



HAL
open science

'Contact' as a Manifestation of Sensorimotor Empathy: The Experience of Expert Écuyers in Interaction with Horses

Marine Leblanc, Benoît Huet, Jacques Saury

► To cite this version:

Marine Leblanc, Benoît Huet, Jacques Saury. 'Contact' as a Manifestation of Sensorimotor Empathy: The Experience of Expert Écuyers in Interaction with Horses. *Journal of Consciousness Studies*, 2023, 29 (11), pp.80-107. <10.53765/20512201.29.11.080>. <hal-03954164>

HAL Id: hal-03954164

<https://hal.science/hal-03954164v1>

Submitted on 2 Jun 2023

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire HAL, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.



HAL Authorization

Marine Leblanc,¹
Benoît Huet¹ and
Jacques Saury¹

'Contact' as a Manifestation of Sensorimotor Empathy

*The Experience of Expert Écuyers
in Interaction with Horses*

Abstract: Chemero's concept of sensorimotor empathy offers a relevant introduction to the study of human/non-human relationships. This article proposes an empirical characterization of this phenomenon occurring in human-horse interactions through the notion of 'contact', which is a core concept in the technical tradition of the equestrian world. According to the assumptions of 4E cognition, we approach the notion of contact with a broader meaning than how it is usually defined, i.e. as the connection of the rider's hand with the horse's mouth. We state that contact involves the whole body and that it is not a passive touch but a dynamic one. Contact is intersubjective, meaning that its quality depends on the two agents of the interaction: the human and the horse. Within such an interaction, sensorimotor empathy allows the human and the horse to understand through the body and to fine-tune with each other to bring about 'good contact'.

Correspondence:
Email: leblancmarine@hotmail.fr

¹ Nantes Université, Movement — Interactions — Performance, MIP, UR 4334, F-44000 Nantes, France.

1. Introduction

The aim of this article is to describe and empirically characterize the phenomenon of sensorimotor empathy (Chemero, 2016) occurring in a particular human/non-human interaction situation: work-in-hand² between *écuyers*³ and *sauteurs*.⁴ We intend to assess the relevance of Chemero's concept of sensorimotor empathy to develop a better understanding of human/non-human relationships and therefore contribute to theorizing in 4E cognition regarding human–animal interactions, an area that has received little attention to date in this field.

In the following sections, we first present the concept of sensorimotor empathy as defined by Chemero (2016). Then, we present an overview of the different concepts around sensorimotor empathy that are mobilized in the literature concerning human–non-human interactions. Afterwards, we present the notion of contact in the literature. Then, after having evoked the theoretical and philosophical background which guided our work, we present empirical results that highlight sensorimotor empathy through the notion of 'contact' between *écuyers* and horses. In the next section, we discuss the results by going back to the different stages of sensorimotor empathy, and what this shows about the engagement of the horse and the human in this process. Finally, we discuss sensorimotor empathy as a skill to be developed in *écuyers* and horses.

For Chemero, 'you experience sensorimotor empathy when your lived body expands, and temporarily includes aspects of the non-bodily environment, whether they are tools or other humans' (*ibid.*, p. 144). This author defines sensorimotor empathy as a feeling of connection to tools or other humans that are also connected to us. According to him, this is a skilful, implicit, and bodily engagement, that is to say that it is not enough merely to have skills or knowledge but we need to actively engage these skills or knowledge within the world. Moreover, sensorimotor empathy may be a way to characterize the 'malleable boundaries of the lived body' (*ibid.*, p. 7). That is, to

-
- 2 Work-in-hand is a way of working the horse while being on foot and close to it. This practice is carried out in particular at France's Cadre Noir for the work of the *sauteurs* (see note 4). The *écuyers* (see note 3) stand between the horse's shoulder and his belly, holding the four reins in one hand and the whip in the other.
 - 3 The *écuyers* are the instructors at the National Riding School of France, called the Cadre Noir and located in Saumur. We worked with two *écuyers* as part of this study.
 - 4 Particular horses of the Cadre Noir who perform the 'airs above the ground' practised at Saumur, which are the *Courbette*, the *Croupade*, and the *Cabriole*.

take the example of Merleau-Ponty (1945): the blind person's lived body changes when they are carrying a cane and experiencing the world through it. When this happens, the body schema of the blind person changes and extends. The blind person moves beyond their body. According to Chemero, we are engaged in sensorimotor empathy when we form synergies with tools or other humans.

According to Nalepka *et al.* (2015), in movement science, a synergy is a reduction of multiple elements to form a single unit. A synergy is a temporary unit that behaves in coordination as a single unified system. Chemero (2016) has shown that human-human synergies are possible within an extended multi-person cognitive system. These synergies form when humans 'feel-into'⁵ other humans outside their biological bodies, like when we dance with someone, for example. Kimmel (2021) showed how synergies emerge spontaneously between dancers who practise 'contact improvisation'. This author described the structural aspects that synergies can have and their dynamics within dance duets. He also showed how these synergies are mediated by embodied communication.

The concept of sensorimotor empathy is particularly appropriate in non-verbal interactions because it sheds light on the very embodied aspects of coupling. In recent work, Baraër-Mottaz (2020) highlights this concept of sensorimotor empathy between nursery nurses and very premature newborns. Nursery nurses 'feel' the newborn through their hands and they can therefore build 'elements of understanding of the newborn's experience' (*ibid.*, p. 387). But what does sensorimotor empathy add to the understanding of the interactions between human and non-human, such as the interactions between *écuyers* and *sauteurs*?

2. Sensorimotor Empathy in the Study of Human/Non-human Interactions

To our knowledge, there is still no work in the literature that explicitly mobilizes the concept of sensorimotor empathy in the study of human/non-human interactions, even if the concept of empathy has already

⁵ 'Feel-into' is the literal translation of *emführung* (created by the psychologist Wilhelm Wundt), which is the German origin of the English word *empathy*, introduced by the American psychologist E.B. Titchener.

been mentioned in other works on communication between ethologists and animals (Despret, 2013).⁶

Few articles and books have drawn on the concept of embodied communication between humans and other animals, which is close to sensorimotor empathy. Over the years, researchers have used the word 'embodiment' to express the idea of unity between the body and the mind, and to reject the idea of a separation between these two entities (Dashper, 2017). This concept emphasizes that the body is fully involved in establishing communication between living beings. That is, we communicate with animals through our body. The bodily dimension in this type of interaction is even more intense than during a dialogue between two humans. This is what Katherine Dashper emphasizes when she describes the human–horse interaction:

Humans are verbal creatures, and we tend to favour verbal interactions in our everyday lives, and so the importance of the body can often disappear from our conscious awareness... Being with horses brings awareness of our bodies' actions and interactions back to the foreground. (*ibid.*, p. 165)

