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The *action cam* phenomenon: a new trend in audiovisual production

Abstract

When the GoPro camera was first put on the market in 2004, it brought about a new generation of ultracompact cameras designed to be attached to the user's body, and which came to be known as action cams. Their principal characteristics were their tiny size, their high-quality images and a wide-angle, fixed-focal-length lens. This combination has made it much simpler to get spectacular subjective shots with considerable depth of field. The users of this technology now form a whole generation of citizen-filmmakers who produce thousands of videos every day in a novel realistic style dominated by first-person narrative. Their work is principally shared via video platforms like YouTube and Vimeo, which provide instant feedback in the form of millions of views. In this paper we analyze the common features of the action cam recording style and we state these videos will bring about a redefinition of the realist visual style. Furthermore, we propose to relate the success of the action cam phenomenon with the cognitive concept of embodiment and argue that the viewer's mirror neurons copy the real sensations and enable the viewer to experience, virtually and in safety, the same emotions felt by the person actually taking part in the action..

Keywords

action cam, video platforms, subjective shot, embodiment, realism

1. The *action cam* phenomenon

GoPro is the brand-name of a type of camera first made available to the public in 2004. They are generally known now as *action cams*, and are characterised by: (1) greatly reduced size; (2) resistance to water, physical abuse and other dangers; (3) a wide-angle lens with a fixed focal length; and (4) a wide range of accessories which enable the user to attach the camera practically anywhere and thus obtain unusual

viewpoints¹. It was due to all these peculiarities, which on certain sites have come to be known as “the GoPro philosophy”, that the National Academy of Arts and Sciences saw fit in 2013 to bestow the American Television Emmy Award² on the company.

According to Forbes Magazine³, sales of GoPro cameras have doubled every year since they first appeared on the market, and just ten years later account for one-third of sales of all pocket camcorders. The firm’s shares appeared on the stock exchange in June 2014. In view of this success, traditional camera manufacturers like Rollei, Polaroid, JVC or Panasonic have set up assembly lines for similar products called *action cams*. Firms making electronic devices not linked to photography or video, like leading GPS manufacturer Garmin, have also introduced several models. Little-known makes and even new ones⁴ join the fray from time to time, in attempts to secure a corner of the market. Some online stores specialize in sales of cameras of this type, and offer a range of more than a hundred different models⁵. Alongside this, a burgeoning market for accessories has sprung up, devices manufactured by the camera producers themselves and also by independent makers. There is, in addition, a wide range of prototype accessories designed by the users themselves to fix or move their cameras in the most unlikely places to get the shots they require. Communities of users, sometimes calling themselves GoProers, have formed to communicate with each other on websites where they exchange experiences, explain techniques to get the most from their cameras, solve technical problems, recommend accessories or upload video-tutorials⁶. There is also specific technical literature on the technology of this camera and corresponding work-flows) and corresponding work-flows (cfr. Hetrick, 2013; Schmidt & Thompson, 2015).

In this paper we propose to show how and why the success of the *action cam* is as much due to the existence of free viewing and distribution channels as to the birth of a new realistic audiovisual style which stimulates the viewers’ emotions thanks to its *embodiment*.

2. Action cams and video platforms: a happy coincidence

GoPro and YouTube came into this world simultaneously, between 2004 and 2005. The following decade saw both technologies converge, giving rise to a hitherto unknown degree of dynamism in the world of audiovisual creativity. Pichihua (2014) states that a hundred hours of video are uploaded onto YouTube every minute, and over six thousand million hours of video are watched every month. YouTube’s owners are continuously seeking new ways to stimulate users, in order to maintain growth. One of YouTube’s competitors is Vimeo, founded in 2004 by “people wanting to share their creations and personal moments in their lives”, according to the site’s founding manifesto. These two platforms compete to offer the best quality, but following different strategies. In this respect, Jodar and Polo (2009) state that a key element in today’s digital culture is the appearance of video formats

¹ There is a collection of examples of the kinds of viewpoints made possible with GoPro cameras at www.marketingdirecto.com/actualidad/digital/diez-sitios-muy-locos-para-colocar-la-camara-gopro-y-conseguir-videos-asi-de-sorprendentes/ The examples include the point of an épée during a fencing match, a dog’s collar while he is out walking, a violin while it is being played, or inside the drum of a washing machine in operation.

