Equine Assisted Interventions

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Contributor: Chiara Scopa

Equine assisted interventions (EAIs) is an umbrella term that include programs with recreational, educative or therapeutic aims. These interventions are goal-oriented and based upon the emotional/physical relationship between the human being and the horse. EAIs are provided by a multidisciplinary team and they are adapted to the needs of the patient/beneficiary involved in a wide range of settings.

Keywords: animal assisted interventions ; emotional intelligence ; Equus caballus ; human-animal interaction

1. Introduction

Levinson [1] in his book Pet-Oriented Science Psychotherapy mentioned several examples of how animals could help in enhancing therapies with children. Levinson's statement has been mentioned many times to implement the use of animals in therapeutic interventions and since the 1960s, this practice has become increasingly popular. Nowadays, animal assisted interventions (AAIs) are goal-oriented and structured interventions that intentionally include or incorporate animals in health, education, and human services (e.g., social work) for the purpose of therapeutic, educational, or recreational gains in humans [2]. According to the aim of the intervention, they are usually classified in animal assisted therapy (AAT), animal assisted education (AAE) and animal assisted activity (AAA), and they are structured and managed by a multidisciplinary team [3]. In this huge framework, equine assisted interventions (EAIs) are an emerging field, recently nominated as a very popular and novel practice [4]. EAIs is an umbrella term that includes a wide diversity of methodologies and approaches to improve human wellbeing through the involvement of horses (Equine assisted therapy—EAT; equine assisted education—EAE; equine assisted activity—EAA). EAIs can be adapted to the needs of the patient/beneficiary involved in a wide range of settings and, for this reason, they are used in many institutions worldwide. In particular, equine assisted therapies (EATs) are often integrated in traditional therapeutic plans for individuals with mental and physical disabilities [5][6]. Even though their efficacy has not been completely proved yet, some authors claim social, emotional, physical, and educational benefits for several categories of patients experiencing therapy with horses [7][8][9]. For instance, EAIs seem to stimulate multiple domains of functioning handling emotional, cognitive, motor, and social disabilities with or without actual riding activity. Kendall et al. [10] listed some anecdotal and descriptive hypotheses about how horses lead to positive psychological effects in patients during equine assisted therapy (EAT). Among these hypotheses, it has been suggested that EAT provides an emotional positive context that increases the prospect of beneficial changes in patients. For example, individuals with physical disability may experience a sense of "normality" while riding in contrast with the physical limitations they are used to face in everyday life. In addition, therapeutic equine interventions are conceived to address self-esteem and personal confidence, communicative skills, and social trust, by literally making the horse a therapeutic tool [11]. By using unintentional signals (such as vocalizations or facial expressions, but also by seeking affiliative contact), humans and horses progressively sharpened the skills to communicate reciprocal affective states. The bonding process connecting humans with animals starts with physical contact. Information collected through the body are mainly used to anticipate the movements of the partner (both horse and human) [12]; however, body contact constitutes an emotional connecting channel between interactants as well [13][14], resulting in tangible behavioral and physiological variation. Therefore, human relationship with horses has been prompted by the emotional involvement consistently characterizing their interaction. The occurrence of repeated encounters in the long term is in fact useful for both motor coordination and socio-emotional engagement between the bonding subjects [15]. For this reason, most of the interventions imply physical interaction with animals. The lack of a rigorous scientific approach in the study of these interventions results today as the main obstacle for the development of standardized methods in the field. Here, we identify two main parallel branches in EAIs' context both grounded on the same idiosyncratic process, i.e., the occurrence of coordination—sensu lato—between the interactants. A mutual interaction may in fact result in (I) a motor coordination dynamic or (II) in the coupling of physiological activities (brain/heart/hormonal) of both human and horse [16][17]. In the first case, the movement of the horse's pelvis during horseback riding provides motor and sensory inputs to the human body producing normalized pelvic movement in the rider, closely resembling ambulation in individuals without disabilities [18]. Eventually, the rider's motion becomes phase-

matched with that of the horse, developing in a synchronized gait [19]. As for the second case mentioned, investigating horse-human interaction by simultaneously recording their physiological activities (such as heart rate or hormones levels) has been widely employed in the last decades, even though studies mostly focused on equitation disciplines or training [20]. Inter-subjects coordination is positively affected by the affiliative nature of the encounter since social interaction and the processing of affective information are suggested to facilitate the mechanism of embodiment (i.e., when body postures and facial expressions arising during social interaction play central roles in social information processing) [21]. Since direct human–horse relationship may significantly influence the emotional arousal of both individuals, consequently affecting their behaviors, physiological variables have been gradually incorporated in this field of study as easily accessible sources to evaluate the stress level or emotional condition of both humans and animals [22].

