The role of proximity during long-distance collaborative projects. Temporary geographical proximity helps

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Abstract: The idea that collaboration is easier between neighbours is nowadays being called into question. The outlines of the different types of proximities have become blurred, and the traditional proximity relations are being replaced by more contrasted relations, in which long-distance interactions and distrust towards one's neighbours are promoted by the constant development of Information and Communication Technologies (ICT). This paper aims to analyse the respective role of ICT-based exchanges and of those that are made during face-to-face interactions in cooperation between firms engaged in long-distance collaborations. We base our theoretical considerations on various examples, which are based on the result of field research studies from our own work and then reformatted. We use them as stylised facts.

Keywords: geographical proximity; organised proximity; collaborations.

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1 Introduction

The analysis of different types of proximities, which was initially restricted to the interface between industrial and spatial economics (Kirat and Lung, 1999; Rallet and Torre, 2000), has progressively been extended to new disciplines and fields to include questions related to transport, employment, environment, land planning or urban policies (Torre and Zuindeau, 2009; RERU, 2008). In a boomerang effect, this extension of the initial approach leads to the re-emergence of the question of its relation to space, particularly in the case of inter-firm relations (Boschma, 2005).

This question has become particularly acute because of the development of long-distance relations between firms, particularly between firms characterised by high levels of creativity, innovation or technology, and has led to dramatic changes into social relations and network capital. Indeed, we observe that while clusters are the object of an ever-increasing number of studies, a growing number of alliances are being undertaken between firms located far from one another or between firms that cannot have daily face-to-face interaction with each other and develop their relationships through temporary meetings or long-distance communication tools (Torre, 2008). Thus, some consider that space or geography no longer matters and that what is important is to be able to develop relationships by using the new Information and Communication Technologies (ICT).

The aim of this paper is to analyse this claim and to gain a better understanding of the relations of proximity that develop between distant firms that work together. We try to explain the bonds that develop between firms that are involved in long-distance work relationships. We base our theoretical considerations on an example, from our own work (Gallaud and Torre, 2004) and then reformatted, which we use as a stylised fact. Intentionally simplified and symbolic of the extension of the initial analysis, this example is based on the result of field research studies conducted by authors who, as Pike (2007) has suggested, wish to reach beyond the Manichean opposition between the necessity of face-to-face interactions and the possibilities of ICT-based long-distance relations to analyse the complexity of global relationships (see for example, Dicken et al., 2001; Gereffi et al., 2005; Maskell et al., 2006; Song et al., 2007). Taking into account the various stages of coordination – in the case of collaboration between firms that are not co-located – enables us to place the stages of close interaction and those of distant interaction on a linear timeline and to envisage a first dynamic approach to the processes of spatial coordination.

The remainder of this paper is organised as follows. We first present an overview of the notions of geographical proximity and organised proximity in section 2. In Section 3, we then introduce the dimensions of mobility and ubiquity of long-distant partners and discuss the notion of Temporary Geographical Proximity (TGP), which corresponds to the possibility of fulfilling the needs for face-to-face interaction thanks to mobility. In Section 4, we present elements of the dynamics of long-distance collaboration relations by providing graphs that illustrate the successive phases of mobility and of long-distance exchanges or ubiquity in the framework of these collaborations. In Section 5, we re-examine proximity, by taking into account the combination of TGP relations and Organised Proximity relations. Throughout our paper, we make use of examples that can be considered as stylised facts. We have also made use of graphs to illustrate our considerations.

2 The notions of proximity

In keeping with our previous work, we maintain the distinction between two main categories of proximity: Geographical Proximity and Organised Proximity (Torre and Rallet, 2005), and redefine them more precisely on the basis of recent research on the subject (see RERU, 2008). These notions of proximity refer, above all, to potentialities given to individuals, groups, human actions in general, in their technical and institutional dimensions. This potential may, or may not exist at a time *t*, and therefore may or may not be usable or actionable through the action and representations of the actors (human or non human). These types of proximities have no moral value and their existence constitutes neither an advantage nor a disadvantage. It is activation through human action that gives this potential its significance and value (positive or negative) in relation to the economic and social criteria that are relevant in the societies where it is found.

2.1 Geographical proximity

Geographical proximity is above all about distance. In its simplest definition, it is the number of metres or kilometres that separate two entities. However, it is relative in two ways:

- In terms of the morphological characteristics of the spaces in which activities take place. There can be a 'crow flies' proximity, in the case of a trip by plane, for example, but the nature of the terrain also plays a role: travelling from one point to another on a flat surface is not equivalent to climbing up and down a mountain to go from a point A to a point B.
- In terms of the availability of transport infrastructure. The existence of a road, highway, railway, metro network or river-borne transport will make access to a place almost quick and easy. It is in this sense – that of Perroux – that we view functional distance.
- In terms of the financial resources of the individuals who use these transports infrastructures. A high-speed railway line might enable people to travel more quickly to and from two places, but its cost proves prohibitive for part of the population, at least in cases when the individuals have to travel frequently. Therefore, we shall say that the Geographical Proximity between two people, or between people and places, is partly related to the cost of transport and to the financial means of individuals.