² <http://es.gopro.com/news/and-the-emmy-goes-togopro>

³ See: <http://www.forbes.com/sites/ryanmac/2013/03/04/the-mad-billionaire-behind-gopro-the-worlds-hottest-camera-company/>

⁴ Brands like Magicam, Contour, Oregon, Midland, Lenco or Maptag.

⁵ The online store www.idealoes.com offers 135 different models for sale on the Internet, at: <http://www.idealoes.com/cat/2574416-45/action-cameras.html?ts=1386876195488>

⁶ Good examples of the activity surrounding the performance and technical attributes of GoPro cameras are the blog <http://goprohackses.blogspot.com.es/> and the Facebook page <https://www.facebook.com/Goprohacks.es>

of reasonably high quality in sufficiently reduced file sizes. Such is the case with H.264, MPEG-4 or AVC, which have undoubtedly contributed to the consolidation of the video format on the Internet. Vimeo was set up from the start as a platform intended for more professional use, while YouTube was directed at the general public. By introducing high-definition technology in its channels, YouTube has reduced its technical disadvantages and now hosts numerous professional channels.

Both YouTube and Vimeo are essential tools with which *action cam* users can create specific Internet channels where their videos can be viewed by the public. According to Hand (2013), three GoPro videos are uploaded on to YouTube every minute. There are also specific channels on Vimeo, with audiovisual products mainly of commercial origin, probably because the viewing window offers no other suggested videos as YouTube does. There are differences of content and traffic between these channels, but the most remarkable ones are the two created by GoPro themselves in 2009, five years after their first camera was launched. New channels are constantly appearing, seeking new activity-areas in which the *action cam* can express its full potential, from music and concert channels to those dedicated to sports like paddle tennis. At the time of writing (April, 2015), the Vimeo platform contains 270,000 videos bearing the GoPro label, while 18,000,000 are to be found on YouTube. These results are based on counts of aspects such as titles, descriptions, users who upload the videos, and labels.

3. The action cam style

Ever since the appearance on the market of these ultra-compact cameras which non-professional users could afford, a new form of real-life narration came into being with cameras forming part of the body of the person making the recording. That is, as Salt (2009) states, the developments in technology have connections with stylistic developments. Accessories make it possible to attach the camera to the heads, hands or chests of these new amateur film-makers, or *prosumers*, who incorporate the camera into their bodies, making them mobile camera-vehicles capable of recording all the person's physical movements. The fact that the camera is attached to the character's person greatly increases the character's freedom of movement while the camera is operating and allows for a huge variety of camera positions and points of view. Although these cameras were at first intended only for amateur use, today they are being used more and more in the professional world⁷, and some well-known directors are incorporating into their films shots taken with cameras of this type⁸.

Most of the videos made with *action cams* and uploaded on to the video platforms share several common characteristics. They are videos of reduced length, between two and ten minutes at the most, and with recognizable similarities of style. Here we shall explore the characteristic traits of this style by analyzing a representative sample of 20 videos on different themes and which have been identified by their authors as pertaining to the GoPro label, the first and best-known makers of this type of camera. We have selected 10 videos from the YouTube platform and another 10 from Vimeo, all uploaded between 2013 and 2014. In appendix 1 we provide a list of titles and links to the 20 videos analyzed. The following are the results of our analysis.

⁷ As an example of musical videos, a version of 'Add it up' by This Band can be viewed at: <https://www.youtube.com/watch?v=MGXmOGQpMno>

⁸ For instance, George Lucas's film *Red Tail* includes scenes shot with GoPro cameras, as can be seen at: <http://gizmodo.com/5883408/inside-the-camera-company-that-lights-up-the-great-outdoors>

3.1. A new non-fictional style

Videos recorded with *action cams* clearly intend to represent reality, ranging from everyday family situations like a man shaving in the morning or a toddler playing on a swing (videos 18 and 20 respectively), to high-risk sports like climbing the Moab Towers or para-skiing (videos 6 and 7 respectively); from wildlife scenes (videos 4, 9 and 15), to emotional situations like firemen saving a cat from a fire (video 14); from top-class sportspersons showing their skills (videos 5 and 11), to anonymous citizens recording their holidays or their flashmob experiences (Videos 19 and 17 respectively). In spite of all this diversity, all such videos belong to Platinga's (1997) classification of 'non-fiction' which can be defined as any discourse which asserts that what is shown or related is a true fact.

