Paper # 2

Motion Capture Technology:

The Film Industry's Contextual Lens of Ambiguity

Mary Goodwin

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Certain big-budget films of the past 20+ years, like Peter Jackson's *King Kong* (2005) and *The Lord of the Rings: The Two Towers* (2002), James Cameron's *Avatar* (2009), and George Lucas' *Star Wars: The Phantom Menace* (1999), share not only the Hollywood emphasis on spectacle-oriented blockbusters, but their widely-discussed use of motion capture technology. By registering an actor's performance through reflective or position-tracking markers or a suit, kinesthetic performance data can be translated into a computer animation system and refined in order to construct 3D computer-generated characters in film – although this technology continues to be used for real-time performance or to inform the movements of characters in animated films, it is the use of motion capture to augment these *live action* Hollywood blockbusters that has generated such a critical discourse over where the technology 'fits in' with the filmmaking process. By examining motion capture technology's origins, development, and debated relationship to modern cinema, it can be argued that its historical significance as a contextual element that influences multiple films stems from its provocative nature as a lens through which questions of technological media synthesis and the notion of realism in cinema have been raised. This ambiguity generated by motion capture's conflicting realist and non-realist elements, functions, and status in the industry give a greater understanding of these increasingly blurred approaches in modern cinema, and to the technical and industrial intertextuality of the media world in which film has operated since the 80s.

In order to fully investigate the historical significance of motion capture as a contextual element, it is imperative to analyze the origins and development of the technology, as well as the significance of this history for the element's influence on the industry today. An illuminating look at motion capture's origin within the media sphere comes from David Sturman's article from the 1994 SIGGRAPH computer animation and graphics conference, which details specific technical milestones in the technology's development, as well as a revealing outlook of the contextual element's future from that point in time. Motion capture, as Sturman specifics, consists of the "recording of human body movement (or other movement) for immediate or delayed analysis and playback", and although this technology had roots in the medical field, the use of motion capture for "computer character animation [was] relatively new, having

begun in the late 1970's, and only [in 1994] beginning to become widespread" (Sturman). Although the impetus for motion capture's adoption into filmic media brought along with it the adaptation of traditional animation techniques like rotoscoping, the emphasis remained on new computer graphic technology as a receding parameter and continuous enabler of the technique's development. Issues that persisted through 1983, like "manual post-processing to recover trajectories when a [position-tracking] marker is lost from view…the slow rate of rendering characters, and the expense of the motion capture hardware" are all issues that would be resolved by computer systems and hardware rendering become more sophisticated, faster, and more financially viable through eventual normalization of this technology's potential (Sturman).

This relationship between motion capture technology and the conceivable processing power available within the industry suggests this element's status as a significant marker of the 'organic vs. inorganic' debate that cites even rotoscoping as a contributing example. The subtle divide between the organic, hand-motivated, manual aspects of filmmaking and the usually-unfamiliar innovations of increasingly digital or technically-augmented aspects of the process, in which practical effects and hand-drawn frame animation have often been touted over "shortcut" techniques like motion capture have never been new within filmmaking as a process, and black-and-white divides like this are often flawed. By 1988, for example, even Jim Henson Productions (renowned for practical effects and puppetry) "had been trying to create computer graphics versions of their characters," and deGraf and Wahrman's "Mike the Talking Head" live motion-capture-informed performance demonstrated that this "technology was ripe for exploitation in production environments" (Sturman). Demonstrated by this late 80's adoption of motion capture from medical and experimental environments into media production (including film), even practical-focused (or 'organic') production groups have been striving for the founding technical origins of this contextual element as early in film history as the actual technology of the time would allow.

As early 90's improvements and demonstrations of motion capture's potential in performance of computer animated characters by companies like Videosystem and SimGraphics moved the technology closer to an industry-wide adoption, the application of the tech expanded to characters for trade shows,

television, live entertainment, and budding virtual reality (Sturman). The dual emphasis that remained on both the piecemeal improvement of the technology itself and the ability of the actor(s) to serve as the interface for character performance signifies even at this early stage of development the idea of maintaining 'organic roots' of the film practice within an 'inorganic' filmic technology. Motion capture's ambiguity then as an element drawing both on 'organic' and 'inorganic' sources (and to eventually incarnate both realist and nonrealist approaches in film) is significant for being indicative of this divide over the credibility and source of filmic production that was not new to this particular element, but which also would take on greater prominence in turn-of-the-century and contemporary Hollywood filmmaking as the emphasis on digital CGI/VFX took on greater importance.

Sturman concludes in his 1994 article that despite motion capture's then yet-to-be-solved problems, the practice had become a viable option for computer animation, predicting that motion capture would doubtless "become one of the basic tools of the animator's craft" (Sturman). This window-in-time outlook from an industry professional close to motion capture's development therefore reveals the focus on developing the technology itself for animation with crossover potential, but also the unlikelihood that even those developing the technology predicted the extent of its integration into live action filmmaking. This partially unexpected nature of how quickly motion capture would take off with turn-of-the-century filmmaking highlights the significance of its role in that early 2000's emphasis on digital technology in Hollywood filmmaking, as an element raising continually more questions of what stylistic aspects of these live action films are 'organic' or aesthetically 'realistic'.