For example, according to Dashper, in the context of competition, riders often say that their horse is fine in the warm-up arena and that, when they arrive in the ring, their horse suddenly becomes tense, lacks energy, or may attempt to escape. The horse is very sensitive to his environment as well as to the rider's body, which is closely linked to him. The fact that the horse is tense can be explained in part by the fact that he perceives the change of state in the rider. Some riders are aware of this and force themselves to focus on their own body in order to calm the horse. For example, by breathing deeply to relax themselves (and the horse) or by setting a slower pace with their body so that the horse will adopt that pace. The sensitivity of horses together with this close bodily relationship compel riders to pay attention to their bodies because the slightest change of their behaviours, voluntary or not (like holding their breath), could be interpreted as a danger by the horse and cause a fearful reaction. So, the emotions of the rider, often invisible to an outside observer, influence the horse and vice versa. Pereira (2009) considers this interspecific communication

⁶ Despret defines empathy in these interactions as 'the process by which one delegates to one's body a question, or a problem, that matters and that involves other beings' bodies. Bodies are articulating, and become articulated, in the asking and in its responses' (Despret, 2013, p. 70).

within a semiotic approach. According to Pereira, there are several forms of communication in equestrian practices. He takes the example of show riding, which leads to intra- and interspecific forms: humans communicate in a complex way with their horses to develop an equestrian figure intended for an audience, with which they interact. In a carousel where several rider–horse pairs move at the same time, this implies another intraspecific communication (rider–rider and horse–horse).

This leads Pereira to postulate that there are several equestrian semiotic-like languages, that is, there are different ways of speaking to horses depending on the cultural and historical context. In this way of conceiving horse riding, it is therefore necessary to consider the synchronic and diachronic dimensions of interspecific communication.

On the basis of the assumptions of this semiotic approach, Pereira states that: ‘Any sign induces the existence of a sensitive experience. From a physical point of view, signs, a central concept of communication, are at the same time waves acting on the nerve endings in the ears of the man or the horse, physical pressures exerted on the body of the horse by means of artificial or natural aids (whip, hands, legs, rider’s seat, etc.). Isolated, they are *a priori* meaningless’ (*ibid.*, p. 57). That is to say, the rider’s aids are always combined so that the horse understands what is being asked of him. For example, when the rider wants to gallop, he places his legs in a certain way by exerting a slight pressure on the horse’s body with his calves, while pushing his pelvis forward so that the horse understands his intention. Little by little the rider refines his aids and sometimes a single sign is enough, but for that, the rider has to have built a strong connection with their horse, which requires a lot of time and skill.

Argent (2012) has worked on how horses use the kinesic, haptic, and proxemic communication modes to create meanings, and how these meanings can be accessible to us. She introduces the notion of embodied synchronous movement. In doing so, she approaches the concept of sensorimotor empathy. Indeed, she evokes the ability for humans and horses to synchronize their movements with each other or with their own species. Argent says that this corporeal synchrony induces a feeling of loss of boundaries for humans and also of being connected with something bigger than themselves. According to her, this leads to joy and ecstasy. She suggests that horses who share, at least in part, the same emotions as humans and this natural way of synchronizing with others could have the same feeling as humans when they synchronize with horses. This feeling of unity with

someone and with something bigger than oneself that she describes is close to the concept of sensorimotor empathy. That is to say, close to a feeling of connection and the fact of extending one's body schema through the other, of moving beyond oneself.

As we have seen, work on human–human and human–tool synergies has been characterized by Chemero in terms of sensorimotor empathy. Regarding human–animal interactions, works such as those of Argent (2012) are consistent with the concept of sensorimotor empathy. In the present article, we propose to evaluate this concept, through the notion of contact within *écuyer–sauteur* interactions. Sensorimotor empathy could lead to a new way of understanding and explaining how two different species reach mutual synchronization.

3. Contact

The notion of contact is central in the technical tradition of the equestrian world. McGreevy *et al.* (2005) define this contact as 'the connection of the rider's hands to the horse's mouth, of the legs to the horse's sides and of the seat to the horse's back via the saddle' (*ibid.*, p. 18). In work-in-hand situations, contact is reduced to the connection between the hand of the *écuyer* and the mouth of the horse via the reins, because the *écuyer* is not on the saddle but beside the horse. In the literature on human–horse communication, the notion of contact is mostly discussed within biomechanical approaches (Eisersiö *et al.*, 2015; Christensen *et al.*, 2021). Eisersiö *et al.* (2015) suggest that the range of rein tension depends on the gait, the rider's position, the educational level of the horse, the rider and horse *per se*, and the right or the left rein. Interestingly, Ödberg and Bouissou (1999) highlight that many practices contrast with the claims of the International Federation for Equestrian Sports (FEI) about what contact should be like. Indeed, according to the FEI, the horse has to accept 'the bridle⁷ with a light and consistent soft submissive contact' (Fédération Equestre Internationale, 2020). Ödberg and Bouissou (1999) report that 'strong collection⁸ is necessary during high school exercise...' (p.

⁷ The bridle is a harness placed on the horse's head to direct him, and control his speed and balance. It is made up of two bits (metal pieces inserted into the horse's mouth), which are attached to two pairs of reins.

⁸ 'The position of the head and neck of a horse at the collected paces is naturally dependent on the stage of training and, to some degree, on its conformation. It is distinguished by the neck being raised without restraint, forming a harmonious curve

27). However, they highlight that all too often this collection is obtained through coercion.

For Ödberg and Bouissou, collection should be obtained through as light as possible contact. According to them, only a few riders succeed in approaching the ideal of working solely with the weight of the reins. To work just with the weight of the reins does not mean a loss of contact ('behind the hand'). Indeed, to work in this way means that 'the horse moves resolutely forward at the slightest demand' (*ibid.*). But the authors refer to the fact that many instructors nowadays require the opposite of the academic ideal and ask the horse to lean hard on the hand. Yet, for Ödberg and Bouissou, contact does not mean leaning on the bit. According to them, lightness and elegance are impossible to obtain that way: 'one only gets horses which are confined between a hard hand and (inevitably) hard legs. Although the rules officially require lightness, in modern dressage competitions sins against it are rarely penalized' (*ibid.*). In equestrian practices, the degree of lightness that is required seems complex to reach and is ultimately little known, and therefore deserves to be explored.

In this study, according to the assumptions of 4E cognition, we approach the notion of contact with a broader meaning than how it is usually defined, i.e. as the connection between the hand of the *écuyer* and the mouth of the horse. From the 4E cognition perspective, we postulate that contact involves the whole body. We hypothesize that this contact of the hand to the reins is not passive; it is what Gibson (1962) terms the 'active touch' or, according to Travieso *et al.* (2020), the 'dynamic touch'. For these authors, active touch or dynamic touch is an active exploration of something through multisensorial dimensions. We also hypothesize that dynamic touch could be a necessary step in the process of sensorimotor empathy.

We tested these hypotheses in an empirical study with expert *écuyers* interacting with horses in the Cadre Noir. Indeed, work-in-hand with horses seemed to offer a promising study situation to test this new understanding of contact.

from the withers to the poll, which is the highest point, with the nose slightly in front of the vertical. At the moment the athlete applies their aids to obtain a momentary and passing collecting effect, and the head may become more or less vertical. The arch of the neck is directly related to the degree of collection' (Fédération Equestre Internationale, 2020, p. 23).