Nichols (1991; 1994), who has gone to greater lengths than anyone else in defining and classifying the documentary film (i.e. "non-fiction"), distinguishes six modes or sub-genres of the representation of reality, which he organizes according to their recurrent features: expository, participatory, performative, reflexive, observational, or poetic. The expository mode is characterized by the way it speaks to the viewer using a voice that does not belong to the world under observation; it is very common in conventional television reporting. In this mode, interviews are subordinate to the theme, and real-life events are often dramatized. In the participative mode, by way of contrast, the narration is not that of a single voice: the characters speak to each other and to the director, which makes the presence of the camera evident.

When the mode is performative, the film is constructed around the person of the director, who displays personal subjectivity and performs to the camera with all his or her personality. The reflexive mode makes the viewer conscious of the actual process of recording real events and the conventions of the genre. The fifth mode, observational (also known as factual or fly-on-the-wall, terms used to indicate a zero degree of intervention), maintains the myth of objectivity by filming reality without attempting to control it, recording concrete everyday events and giving an impression of real-time, real-life experience. The visual style of this sub-genre is based on the use of hand-held cameras, loss of focus, frame-changes and erratic movements, all of which have been used in fictional works as a sign of realism. Finally, the poetic mode aims to create a specific mood rather than to provide information.

Although the *action cam* style is definitely of a non-fictional nature, seeking to make statements about reality, its formal characteristics are difficult to reconcile with any of the modes defined by Nichols. They might be seen as close to the observational mode because they record concrete everyday events and leave an impression of reality, but the visual style is not founded on an erratic use of the camera. The characteristics of these cameras give a stable image located in the centre of the action. The presence of the camera and of the person making the recording are also evident. It would therefore seem that the result is a kind of mixture of four modes: participative (the obvious presence of the *action cam*), reflexive (the viewer is made conscious of the process because in some shots the camera itself can be seen), performative (a subjective point of view) and observational (the recording of real events leaving an impression of personal experience).

3.2. A new style of realism

According to Salt (2009), the most useful basic way of regarding the medium is a more or less faithful technological reproduction of audio-visual reality. All films can be considered to lie on a spectrum between two extremes, from extreme naturalism to extreme expressivism, labelled as "realism" and "formalism." In general, formalists deliberately stylize and distort the raw material of reality; the camera is used as a tool to express a psychological or

subjective truth which sometimes requires distortion in order to be effective. Realists, on the other hand, tend to reproduce reality with a minimum of distortion, in an attempt to suggest that they are copying things as they really are, thus maintaining the illusion that the image has not been manipulated and objectively mirrors real life. This style requires the reproduction of the tangible surface of things with a minimum of enhancement, since the aim is simplicity and spontaneity⁹. The concept can be applied to both fiction and non-fiction, since what is represented does not have to be true, only to appear to be true. In the realistic style the camera is usually held at eye-level, using a lens with an angle of vision of around 40°, similar to that of the human eye. The formalist styles, on the other hand, make use of different camera angles, a variety of lenses, and changing angles of vision in order to create visual metaphors. An extreme high angle, for instance, may indicate that the character is metaphorically depressed, while distortions of lens angle may metaphorize a confused state of mind (Ortiz, 2011).

In Grodal's view (1997: 2009), research on human cognition has produced evidence of a half-way stage between realism and formalism. This intermediate position, referred to as "ecological conventionalism", interconnects representation and emotion. Grodal emphasizes the paradox inherent in the idea that one way of expressing reality is an imperfect sequence of images typical of amateur film-makers: imperfect focus, erratic camera movements, bad lighting and so on. Images of this type, rather than emulating the human eye, simply indicate that the scene has been recorded with no previous preparation. In other words, we associate imperfect images with live recordings. He also claims that imperfection in a specific context may evoke a sensation of subjective experience. This is what occurs, for instance, in the film *The Blair Witch Project* (Myrick & Sánchez, 1999) where erratic camera movements cause the viewer to experience the kind of panic felt by the characters.

