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## **The circus actor: toward a cognitive approach**

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Here we are, spectators, spellbound by the trapeze artist who is gracefully performing the most complex and perilous acrobatic moves, one after another. Maintaining a permanent connection with us, she shares the emotions she blends into her rendition of the acrobatic, choreographic or dramatic scores of her show.

The clown, as a virtuoso of failure, keeps triggering laughter among us through his highly sophisticated physical and emotional control. The juggler moves us by turning the trajectory of the objects which he manipulates into kinetic art. The trainer communicates with his animals as well as with the spectators and the space...

Circus actors, or *artists* as they are officially called in the profession,<sup>1</sup> have many skills. Like other artists in the performing arts, they perform right in front of the spectators, but they also have competencies that are more specific to their own disciplines: acrobatics, juggling, animal training... Various categories of sensory-motor or psycho-cognitive activities (such as motor execution and coordination, perception and motor control, the creative process itself and any acts intended to elicit the spectators' reactions) are used by circus actors according to modalities of breathtaking complexity the most essential of which remain unknown.

Similar sporting activities – acrobatics in particular – that have been largely explored and studied by scientists, can partly help us to understand the above-

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<sup>1</sup> The circus actor is also called an 'artist' since he is often the originator of the shows he performs.

mentioned modalities. However, the processes involved in sports, the purpose of which is competition and evaluation through measures or scores, differ indeed from those involved in the performances of circus actors, which aim primarily at the creation and production of artistic shows.<sup>2</sup>

Moreover, the context of professional practice in the circus is very different from that of sport. The everyday practice of their art – including composition, writing and staging, includes specific features of pronounced aesthetic constraint, besides the various economic, professional and production factors – and this applies to both public and private sectors. ‘The circus artists perform at the theatre, music hall, cinema, television, cabaret, in the streets, as well as... at the circus!’<sup>3</sup>

The study of the circus and its actors requires a particular approach, as shown by the colloquia organized by the French medical association, Société Française de Médecine du Cirque:<sup>4</sup>

Oddly, there is a complete absence of circus practices in the scientific publications on motor control... and rather than being a field for the application of theories on motor control elaborated elsewhere, the research on circus skills undertaken *in situ* (acrobatics, juggling, etc.) can, or rather *should*,

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<sup>2</sup> Philippe Goudard, Philippe Perrin, Michel Boura , ‘Les Arts du Cirque: Histoire et spécificités d’une activité physique artistique (1<sup>ère</sup> partie)’, *Cinésiologie* 30(140) (1991).

<sup>3</sup> Philippe Goudard, *Le Cirque entre l’élan et la chute* (Montpellier: Editions Espaces 34, 2010), p. 19.

<sup>4</sup> Created in 1990 in Nancy, France, by Michel Boura, Denys Barrault, Philippe Perrin and Philippe Goudard.

offer a perfect place for these theories to be discussed, confronted and developed.<sup>5</sup>

Actually, such *in situ* observations have begun some fifty years ago in France. That is why we can here offer a set of scientific research results specific to the circus and its actors. Based on personal practice and observation since 1974, and developed in various French universities between 1988 and 2013,<sup>6</sup> these results relate to circus skills and higher professional education in the circus arts, as well as to other research carried out mainly in France, particularly in the mid 1960s by Paul Bouissac, a pioneer in the field.

Such a conceptual and practical corpus offers the bases and opens up the perspective for a cognitive approach to the circus arts. For example, based on the observation that circus actors use physical, neurophysiologic, symbolic and linguistic processes that bring a coherent meaning to their exchanges with the spectators, the hypothesis of invariant properties and cognitive processes that are specific to the circus can be posited for appropriate experimentation.

Nowadays, circus actors perform across the five continents. Their mainly gestural art reaches past national borders and blends into all cultures. At the same time, their refined artistic discipline and rigid organization constitute a closed world.

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<sup>5</sup> Benoît Bardy and Brice Isableu, 'De l'intérêt de la complexité des habiletés dans les arts du cirque', in Philippe Goudard and Denys Barrault (eds), *Médecine du cirque* (Montpellier: L'Entretemps, 2004), p. 114.

<sup>6</sup> Publications and works to be found in  
<<http://philippegoudard.net/index.php/recherche/publications-travaux-et-actes>>.

