

G. Riva, M.T. Anguera, B.K. Wiederhold and F. Mantovani (Eds.)
**From Communication to Presence: Cognition, Emotions and Culture towards the
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14 Learning Communication Skills through *Computer-based Interactive Simulations*

Olivia REALDON, Valentino ZURLONI, Linda CONFALONIERI,
 Marcello MORTILLARO, Fabrizia MANTOVANI

Abstract. A learning environment for the training of communicative competence has to consider the complexity of human experience, since it requires a number of cues that are managed *hic et nunc* in the flow of communicative exchange. Therefore, communicative competence has been traditionally considered as a typical face-to-face learning topic. So far, few opportunities exist to learn by experience in an e-learning environment that can combine user's practising and experiencing with an adequate scaffolding structure, giving the learner both the opportunity to fail and the opportunity to give sense to the perspectives selected. Recent work on computer-based interactive simulations and autonomous agents is offering new opportunities for the training of communicative competence in different contexts. Simulation creates a unique environment for developing and executing communication skills. Moreover, the communicative interaction can be developed and enhanced in a realistic, but non-threatening situation. The present chapter aims at analysing how communication skills should be learned through computer-based interactive simulations. First, a definition of communication skills will be indicated considering their involvement in tackling communicative exchanges effectively. Second, an architecture for building interactive simulations will be proposed. In particular, a road map for building e-learning simulations specifically targeted at the training of communication skills will be sketched out, focusing on the development of a narrative structure that should adequately reduplicate the flow of the communicative interaction.

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14.1 Introduction

In general, communication is essentially based on our experience of the world. Many different factors come into play here, since experience is a complex structure, made up at the same time of sensorial and perceptual, cognitive and emotional, inter-subjective and cultural processes, mutually connected with each other. Therefore, communication is influenced and guided by perceptual, cognitive and emotional constraints which control and manage the interaction with reality. Within such perspective, meaning can be seen as the semantic expression of our experience. Meaning entails a remarkable amount of variability in order to fit and express in the right way the continuous flow and the great variety of human experience [1].

A learning environment for the training of communicative competence has to consider the complexity of human experience and the semantic flexibility that enables speakers to use meanings in a pliable way, according to their communicative intentions. Therefore, it should allow trainees to re-define and re-negotiate meanings as happens in the communicative interaction.

As a consequence, the learning of communicative competence should be rooted in experience, since it requires a number of cues that are managed *hic et nunc* in the flow of communicative exchanges. Therefore, communicative competence has been traditionally considered as a typical face-to-face learning topic. However, rooting learning in experience does not mean, in itself, simply doing something. So far, few opportunities exist to learn by experience in an e-learning environment that can combine user's practising and experiencing with an adequate scaffolding structure, giving the learner both the opportunity to fail and the opportunity to give sense to the perspectives selected. Recent work on computer-based interactive simulations and autonomous agents [2-4] is offering new opportunities for the training of communicative competence in different contexts. Modelling the real world, decision making in a simulated environment occurs under pressure, often including conflict, emotional factors, and difficult circumstances. Simulation creates a unique environment for developing and executing decision-making skills. Moreover, the communicative interaction can be developed and enhanced in a realistic, but non-threatening situation. Users can train their communicative style in critical settings through different interactive scenarios that lead their identification and experience in a safe context. The present chapter aims at analysing how communication skills should be learned through computer-based interactive simulations. First, a definition of communication skills will be proposed considering their involvement in tackling communicative exchanges effectively. Second, an architecture for building interactive simulations will be proposed. In particular, a road map for building interactive simulations specifically targeted at the training of communication skills will be sketched out, also focusing on the development of a narrative structure that should adequately reduplicate the flow of the communicative path.

14.2 Defining Communication Skills

The issue of defining communication skills can be suitably addressed by providing a conceptual framework within which communication processes can be analysed and

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accounted for. Communicative efficacy can be seen as the outcome in the process of mastering communication skills. Hence, the communication competence will be viewed as consisting in the repertoire of communication skills involved in tackling communicative exchanges effectively.

In the following section the basic components that concur in defining and generating communicative exchanges will be highlighted at the same time pointing out how to shape them in an effective way.

14.2.1 The Design of Meaning: Meaning Flexibility, Modal Meaning and Meaning Regularity

Meaning can be viewed as the access to the symbolic domain and it is the way through which individuals become able to communicate each other their internal states of mind [5]. Nonetheless, meaning is a complex matter since, on the one hand, it is endowed with a high flexibility and adaptability to the contingent situations of interlocutors. On the other hand, it shows consistent regularities connected with the need, in any communicative interaction, to expect some kind of stability over time, in order to be graspable and intelligible. In other words, meaning appears to be struggled between contingency and fixedness, with the difficulty to grasp and to confine it into a circumscribed room.

14.2.1.1 Meaning Flexibility

The comprehensive phenomenon of meaning variability can be synthesized in the claim that meaning never repeats itself. A twice-said utterance does not have the same meaning as the first one, since it inevitably arises novel semantic hidden nuances. By definition, a semantic clone is impossible [6]. There are several communicative phenomena implied in the process of generating such variability in the meaning design: among them, we'll focus primarily on the role played by context, since it more suitably applies to the objectives of this contribution.

The basic idea is that the meaning design of a word or an utterance or a facial expression does not depend on a universal, abstract, and fixed semantic system, but is strictly connected with context. No meaning is totally foreseeable or definable *a priori*, since it hinges upon context in a contingent way. Hence, the same message in different contexts may receive a different interpretation. Besides, there may be a basic ambiguity between a given communicative intention by the speaker and the ascription of another intention to him by the interlocutor [1].

This context-dependence of the meaning of any word, of any utterance, of any facial expression implies that it becomes impossible to grasp the comprehensive features of any meaning, since, in speaking and in interpreting the utterances of others we rely on a number of assumptions, taking for granted, in a given communicative exchange, quite a good number of things [7]. Such assumptions are not semantic in their nature, but belong to our knowledge encyclopaedia, since they are derived from our experience of the world, within our culture of reference. Specifically, circumstantial assumptions concern the specific conditions of a given context, the communicative intention of the speaker, as well as the intention ascription by the recipient. People's interpretations of their own and other people's expressions are not necessarily stable or constant over a period of time, but they may

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change as the context changes. For instance, in the phenomenon called contextual resemanticization, analysed by Violi [8], the speaker can assign specific semantic traits to something that does not possess them of its own, but that obtains them thanks to a specific contingent situation. The phenomenon of contextual resemanticization puts in proper light the great plasticity of meaning, allowing a wide range of opportunities in its use as the result of accurate processes of semantic adjustment. Therefore, one cannot tell which semantic feature in a word, an utterance, or a facial expression depends upon context and which depends upon the text, since they basically contribute in an interdependent way in generating meaning: the former is influenced by the latter in the same moment in which the latter influences the former.