The realistic style of *action cam* recordings portrays an objective reality, but lacking the typical features of realism, usually associated with live reports: instead of a hand-held camera, a camera attached to the body; instead of an eye-level viewpoint, a multiplicity of viewpoints; instead of a standard lens, an extreme wide-angle lens; instead of occasional losses of focus, correctly focused images; and instead of erratic movements to follow the action, a camera perfectly located at the centre of the action. These videos, therefore, exemplify a new realistic style based on a perfectly focused image distorted by the wide-angle lens, situated at the centre of the action but also providing unusual points of view and transmitting the movements of the operator's body. The realistic style of the *action cam* will probably modify what the reproduction of reality in a simple, spontaneous matter has hitherto meant for film-makers.

3.3. *Wide-angle, fixed-focus lenses*

Camera lenses are usually classified in three main groups: standard, long-focus and wide-angle. Standard lenses possess an angle of vision of about 40°, similar to that of the human eye. With long-focus lenses, the angle of vision is smaller, and with wide-angle lenses it is greater. According to Proferes (2008), Lumet explained how, in order to increase the dramatic power of *12 Angry Men* (1957), he resorted to frequent lens-changes, from 28 mm to 40 mm and then to 100 mm. As the focal length increased and the depth of field was reduced in consequence, the sensation of claustrophobia grew stronger. In order to avoid the metaphorical connotations which can be produced by optical distortions caused by the lens, realistic directors tend to use standard lenses.

⁹ A good example of the realist style is the Dogme 95 film movement, which recommends using hand-held cameras, real locations and natural lighting, among other norms.

One of the characteristics of ultra-compact cameras of the *action cam* type is the use of extreme wide-angle lenses, since they were designed to cover as wide a field of action as possible while maintaining sharp focus in a considerable depth of field. Depending on the recording format and the model of camera, angles between 120° and 180° are to be found. Obviously, such extreme angles produce considerable distortion of the image, increasing towards the edges, as shown in Figure 1. Such images are in no way realistic since a human being's angle of vision is around 40°. Nevertheless, this type of distorted image, together with a subjective point of view, is the most easily recognizable feature of videos filmed with *action cams*.

Figure 1. Examples of image-distortion produced by action cams



3.4. *First-person narration with an (almost) exact POV*

In 1972 the French theorist Genette first coined the term *focalization* as an instrument in narratological analysis, and identified three types: “zero focalization”, “internal focalization”, and “external focalization”. The first of these is the case of the omniscient narrator who knows everything about the characters. With internal focalization, the narrative is filtered through one of the characters, while with external focalization the narrative is related from outside one of the characters. Jost (1987) applied Genette's terminology to the world of audiovisual media, proposing the terms “ocularization” and “auricularization”. “Primary internal ocularization” would be when the camera sees the world from a character's point of view, as occurs with subjective shots. “Secondary internal ocularization” occurs when what we see in one shot refers back to a previous shot from a character's point of view, as in angle/reverse angle techniques. “External (or zero) ocularization” is when a particular shot is not attributable to any character's point of view.

Branigan (1984) distinguishes between omniscient-narrator or third-person narrator (when the narrator is not part of the text, is non-existent and yet is everything), and subjective narration or first-person narrative when the narrator is identified with a diegetic or non-diegetic character in the story. One way of establishing the nature of the narrative as subjective or first-person is the point-of-view shot (POVS), defined as a shot in which the camera is located in the same position as the character so that we see what he or she sees under normal conditions, in real time and with the camera identified with the character's physical point of view. The camera takes over the functions of the character's eyes, and therefore our perception of reality is restricted by that of the character.

If what we see is affected by some special mental state (as when a subjective shot is out of focus because the character is drugged) Branigan calls it a “perception shot”. If what we see is affected by the character's mental state but does not coincide with his or her point of view, it is a case of “projection”. The POVVS can also be “prospective” or “discovered”. The first of these is more common, as when we see someone looking at something and then see what they are looking at. A “discovered” POVVS, on the other hand, is when we first see something and then see the person who is looking at it. Branigan argues that the POVVS cannot be natural in subjective structures because there is no way in which a character and a camera can be in the same place at the same time.

According to Gaut (in Platinga & Smith, 1999), character-viewer identification plays an important role in our emotional response, but the POVS is not the only way to produce it. Although shots of this kind enable us to identify perceptually with the character, it carries the disadvantage of not allowing us to see his or her facial expression, so the character's feelings are not revealed and empathy is not facilitated. This is why the reaction shot is also important. In *The Silence of the Lambs* (Demme, 1991) for instance, we first see Starling's emotional reactions in the autopsy room, and then get the POVS. The viewer is thus encouraged to imagine what he is seeing from his emotional reactions, and the POVS confirms it. The combination of the reaction shot and the POVS makes it possible for the viewer to identify emotionally with the character.

