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The acquisition of socio-motor improvisation in the mirror game



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ABSTRACT

Socio-motor improvisation is defined as the creative action of two or more people without a script or anticipated preparation. It is evaluated through two main parameters: movement synchronization and movement richness. Experts in art (e.g., dance, theater or music) are known to exhibit higher synchronization and to perform richer movements during interpersonal improvisation, but how these competences evolve over time is largely unknown. In the present study, we investigated whether performing more synchronized and richer movements over time can promote the acquisition of improvisation. Pairs of novice participants were instructed to play an improvisation mirror game in three different sessions. Between sessions, they performed an unintended interpersonal coordination task in which synchronization and richness were manipulated, resulting in four different groups of dyads. Our results demonstrate that synchronization during improvisation improved for all groups whereas movement richness only enhanced for dyads that performed synchronized movements during unintended coordination tasks. Our findings suggest that movement synchrony contributes more than movement richness to the acquisition of socio-motor improvisation in the mirror game.

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1. Introduction

Improvisation plays a critical role during our life span – “Life is a continual improvisation” (Agre & Chapman, 1987). Even in our social interactions, we constantly improvise by spontaneously coordinating our speeches and movements to those of our interactant (Nachmanovitch, 1990; Shockley, Richardson, & Dale, 2009). We call this phenomenon *socio-motor improvisation* (or joint motion improvisation), and define it as the creative action of two or more people without a script or anticipated preparation (Noy, Dekel, & Alon, 2011). This phenomenon occurs when we walk with someone (Sawyer, 2001), or when we are engaged in a joint action, such as lifting together a wooden plank (Richardson, Marsh, & Baron, 2007). During these interactions, no scenario is usually prepared in advance. Instead, we continually adapt our own verbal and non-verbal behaviors to the environment, including other people, in order to maintain a successful interaction (Ekman & Friesen, 1969). This continuous adaptation is fundamental and conveys relevant aspects of our interactions, such as our intentions and

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feelings (Goldin-Meadow, 1999; Krauss, Chen, & Chawla, 1996; Schmidt & Richardson, 2008). The aim of this study is to better understand the mechanisms underlying the improvement of socio-motor improvisation competences over time.

Improvisation is often observed in artistic endeavors such as music, theater or dance, when people interact with each other in complex and emotional ways (Johnstone, 1987; Limb & Braun, 2008). In a jam play-band, musicians have to adapt their music in order to stay synchronized with each other (Berliner, 1994; Walton, Richardson, Langland-Hassan, & Chemero, 2015). When two dancers improvise together, they have to synchronize their behaviors while individually performing complex and rich movements. Thus, the capacity to improvise could be captured and evaluated by two complementary parameters: (i) the synchronization between the participants' movements, and (ii) the richness of their movements performed while improvising. For synchronization, Noy et al. (2011) showed in dyads performing joint motor improvisation that experts in art are able to perform moments of creativity with a high level of synchronization and with no specific leader or follower. They called this phenomenon *moment of togetherness* (Noy, Alon, & Friedman, 2015), which relates to “a state of unselfconscious awareness in which every individual action seems to be the right one and the group works apparently in perfect synchrony” (Seham, 2001). For richness, the literature suggests that this concept is intertwined with the notion of creativity, which is a key component of improvisation (Blom & Chaplin, 1988). Indeed in art performance, coaches or choreographers often report that the ability to improvise is expressed through the capacity of artists to be creative. In the context of socio-motor improvisation, the ability to improvise corresponds to the richness of movements performed during the interaction. In music for instance, the quality of improvisation is judged through the ability of musicians to perform rich and complex sequences (Badino, D'Ausilio, Glowinski, Camurri, & Fadiga, 2014; Berliner, 1994). In joint motor improvisation, performance richness is also measured through an index of complexity (e.g., Noy et al., 2011).

We believe that evaluating socio-motor improvisation through these two parameters – synchronization and richness – is also relevant in the context of our daily dyadic interactions. First, synchronization between our movements and those of our interactant occurs spontaneously when visual coupling is available. It includes for instance, bodily synchronization during conversation (Schmidt, Nie, Franco, & Richardson, 2014) or of limb swinging during walking (van Ulzen, Lamoth, Daffertshofer, Semin, & Beek, 2008). Moreover, synchronization has an important social role since it promotes interactions and acts as “social glue” between interactants (Hove & Risen, 2009; Schmidt & Richardson, 2008). It improves social competences such as affiliation between interactants (Kendon, 1970), altruistic behaviors (Valdesolo & Desteno, 2011) or cooperation (Wiltermuth & Heath, 2009). Second, the richness of our motor repertoire captures the complexity of these interactions. For instance, discussing while dancing with a partner involves a richer set of nested actions and body postures than only saying “Hello” to this partner. To generalize, a link can be drawn between the repertoire of movements we are able to perform during social interactions and the success of these interactions. Such a link has been observed in autistic children (Wing & Gould, 1979), for whom impairment in social interaction is accompanied by a reduced movement repertoire.

Recent experiments have measured improvisation competences through these two parameters, using a mirror game paradigm (Hart, Noy, Feniger-Schaal, Mayo, & Alon, 2014; Noy et al., 2011). In Noy et al. (2011), two improvisation groups were studied: a group of novices and a group of experts in music, dance or theatre. Dyads of novices or experts were asked to create complex movements while staying as coordinated as possible. Improvisation competences were measured through the two complementary parameters mentioned previously: synchronization between movements of the dyad and richness of movements performed during the interaction. Two conditions of improvisation were manipulated: a Leader/Follower condition (LF) where only one participant, designated as the leader, was improvising, whereas the second participant was designated as the follower, and a Joint Improvisation condition (JI), where no follower or leader was designated. The experimenters unsurprisingly observed that experts exhibited significantly higher synchronization and richness than novices. However, they also found two different patterns of behavior depending on the improvisation level of expertise: (i) novices were better – i.e., showed higher synchronization and higher richness – in LF than in JI whereas (ii) experts in improvisational arts were better in JI compared to LF. Others studies involving different tasks showed that experts were more synchronized and performed richer performance than novices. For instance, Issartel, Marin, and Cadopi (2006) asked pairs of dancers and pairs of non-dancers to freely move their forearm in the sagittal plane while taking into account the movements of the other participant during an interpersonal coordination task. The results revealed that dancers were able to produce more synchronized and richer movements than non-dancers. Schmidt, Fitzpatrick, Caron, and Mergeche (2011) also found that experts in trained martial arts showed better synchronization than novices during interpersonal coordination in a sword task. More recently, Washburn et al. (2014) investigated the impact of dance expertise on interpersonal coordination. Dancers and non-dancers were asked to synchronize with a confederate who performed three different sequences of dance-like movements with different levels of difficulty. They observed that dancers were better coordinated with the confederate than non-dancers, and that interpersonal coordination was higher (for participants from both groups) in low-difficulty sequences. These results show that dancers are better than non-dancers at coordinating with another dancer, even if the interaction requires a richer repertoire of movements.

Taken together, these studies showed that (i) improvisation competences can be acquired and improved; and (ii) experts in improvisation activities are more synchronized and perform richer movements than novices during improvisation. However, they raise new questions concerning the processes by which these improvisation competences are acquired. How do they improve over time? Why are experts better at improvising than novices? Are they better because they are used to synchronize with others or because they are used to perform richer movements? Synchronization and Richness therefore appear as two parameters capturing the acquisition of socio-motor improvisation, as well as the acquisition of intra-personal coordinative patterns. In the framework of coordination dynamics, learning in rhythmical bi-manual coordination tasks has

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