Geographical proximity is neutral in essence. It is the human actions and perceptions that give it a more or less positive or negative dimension, as well as a certain usefulness. It is the way in which actors use it that matters. Thus, the fact that two firms are located in proximity of each other may or may not be a source of interaction: these two entities may remain indifferent to each other or they may choose to interact; in this latter case, we talk of a mobilisation of the potentialities of geographical proximity. However, this mobilisation can have different results depending on the actions undertaken. For example, in the case of innovating firms, it might be the diffusion of scientific or technological knowledge through geographical spillover effect (Bonte, 2008), but it might also lead to firms spying on other firms or unduly reaping the benefits of an

invention that is supposed to be protected by intellectual property rights (Boschma, 2005; Arend, 2009).

Geographical proximity can be activated or mobilised by the actions of economic and social actors. Depending on their strategies or strategic choices, or according to their perceptions of their environment, the behaviours and attitudes of these actors vary and they mobilise geographical proximity differently. More precisely, actors might seek to get closer to or further away from certain people or places, or they might feel satisfied or dissatisfied with the geographical proximity of certain people, places or technical objects. geographical proximity can be enhanced by the deploying of urban space or by the setting of localised clusters of innovation for example.

2.2 Organised proximity

Organised proximity too is a potential that can be activated or mobilised. Organised Proximity refers to the different ways of being close to other actors, regardless of the degree of geographical proximity between individuals, the qualifier 'organised' referring to the arranged nature of human activities (and not to the fact that one may belong to any organisation in particular[1]). Organised proximity rests on two main logics, which do not necessarily contradict each other and which we shall call the 'logic of belonging' and the 'logic of similarity'. Both can help in the setting of trust relations.

The logic of belonging refers to the fact that two or several actors belong to the same relationship graph or even to the same social network whether their relation is direct or intermediated. It can depend on the sector they are operating on; in this case, they share common creative or innovation capital. It can be measured in terms of degrees of connectivity, reflecting high degrees of organised proximity and therefore a great potential of interaction or common action (Bouba Olga and Zimmermann, 2004). The development of interaction between two actors will be facilitated by their belonging to the same tennis club or internet knowledge network. Similarly, cooperation will, *a priori*, develop more easily between researchers and engineers who belong to the same firm, the same technological consortium or innovation network. For example, it includes common organisational culture between the members of a team.

The logic of similarity corresponds to a mental adherence to common categories; it manifests itself in small cognitive distances between some individuals. They can be people who are connected to one another through common projects or share the same values such as culture and religion. Social norms, common language take part of this Organised Proximity. It can also, however, correspond to a bond that sometimes emerges between individuals without them having had to talk to get to know one another. It facilitates the interactions between people who did not know one another before but share similar references. Thus, collaboration is all the easier when it involves individuals who share the same culture. Similarly, researchers who belong to the same scientific community will easily cooperate because they share not only the same language but also the same system of interpretation of texts and results.

The logic of similarity possesses two facets. It can develop within a reciprocal relationship; a relationship that shortens the cognitive distance between the actors involved (common project, common education, knowledge circulating within a network etc.); it can also emerge from a common basis, facilitating the communication between strangers (see the example of diasporas). The actors linked by a logic of similarity share certain resources, of a material (diplomas or social status) or cognitive (routines,

conventions, etc.) nature, which can be mobilised when the properties described here are activated.

Just like geographical proximity, organised proximity refers to a potential that is neutral in essence. It is the perceptions and actions of individuals that give it a more or less positive or negative dimension and, therefore, a certain usefulness. Thus, being connected by a logic of belonging is not a guarantee that interactions will occur, and even less a guarantee of the quality of these interactions. It is human actions that determine whether or not actors are going to start interacting; and results of the interactions vary in this regard: a firm may enter into a relationship with a laboratory to collaborate with the latter or rather to try and rob the laboratory of one of its inventions. For the logic of similarity, a common project has as much chance to lead to an industrial or technological success as to end up in a failure resulting in heavy losses for the parties involved. Finally, the logics of similarity and of belonging can also facilitate collaborations that might be immoral in their motivations. For example, Mafia organisations often feed on both the logic of similarity (ethnic origins) and the logic of belonging (strong connection within a network of actors), which can be considered immoral ethically.

3 Proximity and long-distance relations

Taking into account long-distance relations rests on the explicit integration of the processes of mobility and ubiquity of actors, mobility and ubiquity, which have increased dramatically with the development of transport and communication infrastructure. The multiplication and ever-increasing technological level of land and aerial transport infrastructures has now combined with the revolution of ICT. All have led to significant modifications in actors' relations to space and to the development of new relations between economic and social actors (Rallet and Torre, 2005).