Smith (2004) uses the term alignment to describe the process by which spectators are placed in relation to character. The POVS is a perceptual alignment. Besides, he states that we should think in terms of POV structures (the positing of a perceiver/the image of the perceived) instead of POV shots. This structure can function as a way to emphasize an alignment with a particular character, a rhetorical underlining of the narration's delegation of the storytelling function to a character. Another function is to represent the field of vision of a character in a particular moment seeing no more than the character does. Thus, the POVS serves to forge a close link between character and spectator by virtue of restricting what the character sees.

Until recently, using subjective shots has always been a technical challenge because of the obstacles posed by the size and weight of the cameras. The arrival of the Steadicam, the first image stabilizer invented by Garret Brown in 1975, went a long way towards solving the problem. It was first used during the filming of *Bound for glory* (Ashby, 1976) *Rocky* (Avildsen, 1976) and *Marathon Man* (Schlesinger, 1976) and revolutionized the film industry by making lengthy movements possible without the usual shake caused by hand-held cameras. The invention reached maturity when it was used in many later, groundbreaking films like *The Shining* (Kubrick, 1980) and *Return of the Jedi* (Marquand, 1983). Even here, however, the camera was not located exactly in the same position as the character, but only offered a view seen from the location of the character's body.

In contrast to the Steadicam, *action cams* simplify subjective shots because they are designed to be attached to an operator who also becomes a character¹⁰. In this way, the subjective first-person narrative of the POVS coincides, to within millimetres, with the viewpoint of the person taking part in the action: an almost exact subjective shot. In spite of what Branigan (1984) says of the subjective shot in films, this kind of POVS is natural because it is possible for the character and the camera to be (almost) in the same place at the same time. Nevertheless, while the usual subjective-point-of-view shot is taken with a standard lens and its angle of vision similar to that of the human eye, *action cams* employ a wide-angle lens which produces a distorted image.

In the analysis we have carried out¹¹, we have found three types of subjective shot: (1) POVS in which the camera is embodied but makes no reference to the operator's body (EPOVS, that is, Embodied Point Of View Shot), (2) POVS in which the camera is embodied and also makes reference to the operator's body (REPOVS, that is, Referentially Embodied Point Of View Shot), and (3) action shots taken using accessories which maintain the camera at some distance from the body to which it is still attached (OES, that is, Out-Embodied Shots). These are still to some extent embodied but give an externalized vision of the operator's body. Figure 2 shows examples of the three shot-types we have identified.

¹⁰ It should be pointed out, however, that there is a Steadicam designed specifically for use with a GoPro camera. It is made by Tiffen, and is called the Steadicam Curve.

¹¹ Appendix 2 contains a table of the frequency of EPOVS, REPOVS and OES in each video.

Figure 2. Shot-types: EPOVS (top), REPOVS (centre), and OES (bottom).



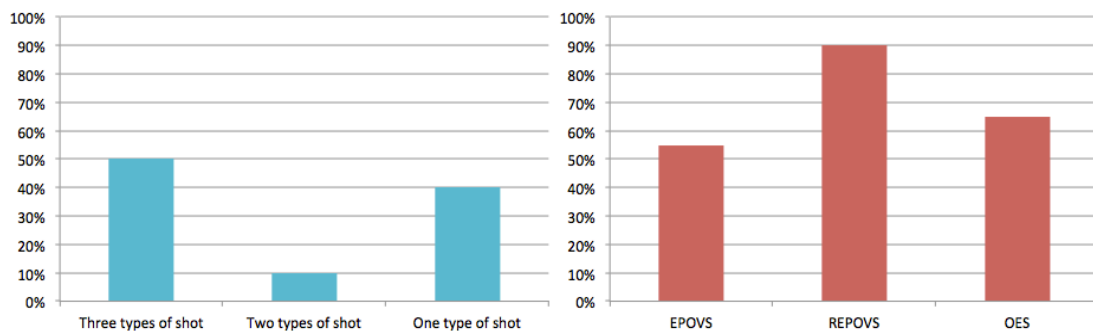
Out-embodied shots produce a strange sensation of subjective movement in which the body is stationary while the surroundings are in motion. It is like being both inside and outside of the action at the same time. It is *par excellence* the most characteristic and spectacular type of shot made in *action cam* videos. By “out-embodied shots” we mean all shots in which the operator’s body is made visible by attaching the camera in some way to the operator’s body, but at a distance, as shown in Figure 3: (1) by being attached to an accessory such as a pole or stick; (2) by being attached to one of the operator’s extremities (like hands or legs), or (3) by being fixed to an object which takes part in the action and is itself in contact with the operator’s body, such as a ski or a surfboard. Very often an OES shows the operator’s face and therefore might be considered a self-portrait, but can also give a different or unusual point of view of the action. When the operator’s face is visible the OES is combined with an EPOVS, which is similar to a reaction shot since such a combination helps the viewer to identify emotionally with the operator/character.