The circus revival since the 1970s has undoubtedly provided access to this usually closed world, where legends and secrets prevail. Young people of all backgrounds, including researchers, could thus approach the circus as a field of scientific studies. The present article is both a witness and an outcome of such developments.

Given the history and the conditions of current circuses, we can presumably identify some universally shared elements for circus actors and spectators. Are there any important invariants to be found in the circus? Could scientists bring them to light?

### *Circus sciences and arts: an ancient culture*

The various disciplines gathered under the umbrella of the Modern Circus in the eighteenth century are fascinating to scholars and scientists alike since they provide the opportunity to look beyond physiology or human behaviour, thus giving access to the bizarre, the unusual, and the nonstandard.

Already before the age of collections and museums, the cabinets of curiosities that appeared during the Renaissance displayed extraordinary phenomena, both physical and anthropological. Dwarfs were shown, for instance, next to odd animals in royal menageries in Europe. Based on such exhibits, the concept of ‘Savage’<sup>7</sup> was invented and exploited in the circus shows of the nineteenth century. The Hagenbecks, or Miss Lala, captured at the Fernando circus by Edgar Degas for

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<sup>7</sup> Pascal Blanchard, G. Boetschet, Nanette Jacomijn Snoep, sous la direction de Lilian Thuram, ‘Exhibitions. L’Invention du sauvage’, *Beaux Arts* (Hors-Série, nov. 2011).

posterity, as well as the phenomena exploited by Barnum, or the main characters of Tod Browning's *Freaks*, are all examples. This relationship to strangeness refers the spectator and the artist to a cognitive process of self-perception considered by Stiker as 'a pattern which is not that of equality, but of identity'.<sup>8</sup>

With regard to physical education, biomechanics and the physiology of human as well as animal movement, Antoine de Pluvinel and Arcangelo Tuccarro should be mentioned. In 1594, the riding master De Pluvinel lays the foundations for an equestrian art in which the aesthetics break with the art of war.<sup>9</sup> On the subject of acrobatics, early as 1599 Tuccarro devotes an illustrated handbook on exercise and dance that he dedicated to King Charles IX of France.<sup>10</sup> Later on, during the nineteenth century, Jean-Eugene Robert-Houdin, magician, physicist and engineer, a precursor of robotics applied to the circus, recreates a trapeze artist's movements with his 1845 automaton, *Voltigeur au trapèze*, a star in his Théâtre Robert Houdin de Paris. Through their chronophotographs, first Eadweard James Muybridge in 1878, then Edouard-Jules Marey in 1882, helped improve the analysis of the movements of acrobats and riders. From 1895 onwards, the cinematograph will bring the perception and understanding of the movements of acrobats, jugglers, magicians and circus clowns to light. Remarkably indeed, since the pre-cinema era, cinematographic art, which requires the spectator to rebuild a reality existing only as light stimuli on a screen and which calls for a complex cognitive process of

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<sup>8</sup> Henry-Jacques Stiker, *Corps infirmes et sociétés* (Paris: Dunod, 1997), p. 155.

<sup>9</sup> Antoine de Pluvinel, *L'instruction du roy en l'exercice de monter à cheval / par messire Antoine de Pluvinel... enrichy de grandes fig. en taille douce... desseignées [sic] et gravées par Crispian de Pas, dédicace au roi par René de Menou, éditeur* (Amsterdam: Schipper, 1666).

<sup>10</sup> Arcangelo Tuccarro, *Trois dialogues de l'exercice de sauter et voltiger en l'air* (1599; Archival Facsimiles limited, 1987), p. 197.

emergence, has been a source of interest and an inspiration for the new technique, and soon the art, of moving images. Georges Méliès and some brilliant circus actors such as Buster Keaton or Charlie Chaplin made a masterful contribution in this regard. From late nineteenth to early twentieth century, Marthe and Juliette Vesque have dedicated their lives of sketchers and watercolor artists to the circus, leaving 8000 drawings whose exquisite detail and infinite precision show the postures, phases of movements and trajectories of circus artists and animals. Their work constitutes a documentary source of top quality scientific data.<sup>11</sup> Some science journals feature ‘human phenomena and physiological curiosities’<sup>12</sup> or ‘Indian acrobats’<sup>13</sup> as early as the first years of the twentieth century.