3.1 Mobility and ubiquity condition long-distance relations

The phenomenon of mobility is related to Geographical Proximity. The mobility of people, which increases with transport infrastructure, enables individuals to act in different places, at different, but often close, moments in time. It can be long-term mobility, when people move homes, for example, or when a firm relocates to new premises; it can be 'short term' or temporary in the case of people going on holiday or on work-related trips; or it can be 'pendular', for example, in the case of individuals who need to travel everyday to go to various distant work places.

These types of mobility have developed dramatically due to the technical improvement of transport and communication infrastructures and technologies; the fact that the distances travelled are greater (and often covered within an equivalent time) and the significant increase in short-term trips bear witness to this. This evolution is possible due to the development, and above all, the technological improvement of transport technologies: Increasing frequency of flights, increasing number of high-speed trains or of highways, for example, or the shortening of the time needed to go from one point to another (particularly in the case of the railway).

Transport infrastructure and technologies help to 'shorten distances', that is, to reduce access times or draw individuals closer to places or objects they are interested in; this is due to the multiplication of connections and due to the increase in travelling speeds. They increase the opportunities to meet with and be in contact with others and contribute to activating the potential of the different types of proximities, by promoting and facilitating interactions between people, helping them to develop maintain or re-activate relationships. They are at the heart of temporary meetings, which are characterised by a temporary and simultaneous activation of geographical and Organised Proximity by enabling actors located far from one another to meet face to face.

The phenomenon of ubiquity is related to organised proximity. Due to the development of ICT, actors or groups of actors now have the ability to be at once here and there and, therefore, to perform a range of actions that transcend location or mobility. Any actor cannot only be at once mobile and physically present in one place, but it can also act in real time in different places. An individual can interact by telephone or through the internet with people who live in other countries or regions. A firm can act at once locally and globally, for example, by making its suppliers compete with each other at a global level or by passing orders on stock exchanges abroad.

ICT represent an additional way of 'travelling', which complements the traditional transport infrastructure, with multi-location in real time. Its main advantage lies in its increasing the modes of communication and connection between individuals, and therefore in its multiplying the possibilities of interactions. As social psychologists have shown (Walther et al. 2005), computer-mediated interactions mobilise an important part of the cognitive and emotional capacities of individuals and contribute to the creation of new social relations.

Its evolution has above all had an impact on organised proximity, in its potential dimensions as well as in its activations. Indeed, ICT are closely related to the logic of belonging and the logic of similarity in that they contribute to the creation of connections and networks between human beings. Furthermore, they enable individuals who are separated by large geographical distances and short cognitive distances to enter into interaction with one another, which used to be difficult in the past. ICT facilitate the creation of relationships between people located geographically far from one another or between people who have never met.

3.2 Introduction of TGP

To account for these processes, let us introduce the notion of TGP, which constitutes one form of geographical proximity that enables actors to temporarily interact face to face with one another; these actors may be individuals or organisations such as firms or laboratories (Torre, 2008; Torre and Rallet, 2005).

The development of communication technologies and ICT facilitates long-distance exchange; consequently co-location, which is often considered as a necessary condition of cooperation between organisations, no longer constitutes an absolute necessity. A large part of the information and knowledge that is necessary for production or innovation activities can be transferred from a distance, through telephone or internet-mediated exchanges (Walther et al., 2005). However, times of face-to-face interaction are necessary and beneficial in this context. The example of the Airbus or Renault platform teams, or that of the travelling done by members of Research and Development (R&D) collaboration projects undertaken by biotech start-ups are good

examples of such situations. Face-to-face interaction cannot altogether be eliminated, including in the case of communities of practice (see Torre, 2008). As a consequence, ICT cannot be considered as substitutes of face-to-face relations: they are useful tools to support or enhance the interaction between two or among several individuals.

Space matters but in a new way; one that consists of temporary face-to-face contact between two or among several individuals. TGP corresponds to the possibility of satisfying *needs for face-to-face contact between actors, by travelling to different locations. This travelling generates opportunities for moments of Geographical Proximity, which vary in duration, but which are always limited in time.*[2] *TGP is limited to certain times; this form of Geographical Proximity should not be mistaken for a permanent co-location of firms or laboratories.*

The necessity of TGP is embodied in the existence of places that are especially made for TGP-based activities. In the case of private individuals, they can be conferences, theme or recreational parks. In the case of firms or laboratories, they are specialised venues:

- Trade shows, conferences and exhibitions enable actors to fulfil certain needs related to the processes of production, research or innovation, such as the collection of information, sharing experiences and speculations about a certain type of production (Entwistle and Rocamora, 2006). The 'hub' formula, which enables individuals from different horizons to meet in the same place, enables them to save on transport costs; these hubs are readily viewed as temporary clusters (Maskell et al., 2006), a term which highlights the relation with the permanent clusters formed by localised systems of production. But above all, these places respond to a need for face-to-face relations related to the wish to reduce the costs of transactions (Norcliffe and Rendace, 2003; North, 1991).
- Common 'platforms' of project teams are meant to enable the participants of a project to work together for a period of up to several months in the framework of a project team. It is also the case of the members of a project undertaken by the geographically dispersed subsidiaries of a firm (Aggeri and Segrestin, 2001; Talbot and Kechidi, 2010). Once the partners have reached an agreement as to the characteristics of the project, the platform is dismantled and the participants go back 'home'.