4. Philosophical and Theoretical Background

As stated above, the concept of sensorimotor empathy is a feeling of connection with other people, objects, or animals which allows the malleability of boundaries of the lived body. In an interaction, this feeling of connection may happen when we mutually synchronize ourselves with someone else. The two criteria of mutual sensorimotor empathy are: a feeling of connection to someone, and motor synchronization with that someone (Chemero, 2016). This mutual sensorimotor empathy means that the horse and the *écuyer* are mutually connected. Otherwise, the *écuyer* may feel sensorimotor empathy for the horse (e.g. understanding the emotions/intentions of the horse through his perceptions) without being able to connect the horse to him and therefore it may not lead to motor synchronization. The background of this study and of sensorimotor empathy are in line with the broader field of 4E cognition, in which researchers conceive cognition in opposition to 'the internalist, brain-centered views of cognitivism' (Newen, De Bruin and Gallagher, 2018, p. 4). The 4E cognition approach emerged at a time when 'work inspired by Gibson's ecological approach to psychology contributed to a growing realization that cognition was not limited to processes in the head, but was embodied, embedded, extended, and enactive' (*ibid.*, p. 4). For researchers in this field: '...the cognitive phenomena that are studied by modern cognitive science, such as spatial navigation, action, perception, and understanding other's emotions, are in some sense all dependent on the morphological, biological, and physiological details of an agent's body, an appropriately structured natural, technological, or social environment, and the agent's active and embodied interaction with this environment' (*ibid.*, p. 5). The present study thus focuses on sensorimotor empathy (Chemero, 2016) within *écuyer-sauteur* dyads. Chemero maintains a firm stance on the role of the body in cognition. Indeed, he defines his position by borrowing the term of radical embodied cognition from Andy Clark (1997). As he points out: 'I hereby define radical embodied cognitive science as the scientific study of perception, cognition, and action as a necessarily embodied phenomenon, using explanatory tools that do not posit mental representations. It is cognitive science without mental gymnastics' (Chemero, 2009, p. 29).

To study the phenomenon of sensorimotor empathy, we use a theoretical framework⁹ which is based on the ontological and epistemological assumptions of 4E cognition. It is more particularly rooted in an enactive approach, based on the fundamental assumption that living beings are autonomous systems that are structurally coupled with their environment (Maturana and Varela, 1987). This structural coupling implies that changes in a system are coupled with changes in the environment and/or other systems.

The consequence of our approach for the analysis of the *écuyer*'s activity is that we cannot define an individual's experience without considering their dynamic relation with their social, cultural, or physical environment. This coupling between an individual and their environment is asymmetric because it is oriented by the perspective of the individual, that is to say, it makes it essential to account for the dynamics of these interactions 'from the system's point of view', or 'from within' (Varela and Shear, 1999).

The notion of pre-reflective self-consciousness (Legrand, 2007) reflects this asymmetric coupling, at the level where it gives rise to experience for the individual (Theureau, 2006). That is to say, an individual does not evolve in their environment in a purely physical way but they perceive and act according to whatever makes sense for them in it. This notion is concerned with what is meaningful for the individual, their preoccupations, the knowledge mobilized in the action, their actions, and their perceptions. As a lived experience, sensorimotor empathy includes a pre-reflective dimension. It is the experience of an actor's meaningful connection with other living beings. The phenomenon of pre-reflectivity is important because it allows empirical access to the actor's sensorimotor empathy, with consideration of their own point of view. Indeed, the exploration of this pre-reflectivity allows access to the embodied dimensions of an actor's experience from their point of view, at every moment. Also, under specific conditions it is possible to access pre-reflective self-consciousness (see the fifth section: 'Exploring the Role of Contact in *Sauteur-Écuyer* Interactions'). This access is essential for identifying the moments when one feels connected and in sync with someone or something.

⁹ The 'Course-of-Action' research programme (Theureau, 2006; 2015).

It is therefore this philosophical and theoretical background that has enabled us to develop our empirical approach to contact as an expression of sensorimotor empathy among expert *écuyers*.

5. Exploring the Role of Contact in *Sauteur–Écuyer* Interactions

This study was carried out with the two *écuyers* of the Cadre Noir in Saumur who are considered as 'experts'¹⁰ in work-in-hand. They were both male. One of them was 52 years of age. He was Chief Warrant Officer and Manège Master, and was in charge of the *sauteurs*; he joined the Cadre Noir in 1998. The other was 47 years of age and was the deputy head of the *sauteurs*; he joined the Cadre Noir in 2001. The researcher forged a relationship of trust with them, following them in their activity as trainers of horses and *écuyers* every day for nine weeks a year.

To carry out this study and to obtain access to the sensorimotor empathy within *écuyer–sauter* interactions, we observed and filmed a hundred of the *écuyers*' sessions with horses. We also kept an ethnographic journal. Following the sessions, first-level self-confrontation interviews (Theureau, 2010) were carried out based on session videos. These first-level interviews allowed access to the pre-reflective self-consciousness of the *écuyers*. More precisely, they allowed information to be collected regarding the *écuyer*'s concerns, his expectations, his knowledge mobilized in the situation, his significant actions, his emotions, what he feels in his body, his focus, as well as the interpretations that may emerge from the situation. These meaningful elements in the *écuyer*'s own world emerged at each moment of his activity and could be perceptual, proprioceptive, or mnemonic. These data were collected through an appropriate questioning so that the *écuyer* comments, shows, or mimes these different dimensions, which could then be discussed with the researcher thanks to the video. We also wanted to access the experience of the horse, and for this we used ethological observation tools (Minero, Dalla Costa and Dai, 2015) in a comprehensive ethological approach (Conrad, 2021).

¹⁰ 'Experts' because recognized by their peers, having proven their worth by training several horses and reaching the highest level with them.

To explore sensorimotor empathy in the contact, we investigated: (1) the meaningful dimensions of the contact, (2) the dynamics of the contact, (3) the intersubjective dimensions of the contact.

5.1. *The meaningful dimensions of contact*

First, to explore the sensorimotor empathy of the *écuyer* and the meaningful dimensions of the contact, we built mind maps¹¹ (one for each *écuyer*, *cf.* Figure 1, below) on the basis of thirty interviews. These mind maps aimed, on the one hand, to explore the meanings given by the *écuyers* to the notion of contact, and, on the other hand, to identify in the experience of the *écuyers* the significant moments when they managed to connect with the horse and therefore to ‘expand through him’. To build these mind maps, we made transcriptions of interview passages¹² with the *écuyers* that evoked the notion of contact. We categorized the selected excerpts¹³ into three generic categories that refer to the main categories of human experience (Theureau, 2006).

5.2. *The temporal dynamics of contact*

Secondly, to explore the dynamics of the contact and the fluctuation of sensorimotor empathy in the couple, we analysed the dynamics of interactions and contact over a whole session (*cf.* Figure 2, below). To do this, we transcribed the description of the session and the transcript of the interview into a double-column table (*cf.* Table 1, below).

¹¹ In this study, mind maps are diagrams where there is a main category in the centre which corresponds to the *écuyer*'s central preoccupation (e.g. contact), with sub-categories such as (1) actions, (2) knowledge, and (3) perceptions radiating from this centre.

¹² Excerpts from 30 sessions.