The plasticity and variability of meaning can be considered as posited upon the assumption that meaning is the semantic expression of our experience. That is, meaning does not refer to a fixed and immutable reality, but comes out of the specific interlocutors' point of view (i.e., experience) about reality. Therefore, since communicative exchanges are based on experience (that is a complex structure, simultaneously made of perceptual, cognitive, emotional, and cultural processes, mutually embedded with each other), they will be influenced and guided by perceptual, cognitive and emotional constraints that control and manage our interaction with reality.

Meaning plasticity is hence called for insofar as it enables the expression of the continuous flow and variety of human experience.

14.2.1.2 Meaning Regularity

The semantic variability processes, if assumed at their utmost complexity, make communication virtually impossible, by preventing mutual comprehension. Semantic variability phenomena are indeed compensated and balanced by *semantic stability* processes, which make possible and explain the probabilities of order and regularity in the meaning exchange. So, the meaning design comes to be a quite complex set of patterns in which contingent and momentary components are combined with more enduring and well-grounded ones [6]. Besides, such components of stability are at the base of message intelligibility conditions and of mutual understanding between communicators.

Semantic stability involves some kind of *convention* between interlocutors, because of their sharing the same cultural belonging. As culture is a mediation system which supplies people with a grid of categories, symbols, values, and practices, that enable them to interpret reality, it also provides the learning and the sharing of processes of signification and signalling systems [9]. Such processes are to be considered as the outcome of a long, complex and sometimes hard route to obtain consent and devise conventions between interlocutors (*conventionalisation process*).

A conventionalisation process presupposes the active participation of the communicators, as well as rules, practices, values, and meanings negotiation and sharing, although they may be local and temporary. It ends in working out a set of what Bruner calls *communicative formats* [10,11], each of which is made of a structured sequence of interactive (verbal and non-verbal) exchanges, which allow communicators to reach a joint aim, follow the same procedures, as well as share the meaning of what they are going to say or to do. Many communicative formats show

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a high and strong regularity structure, such as the greeting exchange, the call for apologies, and the like. These cases can be called *standard* (or *default*) *formats*, and are based on recognising and accepting a shared system of rules and patterns. Usually, words and other communicative signs are "anchored" to a default format that makes their meaning foreseeable and definable.

Specifically, communicative formats swing from *re-production processes* to *production processes*, with an oscillating motion similar to the one proposed by Bourdieu [12,13] for cultural practices. On the one hand, given the nature of reproduction processes, communicative formats tend towards repetition and recurrence in an almost stereotypical way, by creating proper "communicative routines" (obviously articulated in sub-routines), and also by establishing a continuity with semantic and communicative past conventions. These recurring and reduplicating processes are at the base of meaning stability and regularity. They are grounded on *context regularity*, as, if it is true that contexts show a great deal of variability and unpredictability, then it is also true that in most cases contexts are structured and provide regular forms to our everyday experience of the world [14]. On this platform, individuals build and share their scripts with reference to specific situations.

Standard context is the context that presents a high routine regularity in the repetition of interactions, sequence of events and communicative exchanges. In such a way, we can assume that *context regularity is equivalent to meaning regularity* [14]. No communicative act, like an utterance, or a facial expression exists without being context related, since it is always indexed in a standard context of use. The meaning of any communicative act is given by the mental representation of standard context regularity. On the other hand, thanks to production processes, communicative formats are neither totally constrained nor completely determined by the past and by context regularity, but they produce variations and deviations as an effect of contingent conditions and novel unpredictable aspects that every communicative situation potentially brings in itself [1].

Context regularity is the outcome of a historical and cultural process, not a logical necessity, since the past neither determines nor constrains the present, although the former steers the latter. In this way, contextual variations may always, in theory and in practice, take place related to *hic et nunc* situations. These variations usually involve a signalling action and a communicative re-adjustment and re-negotiating process between participants.

From this point of view, communicative efficacy is grounded on the ability to tackle, in communicative exchanges, the challenge connected with meaning as a mental and cultural scheme, endowed with a high flexibility and adaptability to the different contingent situations of interlocutors. Such flexibility is grounded on daily experience and, at the same time, allows for meaning to fit the large amount of variability that experience entails. The semantic variability calls for an inferential process, as modal meaning is not an immediate and fully evident datum; rather, it is generated by communicators during their interaction in a dynamic way in the light of the principle of semantic and pragmatic synchrony [1]. At the same time, meaning shows stability over time owing to its conventional nature. As patterned, meaning is coded in some way and follows at least some standard features to be taken by default.

Given this framework, the attainment of communicative efficacy in the sharing and negotiating meaning process seem to be faced with a substantial dilemma: on the one hand, meaning plasticity need to be acknowledged as a basic requirement enabling the fitting and the expression of the continuous flow and variety of human experience.

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The effectiveness in communication exchanges hence calls for the ability to co-construe and to set the hedges that define the boundaries of meaning. Language quantifiers, logical connectives, deictic terms, and qualitative adjectives (among others, “that is to say”, “more or less”, “technically speaking”, and so on) make semantic flexibility and gradualness virtually possible, by bringing in light and actually exploiting, within the communicative exchange, the multiple affordances of meaning. On the other hand, the sharing of communicative formats, as rooted in context regularity, provide the necessary requirement for predictability and intelligibility of meaning.

As such, regularity and flexibility define the boundaries within which efficacy can be attained: such a communicative “space” can be seen as the outcome of intertwined paths: relying more on meaning regularity can lead to stiff and over-conventionalised patterns of communication, while indulging in meaning creativity and plasticity can feature communicative exchanges with ambiguity and confusion, eventually preventing reciprocal comprehensibility [14].

14.2.1.3 Meaning as Inferential Outcome and Multimodal Configuration

Since the meaning design is never a fully evident datum, univocally correspondent to an object or an event, it entails the resort to some inferential process by both interlocutors. That is, meaning exhibits an intrinsic opacity insofar as it is the semantic expression of each interlocutor’s experience, which does not only generate what is said, but also points out and indexes how to intend what is said. Therefore, words utterances and facial expressions are to be intended as communicative cues from which communicators can proceed to make suitable inferences through logical implication, analogy and similarity processes.