However, there are two main reasons for the need for TGP: Business trips are undertaken to reach a common decision or determine the characteristics of a cooperation project or an activity that can only be performed in a place other than the individual' usual workplace. These meetings are needed at regular intervals during the coordination process. Their frequency and regularity are the cause of most business trips. The face-to-face interactions do not, in this case, occur in places exclusively dedicated to meetings but in 'ordinary' places, i.e., in the participants' usual workplaces, firms or laboratories.

4 The dynamics of long-distance collaborations

We have seen that, depending on the situations, the different types of proximities combine with substitute or complement one another to respond to various patterns of

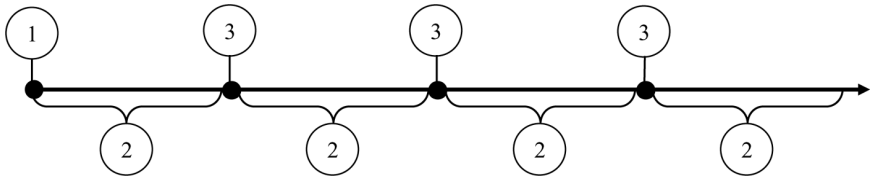
separation, activation or combination. This typological approach makes it possible to explain the existence and the success or failure of localised systems of production or innovation, which consist of more or less successful combinations of geographical and organised proximity. The elements of long-distance relations must now be taken into account, with the introduction of the interaction of the different types of proximities in the exchanges between the participants of a collaborative project undertaken by firms that are located geographically far from one another.

Let us look at a symptomatic situation: the long-distance collaboration between two firms working on a common project, of R&D for example. This case is representative for it highlights the process of dynamics of innovations. The stylised facts correspond to field observations and surveys on the question of biotechnologies (Gallaud and Torre, 2004) but they could also apply to situations studied in the aeronautical industry (see Talbot and Kechidi, 2010). The process presented responds to the general model of localised technological change described by Antonelli (2008) and yet can be applied to the more general scale of inter-firm relations.

The analysis of the dynamics of proximity necessitates an understanding of the stages of interaction between the actors participating together to the innovation process; in other words, either between the participants – located at some distance from one another – of a common project of production and knowledge exchange, two partners located at some distance from each other and involved in common R&D project necessitating interactions for the transfer and the co-creation of knowledge. The process of collaboration, which takes place over a period of several months or years, involves frequent exchanges and interactions of different natures. It can be illustrated as follows (Figure 1).

The horizontal straight line represents the time course of the process of collaboration. The numbers correspond to different sequences of face-to-face or long-distance interactions. We retain three main sequences.

Figure 1 The process of collaboration between firms and the stages of interactions between the participants



① Initiation of collaboration ② Long distance interactions ③ Temporary meetings

Short stage 1 is that of the initiation of the collaboration

This is an initial stage of co-presence, which depending on the case can involve

- individuals who belong to the same organisation,
- people who already know one another but belong to different organisations or
- newly acquainted partners.

This stage is always characterised by a high level of uncertainty concerning the personality and work methods of the participants and to the characteristics of the common production or innovation project. The purpose of these meetings between

partners, which last for long periods of time, is to build a common knowledge base integrating the knowledge- and experienced-based know-how of the different participants.

The aim of the stage of initiation is to enable the project participants to get to know one another, adjust their points of view, prepare the technical and human aspects of the cooperation, plan the future stages of the project and negotiate agreements concerning the possible gains or losses resulting from the cooperation process. Its purpose is also to promote the development of trust relationships between the participants of the common project. The duration of this initial stage depends on the complexity of the project and on the number of partners involved (from a few days for small organisations to several months in the case of the platform teams of large manufacturers).

Long stage 2: Long-distance teamwork

Once the partners have reached their agreements and have adjusted their points of view, the partners – teams or individuals – separate and they carry on working together 'from a distance'. The project develops and progresses due to exchanges made through ICT (telephone, fax, the internet, text, communicating terminals, etc.). Thus, the participants of the project exchange information or knowledge and solve the daily operational problems. It should be noted that this phase is the longest of the three.

During this stage, the relationship between the partners rest on the trust that was initially created, as well as on the common rules decided or implemented by the management team. The long-distance interactions that develop between the partners must not only foster the process of production at technical level but also promote the development of cooperation. They enable the members to communicate and discuss the technical characteristics of the products, the necessary improvements, the small problems encountered during the daily operation of R&D or production activities, and to prepare future operations. However, their function is also to validate or invalidate the actions decided upon or the agreements made during phase 1.