¹³ Selected on the basis of their ability to represent a set of situations (typical situations) even if each situation is unique.

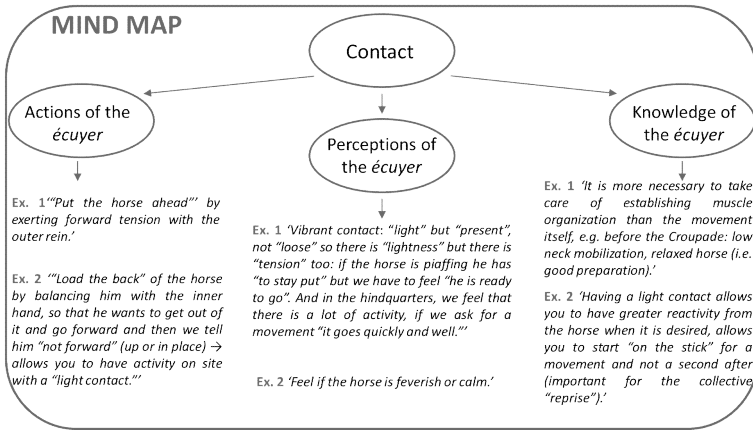


Figure 1. Construction of mind maps based on the transcript of thirty interviews to explore sensorimotor empathy through the contact.

Excerpt from the description of a session	Excerpt from the interview about the session
(0: 14: 51.5) E. continues to push the horse back while tapping his sacrum with the whip, to ask him to do <i>Croupades</i> . The horse shakes his head a little and tries to escape upwards by doing a cabriole.	(0: 08: 42.9) E.: It is I who make him move back... [...] Let him stop pulling... and use my hand to jump. [...] He must find another solution to move his body than to come and jump into my arms...
(0: 14: 53.7) E. stops him immediately by making a grunt (<i>as if he is growling</i>) and making a sharp gesture with his reins.	(0: 08: 52.2) Researcher: OK. And do you make him move back for a question of contact?
	(0: 08: 56.2) E.: Yeah, to control his forehead. Because I advanced the whole series before but lost the contact...

Table 1. Double-column table. First column: transcript of the session of the écuyer and the horse, and the description of the session by the researcher. Second column: transcript of the interview with the écuyer corresponding to the session. E. corresponds to the écuyer.

The description includes elements of observation and interpretation of the behaviour of the horse by the researcher and her inferences as to the emotional state of the horse based partly on equine ethology tools

(Minero, Dalla Costa and Dai, 2015), and partly on ethnographic descriptions and notes. We transcribed the analysis of the session in the form of a timeline (cf. Figure 4, next section) which was the synthesis of the flow of the horse’s behaviours in connection with the actions/preoccupations of the *écuyer*.

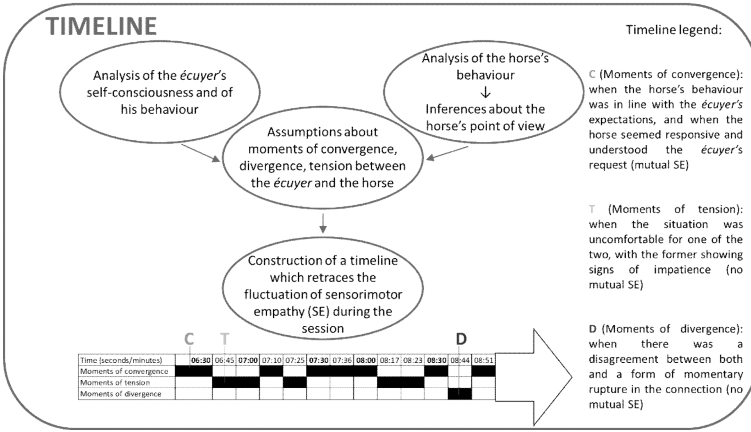


Figure 2. Construction of the timeline of a whole session.

5.3. The intersubjective dimensions of contact

Finally, to explore the intersubjective dimensions of the contact, and the sensorimotor empathy of the *écuyer* and the horse, we focused our attention on meaningful moments for the *écuyer* and the horse in the building of an intersubjective agreement. These moments were characterized by the perceptual experiences of the *écuyer* through the quality of contact, which allowed access to the horse’s own world. This exploration allowed us to see how their own worlds attuned together (see Figure 3, below).

Copyright (c) Imprint Academic
For personal use only -- not for reproduction

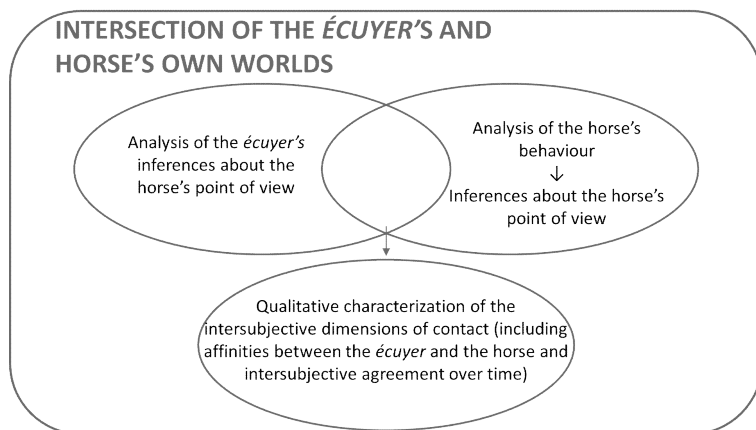


Figure 3. Intersection of the *écuyer's* and horse's own worlds.

6. The Features of the Contact in the Own World of the *Écuyers*

The results of the study confirmed that contact is a central concern for the *écuyers* and that it cannot be reduced to the relation between the hand of the *écuyer* and the mouth of the horse. The results also supported the hypotheses we stated above: contact is an active, multi-sensory exploration through dynamic touch, which could be the first step in the process of sensorimotor empathy. In this section, three points of the results are presented in relation to these assumptions: (1) contact is global, (2) contact is dynamic, (3) contact is intersubjective.

6.1. Contact: a complex perceptual configuration that goes beyond the hand–mouth relationship

Mind maps showed that the contact was multimodal, i.e. it was not limited to the hand–mouth relationship. It involved perceptions that accounted for the horse's balance, impulse, and cadence through different perceptual and/or somaesthetic modalities (e.g. the perception of the shape of the horse's back, listening to the rhythm of the hooves on the ground, the fine perception in the hand of the *écuyer* and/or in the whole body, the ability to feel one's own body parts in space and one's own balance, etc.).

These perceptions were coupled with actions of the *écuyer* and the horse that mutually influenced the contact. The actions of the *écuyer* played on the horse's impulse, balance, and emotions. They were linked to knowledge that the *écuyer* could mobilize in the interaction: the personality and history of the horse, the biomechanics of the horse, or embodied knowledge constructed through work experience with horses. All this was accompanied by perceptions that made it possible to determine the quality of the interaction with the horse, to act at the right time, to give information about the horse's emotions and mood (see Table 2). The mind maps allowed us to see that the contact was global. Indeed, the *écuyer* did and perceived many things through the hand that holds the reins, but he also had syncretic perceptions of the coupling that he formed with the horse that were difficult to characterize. For the *écuyer*, this contact was a way of extending his lived body through the horse, which allowed him to try to establish and to keep a good connection with the *sauteur* and which resulted in a good contact (e.g. 'vibrant contact').