Moreover, as Anolli [1] pointed out, meaning is not connected with a unique and exclusive signalling system, but is generated by the network of semantic and pragmatic connections between different signalling systems. Indeed, besides language, that remains the most flexible and stable communication medium, exclusive to the human species, there are several other communicational devices that participate in the generation of meaning, like the paralinguistic (or supra-segmental), the face and gestures system, the gaze, the proxemic and the aptic, as well as the chronemic. In any communicative exchange, speakers are hence able to arrange a set of different signalling systems to communicate and make public their communicative intention.

Among others, Anolli [14] argued that each of these communicative systems bears its contribution and participates in defining the meaning of a communicative act in an autonomous way. Such multiplicity enhances the freedom degrees of speakers to manifest and calibrate his/her own communicative intentions as related to a specific situation. However, the generative capacity of each signalling system should be connected to produce a global and unitary communicative action, with a more or less high consistency degree.

The process of meaning generation via different signalling systems (multimodality) is ruled out by the so-called *principle of semantic and pragmatic synchrony*, set out by Anolli [14], according to which meaning, whatever it may be, is originated by a non-random combination of different portions of meaning, each of whom produced by a given signalling system. Thus, the meaning of a word, an

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utterance or a facial expression hinges upon its relations to every piece of meaning arising out of each signalling system within the same totality.

Modal meaning is the standard outcome of the semantic and pragmatic synchrony process, that is, the prevailing and recursive meaning throughout conventionally given situations within a certain cultural community. As Anolli [6] argued, modal meaning is the preferred (or default) one, regularly predominating in a given set of contexts.

While, although, language is subject to explicit and formal learning ever since early stages in individual development, the learning of non verbal communication is substantially implicit and ruled out mainly within interactions between individuals belonging to the same cultural community. As such, non verbal systems are only partially subject to the conventionalisation process and are mainly apt to provide an iconic, spatial and motor representation of reality, rather than a propositional one. Non verbal signalling and signification systems' main function can hence be identified in generating and qualifying interactions, as well as deeply influencing the relationship patterns between the interlocutors. Facial expressions, gaze, gestures, posture and physical distance are comprehensively shaped, together with verbal signs, in order to express and communicate emotions, to qualify the ongoing relationship within a definite context of interaction (for instance, by defining one's role in a dominance-submission relationship), as well as to enhance persuasion processes.

14.2.1.4 Indexicality and Local Management of Meaning

Indexicality refers to the connection between interlocutors, message and context. From this perspective, context consists in an array of constraints put upon a given event or situation. Such constraints basically contribute in defining the meaning of a given utterance or gesture by telling and selecting the perspective for its interpretation. In other words, contextual information is embedded in discursive practices and in the social distribution of knowledge shared within a given cultural community. Rooting in the view on sign as inference advanced by Peirce [15], Anolli [14] states that by indexicality is meant the process through which utterances, gestures, and facial expressions are anchored to their context of use.

Along this line, indexical (or contextualisation) cues can be identified in all those verbal and non verbal cues that serve a considerable range of functions within the communication process, such as: (a) defining the social identity of the interlocutors (i.e., by selecting social status appropriate expressions); (b) qualifying the utterance in terms of overall positive or negative affective attitude, through the use of quantifiers and superlatives; (c) defining the ongoing social activity (i.e., by employing words whose meaning is related to the knowledge encyclopaedia of specific professions); (d) featuring the epistemic value of the message (i.e., by using adverbs and specific verb modes, like the conditional, or by employing para- and extra-linguistic signals, in order to express one's perspective on the truth content of the utterance, or gesture, or facial expression being acted).

The appropriate selection of indexical cues turns then out to be a most relevant device in an effective *local management of meaning*, since it calls for the ability to set communicative structures in a pliable way, in order to meet the varying and contingent features of the communication flow. As such, indexical hints can be considered as metapragmatic signs [14], in that they provide the contextual

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assumptions that give the frame for interpreting the message exchanged. As a consequence, knowledge and training in the use of indexical cues, as anchored to a given cultural (or micro-cultural) community, becomes a necessary requirement in order to enable interlocutors to constantly keep in focus the ongoing communicative exchange, by co-adjusting their verbal and non verbal signals and by selecting the locally most appropriate contextual perspective .

14.2.2 *The Intention Design*

According to Grice [16], meaning should be considered in a subjective manner as what the speaker means, that is, his/her communicative intention. The interdependency of meaning and intention is a relevant matter to consider in the study of communicative competence. On the one hand, flexibility and regularity of meaning enhance the freedom degrees of speakers in the processes of both intention expression and ascription. On the other hand, intention selection and intention ascription are the requisites for generating, negotiating and modifying meanings. There can't be any communicative exchange without selecting and pursuing specific intentions.

Intention plays a fundamental role in people's communicative exchanges, since it concerns not only the speaker in producing his/her communicative act but also the addressee in recovering and interpreting the meaning of the speaker's message, attributing to it a specific intention. In this way, the communicative exchange is created and governed by a reciprocal game between the communicators: the display and ostension of a given intention by the speaker (*intentionalization process*) and the ascription and attribution of a certain intention to him/her by the addressee (*re-intentionalization process*).

From the speaker's point of view, intention is characterized by an articulated gradation and differentiation within itself. In everyday life, intentionality (as an attitude to produce distinct and specific intentions) is regulated by continuous variations of intensity and precision. This intentional gradability allows communicators to manage the focusing of different communicative acts. Next to plain (common and ordinary) communicative acts, in which the intentional process is almost automatic, there are complex communicative acts (like seductive, ironic or deceptive communication) in which the communicative intention that the communicator conveys to the interlocutor has to be managed by attentive and conscious processes.

In everyday conversation a speaker has to select and choose an intentional layer to convey what he/she has in mind. Since in the production of a communicative act a speaker can only express a part of his/her mental content, the speaker is obliged to follow only one of the different meaning routes he/she has at his/her disposal for conveying what he/she has in mind. Such a choice and continuous gradation of communicative intentions make the communicative act particularly complex, since, on the one hand, it needs a precise cognitive and emotional direction; on the other, it can give rise to communicative uncertainties and difficulties. One intention is usually embedded in another which surpasses and includes the first one. As a consequence, complex communicative acts require the speaker to monitor continuously the efficacy of his intentional effort to reduce such communicative uncertainties. In such circumstances, *explaining* skills can be considered as an attempt to reduce such

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complexity, identifying and specifying the problem that requires explanation, presenting or eliciting a series of linked statements, and checking that the explanation is understood by the addressee.