Depending on how the partners interact with one another, virtuous or vicious circles of trust can set in. A virtuous circle sets in when a dynamic of positive retro-action develops, with a construction of reputation through reciprocal interactions. A vicious circle sets in when technical, economic, financial or human-related problems occur and result in a deterioration of trust and, in turn, generate distrust or mistrust or even conflicts between the participants of the project. This can lead to the setting up of unscheduled or ad hoc meetings.

Stage 3 is that of occasional face-to-face meetings

These meetings generally last for one to a few days. There are two types of occasional meetings: the scheduled ones and the ad hoc, unscheduled ones.

The scheduled meetings are fixed in advance, either contractually or informally, generally at the beginning of the project. They take place in a selected venue and are attended by all or some of the cooperation partners to review the progress of the joint projects and to validate the agreements reached previously concerning the future stages of the collaboration. These meetings generally take place twice in an year and are aimed at verifying that the work is performed properly, at determining what has been achieved and at preparing the future stages of the collaboration, and in some cases, at modifying the

organisation of the project to adapt to possible changes that might have occurred at one of the partners' since the previous meeting.

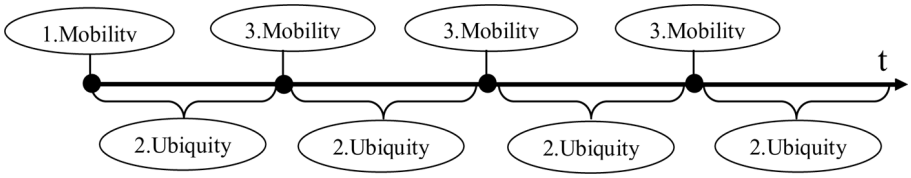
The purpose of these meetings is to reduce and to help make the perceived risk more manageable, whether the risk is related to the characteristics of the partners themselves or to those of the tasks that must be undertaken. The aim is to assess whether mistrust has arisen between the partners, and if necessary, to re-establish the foundations for renewed trust. However, these meetings also offer the different partners the opportunity to meet and interact outside the strictly professional context and to discuss things other than technical or economic questions; thus, they can spend time and talk together and, thus, consolidate or rebuild the mutual trust that binds them together.

Ad hoc meetings become necessary when long-distance interactions are not enough to solve certain problems that degenerate into conflicts. In this case, some members of one or several teams travel to meet one another and discuss, in person, the problems that have arisen to find solutions to them. The meetings enable the members to meet face-to-face, to communicate verbally or non verbally and to interact outside the strictly professional context. This informal part of the meting is also very important because it gives the opportunity to the participants to know each other to increase trust and to reach informal agreements. Ad hoc meetings can also consist of a concerted search for solutions involving all or most of the participants of the project. In this case, the meetings involve more people and coordination is, as a result, more difficult.

Occasional meetings give the partners the opportunity to alleviate their cognitive dissonance to bring out and address interpersonal differences or to thoroughly discuss the problems that are related to the uncertainty that comes with any new innovation process. These also enable the partners to redefine or renegotiate certain aspects of the agreement, if necessary. Furthermore, they are a way for the partners to show their good will and their desire to move past the conflict stage and resume the cooperation process.

To each phase correspond mechanisms of mobility or ubiquity of the actors, as well as the use of specific technologies. As Figure 2 shows, phases 1 and 3 of the collaboration process correspond to phases of mobility (of either one of the parties or both, depending on where the meetings take place), whereas phase 2 is characterised by the use of ICT to facilitate long-distance communication, which establishes relations of ubiquity.

Figure 2 The mobility and ubiquity of the actors during the process of collaboration between firms



5 An analysis in terms of proximity

The inventory and characterisation of the various phases of coordination between partners located at a distance from one another, as well as the examination of their

succession, make it possible to approach proximity relations in terms of their position in time and so to add dynamism to collaborative relationships. The example discussed above enables us to highlight:

- the way in which TGP and Organised Proximity interact
- the modes of activation of the potentials of both types of proximities
- the way in which the potential and interactions of organised proximity are created.

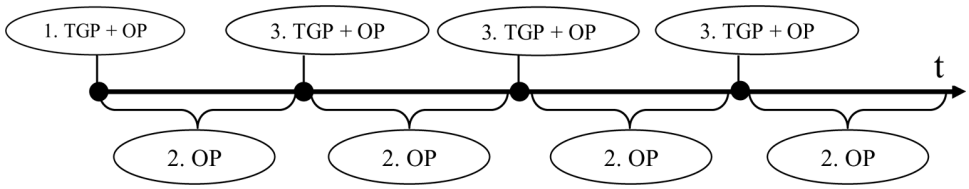
5.1 The stages of proximity

Let us re-examine the above example in terms of sequences of proximity. We point to the possible articulations between organised proximity and TGP.