Moreover, it has been recently demonstrated that horse's physiological activities overlap with the human' ones, as long as the interaction occurs and that this convergence increasingly synchronizes when the interaction get "more intimate" [23]. Due to the prominent emotional involvement and the standardized methodologies characterizing animal assisted interventions, EAIs provide an attracting setting to test new approaches to study human–animal interaction. Scientific literature on this topic has been mostly focused on the human side, categorizing contexts and programs in which working with horses resulted effectively [24]. Nonetheless, those mechanisms implied in relating with animals that lead to beneficial effects on human life, have been a neglected topic in the recent scientific scene.

2. From the Encounter to the Relationship: When Humans and Animals Interact

Human–Animal Bond: A Theoretical Framework

The human–animal bond has been defined as the mutually beneficial and dynamic relationship between humans and other animals, modulated by reciprocal behaviors that are essential to the health and wellbeing of both subjects involved [25]. This includes, but is not limited to, emotional, psychological, and physical interactions of humans, animals, and the environment.

In human psychology, the bonding process implies the establishment of a close, interactive relationship between the individuals involved [26]. Bonding typically goes in parallel with the concepts of attachment and affiliation, whose different degrees of intimacy determine the nature of the interaction. In particular: Affiliation is the simple act of being responsive with other human/animal subjects, but when affiliation requires social engagement and persistent reciprocal interaction with others, it develops into attachment [27]. According to this logic, bonding is the natural consequence of attachment and it is highly influenced by it in its essence, thus affecting the nature and quality of the bond itself. Bowlby formulated bonding and attachment theories in the sixties of the last century, integrating information that arose from his studies about child development and mother–child attachment. The 'theory of attachment' focused on the infant–caregiver relationship and its association to the healthy growth process. In his theoretical approach, Bowlby stated that childhood experiences lacking of a sense of safety and warmth, might influence the responsiveness of the adult in terms of stress and fear. As for humans, in all mammal species the developmental phase is based on reliability in caregivers, whose nurturing behavior contributes to resilience in facing adversities later in life [28]. Even owners' relationship with their pets can be described as parallel to the parental/child relationship: The caregiver's role in fact fulfills the people' intrinsic desire to protect and, on the other hand, pets depend on caregivers for care and protection. This represents a strong component of the human–animal relationship. Nevertheless, the classification of the multiple ways in which humans and animals come to interact is still under debate; moreover, it is difficult to force every interaction into an exclusive definition regardless of the animal species involved. In their review Hosey and Melfi [29] pointed out the slight differences between human–animal 'bond', 'relationship', and 'interaction' as previously defined by other scholars. In particular, the first to conceive a theoretical framework in this field was Hinde [30] who differentiated between the terms 'interaction', i.e., a sequence in which individuals show reciprocal behaviors to each other (which can be both positive or negative) and 'relationship' that implies the occurrence of a series of interactions over time. Eventually, Russow [31] listed some specific criteria that are necessary to outline a fully developed human–animal bond, such as reciprocity and persistence of the encounters. However, human psychological attributes, such as personality traits, empathy towards animals and people, human perception of pain in animals can also influence the interaction, consequently affecting the animal welfare and its cognitive performances [32].

Regarding human–animal attachment, in particular farm animals such as horses, three factors have been identified as having major impact on these animals' ability and willingness to interact with humans: (I) The nature, quality, and frequency of contact with people, (II) the time period, and (III) the social environment in which it occurs. In conclusion, the inter-specific bonding process clearly presents different characteristics if compared to the intra-specific one; however, they both appear to be based on the same essential mechanisms, i.e., reciprocity and emotional involvement.