In order to succeed, the communicative exchange has to be characterized not only by the producing of a communicative intention in the speaker, but also by its recovery by the addressee. The recovery act involves a precise and conscious activity and the participation of the receiver in the meaning elaboration, since meaning is defined only when the addressee recognizes the speaker's communicative intention [16,17]. However, the idea of recovery as an act of recognizing the source's communicative intention entails an asymmetrical direction, like in a dance where one leads and the other is led [18]. In this sense the speaker appears more significant than the hearer. The former takes a more important position as a source; the latter has only to carry out the recovery as accurately as possible. The more precise the hearer is in this activity, the more suitable he/she is in the communicative exchange and the better he/she does his/her communicative task.

As a consequence, the recovery act appears to be insufficient to explain the interpretation activity of the hearer in relation to the speaker's intention. Therefore, the addressee must attribute a certain intention to the source's communicative act [19]. This intention ascription in the hearer is the "other face" of the intentional stance and is the equivalent of intention production in the speaker. Such a process is characterized by different features: a) it is an autonomous process, carried out only by the addressee; b) it is an active and subjective process, because it depends completely on the addressee's abilities as well as on the perspective he/she chooses to follow.

It is worth remarking that we are faced with an essential condition of communicative interaction, because the speaker and the hearer have different points of view about the same events and objects as topics of communication, even if they share a mutual cognitive background and mutual, culturally defined knowledge. Such a difference in their points of view, that can be radical in some circumstances, involves and presupposes in any case different interpretations and meaning-making in the speaker and the hearer with reference to the same episodes and facts. They possess a different encyclopaedia of knowledge, because they have a different amount of experience in qualitative and quantitative terms. Moreover, they may refer to different beliefs and values systems, as well as be guided by different desires and goals.

In such a perspective it is obvious to expect a plurality of interpretations in the intention attribution from the addressee to the source's message. This plurality is not to be considered as a pathological accident, but it is the standard activity of the addressee. Intention ascription is an open field, and the addressee is allowed a broad space to justify his/her interpretative choice, connected with some cues of the communicative act.

Given the significance and the relevance of his intention ascription, the addressee is as important as the speaker in the communicative exchange. Therefore, intention ascription is a fundamental communicative skill to improve in order to ascribe an intention to the speaker consistently, since it places the addressee and the speaker on the same parathetic level. As a consequence, they share the same responsibility in the construction of the communicative act.

In a standard condition, during the fast flow of communicative exchanges, intention ascription seems to be a default and immediate process, regulated by the

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taking-for-granted principle [20], and rooted in context regularity and in the routine exchanges embedded in meaning stability phenomena. However, the actual intention is often implicit, not directly said by the speaker, but made understandable by means of sufficient leakage cues. In these cases, intention attribution is a significant and subtle communicative task for the addressee. The fundamental questions may be the following: “Why does he tell me such and such a thing? Why does he use this voice intonation?”, and the like. We are not interested in limiting our communicative understanding to the apparent, surface intention; we are usually interested in grasping the profound, actual intention of the speaker. If the addressee confines him/herself to taking into consideration only the surface intention, he is quite likely to go wrong sooner or later; in any case, he does not seem a very competent communicator.

It is in such circumstances that emerges the importance of training intention ascription skill to achieve effective communicative competence. The discovering of the actual intention involves a precise, clever inferential process in the trainee. It is an issue of practical reasoning, often based on heuristics and biased by previous patterns of interaction with the interlocutor. Sometimes a few weak clues are sufficient to produce a large inducing process and to reach significant conclusions, which, of course, are not always correct.

To investigate the accuracy of his inferences, the trainee has to search for adding clues from the interlocutor, i.e. re-presenting the perceived essence of the interlocutor’s intentions through *reflecting* [21]. Reflection, as a communicative skill, consists of bringing to the surface and expressing in words those states of mind that lie behind the speaker’s words [22]. In many professional contexts, it means a restatement of what the client was saying, used to reflect the intention he was expressing, whether or not such intention was directly expressed or only implied [23]. Interpreting back the core message contained in the interlocutor’s previous statement enables issues that are vague and confused to be thought through more clearly and objectively [24]. By reflecting, the trainee not only conveys a desire to get to know if his attributions were sufficiently accurate, but also demonstrates to the interlocutor the level of understanding accomplished, despite the fact that the original message may have been inchoate and vague. Moreover, reflecting confirms the speaker in his effort to contribute to the communicative exchange, helping him to express thoughts gradually more clearly and fully. Supported in this way, the speaker is often motivated to continue to explore particular themes more deeply concentrating upon facts, feelings or both, depending upon the content of the reflective statement [25]. From the trainee’s point of view, confirmatory responses also serve an important feedback function by indicating accurate understanding of the world of the speaker [26].

14.2.3 Obliquity

The intentionalization and re-intentionalization processes show how the communicative exchange is created and governed by a reciprocal game between the communicators, played hand by hand and move by move [18]. The indefiniteness both in intention production and in intention ascription makes communication seem like an unforeseeable route, not deducible from previous exchanges. On one side, the speaker has the possibility of selecting a certain route of sense instead of another one. It greatly increases the degree of communicative freedom at disposal of the

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communicator. Therefore, intention plurality and graduation entail an intentional opacity, since in many cases communicative intention, embodied in an utterance or gesture, is shaded and changeable. On the other, intention ascription is indeterminate, since it can take different routes, none of which is either privileged or foreseeable. Following such considerations, Anolli proposed the MaCHT theory [18], in which many communicative phenomena (such as irony, deception, seduction, and so forth) are considered as chances for communication itself, since they enhances the degrees of freedom available to communicators in their interaction. Communicators have the opportunity to manage their communicative strategy in the best possible way, given the contextual constraints and their respective encyclopaedia of knowledge. These phenomena represent examples of an “oblique” communication with the purpose of optimising interaction with the partner.