In essence, the model we propose is not unlike Kline and Rosenberg's chain linked model (1986), but it provides a spatial perspective of the relations between actors in this dynamic framework. For convenience sake, only the chronological succession of the various stages is illustrated here, time becoming linear and reversible from Stage 2. However, the effects of retro-action and the learning loops, which are not discussed below, must not be neglected, particularly between the different stages of design and development of a product.

Figure 3 provides an illustration of these relations.

Figure 3 Geographical proximity and organised proximity during the process of collaboration between firms



OP: Organised Proximity, TGP: Temporary Geographical Proximity.

Short stage 1: Initiation of the collaboration – relations of TGP and organised proximity.

The initiation of a collaboration project is a stage of either creation or activation of the potential of organised proximity. The potential of organised proximity is created when the actors do not know one another or do not share the same references. It is activated by the face-to-face interactions between the actors of the process of collaboration, which contribute to the development of knowledge-based relationships and of trust relations (see Nooteboom, 2000). This operation aims to create bonds of belonging. The first stage also relies on TGP, for the meeting between the protagonists lasts for a limited period of time. The potential of Geographical Proximity is mobilised when different individuals meet in the same place.

Long stage 2: Long-distance teamwork – relations of Organised Proximity developing without permanent face-to-face interactions

The stages of long-distance teamwork enable the partners to continue collaborating even in the absence of face-to-face interactions by using communication infrastructures.

These stages exclude relations of geographical proximity and aim to promote interactions of organised proximity. The potential of organised proximity, which already exists, is mobilised in a 'positive' manner by the multiplication – through the use of ICT – of interactions between people who are located far from one another. The geographically distant actors find themselves in a situation of ubiquity; they exchange technical information and use their bonds of belonging to a common project to facilitate coordination.

Short stage 3: The occasional meetings – Relations of TGP and of Organised Proximity

The occasional meetings involve the resources of TGP. They are stages of short-term, face-to-face interaction, during which transport infrastructures are used. The actors are then in a situation of mobility; during these meetings the partners reconfirm their initial agreements, maintain or consolidate their mutual trust, try to find solutions to possible tensions and conflicts and plan the future stages of the collaboration programme. As in stage 1, the potential of geographical proximity is mobilised when different individuals meet in the same place. TGP enables the partners to confirm their bonds of belonging; the potential of organised proximity is reinforced by the confirmation of the knowledge- and trust-based bonds.

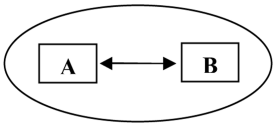
In the case of an ad hoc meeting, using the virtues of TGP is an effective means of preventing a conflict from escalating into a more acute stage that might result in the partners choosing to take legal action or to resort to public denunciation. In this regard, TGP offers the partners another chance to make the process of long-distance cooperation a successful one, by giving them the opportunity to reconcile their points of view, to partly modify the relational configuration or review the ways in which they cooperate.

5.2 The dynamic combination of the different types of proximities in the case of inter-firm collaboration

Let us now summarise the above considerations, by positioning the different stages of interactions in a graph illustrating all the possible proximity combinations. To remain consistent with our initial example, we intentionally limit ourselves to the case of inter-firm relations. Nevertheless, we need to be able to apply and generalise our model to other case studies, particularly those concerning laboratories, institutions or physical persons.

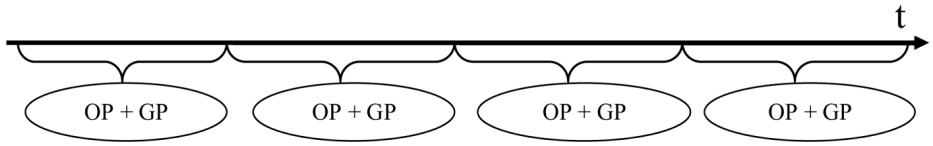
Let us consider three situations involving two or three firms. For each case, we first describe the spatial situation and the type of relation that exists between the firms, and then analyse the situation in terms of proximity relations.

First situation: Two firms located in the same area

	The two firms A and B collaborate locally, for example, within a localised system of production or an agglomeration. Their relations rest on a combination of Geographical Proximity and Organised Proximity. This is a classic case of co-location. ICT are not used.

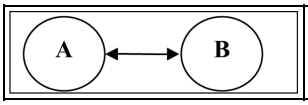
The process of collaboration unfolds in an extremely simple manner, as it consists in a succession of similar phases of combined geographical and organised proximities. These sequences only differ according to the volume and the frequency of the interactions between the local actors (Kirat and Lung, 1999).[3]

Figure 4 Dynamics of proximity in the case of two co-located firms



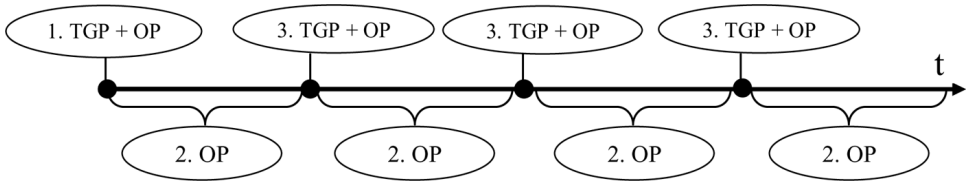
OP: Organised Proximity; GP: Geographical Proximity (co-location).