3. The Emotional Side of Human–Horse Relationship (HHR)

Domestic animals such as dogs and horses have shared many years of co-evolution with humans (about 5500 for horses), thus promoting the possibility to establish and grow inter-specific relationships. As pointed above, the main features of an effective human–animal relationship seem to be the exchange of reciprocal behaviors between the subjects involved and the occurrence of repeated encounters. To comply both prerequisites, humans and animals evolved the capacity to communicate through a shared interface, which works as a cross-species common platform. The language used is mainly based on non-verbal signals, relying on (I) physical and (II) emotional connection. Physical contact and emotional reactivity represent the emotional channels connecting the subjects . In their recent review, Payne et al. [14] gave an extensive summary on human–animal physical contact (I), underlined its pivotal role in bond formation according to the 'human attachment theory' [26][33]. In particular, petting and scratching have been found to actively reduce heart rate and fear indicators in horses [34] and dogs [35], even if provided by unfamiliar humans. Contrary to human–dog or human–cat interactions, humans and horses experience high level of body-to-body contact when engaged in an interaction. Even if horses are able to respond to a known vocal order coming from both familiar and unfamiliar humans [36], the body is the basis from which non-verbal human–horse communication grows, specifically in riding activities, in a sort of "kinesthetic empathy". On the other hand, emotional connection (II) fosters the bonding process between individuals due to the activation of a sophisticated mechanism of self-tuning its own emotions on others' emotions. In humans, this skill called emotional intelligence (EI) [37], seems to influence inter-individual relationships since higher scores on emotional intelligence tests have been associated with various indicators of social adaptability and with the development of emotional competencies. With all due limitations of animal emotional competence, the possibility of the same strategy in human–animal relationship deserves further investigation. By using their emotional competence, horses could have evolved the capacity to foreseeing and accordingly reacting to the human's emotional state. This ability to cope with emotions is likely to influence the emotional valence of the interaction as a whole. Mendl et al. [38]argued that animal discrete emotions could be represented in a two-dimensional space; similarly, each emotional experience is valenced (a) as positive or negative, rewarding or punishing, pleasant or unpleasant, and it comes with a specific level of arousal (b) (from low corresponding to calm, to high corresponding to excited). As for humans, also in animals these subjective experiences come along with neural, behavioral, and physiological changes (facial expressions, activation of neural processes, heart rate variation) which can be objectively measured. In this perspective, depending on the perceived valence (positive/negative) of the encounter, the human–animal relationship could range from reassurance to fear, involving the activation of different cerebral processes that strengthen the positive or negative emotions induced [39]. Speaking about rewarding stimulation, seeking affiliative interactions is considered rewarding per se. Phillips [40] claimed the role of oxytocin in liking and the one of vasopressin in wanting and their unambiguous connection to pleasure in humans. In horses, social grooming has been found to reduce the groomer's heart rate. So that, inter-specific relationships could be used as a mechanism to promote healthy neurobiological development through touching and proximity, evocating rewarding emotions (positive valenced) in both humans and animals. In this perspective, the quality of a relationship in a group acquires an adaptive value [41][42]. Furthermore, Hinde's definition of relationship suggests that the core of a successful interaction is the "positive" or "negative" valence of each interaction, which constitutes a step towards the next one; meaning that the nature of the first interaction determines expectations for subsequent encounters. It has been investigated how horses are able to build a bond and keep positive long-term memory of humans when a positive reinforcement (i.e., reward, in this case food reward consisting of a few hand-given grain pellets) is associated to the interaction [43]. Not surprisingly, Baragli et al. [44] demonstrated that horses perceive and respond to humans based on their past interactions. In their report, Proops et al. [45] described how horses are able to form long lasting memories of specific human individuals only by the previous observation of these individuals' subtle emotional expressions in pictures. Authors first presented horses with a photograph of a happy (positive valence) or angry (negative valence) face belonging to one of two human models; several hours later, the horses were presented with the same human subject previously shown in the photograph but assuming a neutral expression in this occasion. Results revealed a significant difference in the first gaze, with horses that had previously seen the angry face showing a left gaze (right cerebral hemisphere) bias when viewing the same live subject with the neutral face. In this case, horses remembered the identity of those individuals, which had been perceived as potentially harmful in the last encounter. This refined skill seems to allow horses to use the valence of human facial expression as a basis for future encounters with the same subject, building specific individual emotionally valenced memory to quickly detect intentions and emotional states. It could be argued that, as is the case of humans [46], in horses those emotions associated to pleasant events decrease in intensity less than the emotions associated to unpleasant events, thus reinforcing the memory of a positive interaction rather than a negative one. Animals share the same central and peripheral neural mechanisms involved in experiencing emotion in humans; for this reason, they will actively seek situations assumed to provide them with a pleasurable experience and avoid those that might be assumed to be negative. Therefore, it is likely that animals experience similar humans' emotional states [47]. Finally, even though horses are considered prime examples of human companionship, little is known about horse–human attachment

process, if we exclude the huge amount of research limited to equitation. The many aspects of human–animal interaction can be truly acknowledged only by conducting cross-analyses on social and emotional competences of both individuals involved.