6.2. Contact: a precarious state of equilibrium in a dynamic of interaction

The timeline (Figure 4, below), tracing the flow of the horse's behaviours in connection with the actions/concerns of the *écuyer* during a whole session, shows a fluctuation between states of convergence, tension, and divergence in the mutual understanding between the *écuyer* and the horse. It highlights the dynamics of these changes which could be short, long, progressive, or brutal. These changes reflect an ever-fluctuating contact that was a source of adjustment between the *écuyer* and the horse, and the precariousness of the states of balance between both. So, from the *écuyers'* experiences, contact was not something stable, but was built moment by moment during their ongoing activity. This contact was very precarious and could deteriorate at any time. This dynamic contact showed fluctuating engagement in sensorimotor empathy. Moments of tension were characterized by early signs of annoyance or discontent (e.g. the horse trying to hit the *écuyer* or the *écuyer* raising his voice). In contrast, the moments of convergence reflected movements in synchrony, a vibrant contact, horse and *écuyer* were mutually connected and formed a synergy, they were both engaged in a process of sensorimotor empathy (see Picture 1 and 'Transcript of the *Cabriole*'). Moments of

ACTIONS	KNOWLEDGE	PERCEPTIONS
Impulse	Biomechanics knowledge	Quality of the interaction
<i>“Put the horse ahead” by exerting forward tension with the outer rein.’</i>	<i>‘It is more necessary to take care of establishing muscle organization than the movement itself, e.g. before the Croupade:¹⁴ low neck mobilization, relaxed horse (i.e. good preparation).’</i>	<i>‘Vibrant contact: “light” but “present”, not “loose” so there is “lightness” but there is “tension” too: if the horse is piaffing he has “to stay put” but we have to feel “he is ready to go”. And in the hind-quarters, we feel that there is a lot of activity, if we ask for a movement “it goes quickly and well”.’</i>
Balance	Embodied knowledge	Timing
<i>“Load the back” of the horse by balancing him with the inner hand, so that he wants to get out of it and go forward and then we tell him “not forward” (up or in place) → allows you to have activity on site with a “light contact”.’</i>	<i>‘Having a light contact allows you to have greater reactivity from the horse when it is desired, allows you to start “on the stick” for a movement and not a second after (important for the collective “reprise”).’</i>	<i>‘In the Terre-à-terre¹⁵, when you brake the horse to “sit/grow him” before the Cabriole,¹⁶ you feel (in your fingers) that the horse wants to move forward and that’s when we can ask him to jump.’</i>
<i>[CONTINUED]</i>		

¹⁴ ‘On the aids of the rider the horse raises his croup. When “touched by the whip” he bucks and stretches out his hind legs’ (<https://www.ifce.fr/cadre-noir/le-cadre-noir/le-cadre-noir/sauts-decole/>).

¹⁵ A very collected canter almost on the spot.

¹⁶ ‘From the *Terre-à-terre* the horse raises his forehead and leaves the ground with a thrust from his hind legs. When “touched” by the whip he gives an energetic buck with his hind legs extended horizontally. The *Cabriole* is the most classical of the airs practiced at Saumur’ (<https://www.ifce.fr/cadre-noir/le-cadre-noir/le-cadre-noir/sauts-decole/>).

ACTIONS	KNOWLEDGE	PERCEPTIONS
Emotions	Horse's personality	Emotions/moods
<i>'Put more contact on the right rein to help a horse rise to Courbette¹⁷ or to Cabriole and make him "gain courage". Once the horse is at the highest point (Cabriole), release the fingers so that he can "open" and detach the hind legs.'</i>	<i>'There are horses for which it takes a very light contact to make them "go up" to the Courbette or the Cabriole, and on the contrary, for others (timid horses, lacking in confidence) they need more contact (on the outer rein) to have more confidence when moving.'</i>	<i>'Feel if the horse is feverish or calm.'</i>

Table 2. Excerpts of transcripts that illustrated the different categories and subcategories of the mind map.

convergence were often preceded by moments of tension. It was as if the *écuyer* needed to put the horse in a particular energy to connect the horse to him and put him in a muscular state to achieve these jumps. In moments of convergence there was still tension because the horse needed this tension to make the movements. But there was a kind of acceptance by the horse, with the horse seeming to be engaged in the activity in a positive way, contrary to the 'moments of tension' when the horse answered the *écuyer* back. Moments of divergence between *écuyer* and horse were characterized by an abrupt break in connection (e.g. the horse stopped and backed up, ears back).

¹⁷ 'The balance is prepared on the haunches; the horse raises his forehand (his front legs), taking the weight on his hind legs. He stays in this position for several seconds' (<https://www.ifce.fr/cadre-noir/le-cadre-noir/le-cadre-noir/sauts-decole/>).

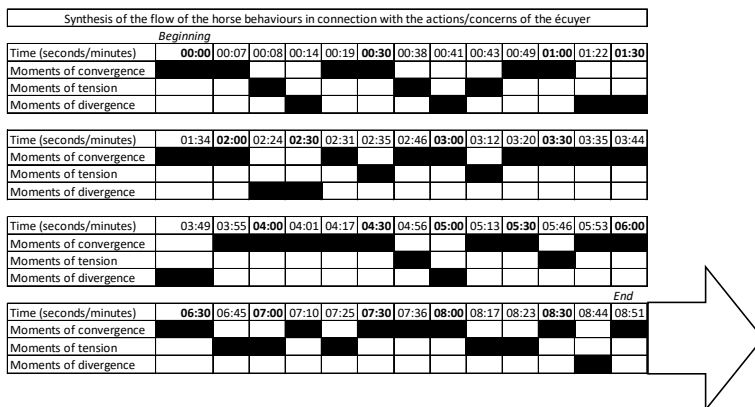


Figure 4. Timeline of the interaction between the écuyer and the horse during an entire session. This interaction oscillated between moments of convergence, tension, and divergence between the two agents.



Picture 1. Cabriole.

Before this succession of images, the écuyer and the horse were in divergence. The horse sent his foreleg dangerously towards the écuyer. The écuyer raised his voice for the horse to listen. There was a momentary rupture in the interaction because the écuyer was angry and the horse backed up, scared. Then the écuyer clicked his tongue in rhythm (communication codes) so that the horse went to *Terre-à-terre* at the same rhythm. The horse was very active. The écuyer felt it and asked for the *Cabriole* at the right moment. They went from a moment of divergence to a moment of convergence.

Transcript of the *écuyer*'s comment about this *Cabriole*: 'There I find that the *Terre-à-terre* is super nice, it is very responsive, it is "pam-pam, pam-pam, pam-pam" (mime) and I find that it is very jumped, very vibrant. It's bouncy, he's full of "tchi-tchi, tchi-tchi" (mime). And there I only put the handle (of the whip to ask for the *Cabriole*), I felt him (the horse) so well that I just showed him the arm so that he says to himself: "Here we go".'