The second situation: Two firms engaged in long-distance collaboration

	The two firms are located in separate and distant locations. They have undertaken a collaboration project.

We have here the type of long-distance collaboration described above. It is necessary to have an initial stage of Temporary Geographical Proximity, before entering into long-distance relations based on situations of ubiquity and on the mobilisation of Organised Proximity. Occasional meetings – which are made possible by mobility – rest on a combination of TGP and Organised Proximity.

Figure 5 Dynamics of proximity in the case of two firms collaborating from a distance



OP: Organised Proximity; TGP: Temporary Geographical Proximity.

The third situation is that of firms that have local and distant relations

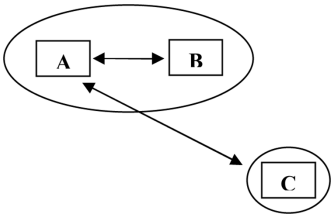
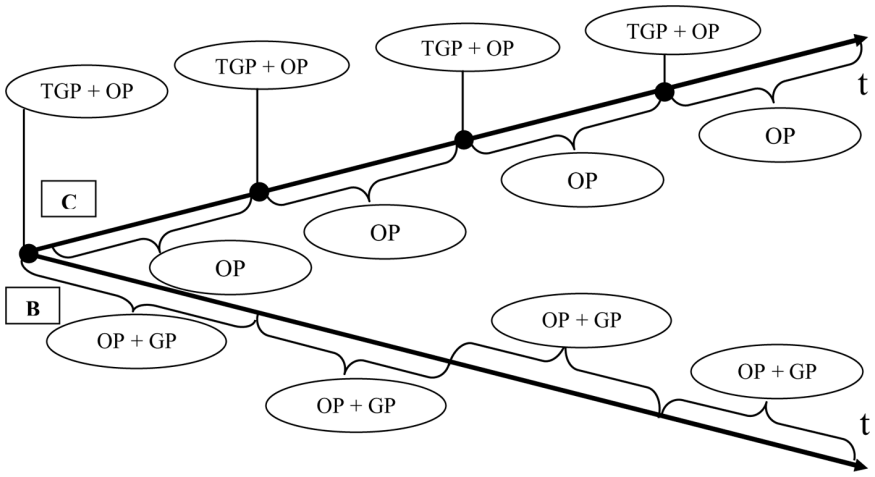
	Firm A collaborates locally with firm B located in the same area. Firm A also collaborates from a distance with firm C located in a distant location. Thus, Firm A is involved in two collaboration processes simultaneously. It mobilises all the resources of geographical proximity and of organised proximity, depending on the sequencing of the stages of mobility, ubiquity and co-location, sequencing that has the shape of a what we could call a 'crocodile's mouth'.

Figure 6 Proximity dynamics in the case of a firm engaged in both local and long-distance collaborative relations



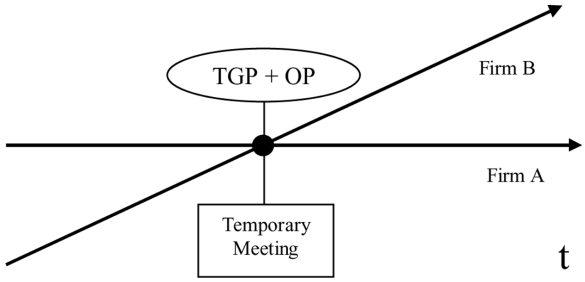
OP: Organised Proximity; TGP: Temporary Geographical Proximity;
GP: Geographical Proximity (co-location).

5.3 Extensions

The example presented above is intentionally limited to the situation of two firms that collaborate with other firms. However, it enables us to envisage more complex dynamic processes, of which we shall only provide a graphic illustration here.

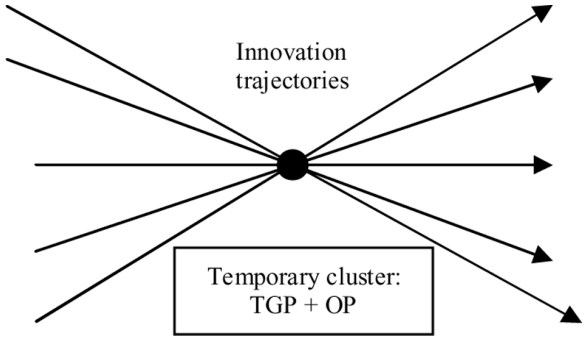
The above-mentioned examples of collaborations can be extended to firms that are characterised by independent innovation trajectories, but which interact with each other in specific places, such as trade shows (see Figure 7). The firms have undertaken different paths of proximity relations, whereas the trajectories of firms or innovation intersect at the place in which the actors can temporarily interact face to face.