The necessity of adopting a type of communication which is “oblique” or indirect is not limited to seductive communication, in which it allows the seducer to combine openness and pleasure whilst allowing him at the same time the reciprocal “disarmament”, regarding the content, timing and method involved in the communication. In everyday life there is a great amount of interactive situations that requires different degrees of indirectness and, in some cases, of ambivalence of the communicative strategies. For instance, irony is a skilful device to assure oneself of many more degrees of freedom than an explicit utterance does [27]. The basic ambiguity of irony allows one to negotiate and re-negotiate the meaning of an ironic comment. Because the ironist is not constrained to undertake responsibility for his/her words and, consequently, he has neither to compromise his/her image nor to lose face [28], the responsibility for the appraisal of ironic value of an utterance moves from the ironist to the addressee. It is up to the latter to recover and attribute an ironic meaning and intention to the utterance of the former. In particular, the ironic sense of a comment is effective when it is not only intenzionalized by the ironist, but also “re-intentionalized” by the addressee. Therefore, oblique communication allows speakers to calibrate the weight of the indirect meaning of their speech. An indirect expression of one’s thoughts, desires and feelings cannot only hide one’s real intention, but it can also define it and re-draw the limits of social interaction between interlocutors.

As a consequence, a skilled use of irony and humour may serve different communicative functions, and hence prove their importance for the training of communicative competence. It helps to regulate interactions and serves as a social mechanism to facilitate or inhibit the flow of the communicative exchange [29]. For instance, humour assists in maintaining the flow of interaction, filling in pauses in our conversation and sustaining the interest and attention of our conversational partner [30]. In many professional contexts, introducing a topic in a light-hearted way helps the trainee to “search for information”, probing indirectly the client’s general attitudes and values about an issue and to reveal “touchy” subjects.

14.2.4 Communicative Synchrony and Relationship Management

In communicative exchanges, speaker and interlocutor are at the same level and share the same responsibility; as such, they both participate in that process. As Cohen and Levesque [31] sketched out, “the joint action of dialogue claims that both parties to a dialogue are responsible for sustaining it. Participating in a dialogue requires the

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conversations to have at least a joint commitment to understand one another”. Moreover, a participation framework implies a mutual process of co-constructing and sharing meaning in a continuous stream of communicative exchanges, as shown by Duranti [32].

According to Burgoon [33], when people communicate, they have to “adapt their interaction styles to one another. For example, they may match each other’s behavior, synchronize the timing behavior, or behave in opposite ways”. Actually, it is well understood in common observations as well as in the scientific field that participants in communicative interaction are usually engaged in a common rhythm. As Cappella [34] pointed out, “co-ordination in social interaction means that people adjust their actions to those of their partners”. The notion of interactive co-ordination and mutual adaptation in communication covers a broad range of processes, such as synchrony, mirroring, matching, reciprocity, compensation, convergence as well as divergence. Some of these phenomena have more to do with the temporal co-ordination of the interaction, whereas others focus on the reciprocal adaptation of communicative styles in terms of converging vs. diverging from one’s partner’s style.

Anolli [18] collected all these processes under the label of *communicative synchrony* as a global and basic property of communication. In fact, communicative attuning and synchrony allow communicators to decline their communicative competence in a practical way for convergence or divergence, and create a broad set of chances for different solutions, ranging from direct and open communication patterns to indirect and cryptic ones.

From a sociological point of view, different scientists have drawn special attention to time patterns in organizing communicative exchanges. The notions of “synchrony of rhythms” proposed by Goffman [35] and “temporal symmetry” advanced by Zerubavel [36] are in this sense. Schutz [37] has widened the concept of a mutual tuning-in relationship as a theoretical extension of the notion of mutual sharing of Cooley [38] and Mead [39]. The “mutual tuning-in relationship” involves, in a particular way, the organization of interaction sequences between partners in a temporal succession.

Within the psychological field, among others scholars, Giles [40], Giles and Powesland [41], and Giles, Coupland, and Coupland [42] deserved attention for their proposal of the Communication Accommodation Theory. According to the CAT, attuning and accommodation strategies consist of a broad set of linguistic and extra-linguistic signals which enable us to adapt our communicative acts to those of our partners, shifting them along a convergent or divergent direction in the sequence of exchanges. In the first case, the communicative styles of the participants become more similar and assume a homogeneous shape; in the second one, the differences become greater, creating a process of schismogenesis. The CAT has been supported by experimental results, since it has been verified that pronunciation [40], speech rate [43], utterances and length of pauses [44], vocal intensity [45, 46], as well as vocal fundamental frequency patterns in childish babbling [47] vary in a sequence of communicative exchanges in conformity with mutual adjustment and attuning.

More recently, Gregory [48], Gregory and Webster [49], and Gregory, Dagan, and Webster [50] have analyzed the accommodation of vocal long-term features, showing that communicators are able to mutually co-ordinate their speech styles in a subtle way, by assuming and maintaining the same specific range of vocal pitch.

The emergence of this synchronized and adapted pattern appears to be of crucial importance in ensuring efficacy and comprehensibility in communication, and in

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determining the perceived quality of the relationship, effectively managing relational and communicative distance. This topic has been stressed by Grammer [51], and Grammer, Kruck, and Magnusson [52] in investigating the role of communicative synchrony in seduction interaction among people who meet for the first time. In fact, rhythm co-ordination is fundamental in determining the development of interpersonal attraction and a higher degree of satisfaction about the relationship [53]. Patient satisfaction in the physician-patient relationship is also highly related to interactive and communicative synchrony [54]).

Within the perspective here presented communicative efficacy indeed serves and is connected with the basic functions of communication. Besides the facets of effectiveness linked with the propositional function of communication [55,56], which has to do with meaning generation and sharing, the other basic function of communication is the relational one [57]. From this point of view, communication is the psychological dimension through which and by means of which the speaker and the interlocutor's identities are reciprocally defined. In communicating, partners define themselves, the interlocutors and feature the relationship between them. Indeed, for most people, communication takes place within the context of ongoing relationships. As Fogel [58] has illustrated, it is within the context of relationships that individuals develop and grow. Therefore, communication is the basic process through which most patterns of human relationships (from dominance to submission, to conflict) are built upon, can be modified, and can be terminated.

There is a close association between effective communication and relational satisfaction. The relational aspects of communicative efforts are as crucial to effective communication as is the meaning of the message itself, although a sharp dichotomy does not exist: the message transmits relational cues, too [59].