These few examples, including *L’acrobatie et les acrobates* (1880) by George Strehly, a Latin teacher at the Sorbonne as well as an acrobat,<sup>14</sup> or the outstanding *Symbolisme de l’acrobatie antique*<sup>15</sup> by Waldemar Deonna, also a Latinist, demonstrate that scientists and scholars have shown a keen interest in the circus, and that circus actors could, in turn, benefit from their works and bring their art to bear in the broader scope of scientific, natural and cultural phenomena.

### *Toward a scientific approach specific to circus actors*

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<sup>11</sup> See Marthe and Juliette Vesque, ‘Le journal de Marthe et Juliette Vesque (1904-1947)’, MuCEM (Musée des Civilisation Europe Méditerranée).

<sup>12</sup> Guyot-Daubès, *Les hommes phénomènes. Force, agilité, adresse* (Paris: Masson, Libraire de l’Académie de Médecine, 1885).

<sup>13</sup> See the revue *Actualités scientifiques* (Paris, from 1902).

<sup>14</sup> G. Strehly, *L’acrobatie et les acrobates* (1880; Paris: Solène Zlatin, 1977).

<sup>15</sup> Waldemar Deonna, *Le symbolisme de l’acrobatie antique* (Brussels: Latomus, Collection 9, 1953).

The above-mentioned pioneering works often focused on a particular discipline (acrobatics or equestrian art) or methodology (the study of documents, description, modelling by drawing, building or recording, etc.) and opened the way for an experimental and analytical scientific approach aiming at elaborating theories on the circus and its actors.

In France, such a methodical, systematic, scientific study of the circus was made possible thanks to the work of three prominent professors within their respective fields: Claude Lévi-Strauss, the father of modern anthropology, who held the chair of Social Anthropology at the Collège de France; Michel Boura, a Professor of physiology at the Faculty of Medicine in Nancy; and Gérard Lieber, a Professor of Theatre Studies at the University of Montpellier. They indeed facilitated circus studies that proved crucial to the scientific approach and all the results of such studies became avenues for research in the cognitive sciences. These studies shared a specificity – they investigated the circus and its actors with an interdisciplinary vision instead of focusing on one ability at a time. They assumed the existence of invariants that were common to the various circus processes that they thoroughly explored and experimented with.

Paul Bouissac, a pioneer in the field who was strongly encouraged by Claude Lévi-Strauss to carry out his studies, was the first to apply a scientific approach to the circus, which he frequented and practiced – he founded and managed the *Gérard Debord Animal Circus* between 1964 and 1966. Among his numerous publications,



*Circus & Culture*<sup>16</sup> is a collection of articles and papers dating from 1966 to 1974 in which he lays the foundations for the linguistic and cultural specificity of circus art and groups disciplines around cardinal notions including equilibrium and disequilibrium, abstraction, and discontinuity, among others. In *La mesure des gestes*,<sup>17</sup> Paul Bouissac offers prolegomena for a semiotics of the circus that was based on description, symbolism and measurement, linking the circus to cognitive science for the first time, and establishing a connection between the syntagmatic model and a cybernetic and mathematical model of gestures.

It is truly remarkable that twenty years on we were to produce the very same assumptions and conclusions while approaching the circus through other disciplines, admittedly without knowing of Paul Bouissac's work at the time (he had been working back then at the University of Toronto since 1962).

From 1988 onwards, I had the opportunity to carry out some research under the supervision of Michel Boura in Nancy at the physiological laboratory of physical activities in the Faculty of Medicine and the Institut National de la Santé et de la Recherche Médicale (INSERM), having practiced circus myself since 1974, as an actor (first as a trapeze artist, then as a clown) and producer. The focus of this research consisted primarily in energy studies and the incidence of pathology in the various circus disciplines taught at the French Center for higher education in the Circus arts, the Centre National des Arts du Cirque. I was soon joined by Philippe

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<sup>16</sup> Paul Bouissac, *Circus and Culture. A Semiotic Approach* (Bloomington and London: Indiana University Press, 1976).