Figure 3. Types of OES, with the camera attached to: an accessory (top), an extremity (centre), an object with the body (bottom)



Not all the videos analyzed here show combinations of the three types of shot, but half of them do (Figure 4, left). Eight show only one shot-type (six REPOVS and two OES), while two show a combination of two shots (one either EPOVS or REPOVS and the other an OES). The most commonly-used shot is the REPOVS (18 of the 20 videos), followed by the OES (13 of the 20 videos) and the EPOVS (11 of the 20). This exploratory analysis therefore suggests that we might propose the hypothesis that the most widely used shot is the REPOVS (90%) followed by the OES (65%), and that about half of all videos make use of combinations of the three shot-types (50% of cases), (Figure 4, right). In future research we hope to be able to reinforce these data by analyzing a larger number of videos.

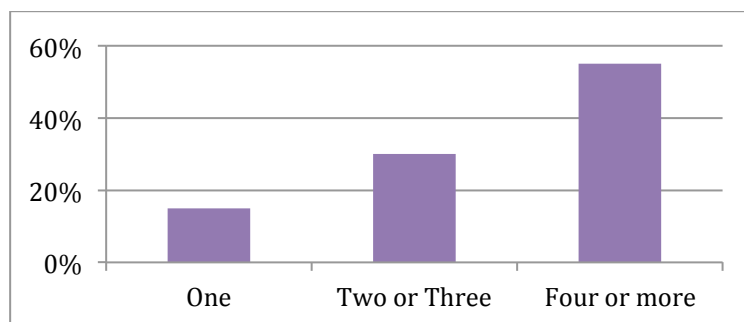
Figure 4. Percentage use of the three types of shot



3.5. Multiple camera positions

Camera positions determine how we see the action take place and the way we experience it. The *action cam*'s reduced weight, together with the collections of accessories and supports available enable the user to vary the camera positions in ways which until recently were only possible in computer-generated images. In the videos subjected to analysis we have counted the number of camera positions for a given action¹². Figure 5 shows the percentages of numbers of camera positions. Of the twenty videos analyzed, only three were made with a single camera position; six used two or three positions, and the rest used four or more, up to a maximum of eight or nine positions (videos 18 and 16, respectively). In other words, more than half the videos analyzed used more than four camera positions. Video n° 16 in particular used nine different positions in 1:23 minutes of recording.

Figure 5. Percentage of the number of camera positions



¹² Appendix 3 contains a table showing the camera positions and their duration. In general, the videos are short and record only one action, but when a video presented several actions we limited our count to the principal one. In video n° 6, for example, there are two actions, one of climbing the Moab Tower and another of Backpack jumps; we concentrated our analysis on the climbing action.

3.6. *Embodiment*

Although cognitive science initially saw the human mind as a kind of superior software, the brain is now seen to be interdependent with the rest of the organism, so cognition is determined by an integrated biological organization in which all the anatomical, biochemical and neurophysiological systems of the human being play their parts. Everything we experience, understand, communicate, imagine, evaluate or do is the result of the nature of our bodies, hence the coined term *embodiment*. We can see how we access reality through the filter of our embodied nature in the metaphorical projections produced by our sensory-motor system. Body-centred projections which enable us to understand abstract concepts are human universals and are reflected in all languages. The concept of verticality, for instance, whose root probably lies in the behavioural inevitability by which every small child struggles to walk upright constitutes a template for metaphorical projections, as when we say that a person has been promoted to a *higher* level or is a *rising* star in an organization (cfr. Lakoff & Johnson, 1999; Gibbs, 2008).