14.3 Developing Effective Simulation Models

Although there is a shared consensus about the affordances interactive simulations can provide, less convergence can be found regarding the architecture they should be built on, especially as far as the training of communication and relational skills is concerned. The aim of the following sections will be to sketch out a road map, theoretically-based and application oriented, aimed at building interactive simulations specifically targeted at the training of communication skills.

First, some basic assumptions regarding the perspective selected for learning in simulations, the multiplicity of specification layers and the expertise resources at issue when developing simulations will be outlined. The topics hence covered will include: (a) identifying a theoretical framework for learning in simulations (expert-novice interaction); (b) defining the specification layers targeted in creating the simulation model; (c) identifying the type of expertise that is required for developing effective simulation models

Second, guidelines for scripting the communicative exchanges will be proposed. We will focus on the development of a narrative structure that should adequately reduplicate the flow of the communicative path.

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14.3.1 Basic Distinctions

14.3.1.1 Learning in Simulations: the Expert-novice Interaction

In the light of widely recognized theoretical and empirical evidence [60, 61], learning cannot be considered as a private affair taking place in the mind of the ‘learner’, this last meant as an isolated pole. Rather, it must be conceived as a social process involving interaction between two or more individuals where knowledge appropriation takes place within and by means of social interaction (concept of distributed knowledge).

Moreover, not only does learning entail interaction, but it also requires *participatory appropriation* [61], in that it involves mutual influence between the learning actors. In other words, learning cannot be conceived as knowledge transmission from an active expert to a passive unskilled learner, but, rather, it may be viewed as an interactive process where expert and novice actively influence each other in an interdependent way: since both take part in such activity (participation is a necessary requisite), the expert influences the novice in the same moment in which the former is influenced by the latter.

The basic idea underlying this approach is that of learning within a community: learning occurs when people participate in shared endeavours with others, with all playing active although sometimes asymmetrical roles in a socio-cultural activity [62]. Such a perspective contrasts with models of learning that are based on one-sided notions of learning – either that it occurs through transmission of knowledge from experts or acquisition of knowledge by novices, with the learners or the others (respectively) in a passive role.

Within this perspective of learning as participation, both experts and novices need to be routinely included in the range of practises of the cultural community they belong to. Hence, simulations can be seen as devices through which knowledge, practices, and perspectives on a specific domain are participated and experienced among novices and experts.

14.3.1.2 Interactive Simulations Specification Layers

Interactive *computer-based* simulations can be viewed as artefacts for learning. As such, they can be featured both as cultural artefacts and as technological artefacts. Following the categorization proposed by Wartofsky [63], in the latter sense they are primary artefacts, that is, materials tools made possible and designed within the technological and graphic affordances thus far available. Moreover, they are secondary artefacts, that is, they consist in mental models and symbols apt to generate different meaning paths. Simulations are therefore built up out of the selection of specific communicative intentions and, at the same time, can be seen as social practices, that is, sequences of organized behaviours and activities which, in order to be participated by expert and novice, need to be suitably scripted and designed. From this point of view, simulations are conventions, insofar as they play a mediation role in the learning process, by shaping it and organizing it (concept of *mediated action*) [64], though not determining it completely: since simulations are cultural artefacts, there is a strong interdependence between simulation-developers, simulation-users and the artefact that mediates the whole learning process.

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Therefore, conceptualizing simulations as artefacts for learning entails distinguishing at least between two different layers in their development: (a) the simulation architecture and rationale, that consists in identifying the multiplicity of meaning paths and strategies which can lead to pursue a specific professional goal by mastering specific communication skills (*architecture model specification*) and (b) the simulation design, that consists in the ‘visible’ output of the architecture simulation (*design model specification*). As will be highlighted further, this contribution will mainly deal with architecture model specification issues.

14.3.1.3 Types of Expertise

In developing the simulation model, both at the architecture specification level and at the design specification level, several types of expertise are involved. Speaking about types of expertise does not imply a one-to-one correspondence with specific expert professionals: rather, the aim is to identify the resources in expertise that are required for anchoring simulations to specific contexts, defining standard regularities and suitable effective deviations from such regularities, in order to manage communicative exchanges effectively.

Conceiving simulations as artefacts gives us the opportunity to identify the expertise domains that need to be taken into account for their development, providing validity and accuracy related to the specific learning goals. First, simulations have to do with conventions resulting from a specific professional culture. Hence, domain specific professionals are needed to identify the relevant cultural practises and the routine sequences of interaction that entail specific communication skills to be managed effectively. Expertise in training communication skills has, moreover, to be connected with identifying the specific shape that practises and the intentional project that directs them, take within the learning path. Finally, being material artefacts, they need to be expertly designed in order to accurately reproduce the perspective architecture behind them. Of course, in the light of the principle of distributed knowledge informing the whole paradigm of learning as participation, none of these types of expertise can be thought of as self sufficient in the process of simulation development, each being, rather, at least, at a minimal level, necessary though never sufficient in itself. More in detail, the types of expertise required in development effort here at issue are: *the professional expertise, the expertise in training communication skills, and the technological and designing expertise.*

14.3.1.3.1 Professional Expertise

By professional expertise is meant the expertise on a specific professional domain, in managing and mastering effectively specific interactional and communicative routines, like, e.g., in the banking domain, expertise in mastering cashier-client communicative exchanges, or in the medical domain, expertise in managing patient-physician communicative interaction. As Schank [65] points out, this type of expertise is often linked to those professionals who, given a specific domain, have succeeded in identifying those perspectives that let them negotiate meanings, and manage relationships and emotions effectively. In other words, their experience in meaning generation and strategic mastering of intention expression and intention ascription gives them the opportunity to distinguish between more effective solutions and less effective solutions.

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Since experience can be viewed as made up of the perspectives through which meanings are generated, this type of expertise is the requisite for (a) identifying those sequences of action that, in these professional's experience, have generated critical and challenging interactive situations that entail communication skills to be tackled, (b) identifying the communication skills they found most often involved in ruling and acting different strategies, and (c) scaling these communicative solutions according to how they found them to be effective. Of course, being rooted in experience, this type of expertise is intrinsically *domain specific* and cannot be considered as immutable and unchanging, being, rather, subject to re-definition in the light of ongoing cultural (and micro-cultural) adjustments.