<sup>17</sup> Paul Bouissac, *La mesure des gestes. Essai sur les problèmes méthodologiques de la description et de la transcription des comportements acrobatiques*, MA diss., Lettres, Paris, 1970; and Idem, *La mesure des gestes. Prolégomènes à la sémiotique gestuelle* (The Hague-Paris: Mouton, 1973).

Perrin, today a Professor of Science and Techniques of Physical and Sports activities in Nancy (INSERM and Faculty of Sport) – his works on human equilibration are an authority – - and Denys Barrault, a sports medicine doctor, then chief physician at the Institut National des Sports et de l'Education Physique (INSEP) in Paris and team physician for the French gymnastics, diving and judo Olympic Teams. Circus medicine in general and our results in particular are deeply indebted to their work.

The method of calculation of workload that we established then enabled us to highlight the fact that there exists a specific relation between the workload and the onset of the pathology, that practicing circus art professionally without getting injured is impossible, and that articulations, as organs contributing to maintaining equilibrium, are the most affected. Moreover, our study revealed that the onset of pathology coincides with the aggravating influence of a number of factors, the first of which is the practice of circus art itself, through the circus actors' performances, the working conditions, the social and economic factors and current behaviours – that is, a unique culture of effort. The pathology affecting circus actors therefore results from their quest for imbalance in practicing the discipline as much as from their lifestyle, in the art as much as in the profession<sup>18</sup>. These initial results were followed by systematic studies on circus artists' health diseases, their prevention and treatment, as well as the neuromotor specificities of circus practices<sup>19</sup>.

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<sup>18</sup> Philippe Goudard, *Bilan et perspectives de l'apport médical dans l'apprentissage et la pratique des arts du cirque en France*, MA diss., Médecine, Université de Nancy I, 1989; Philippe Goudard, Pilippe Perrin, Michel Boura, 'Intérêt du calcul de la charge de travail pendant l'apprentissage des arts du cirque', *Cinésiologie* 31(143) (1992), pp. 141-50.

<sup>19</sup> Pilippe Perrin, 'L'équilibration dans les sports acrobatiques', in Goudard and Barrault (eds), *Médecine du cirque*, pp. 19-27; Brice Isableu and Benoît Bardy, 'Contrôle de la distribution des masses: Modélisation et perspectives au cirque', in Goudard and Barrault (eds), *Médecine du*

They also produced other questions. First of all: what does the circus actor's art involve? That question elicited several answers<sup>20</sup>. The circus actor, in each of the disciplines of acrobatics, of juggling, of training, and of clowning, moves from a steady state (static or dynamic) to a deliberate imbalance, that he compensates by a figure or a posture, before recovering a steady state. This self-destabilization on the part of the actors is achieved through the most clever, complex, and risky of actions, to the degree of endangering their own life. Thus, risk is at the heart of the circus actor's activities.

Alternating between postures (anti-gravity invariant schemes)<sup>21</sup> and figures (the sequences of movements) connects steady and unsteady states to some references. These references are the objects, apparatus or animals acting, on the one hand, as performance markers, and on the other hand, as the cognitive, postural, spatial and behavioral referents, which work upon the circus actor as much as on the spectators. These alternations between postures and figures can be considered as syntagmas, elements of a language that is specific to the circus, to which the notion of imbalance is central. The momentum, impulses, landings, and rotations in the three planes – sagittal, frontal, horizontal – produce trajectories that are operated and adjusted by the artist in accordance with the space in which he performs and his apparatus (*topocinèse*), as well as with his own perceptions (*morphocinèse*).

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*cirque*, pp. 29-34; Denys Barrault, 'Les pertes de figure en acrobatie', in *Ecrits sur le sable*, ed. by Philippe Goudard and M. P. Barberet (Montpellier: Artistes Associés pour la Recherche et l'Innovation au Cirque, 1994), pp. 143-52; Francis Lestienne, Philippe A. Liverneaux, F. Thullier, 'Perception de l'espace: Rôle du mouvement céphalique dans l'orientation du regard', in *Ecrits sur le sable*, pp. 167-79; N. Holtz, 'La jonglerie des chiffres', in *Ecrits sur le sable*, pp. 181-7.

<sup>20</sup> Goudard, *Le Cirque entre l'élan et la chute*.