4. Horses' Perception and Communication of Emotions

In order to be effectively defined as 'relationship', human–horse interaction would need an additional feature, which is the occurrence of transfer of emotions underpinning stimuli, facial expressions, and vocal/non-vocal signals between the subjects. Emotional contagion occurs when the perception of emotion expression induces the same emotion in the receiver as in the producer of the signal and this mechanism is considered the basis of empathy [48][49]. Hence, the assessment

of the ability in a given species to express and perceive emotion expressions starts with analyzing its emotional repertoire. Natural selection has fostered those behavioral strategies that promoted affiliative interactions and social stability, with emotional transmission enhancing higher coordination among group members and stronger inter-individual bonds. Under natural conditions horses live in stable social groups [50] in which the within-members transmission of positive valenced emotions could contribute to group synchronization [51]and the rapid transfer of negative ones such as fear may, on the other hand, work as survival strategies for a prey species such as the horse. As above explained, emotions are characterized by two dimensions: valence (positive or negative) and arousal. A signal performed by an individual could induce in the receiver both the same arousal level (i.e., contagion of emotional arousal) and the valence (i.e., contagion of emotional valence). Briefer et al. [52] evaluated if horses are able to decode the emotional valence and arousal of whinnies performed by familiar or unfamiliar conspecifics and whether any form of emotional contagion occurs. Results showed no clear evidence of contagion of emotional valence; nonetheless, authors demonstrated that horses reacted differently to separation and reunion whinnies when they are produced by familiar conspecifics, but no differences were found when unfamiliar individuals performed them, thus advocating the occurrence of emotional arousal transfer. Therefore, this study suggests that horses are able to convey emotional states using vocalizations and to perceive variation in vocal parameters accounting for emotional valence. In addition to vocal signals, horses display a wide range of facial expressions [53].

In Wathan et al. [54] horses were presented with photographs representing facial expressions of their conspecifics captured in different contexts and their reactions were recorded. Results showed that perception of positive expressions elicited more approaching behaviors (positive valence) and decrease of heart rate (low arousal level) in tested subjects; on the other hand, negative expressions triggered avoidance behaviors (negative valence) and increase of heart rate (high arousal level). The same study was replicated to investigate whether horses enact the same mechanisms when viewing photographs of human positive (happy) or negative (angry) facial expressions [55]. Results of this last study suggested that horses may have adapted an ancestral capacity to perceive and appropriately respond to emotional expressions of conspecifics and throughout their coevolution with humans, they may have extended this ability to communicate with morphologically different individuals, i.e., humans. Finally, in Nakamura et al. [56], horses matched human auditory (voice) and visual (facial expressions) stimuli, respectively performed by a speaker and a screen. In this case, horses' heart rate increased when looking at a negative facial expression after hearing a positive voice (incongruent condition), indicating that cross-modal perception of human emotions occurs in a generalized form towards unfamiliar people.

Nevertheless, suggesting the occurrence of the contagion of emotional valence and/or arousal could be an overstatement in these cases, since authors used bidimensional representation of facial expressions (i.e., photographs or screen) which is for sure different then observing a live face. Moreover, Smith et al.'s [55] work has been highly criticized for the analyses of data and methodological approach. These recent studies, however, shed light on the innate and acquired characteristics that horses deploy when interacting with other individuals. Regardless if they are conspecifics or humans, horses would be perfectly able to develop, manage, and keep a relationship with humans, creating a bond based on reciprocal emotional fine-tuning. After all, it could be argued that interacting with conspecifics mimics interacting with individuals of a different species.