From a methodological point of view, robustness, validity and accuracy in the perspectives elaborated by these professionals are deeply influenced by the method employed to gain insights into their experience. Following Schank [65], such perspectives are best identified by asking these professionals to provide *narratives* of their experience, within an interviewing context guided by experts in the training of communication skills. The underlying assumption is that, since this type of expertise roots in experience, it can be properly acquired by relying on the episodic memory, that is by having these experts provide narratives, contextually and temporally grounded, regarding specific events that personally occurred to them, connected with failure, or success, in mastering critical professional situations. The narratives obtained pave the way for communication skills experts to gather the key meanings, structured in sequences of action (scripts), useful for scripting the simulations. Within this framework, a remarkable affordance in developing interactive computer-based simulations lies in the opportunity to make this type of expertise available to a large number of trainees; as a matter of fact, this highly valuable type of expertise is not only difficult to get via face-to-face formal learning, but it's also highly unlikely to be participated to a large number of potential trainees.

14.3.1.3.2 Expertise in training communication skills

This type of expertise involves the ability to master the declarative – both as episodic and as semantic – knowledge [66] concerning communication skills, so as to be able to teach them effectively. It is connected with bridging the gap between more (or less) effective practises in tackling communicative challenges and the grid of micro- and macro-categories that theoretically map and account for the effectiveness of such practises. Such a map makes possible to identify the specific targets of learning, to operationalize the communication skills at issue into their analytic defining components and to build up a learning path viably designed and structured in order to reach the desired learning goals. From this point of view, this type of expertise is connected with featuring the learning objectives in terms of accuracy and exhaustivity.

The affordances provided by these type of expertise in devising interactive simulations match the underlying assumption that learning is a considerable time- and resource-consuming activity. Given that the narratives supplied by domain professionals have been properly acquired, experts in training communication skills can soundly script the flow of communicative exchanges within which the identified and targeted skills are supposed to come into play. In scripting such flow, meanings are generated and relationships are defined as mental representations of those context regularities highlighted by domain professionals. Moreover, variations in such

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regularities (and in mastering the skills connected more or less effectively) account for communication paths that sensibly diverge from practises that, from the domain professionals' point of view and experience, turned out to be less effective than others. Nonetheless, since context regularity is the outcome of a cultural process, not a logical necessity, contextual variations not only are needed to reproduce 'natural' communicative exchanges, but also provide the learner with pliable experiential constraints, hence reinforcing the opportunity to fit and express his/her point of view in the scripted though perceived as *hic et nunc* situations.

Therefore, through this type of expertise, the learning path is modelled by taking into account both a grid of theoretically sound categories and the communicative formats provided by expert professionals, nonetheless leaving room for learner's substantial 'deviations' from regularities. As such, a twofold learning strategy is employed: on the one hand, contributions from expert professionals are optimized and give the learner a number of appropriately context-indexed situations and communicatively skilled routes. Learning from imitation and through repetition is therefore possible. On the other hand, by providing significant off-regularity paths, the learner is given the opportunity to face increasingly difficult and demanding communicative exchanges, that can eventually lead to highly inaccurate communicative outcomes. Whatever the path resulting from the learner's choices, successive feedback sessions are needed, as pointed out further, to give sense to the learner's experience.

Therefore, the basic contribution connected with this type of expertise has to do with developing a simulation architecture in which a multiplicity of communication paths, all ecologically sound though different in presumptive efficacy, are identified in order to provide the learner with appropriate experiential constraints that can enhance both a top-down learning path (by facilitating the appropriation of certain communicative formats, rather than others) and a bottom-up learning path (by letting the learner experience and give shape to the communication exchange). To reach this target, besides the scripting of simulations, the development and definition of the sequence of learner's activities need to be worked out within this type of expertise competence, so as to pertinently match learning objectives (i.e., skills and communicative formats appropriation) with sound and specific methods in the education and training of this repertoire of abilities.

14.3.1.3.3 Technological and designing expertise

This type of expertise encompasses a wide array of specific abilities (ranging from computer graphics, 3D animation in virtual environments, computer science informatics) that are necessary in order to accurately reproduce in a "material" artefact the whole simulation architecture, including the design and animation (voice, facial expressions, gestures, and so on) of the characters involved in the scripted communicative exchanges, other than the definition and the visual reproduction of the environment supposed to frame the interaction itself. Since the aim of this contribution has mainly to do with the simulation architecture specification layer, we won't go through the details and relevant implications connected with the technological affordances so far available in this domain. Rather, efforts will be devoted to bringing into light those constraints that, from an architecture layer development, affect and give shape to the designing process of interactive computer-based simulations.

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Our basic assumption is that, to enable the user to learn by experience, he must be provided with the opportunity to act communicative exchanges with appropriate contextual information. Nonetheless, context assumptions and indexes cannot be considered as the direct outcome of the physical reproduction of most-similar-to-real communicative exchanges; as Mantovani and Riva [67] point out, from the user's point of view, the criterion of validity for experience in mediated environments does not hinge so much on the comprehensive reproduction of the conditions of physical presence (immersion), but on the development of environments in which actors may share a common ground and interact in an ecological and valid way. Moving back to communication skills training, therefore, it is reasonable to point out that animating bodies and faces of the different characters in interaction taking into account micro-movements (of the brows, of the lips, of the arms, etc.), or designing culture and professionally grounded environments is a design target objective that cannot be faced within a fidelity-based approach to experience in virtual environments [68]. Rather, the designing target objective should be to provide learners with a network of situations and characters that are specifically salient to the skills being trained and to their being indexed to the professional contexts at issue.

Moreover, even considering quite a short communicative exchange (say, two to three minutes long), the range of indexes to be provided to the user encompasses quite a huge number of design choices (modelling the physical outline of the characters, animating them via micro- and macro-expressions, providing temporal coordination to the interaction, defining the environment, and so on), and quite a considerable time (and economical resources) to reproduce them (both in the case of realizing videos with human interlocutors, and in the case of designing 3D embodied characters). A matching between resources to be engaged in design development and priorities connected with the learning target (i.e., the training of communication skills) need then to be reached to enable the use of simulations in a variety of application domains, and not only for research purposes.

Therefore, both from a theoretical view on the constraints to be set in giving validity to the learner's experience, and from an application point of view, one can sustain that priorities in the reproduction of contextual cues need to be set, so as to provide the whole designing process with specific guidelines. For instance, in the simulation design of communicative exchanges, synchronisation between verbal and non verbal signalling systems in each character's animation (by accurately reproducing micro-movements of the face, of gaze, etc., both in each character's expression, and in temporal consistency one with the other over the interaction) can undoubtedly be assumed as far more relevant in comparison with a most accurate reproduction of details in the environment. Hence, expertise in the training of communication skills reasonably need to be combined with design expertise in this process, so as to reproduce exclusively those indexes that, from intention and meaning generation to intention and meaning ascription, suitably anchor the scripted perspectives to a given context.