<sup>21</sup> Philippe Perrin, Francis Lestienne, Philippe Goudard, 'L'équilibre du funambule', in *Ecrits sur le sable*, pp. 129-34.

The circus actor therefore operates ballistic objects (juggled objects, animals, etc.), possibly including himself, ensuring ‘airborne rotation ... the continuity of gestual sequence... as well as a full participation against the unbalancing effects of gravity, the quest for the highest difficulty, risk taking’,<sup>22</sup> and then piloting the trajectory of his own body (as an acrobat) or behavior (as a clown). Postures, figures and trajectories are therefore the elements of a language that is specific to circus arts.

‘If circus is a language, how does it communicate with us?’ This question made us consider the circus as an art of abstraction, as well as an art of incarnation. As an abstraction,<sup>23</sup> its trajectories and forms have a physical effect on the spectator. As an incarnation, the show mobilizes his representations, or whatever the signs transmitted by the actors–emitters to spectators–receivers arouse in him. For instance a flying trapeze act mobilizes our experience of gravity, verticality, height, and anticipation of trajectories, but also our personal history, our representations or culture of risk, of solidarity, of life and death, of failure and the surpassing of self. Surrendered to gravity, the acrobat meets our dream of cutting loose from its pull. Thanks to his cognitive system, the spectator at the circus can thus fly while remaining seated, survive the fall and triumph over the risk by way of delegation. Finally, the question ‘What does the circus speak to us about?’ is the main theme of the studies I have been carrying out since 1995 through the program ‘Cirque: histoire, imaginaires, pratiques’. Noting that for thousands of years, in many cultures, the

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<sup>22</sup> Thierry Pozzo and C. Studeny, *Théorie et pratique des sports acrobatiques* (Paris: Vigot, 1996), p. 27, p. 19.

<sup>23</sup> ‘You could still feel the human motion underlying the abstraction... It is quite remarkable how little information is needed to detect a human body in motion’. Ivar Hagendoorn, ‘Dance, choreography and the brain’, in Francesca Bacci and David P. Melcher (eds), *Art and the senses* (Oxford: Oxford University Press, 2010), p. 515.

circus has belonged to a broader entity – shows with a central playing area, which exhibit some common components (the public surrounding the show, seasonal periodicity, performances, real or symbolic games with death...) – we tackled the antique and archaic origins of the circus. We have discovered that the actions engaged by circus actors are related to the notions of cycle, risk and crisis, where the rituals of wandering, of sacrifice, of summons and the conjuring of death have shifted from the religious calendar to ‘secular’ tours organized in accordance with the profit afforded by the shows.

Disequilibrium, impermanence, instability are at the roots and heart of the circus and the disciplines that it is composed of: acrobatics, juggling, animal training, clowning. At the circus, risk is an aesthetics. As an art of movement and gesture, it combines trajectories just like music fashions sounds or image fashions forms and colours.

Circus actors’ living and performing conditions are as important as their shows in the universal fascination they hold when, through their acts, they display ‘chaos organized for sensual pleasure’.<sup>24</sup> Between the impetus and the fall, the circus actor practices an art and adopts modalities of existence in which he is constantly at risk of disequilibrium, impermanence and instability.<sup>25</sup>

Finally, by focusing on the spectators’ reception, from 1990 to 1993 we were able to carry out experiments on the sounds produced by circus actors and objects,

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<sup>24</sup> Dominique Jando, ‘Les numéros de cirque: Un chaos organisé pour le plaisir des sens’, in Noël Daniel, *The circus, 1870-1950* (Cologne: Taschen, 2008), p. 346.

<sup>25</sup> Philippe Goudard, *Arts du cirque, arts du risque, instabilité et déséquilibre dans et hors la piste*, MA diss. Arts du spectacle, Montpellier, 2005; Lille, A.N.R.T., 2008.

and their reception by the spectators and the artists' performances.<sup>26</sup> As early as 1968, Paul Bouissac had published *Volumes sonores et volumes gestuels dans un numéro d'acrobatie. Pour une expression mathématique des gestes*.<sup>27</sup> The similarities between his assumptions and research and our own (carried out decades later), corroborate results obtained using different tools – linguistics, semiotics, cultural studies on the one hand, physiology and theatre studies on the other.