5. Horses in Equine Assisted Interventions (EAIs)

Horses are the most involved animals among AATs, in particular with hippotherapy or therapeutic horseback riding sessions. The riding experience is often used in rehabilitation medicine as complementary activity to improve motor skills in children affected by cerebral palsy [57] and persons with spinal cord injury [58] and multiple sclerosis. Therapeutic activities with horses are widely used also in individuals with autism spectrum disorder. Several positive effects have been reported for patients in terms of social, communication/language, and stress/behavior, as well as a reduction in autism symptoms [59]. The benefits to humans of equine assisted therapy have been well-researched also in post-traumatic

stress and anxiety disorders [60]. Moreover, many studies claimed on the impact of equine assisted interventions as a whole on patients living with chronic illness or eating disorders [61]. It is worth noting that the potential benefits of equine assisted psychotherapy and counselling have been studied as well, even if potential positive results emerged along with negative ones. The most comprehensive work analyzing the application of equine assisted interventions has been recently published by Stern and Chus-Hensen [62], considering both adults and children treatments across different conditions. EAIs, as for all AAIs, are based on the emotional connection and evolving relationship between the animal, the patient/beneficiary, and the professional who provides the intervention. The animal subject should be considered as an integrated complement, who helps in building the connection between the patient/beneficiary and the therapist or the care professional who is managing the intervention [63]. In therapeutic setting, this connection is functional to the onset of therapeutic alliance (TA). TA has been proposed as a pantheoretical factor that accounts for all kinds of therapy with positive outcomes, regardless of the approach and methodology. Therapist personal attributes such as being honest, flexible, respectful, warm, confident, empathic, and trustworthy contribute to a quick and positive development of TA, as well as the use of some techniques such as exploration, reflection, noting past therapy success, facilitating the expression of affect, and attending to the patient's experience [64]. Some researchers pointed out the role of the animal in therapeutic setting as a mean for shaping or growing the positive nature of interpersonal relationship [65]. The animal acts as a social lubricant, a facilitator of social interactions with other human beings, that helps the establishment of the bond between the patient and the therapist making the initial resistance easier to overcome and giving a safer perception of the environment [66]. This interpretation fits with one of the leading hypotheses regarding the benefits of human–animal interactions, which is the "social support hypothesis" [67]. A large body of literature supports evidences that the animal contact reduces psychological stress, increases social behavior in humans, ameliorates relational skills, and finally promotes positive attachment and resilience ability [68]. Beetz et al. [69] suggested in an exhaustive review, that the common mechanism underlying the positive physiological and psychological outcomes of both pet ownership and AAIs, is the activation of the oxytocinergic system (OTS). OTS positively affects hormones (e.g., cortisol), neurotransmitters (e.g., epinephrine, norepinephrine, and dopamine) and the autonomic nervous system reducing blood pressure, heart rate and heart rate variability, fear, and anxiety. Some studies documented a role of OTS in social bonds and in emotional contagion [70], even though this last point needs more investigations. Moreover, this mechanism seems to promote TA and it probably marked the AAIs' success and popularity among therapists [71]. Indeed, a number of specialists encouraged the involvement of animals in therapy, not only to build an effective TA with the patient but also to use the relation between the patient and the animal as a tool to unlock delicate issues, such as unconscious worries and fears. For example, therapists could elicit discussions by pairing the patient to an animal that has undergone the same problem (for example, a person who has been physically abused may relate to an animal with an abusive past, projecting his emotions onto the animal). Moreover, animals are often laden with many different subjective meanings, since people use them to embody emotions or feelings that are both hard to express and likely to be repressed. The subjective meaning that animated or unanimated objects assume depends on the type of interaction with the subject; therefore, the same object changes its proprieties according to the subjective universe: "All the properties of objects are actually nothing more than perceptual cues that are imprinted on them by the subject with which they enter into a relationship" [72] (p. 67). Von Uexküll argued that, when throwing an object at a dog, the object itself switches from a neutral characterization to a meaning-carrier element (a ball becomes a ball for play) as soon as it enters into a relationship with the subject (the dog). Regarding animated objects, animals regularly encounter animals of other species, including humans, thus attributing to these latter new meaning shortly after the interaction. By the same process, animals as well can be significant objects for humans, powering up only through interaction. The nature of previous interactions between horses and humans lead both to attribute a general significance, positive or negative, to each other that were mere neutral objects before the encounters [73]. The same mechanism may occur during EAIs, where both human and horse acquire a symbolic connotation. In addition, some therapists argue that because horses operate as members of a herd, they have evolved an elevated sensitivity towards others, which makes them active catalysts when engaging in social behavior [74].

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