14.3.2 Scripting the Communicative Exchange

In everyday life, through the interaction with a system people formulate mental models of that system. It helps us to predict the system we confront in our environment. A mental model is one's "personal theory", his own *perspective* on

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some domain or environment [69]. Such perspective needs not be technically accurate (and often is not), but it must be functional. Perspectives will be constrained by such things as the user's technical background, previous experience with similar systems, and the structure of the human information processing system.

As Norman [70] pointed out, the perspectives people follow to understand social and physical phenomena [71] and to anticipate their behaviour, are characterized by some elements: (a) mental models, and hence perspectives, are incomplete; (b) the ability to "run" them can be severely limited; (c) they are unstable (people can forget details of the system especially when those details have not been utilized for a while); (d) they do not have firm boundaries; (e) they are unscientific, and often include "superstitious" behavior and/or distrust of technology as a factor; (f) they are parsimonious (people often trade off physical action for reduced mental complexity, especially when reduction of complexity can be applied to multiple systems thus avoiding confusion).

As most real systems are non-linear, complex, highly interactive, and their functioning is normally counter-intuitive [72], these perspectives frequently show lack in accuracy and efficacy. Conversely, professional experts operate to see the larger "chunks" (bigger patterns) and to grasp the context (where the important patterns exist in the world), and have a systematic framework (similar to "local" system) to "store" their understanding (deeper knowledge).

In developing the simulation model, communicative exchanges should be scripted as to reduplicate the flow of the communicative path in an adequate narrative structure. In general, such structure entails a *vertical* and a *horizontal dimensions*. Its validity stands in the ability of the expert in modelling different *ad hoc* perspectives of the real system's functioning (*vertical dimension*). The aim is of balancing the coherence of the story against the amount of control afforded the user [73], fixing adequate contextual boundaries and degrees of freedom to user's experience. Starting from such perspectives, experts in training communication skills begin to script each communicative exchange. At each decision point, different choices are scripted in order to let the user experience a particular communicative skill (*horizontal dimension*).

There are two fundamental types of narratives used in computer learning applications: *linear narrative* and *branching narrative*. Linear narrative is a traditional form of narrative in which a sequence of events is narrated from beginning to ending without variation or possibility of a user altering the way in which the story unfolds or ends [74]. Even though the user has a certain degree of control during level play, the only outcome is successful completion of some objective or failure, in which case the user must try again. All users experience the same story and each user will experience the same story during successive sessions.

Conversely, a typical branching narrative offers the user a piece of a story and then asks him to make plot or character decisions. The effects of these decisions may be very small and short-lived, or they may make a huge difference to the story and change everything from that point on. Branching narratives are typically represented as direct graphs in which each node represents a linear, scripted scene followed by a decision point. Arcs between nodes represent decisions that can be made by the users [75]. Even though branching narrative may introduce variability into the experience a user has with a storytelling system, the variability is scripted into the system at design time and is thus limited by the system designer's anticipation of the user's needs or preferences.

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In selecting the narrative structure, experts in training communication skills have to fix a level of complexity that is appropriate for the learning objectives and goals of the experience that is being simulated, and makes the simulation experience as easy as possible to understand for the learner. Branching techniques vary from very simple, *bulging tree* structures, where each story segment correspond to a branch, to very complex, open-ended structures, such as what mathematicians call a *complete graph*, in which every decision node is connected to every other node.

Once the narrative structure is fixed, experts begin to script different choices at different decision points. According to Schank [65], more than a great number of choices, the simulation of a system for the training of communication skills requires to communicate that there's not always one right answer. The trainee is invited to learn to use his own judgment rather than rely on someone else's. Throughout the simulation, people should be able to make the same choices they'd make in a real situation. Nevertheless, although assuming that no one of the alternative options should be quite wrong, experts should fix one of them as the best practice, consistently to the targeted skill and to the selected perspectives. Once again, it is a matter of interplay between semantic instability and semantic stability. If semantic instability phenomena are not compensated, completed and balanced by semantic stability processes, the probabilities of order and regularity in meaning exchange would be neither possible nor explainable. Fixing the best practice allows experts to ground the communicative exchange on context regularity, since if it is true that contexts show a great deal of variability and unpredictability, then it is also true that in most cases contexts are structured and regular forms in our everyday experience of the world.

14.4 Conclusions

To sum up, in order to reduplicate the flow of the communicative path, a learning environment for the training of communicative competence has to model the complexity of communicative interaction in a viable way. As we have seen, communicative phenomena appear to move restlessly between contingency and fixedness. On the one hand, they are endowed with a high flexibility and adaptability to the contingent situations of interlocutors. On the other hand, they show consistent regularities connected with the need to expect some kind of stability over time, in order to be graspable and intelligible.

In general, it seems that an open-ended narrative structure should allow the e-learning simulation to fit adequately such complexity of communicative exchanges. An open-ended simulation should present the user with a large number of choices at each turn that lead to an almost infinite number of outcomes. However, from the end-user's point of view, creating a highly complex simulation environment leads often the end-user to confusion, frustration, and disappointment with the experience. From the perspective of experts in training communication skills, the complexity of communicative exchanges is not already reproduced by neither existing algorithms nor predictive models for anticipating communicative boundaries and communicative degrees of freedom. The basic idea is that an effective communicative strategy is not foreseeable a priori, since it requires an articulated path of communicative layers and the control of different degrees of freedom. Moreover, the same strategy may imply different levels of efficacy in different

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contexts, since it depends on the context in a contingent way. The efficacy of both communication skills managed step by step during the communicative exchange, and the overall communicative strategy is only definable *a posteriori*. As a consequence, the trainee is allowed to compare the perspective he selected and performed with other pre-scripted perspectives. Therefore, scripting different *ad hoc* perspectives is a fundamental requisite for a narrative structure in order to reproduce both the flexibility and regularity of communicative exchanges. An adequate scaffolding structure for the training of communicative competence in an e-learning environment entails fixing both contextual boundaries and degrees of freedom to let the learner the opportunity to give sense to the perspective selected.

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