### *Prospects for a cognitive approach to the circus actor*

The corpus results obtained between 1962 and 2014 warrants a cognitive approach in the study of processes underpinning the circus actor's work.

Many of the fields explored and highlighted by these scientific works are indeed relevant to the various disciplines that contribute to cognitive science: the cybernetics and mathematical modelling of gesture, the semiotics of acrobatic, clowning, juggling or animal training shows, representations and conveyed symbols, and complex-gesture phenomena involving neural networks in the actor and in the spectator. A cognitive approach to the study of circus actors could tap into the successive disciplines of cognitive science as they are 'successively intertwined'.<sup>28</sup>

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<sup>26</sup> Philippe Goudard, 'Captation et traitement du son des numéros de cirque: une expérience au Centre National des Arts du Cirque (1991-1993)', in Yvan Nommick and Philippe Goudard (eds), *Musique et cirque, une relation féconde* (Colloque Université Montpellier 3 and RIRRA 21 (2013; forthcoming).

<sup>27</sup> Paul Bouissac, 'Volumes sonores et volumes gestuels dans un numéro d'acrobatie. Pour une expression mathématique des gestes', *Langages* 3(10) (1968), pp. 128-31.

<sup>28</sup> Francisco J. Varela, *Invitation aux sciences cognitives* (Paris: Seuil, 1996), p. 120.

Cybernetics deals with the functioning of our brain, with the human brain machine modelled on the computer. Therefore, cognitivism looks at symbols – some wonder if our mind computes symbols. And connectionism developed along the invention of networks such as the Internet. Now, some more interdisciplinary theories combine cybernetics, cognitivism and connectionism. The theory of enactivism<sup>29</sup> postulates that we interact with the outside and that reality materializes at the same time as our action is realized. That raises an important question: does reality exist, or is it a production of our brain? Is what I see independent of the fact that I see it, or is my gaze creating what I see? That notion offers a new approach to life, to mind, to our relationship with the world.<sup>30</sup>

Where *is* the show? On the stage? In the brain? Magnetic resonance imaging reports events a hundred times slower than brain conduction. What happens between two elements detected by MRI? Hence, where is brain plasticity located? Where is the spectator's reception?

The circus actor constantly interacts with space, with spectators, with his own perceptions, as much as with circus culture and history. The cognitive understanding of his complex activities is fuelled by such questions. It should build on 'a consideration of the immediate context and the effects of biological and cultural

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<sup>29</sup> Ibid.

<sup>30</sup> Gwenaëlle Abolivier, 'Fascination du cirque: ce que nous disent les sciences cognitives. Entretien avec Philippe Goudard, scientifique et artiste de cirque', *Ricochet-Jeunes.org, Institut suisse jeunesse et médias ISJM* (2014). <<http://www.ricochet-jeunes.org/magazine-propos/article/426-fascination-du-cirque-ce-que-nous-disent-les-s>> [accessed 12 May 2014].

history on cognition and action'.<sup>31</sup> It should also take into account the composite specificity of the circus – a scientific study of the circus must perforce address many disciplines.

Neuroscience, for instance, may enlighten the complexity of acrobatic practices from two aspects, 'the motor aspect (coordination) and the perceptive aspect (control)',<sup>32</sup> which are interdependent and interact 'under the actor's intentional control'.<sup>33</sup> Yet these two aspects alone can neither assess nor explain the many processes engaging circus actors in their creative productions. Nor can aesthetic studies pertaining to the field of performing arts alone, whether they are based on history, on the analysis of dramaturgy, philosophy or other human sciences provide exhaustive tools in this sense. 'There is the material world of physics and biology on

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<sup>31</sup> Varela, *Invitation aux sciences cognitives*, p. 199.

<sup>32</sup> Benoît G. Bardy, 'De l'intérêt de la complexité des habiletés gymniques et acrobatiques', in D. Hauw and J. F. Robin (eds), *Activités gymniques et acrobatiques* (Paris: Editions Revue EP&S, 1998), Dossiers EP&S no. 39, p. 13: 'La complexité mécanique, motrice ou perceptive de ces habiletés [acrobatiques]... révèle, par la pression temporelle, énergétique ou attentionnelle qu'elle engendre, les limites fonctionnelles de ce système.' (The mechanical, motor or perceptive complexity of these [acrobatic] abilities... via the temporal, energetic or attentional pressure that it engenders, reveals the functional limits of this system.)'

