specifically, the presence of organisational similarity seems to play a key role in activating short encounters among colleagues linked by social similarity as well as by the sharing of a working space with specific characteristics of proximity and visibility.

Firma dello studente

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