According to Grodal (2009) and Elliot (2011), the body has always been taken into account in cinema theory. Embodied components in audiovisual processes were described by Münsterberg, Pudovkin, Eisenstein, Arnheim, Mitry and others. Their ideas were forgotten, however, and were replaced with semiotic, psychoanalytic or Marxist theories which converted the viewer's perception of a film into an apotheosis of vision. Embodied Film Theory, on the other hand, suggests that the viewer does not perceive the image passively, but processes it creatively through embodied information: we cannot understand the world unless we experience it physically. In Grodal's view, films are simulations created by and for embodied minds. Elliot distinguishes two kinds of embodiment: first, the body as an *index of response*, capable of re-living sensations and physical experiences such as nausea, confusion or excitement; and secondly, the body as a *site of reception*, a tool enabling us to understand the moving image.

The discovery of mirror neurons, first found in the ventral premotor area of the frontal lobe of monkeys' brains, and after decades of research shown to exist also in humans, has been a fundamental argument in favor of the concept of embodiment. Mirror neurons are activated not only when we perform an action but also when we observe an action being performed by others. This system enables us to understand the behaviour of other people by a process of simulation rather than by abstract reasoning. Our brain generates a virtual copy of what we observe, so that we can feel what others feel. Embodied Simulation Theory (Gallese, 2005; Gallese & Sinigaglia, 2011) is based on the mirror-neuron system, and argues that human brain mechanisms rely on the projection of others' actions, emotions and sensations on to the observer's own sensory-motor and visceromotor neural representations. Gallese & Guerra (2012) consider that embodied simulation plays a fundamental role in both cinema functions: that of the viewer and that of the film-maker. Our mirror neurons are in effect our emotional response when we watch a film, since the actions represented "reverberate" among our own neurons. When we watch a horror film, therefore, we experience a feeling of fear not because of what we see but because our brain copies the emotions felt by the characters. It is only a virtual copy made at a safe distance, referred to by the authors as a "liberated embodied simulation", a state of immersion in which our attention centres on the narrated events and deploys our simulation capacity, disconnecting for a while our natural protective emotional shield.

Heimann et al. (2014) investigate the effects of camera movements simulating the observer's own approaching movement toward the scene. They conduct a combined high-density EEG study using the camera in four different ways: filming from a fixed position, zooming in on the scene, approaching the scene by means of a dolly, and approaching the

scene by means of a steadycam. The results indicate that a movement of the camera visible in the movie enhances observers' mirror mechanism. This could be related to a stronger feeling of involvement in the scene because of the approaching movement itself. It could also be because of the fact that a video recorded by a moving camera offers more depth cues and therefore more closely resembles real-life vision. Such similarity seems to depend on the filming technique and appears to be strongest when video clips are filmed with the steadycam.

Action cams are usually attached directly to the body in order to record the action, which means that they transmit sensory-motor sensations of much greater precision than those obtained with static or Steadycam-type cameras, as these are not only located at some distance from the body but are also designed to compensate for bodily movement and make it more fluid. The sensory-motor sensations experienced when viewing a recording made with a hand-held camera are also different, because the camera does not enjoy the same freedom of movement as an *action cam*. Our mirror neurons are activated differently when stimulated by a static, stabilized-image or hand-held camera as opposed to an embodied device. It would therefore seem logical to conclude that an action recorded with an embodied camera will transmit sensory-motor sensations with greater precision, thus enabling the viewer to simulate them with greater intensity. *Action cam* images "echo" in the viewer the same sensory-motor stimuli as those experienced by the people who wear the camera attached to themselves while they jump from an aircraft, surf large waves or ski down steep slopes. A close bodily link is therefore produced between the person who records an action with an embodied camera and the viewer who identifies totally with that person through embodied simulation.

4. Conclusions

There is an undeniable attractiveness in first-person audiovisual narrative. One of the greatest aspirations of film-making is to get the viewer to identify with the character, to involve the observer in the story, and this is where such images obtain their strength.

The invention of the *action cam* has brought about a revolution in the audiovisual production by paving the way to a series of creative possibilities and hitherto non-existent narratives, thanks to the combination of reduced size, high image quality, protection against rough use and water, and an extreme wide-angle, fixed-focus lens.