<sup>33</sup> '... des relations [sont] déterminées entre des variables perceptives générées par le mouvement lui-même et des variables motrices qui contrôlent le mouvement sur la base de ces informations. Ces lois en revanche ne sont pas déterminées, car elles sont sous le contrôle intentionnel de l'acteur. L'intention apparaît dans ce contexte comme un élément déterminant du couplage qui vient organiser une relation spécifique entre le flux d'informations et le(s) paramètre(s) essentiel(s) de l'action.' '... relationships are determined among the perceptive variables generated by movement itself and motor variables that control movement on the basis of such information. These laws, however, are not determined, because they are under the actor's intentional control. In this context, intention appears to be a determining element for the coupling that will organize a specific relationship between the flux of information and the essential parameters of action.' Benoît G. Bardy, 'Approche des systèmes d'action en gymnastique', in Hauw and Robin (eds), *Activités gymniques et acrobatiques, recherches et applications* (Paris: Éditions Revue EP&S, 1996), Dossiers EP&S no. 25, p. 64.



the one hand, and the immaterial and mental world of culture, beliefs and art, on the other. Such a dualism is radically questioned by cognitive science.’<sup>34</sup>

Circus actors actually *feel* this impossible dualism that supposedly sets thought and art in opposition to physics and biology, for they spend their entire life combining them, alchemists transmuting matter into spirit, bodies and objects into works of art, emotions into thoughts, reality into imagination and imagination into reality. Actually, *all* of the elements forming the ‘nature of the art’<sup>35</sup> of the circus need to be addressed and clarified in order to understand what circus actors create and offer us.

Cognitive science meets such requirements. By drawing on the resources of neuroscience but also of linguistics, cognitive psychology, artificial intelligence, philosophy, epistemology and anthropology, by questioning the human mind applying a thought process approach rather than a philosophical and conceptual approach.

For the actual question is: What do the circus actors bring into play? What constitutes their relationship with the world? How are their representations of the world constructed? Or else: What is imagination? And how do we, as spectators, mobilize our own imagination in front of their works?

Neuroscience, human equilibration, motor control, mirror neurons, linguistics, semiotics, the modeling of movements, robotics, recording techniques for gesture, sounds or brain processes, the study of notations that are specific to each circus

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<sup>34</sup> Edmond Couchot, *La nature de l'art. Ce que révèlent les sciences cognitives sur le plaisir esthétique* (Paris: Hermann Editeurs, 2012), p. 7.

<sup>35</sup> Ibid.

discipline, of sensory-motor stereotypes and invariants, of functional and cultural analogies, of information processing and human behavior, and their possible applications in circus medicine, disease prevention and therapies, the creation and circulation of shows, vocational training schemes, technical, artistic, and industrial innovation... The paths opened by the results of specific scientific works on the circus lead to an unlimited field of research for cognitive science and technologies when applied to circus actors, disciplines and spectators.<sup>36</sup>

The art of risk, disequilibrium and impermanence practiced by the circus actor elicits a particular meaning from his performance. It relates us to what Jean Genet calls 'the million-years-old genealogical certainty'. Francisco Varela, the proponent of the theory of enactivism, closes one of his books thus:

If the keystone of cognition is its faculty of allowing meaning to emerge, then information is not predefined as an intrinsic order but matches the regularities emerging from cognitive activities themselves... Representation does not play a key role anymore, but emergence does. So the basic idea is that cognitive faculties are inextricably linked to the history of what is being experienced, just like a previously non-existent path appears while walking.<sup>37</sup>

It is indeed in the path journeyed by circus artists that the reality they would share with us will then appear.

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<sup>36</sup> Philippe Goudard, 'Etre auteur de cirque en 2052', SACD, Paris.  
<<http://www.ca.blog.sacd.fr/index.php/author/philippe-goudard/>> [accessed October 2013].

<sup>37</sup> Varela, *Invitation aux sciences cognitives*, pp. 111, 112, 122.