6.3. *Contact: an intersubjective agreement in the history of a singular relationship*

The analyses of the pre-reflective self-consciousness of the *écuyer* showed that the different perceptions related to contact gave rise to the *écuyer*'s interpretation of what was happening from the horse's point of view: 'He (*the horse*) does not understand that when I extend the right rein it does not mean that he has to lean on my hand' (excerpt from a transcript). Also, the pre-reflective self-consciousness of the *écuyer* linked to the researcher's interpretation of the subjective experience of the horse showed that if there was no convergence between the preoccupations of the *écuyer* and the behaviour of the horse, agreement was difficult, which was felt in the contact which could be 'hard', 'contracted', or 'heavy'.

Then, the quality of contact depended on the affinities between the *écuyer* and the horse, together with the moods, emotions, and capacities of the *écuyers* and the horses¹⁸ that were built through experience. The contact was also very personal: each *écuyer* had 'his contact' and each horse was used to working with a particular *écuyer*. Indeed, the contact was very incorporated and therefore very subjective. So, a horse could be 'unsettled' by working with an *écuyer* he was not used to working with, because the latter did not have the same contact as the *écuyer* he was used to working with. To illustrate this point, let us take the example of H., a young horse, which the expert *écuyer* taught how to do the '*Cabriole*'. H. was the horse of an *écuyer* in training (T.) who was learning work-in-hand. The expert *écuyer* had already left H. with the *écuyer* in training for several sessions:

Expert *écuyer*: 'I've left him two, three times because... In fact, you see I was standing behind the horse... And T., was doing

¹⁸ A young horse has a more unstable contact that is potentially heavier and more contracted than an experienced horse.

Terre-à-terre like that, not so bad... And me, when I recovered the horse afterwards, I needed another round of the *manège*, for the horse to put himself with me, because we don't have the same contact. We don't have... the same placement... Not the same way of asking for the *Terre-à-terre*, so I found that it disturbed the horse a lot... The movement was really ok with the horse... I say (*to T.*) listen uh, you, you're going to ask because the idea is that you're the one who asks... Now the horse, he knows how to do it... You just have to learn to do...' (excerpt from first-level self-confrontation interview).

This example illustrates that contact is established on the basis of mutual trust between the *écuyer* and the *sauteur*, in which the embodied dimensions are decisive.

So, through the quality of the contact, the *écuyer* either had a pleasant feeling of connection with the *sauteur* or felt that the horse was not 'with' him. As for the horse, he could be active and relaxed or listless or unhappy and contracted, for example. When the movement requested from the horse was correct according to the *écuyer*, the horse and *écuyer* moved in sync. For example, for the *Courbette*: when the *écuyer* raised his whip to signal the horse to make the movement, the horse would rise at the same time (see Picture 2). The contact allowed the *écuyer* to feel into the horse in order to sense the right moment to ask of the horse and in the right way (see 'Transcript of the *Courbette*', below, or 'Transcript of the *Cabriole*', in the previous section). These moments were described as engaging in mutual sensorimotor empathy because the *écuyer* was actively exploring the contact in an action-perception game with the horse, then felt a good connection with the horse through the quality of contact: the contact was 'light' or 'vibrant', the horse was listening, and both were functioning in perfect synchrony.



Picture 2. Courbette.

Transcript of the *écuyer*'s comment about the *Courbette*: 'That's good. I really feel like I have him there (*mimics his position in relation to the horse and the way he holds the reins*). [...] He's very good there... [...] In fact in my visual below I see that the legs can be pulled a little (*mime*) that it is not really (*miming and gathering his arms*) and then I'm always looking for the perfect thing. [...] Here I do one again (*Courbette*), I made him more "franchi"¹⁹ because in my *contact* it would not fit (*we see the next Courbette*). And there I make him move back to re-engage (*his hindquarters*). So, there you have it, we agree [...] I think we do it again because he was not "franchi" enough. In the last one, I used the fact that I made him back up to engage him there.'

Whether the analysis of the contact was dynamic (timeline), global (mind map), or local (precise moment of a session), we have seen that the *écuyer* and the horse were both engaged in a coupling made of adjustments between each other and with the environment. They were both sensitive to what was meaningful to them given their experience, histories, affinities, personalities, and so on. These fine adjustments were possible thanks to sensorimotor empathy, i.e. skilful perceptual and motor coordination, which is implicit and often unintentional and which the *sauteur* and the *écuyer* have built together through time.

¹⁹ A horse 'franchi': at the level of the energy it is a 'set', we feel the tension of the reins (light tension), and we manage to channel the energy of the horse (*excerpt from the mind map*).

7. Contact as a Manifestation of Sensorimotor Empathy

To answer the initial question: 'what does sensorimotor empathy add to the understanding of the role of the contact in interactions between the expert *écuyers* and the *sauteurs*?', we will discuss several points in relation to the results of our study.

As we have seen, in these interactions the embodied dimensions are decisive. Sensorimotor empathy is characterized, on the one hand, by the malleable boundaries of the lived body through a feeling of feeling-into the horse and, on the other hand, by motor synchronization. The ability to feel-into the horse goes via the 'dynamic touch' (Travieso *et al.*, 2020). In this interaction it is dynamic touch that allows the emergence of the physical attributes of their relationship. This implies an active exploration on the part of the 'active agents' (*ibid.*). As Travieso *et al.* assert, the concept of intentionality is one of the keys to understanding dynamic touch. In this study we have seen that the *écuyer* is an active agent in his relation to the horse because he is engaged in a coupling made of adjustments with the horse and the physical and social environment which surrounds him. He has expectations, for instance concerning the perceptions he seeks in contact; he moves and acts in such a way as to modify the constraints binding him with the horse and the environment as a coupled system. As for the horse, he is a subject and not an object, that is, he organizes his activities in action and perception (Uexküll, 1956), which machines do not do. The horse's own world differs from ours; indeed, he does not have the same perceptions and his environment is not structured in the same way as ours (*ibid.*). Like the *écuyer*, the horse is also considered as an 'active agent' in this study. Indeed, he can cooperate with the *écuyer*, anticipate the latter's request, or propose something else because he doesn't understand or doesn't want to do what is requested.

During a session, the *écuyer*'s own world intersects with the horse's own world. From this intersection of own worlds emerges the contact, which has intersubjective dimensions. Moreover, to find an intersubjective agreement which results in a certain quality of contact (e.g. 'vibrant', 'franchi', or 'light') the agents, with each other, must share some meaningful codes to be understood by the other. These codes or signs induce sensitive experiences (Pereira, 2009): the *écuyer*'s gestures, pressures, sounds, and postures as well as facial and bodily expressions, and the horse's sounds. These signs carry meaning both

for the horse and for the *écuyer*: ‘Some examples of signs: the rider clicks his tongue, which can mean “piaffe” for the horse; the horse that straightens his ears can mean to the rider that he has understood. For communication to work, the couple must share a minimum of codes, otherwise the communication partners cannot understand the signs and give them meaning’ (*ibid.*, p. 61).