Its greatest impact, however, has been felt in the world of audiovisual communication. The number of productions using this format is growing exponentially, with platforms like YouTube and Vimeo playing a decisive role by offering the storage capacity and the free viewing facility that makes such significant growth possible. The new range of narrative possibilities that these cameras offer has proved highly attractive to the general public; the average number of uploads to YouTube, three videos every minute, confirms the fact. Further confirmation is to be found in the extraordinary viewing data, with thousands of *action cam* videos registering millions of views.

An analysis of the characteristics of the *action cam* recording style reveals a series of common features. Although strictly speaking they belong to the non-fiction genre, a discourse which asserts that what is shown or related is a true, they show a mixture of modes. Besides the film-making style lacks the drawback of the imperfect image typical of realism, and therefore are bringing about a redefinition of the realist visual style to which we have been accustomed until now. Half of the videos we have analyzed here show a combination of the three types of subjective shot we have identified: EPOVS, REPOVS and OES. More than half also make use of four or more different camera-positions.

Embodied simulation theory explains why these videos are so successful, especially those recording intense action like parachute-jumping or large-wave surfboarding. The

viewer's mirror neurons copy the real sensations and enable the viewer to experience, virtually and in safety, the same emotions felt by the person actually taking part in the action. This produces an embodied link between a character who records the action from his or her own body and a viewer who fully identifies with that person thanks to the phenomenon of embodied simulation.

The aim of this article is to explore the phenomenon and open up new avenues of research. We believe we have set up a valid functional base and appropriate terminology which will facilitate further studies of the *action cam* style via the analysis of a greater number of videos. We have also indicated a new set of materials to assist in verifying the embodied cognitive response to the moving images.

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Appendix 1: Table of videos analyzed

Nº	Canal GoPro (YouTube)	Title
1	https://www.youtube.com/watch?v=Sm0Ny_LcCAY&list=UUqhnX4jA0A5paNd1v-zEysw	Waltz On The Walls Of City Hall
2	https://www.youtube.com/watch?v=l660jPf3JiE	Russian Swing
3	http://www.youtube.com/watch?v=wIA5oCnbhHA	Kelly Slater 2013 Pipe Masters Champion
4	http://www.youtube.com/watch?v=wJFd-Q0Xzsc	Gentle Giants
5	http://www.youtube.com/watch?v=KgOmCXJQl8s	Kaya Turski - On The Quest For Glory
6	http://www.youtube.com/watch?v=fVcV9ltdZ8w&list=PLSSPBo7OVSZtJV0nQRrogEjhc0QmV1U0	Moab Towers & Magic Backpacks
7	http://www.youtube.com/watch?v=tVE7ug4jJaw&list=PLSSPBo7OVSZtJV0nQRrogEjhc0QmV1U0	BombSquad: Alaskan Speed Flying
8	http://www.youtube.com/watch?v=GdEKSyad_rk&list=PLSSPBo7OVSZtJV0nQRrogEjhc0QmV1U0	Barefoot Waterski Breakdancing
9	http://www.youtube.com/watch?v=7Sv_Bv1H7BQ&list=PLSSPBo7OVSZtJV0nQRrogEjhc0QmV1U0	Whale Fantasia
10	http://www.youtube.com/watch?v=CSJPZ_DQooo&list=PLSSPBo7OVSZtJV0nQRrogEjhc0QmV1U0	Dreams with Kelia Moniz - Roxy Wahine Classic 2011

Nº	GoPro Channel (Vimeo)	Título
11	http://vimeo.com/77453937	Kelly McGarry's Second Place Run - Red Bull Rampage 2013
12	http://vimeo.com/77084007	Fire Breathing With A 24 GoPro Array
13	http://vimeo.com/79529871	Dog Gone Fishing
14	http://vimeo.com/75507229	Fireman Saves Kitten
15	https://vimeo.com/110384001	Lioness Hunts Down a Buck with Kevin Richardson
16	https://vimeo.com/109627796	Shaun White's Backyard Mini Ramp
17	https://vimeo.com/album/1514798/video/91350439	International Pillow Fight Amsterdam versión
18	https://vimeo.com/album/1514798/video/90383722	Art of the Blade
19	https://vimeo.com/album/1514798/video/82210536	Mudpacks in Palau
20	https://vimeo.com/album/1514798/video/74417983	Test FLIGHT AUSTIN