Figure 7 Temporary meeting between actors with divergent trajectories



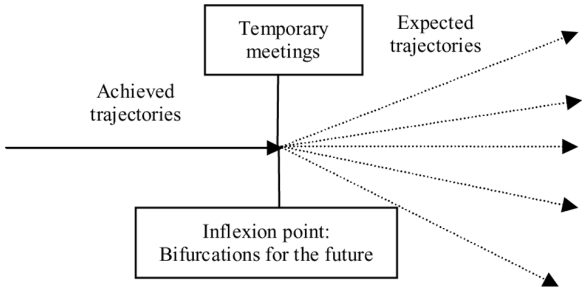
By focusing more particularly on the places of meeting of two or several firms that belong, for example, to the same sector of production or to a similar field of technology, we shall be able to see the outlines of temporary clusters (see Figure 8). In this case, it is the meeting place of different firms that belong to the same sector or the same technological domain.

Figure 8 Focus on a temporary cluster



Let us also mention the meetings that can generate different possible futures from scheduled or unscheduled face-to-face meetings. This situation highlights the uncertainty that can result from an occasional meeting, in the case of a future that cannot be easily planned and is characterised by a high level of uncertainty (see Figure 9). It includes informal meetings as well.

Figure 9 Trajectories: bifurcations and possible futures in situation of uncertainty



The trajectory of a firm is strongly modified by a meeting, which is called into question a past alliance, which is going to lead to the adoption of new parameters of production or innovation or which is going to open the way for new collaborations. We find that an occasional meeting introduces irreversibility, which will determine which future, of all the possible futures, will actually happen.

One last example worth mentioning – and still related to innovation processes – is that of star scientists or prolific inventors, whose career implies short stays in various institutions in the same technological domain but in different locations. These engineers or researchers tend to shift quickly from one firm or laboratory to the other (Le Bas et al., 2009), thus reproducing the patterns of TGP observed among different actors of the process of production or innovation.

6 Conclusions

Currently, the proximity dynamics are called into question because of the upheaval that is transforming the univocal relation between innovation activities and their territories of origin or application, as in the case of clusters. The idea that knowledge is exchanged

more easily between neighbours is becoming less clear-cut, because of the introduction of various types of innovations. The outlines of the different types of proximities have become blurred; the traditional proximity relations are being replaced by more contrasted relations, in which long-distance interactions and distrust towards one's neighbours are promoted by the constant development of ICT. This development facilitates the long-distance transfer of increasingly complex information; promotes the diffusion of informal knowledge, which is difficult to communicate on paper and influences the trust level between actors. This transformation also reduces the necessity for face-to-face interactions and co-location and facilitates long-distance exchanges and cooperation, which, in turn, results in some innovators becoming distrustful of their immediate neighbours as the latter can now more easily copy or pirate their inventions or knowledge. Many alliances develop between partners that are located far from one another and clusters tend more and more to open themselves to the outside – in parallel with the general phenomenon of globalisation.

This paper has aimed to analyse the respective role of exchanges via ICT and face-to-face relations in the cooperation between firms engaged in long-distance collaborations. First, we have presented an overview of the notions of proximity and made a distinction between two main types of proximities: geographical proximity and organised proximity. It led us to a reformulation and a deepening of the notions of proximity. We have then analysed the roles played by long-distance exchanges and by co-location in the relations of collaboration between firms and have introduced the notion of TGP, which corresponds to the possibility of fulfilling the needs for face-to-face contact between actors by travelling between different locations – thanks to mobility. The introduction of TGP helps in understanding the complex balance between proximate and distant relations and re-evaluates the role played by spatial dimensions in contemporaneous economic and social relations. In our third section, we have discussed elements of the dynamics of long-distance collaboration relations by providing graphs that illustrate the successive stages of mobility and long-distance exchanges or ubiquity in the framework of these collaborations. In the last section of our paper, we have re-examined proximity by taking into account the combination of TGP relations and Organised Proximity relations. These examples can be extended to more complex relations, including not only productive links but also personal and social bonds. They pave the way for future researches in the field of spatial and territorial relations.

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Notes

[1]One may be organised or one may organise an activity without necessarily refer to or belong to an organisation, in the strict sense of the term.

[2]The type of mobility we are discussing here is a 'long' mobility, one that is not 'pendular', for example. It consists of time consuming trips with high transport costs. 'Short' mobility, within a local system shall be considered, in a conventional manner, as permanent proximity or co-location.

[3]As mentioned above, we do not consider 'short' or 'pendular' mobility as being part of TGP.