During the building of this intersubjective agreement, on the scale of a session or more broadly of a relationship, the mutual sensorimotor empathy fluctuates between adjustments, agreement, or disagreement. This alternation of states approaches what Pereira calls a ‘bipolar relationship’ (*ibid.*): that is to say, an alternation between two dimensions of friendship and power. According to him, to practice high school riding, you have to manage this bipolarity by being able to adopt opposite postures; this is how the rider is considered to acquire respect for the horse. During a session we can see this alternation of states that the *écuyer* feels through the contact.

Therefore, dynamic touch is a necessary condition for sensorimotor empathy, because it is essential in the exploration of the contact with the horse to have the intention of finding the ‘right contact’. What is decisive in the emergence of the latter is the process of sensorimotor empathy at work between the *écuyer* and the horse. Indeed, it allows both to understand through the body and to adjust finely in order to bring out ‘the right contact’ from the interaction. For example, before a *Courbette* the *écuyer* uses the codes shared with the horse (the whip, the tongue clicks, the actions with the reins, his own energy, etc.) to make the horse piaffe. The horse is very connected to the emotions and intentions of the *écuyer*. If the codes are correctly used by the *écuyer*, the horse understands what the *écuyer* wants and he moves according to the *écuyer*’s expectations: he piaffes and, when the *écuyer* raises his whip, the horse rises at the same time. This process of sensorimotor empathy is very similar to the one described by Kimmel about dancers’ interpersonal synergies. It is this process that allows a dancer to adjust their behaviour so they ‘hook into’ the inner structure of another dancer, and thus build and maintain an optimal or viable connection with them (Kimmel, 2021). We assume that, like the *écuyer*, the horse feels when it is the right moment to make the movement, thanks to the contact, because when the contact is good it means that the horse is well balanced, and has the correct muscular tension to make the movement in good conditions. This is why the horse sometimes anticipates the movements. The *écuyer* says that the horse ‘steals’ the movement, and that the ‘stolen’ movements are the

best, because an experienced horse knows when he is ready, when the timing is right. For the *écuyer*, one of the roles of the contact is to make him feel when it is the right time to ask.

So, the experience of contact for the expert *écuyers* that we describe above is the fruit of the process of sensorimotor empathy. According to Chemero, we experience sensorimotor empathy when we are experiencing ourselves as 'expanding to include other things'. In the case of the *écuyer* and the *sauteur*, we would say that this is a first step in the process of sensorimotor empathy. Indeed, we can distinguish the sensorimotor empathy of the *écuyer* or the horse from mutual sensorimotor empathy. Indeed, the *écuyer* can 'extend himself through the horse' and understand when to act and how, in order to connect the horse to himself. But this remains an 'individual' sensorimotor empathy until he manages to connect the horse to himself. Connecting to the horse is different from connecting the horse to oneself. This is what we see in the *Cabriole*: before it, there is a phase where the *écuyer* connected with the horse tries to connect the horse to him in different ways depending on what he perceives. Synergy can be considered to exist when the horse and the *écuyer* are connected and act in sync. In order to enter a process of mutual sensorimotor empathy which makes it possible to form a complex synergy, the *écuyer* must first facilitate the connection of the horse with him. For this, he sets up actions that are usual and significant for the horse (e.g. clicks his tongue, uses his voice, moves in different ways, uses the whip as a signal for a movement or to give some energy to the horse, etc.). Then, when they are mutually connected, they form a synergy kernel, a term proposed by Kimmel (2021) to characterize the evocative affordances of a more complex synergy. If the *sauteur* and the *écuyer* exploit this synergy kernel correctly, they will be able to form a complex synergy (e.g. a beautiful *Cabriole* or *Courbette*). If we take the example of the *Cabriole* in the results section, before the jump: the *écuyer* uses his voice, clicks his tongue, and places himself in a certain way which is meaningful for the horse. The horse understands right away what the *écuyer* asks and he engages himself in an energetic *Terre-à-terre*, which the *écuyer* feels in the quality of the contact, experienced as 'vibrant'. This 'vibrant' contact is a synergy kernel that the *écuyer* exploits to ask the horse to jump. From this synergy kernel they form a more complex synergy: the *Cabriole*. So, to reach a state of perfect synchronization with the horse, the latter must also be very connected to the *écuyer*. This mutual connection, which manifests through the contact, requires an intersubjective agreement that is

built over time and depends on the affinities and the level of experience of both actors.

To reach synchronization with the horse, the *écuyer* must act in the right way and, if the form of a movement of the *écuyer* is visible (e.g. actions with the reins or the whip), the precise moment at which he acts (which is often a tenth of a second away, because otherwise 'it's too early' or 'too late'), the duration of his action, its intensity, and its rhythm are most of the time totally implicit and belong to the sensorimotor empathy of the latter. As we have seen, the moments of connection between both fluctuate and depend on the *écuyer* and the horse, because the *écuyer* is obliged to 'play' with the willingness or unwillingness of the horse and his level of experience, and sometimes he is not sufficiently attentive to his perceptions and the horse. Indeed, it is more difficult to form a synergy with a horse than with a cane because of the agentivity of the horse. Through a game of mutual constraints, the *sauteur* and the *écuyer* connect progressively and temporarily, acting in sync to perform a difficult and complex movement.

For the *écuyers*, sensorimotor empathy is a skill which implies a disposition to regulate/act correctly and at the right time; moreover, it comes through the ability to perceive the trend of situations (to anticipate; to seize opportunities). This passes via a strong connection to their own body and via their projection in the environment. Sensorimotor empathy is necessary to become an 'expert' in work-in-hand. The *écuyers* have built this sensorimotor empathy through their multiple experiences with different horses, and in particular some very gifted horses that have been able to transmit the 'good feelings' to them.

More specifically during a session, to find the 'right contact' with the horse, the *écuyer* doesn't focus only on the hand to mouth connection. He is attentive to the horse's impulse (his ability to respond 'quickly and effectively' to a request), to his balance and his cadence, and therefore to the conditions that allow this contact. Once the *écuyer* perceives the 'right contact', he maintains it by small actions at the right time and he 'lets it live' by listening to his perceptions. Also, he keeps his fingers relatively open on the reins so that the horse keeps his desire to move forward. As we saw above, the contact is intersubjective, that is, it is the fruit of an interaction between two living beings that have singular personalities and histories, and also intentions that may be convergent or divergent. Moreover, the emotions of each one may influence the relationship. The *écuyers* are always concerned about the history and personality of

each horse. They consider both the distant past of the horse (his life history) as well as his immediate past (e.g. his last session). They integrate all these elements into the 'here and now' of their session. There are horses that are more sensitive than others, horses that can be asked in one way and not in another. In order to take these dimensions into account, *écuyers* have developed dispositions to finely interpret the horses' behaviours. They also pay attention to their own emotional state: often they take a moment to breathe in order to 'bring down the tension' and thus make the horse breathe too. Horses develop sensorimotor empathy too. To develop it, they must have the technique to execute the movements correctly, know the communication codes (e.g. the gesture of the whip which triggers a movement), be sensitive to the *écuyer* and to the possibilities offered by the different configurations of a situation. Indeed, horses, like *écuyers*, adjust at various speeds to their partner, depending on many parameters (affinities, work habits, etc.). Hence there are degrees of typicality in these adjustments, which come when the *écuyer's* and the horse's sensorimotor empathies each develop with a particular *écuyer* or horse.

We hope that this concrete application of sensorimotor empathy between *écuyers* and *sauteurs* improves the comprehension of the role of contact in these interactions and in horse riding in general. We would like this to be a good model for extending this concept to human–non-human interactions in order to characterize the dynamic micro-adjustments at work in the synergies between humans and animals, which result in micro-gestures, perceptual experiences, and a fluctuation between moments of mutual, partial, or ruptured connection. This allows for a theorization and characterization of these moments of interspecies connection and mutual understanding. This could subsequently open up training prospects that allow people in contact with animals to have access to a better understanding of the relationship they could have with them.

Acknowledgments

This work was supported by IFCE (Institut Français du Cheval et de l'Équitation — French Institute of the Horse and Riding) as part of the TraM-InnoForm project.

References

- Argent, G. (2012) Toward a privileging of the nonverbal communication, corporeal synchrony, and transcendence in humans and horses, in Smith, J.A. &

- Mitchell, R.W. (eds.) *Experiencing Animal Minds: An Anthology of Animal–Human Encounters*, pp. 111–128, New York: Columbia University Press.
- Baraër-Mottaz, A.-M. (2020) *Prendre soin du nouveau-né grand prématuré: énonciation d'un dialogue corporel co-construit par l'articulation de ressources multimodales*, Montpellier: Université de Montpellier.
- Chemero, A. (2009) *Radical Embodied Cognitive Science*, Cambridge, MA: MIT Press.
- Chemero, A. (2016) Sensorimotor empathy, *Journal of Consciousness Studies*, **23** (5–6), pp. 138–152.
- Christensen, J.W., Munk, R., Hawson, L., Palme, R., Larsen, T., Egenvall, A., König von Borstel, U.U. & Valain Rørvang, M. (2021) Rider effects on horses' conflict behaviour, rein tension, physiological measures and rideability scores, *Applied Animal Behaviour Science*, **234**, pp. 105–184. doi: [10.1016/j.applanim.2020.105184](https://doi.org/10.1016/j.applanim.2020.105184)
- Clark, A. (1997) *Being There: Putting Brain, Body, and World Together Again*, Cambridge, MA: MIT Press.
- Conrad, A. (2021) Ruyer et les leçons de l'instinct. L'éthologie compréhensive: Von Uexküll, Buytendijk, Ruyer, *Philosophie*, **149** (2), pp. 12–27. doi: [10.3917/phil.149.0012](https://doi.org/10.3917/phil.149.0012)
- Dashper, K. (2017) *Human–Animal Relationships in Equestrian Sport and Leisure*, Abingdon-on-Thames: Taylor & Francis.
- Despret, V. (2013) Responding bodies and partial affinities in human–animal worlds, *Theory, Culture & Society*, **30** (7–8), pp. 51–76. doi: [10.1177/0263276413496852](https://doi.org/10.1177/0263276413496852)
- Eisersiö, M., Rhodin, M., Roepstorff, L. & Egenvall, A. (2015) Rein tension in 8 professional riders during regular training sessions, *Journal of Veterinary Behavior*, **10** (5), pp. 419–426. doi: [10.1016/j.jveb.2015.05.004](https://doi.org/10.1016/j.jveb.2015.05.004)
- Fédération Equestre Internationale (2020) *Dressage Rules 25th edition*, [Online], <http://www.fei.org/fei/regulations/dressage> [19 November 2020].
- Gibson, J.J. (1962) Observations on active touch, *Psychological Review*, **69** (6), pp. 477–491. doi: [10.1037/h0046962](https://doi.org/10.1037/h0046962)
- Kimmel, M. (2021) The micro-genesis of interpersonal synergy: Insights from improvised dance duets, *Ecological Psychology*, **33** (2), pp. 106–145. doi: [10.1080/10407413.2021.1908142](https://doi.org/10.1080/10407413.2021.1908142)
- Legrand, D. (2007) Pre-reflective self-as-subject from experiential and empirical perspectives, *Consciousness and Cognition*, **16** (3), pp. 583–599. doi: [10.1016/j.concog.2007.04.002](https://doi.org/10.1016/j.concog.2007.04.002)
- Maturana, H. & Varela, F. (1987) *The Tree of Knowledge: The Biological Roots of Human Understanding*, Boston, MA: Shambhala Publications.
- McGreevy, P., Mclean, A.N., Warren-Smith, A.K., Waran, N.K. & Goodwin, D. (2005) Defining the terms and processes associated with equitation, *Proceedings of the 1st International Equitation Science Symposium*, pp. 10–44.
- Merleau-Ponty, M. (1945) *Phénoménologie de la perception*, Paris: Gallimard.
- Minero, M., Dalla Costa, E. & Dai, F. (2015) *AWIN Welfare Assessment Protocol for Horses*. doi: [10.13130/AWIN_HORSES_2015](https://doi.org/10.13130/AWIN_HORSES_2015)
- Nalepka, P., Riehm, C., Mansour, C.B., Chemero, A. & Richardson, M.J. (2015) Investigating strategy discovery and coordination in a novel virtual sheep herding game among dyads, *37th Annual Cognitive Science Society Meeting*, p. 6, Pasadena, CA.

- Newen, A., De Bruin, L. & Gallagher, S. (eds.) (2018) *The Oxford Handbook of 4E Cognition*, New York: Oxford University Press.
- Ödberg, F.O. & Bouissou, M.-F. (1999) The development of equestrianism from the baroque period to the present day and its consequences for the welfare of horses, *Equine Veterinary Journal*, **31** (S28), pp. 26–30. doi: [10.1111/j.2042-3306.1999.tb05152.x](https://doi.org/10.1111/j.2042-3306.1999.tb05152.x)
- Pereira, C. (2009) *Parler aux chevaux autrement: approche sémiotique de l'équitation*, Paris: Editions Amphora.
- Theureau, J. (2006) *Le cours d'action: Méthode développée*, Toulouse: Octarès.
- Theureau, J. (2010) Les entretiens d'autoconfrontation et de remise en situation par les traces matérielles et le programme de recherche « cours d'action », *Revue d'anthropologie des connaissances*, **4** (2), pp. 287–322. doi: [10.3917/rac.010.0287](https://doi.org/10.3917/rac.010.0287)
- Theureau, J. (2015) *L'énaction & l'expérience*, Toulouse: Octarès.
- Travieso, D., Lobo, L., de Paz, C., Langelaar, T.E., Ibáñez-Gijón, J. & Jacobs, D.M. (2020) Dynamic touch as common ground for enactivism and ecological psychology, *Frontiers in Psychology*, **11**, art. 1257. doi: [10.3389/fpsyg.2020.01257](https://doi.org/10.3389/fpsyg.2020.01257)
- Uexküll, J. von (1956) *Mondes animaux et monde humain*, Paris: Denoël.
- Varela, F. & Shear, J. (1999) *The View from Within: First-Person Approaches to the Study of Consciousness*, Exeter: Imprint Academic.

Paper received August 2021; revised June 2022.