Support for motion capture's significance as a crossover marker of digital cinema's rise also comes from João Gomide's article, in which he alludes to the paradigm changes in computer graphics since the 1980's, led by research of companies like George Lucas' Industrial Light and Magic (ILM); situated within the available improvements in computer graphics, motion capture's evolution "fulfilled artistic demands, limited by the technological capacity of each period" (Gomide). Although the first feature film to employ the use of motion capture was James Cameron's *Terminator 2* in 1991, marking the technology's

solidification as an approach within mainstream Hollywood live action filmmaking, motion capture animation had first been produced for an advertisement in 1984, in which three 35mm cameras triangulated the 3D positions of an actress, and Robert Abel's team animated and processed the character for the commercial's screening for the 1985 Super Bowl (Gomide). Since motion capture's inception as a feature film tool in 1991, several figures within the film industry have driven the technology's rapid incremental evolution, primarily George Lucas (with ILM), James Cameron, Peter Jackson (often working with Weta Digital), Robert Zemeckis, and Steven Spielberg. The evolution of motion capture highlights its ambiguous crossover status however, as the widespread applications for film, television, video games, augmented reality, and real-time live performance point out that besides motion capture's divided roots in organic/inorganic and realist/nonrealist production aesthetics, the element is also historically important for signifying and amplifying the increasing intertextual overlap between these contemporary media to an extent that few pre-1980s filmic technological innovations had achieved. The crossover media applications that emerged for motion capture since its filmic use in 1991 reflect upon the increase in interconnectivity of contemporary Hollywood's (and entertainment media's) conglomeration and synergy since the 1980's, as motion capture's industrial and aesthetic tendencies that blur the bounds of realism and authorship in film production have extended to the modern industry's continuous self-integration as permitted by technological developments.

In addition to motion capture's status as a reflexive signifier of digital cinema's turn-of-the-century innovation and the organic/inorganic qualities of an increasingly interconnected filmic media landscape, the contextual element has also affected a range of films since the early 2000's via the motivations behind its continuous innovation and its position as a lens revealing competing realist and nonrealist impulses in contemporary blockbuster cinema's hyper-VFX aesthetic. Although motion capture's use in the films *King Kong* (2005, Peter Jackson) and *Avatar* (2009, James Cameron) will illustrate the element's ambiguous significance in the execution of films that have used it to a more visible extent than turn-of-the-century films, the technology's rapid innovation necessitated its progression from more of an on-set reference to the

'performance-capture' it is regarded as today, though still inspiring the same reflexive ambiguity throughout the course of its innovation.

As a critical component of the 1999-2001 emphasis on the 'New' as digital effects and environments, motion capture aided the ability of filmmakers to construct 'realistic' worlds and characters that are intentionally 'unreal' – visuals that could not exist in the real world, organically, but which are presented as visually conceivable through technologic, inorganic means. This influence appeared in digital-focused films like George Lucas' *Star Wars: The Phantom Menace*, which, although it stressed extensive 3D character animation, notably embraced the goal of 'realism'. Animation supervisor Rob Coleman stated that, for the film's computer-generated characters like Jar Jar Binks, he "wanted to make fantasy digital characters have the same kind of life and breadth that humans do" and to "make the digital characters more real than we've ever been able to make them before" (Magid). Although this stage of motion capture's cinematic development had it used as a *reference* for the motion of the film's 3D characters instead of an actual translation of the actor's movement, the intent to translate the subtleties of the human face marks a precursor to motion capture's later facial performance abilities that reveal the consistency with which the creative forces within the film industry – despite criticism of the technology – have intended on striving for the digital capabilities that motion capture would eventually be able to satisfy. Motion capture also served a unique role within this period of digital innovation as, like its companion tools, an approach that facilitated and cooperated with the increased 'economies of scale' of increasingly 'massive' digitally-constructed scopes constructed within spectacle-oriented blockbuster films, as it enabled the repetition and individualization of droid armies in *The Phantom Menace* (Magid). Even when only serving as a reference instead of a performance translation, motion capture *enables* this aesthetic impetus of contemporary filmmakers to imbue distinctly nonreal characters with a visual and emotional realism. As such, the resulting ambiguity between the plastic unreality and emphasized realism that have traditionally stressed their mutual division have been brought to light by motion capture's increasingly significant part in blurring the boundary between these impulses in the production of contemporary spectacle blockbusters.

As motion capture has evolved to include fine-tuned facial performance capture capabilities, the ambiguity it raises over the realist and nonrealist approaches in filmmaking, and the organic and nonorganic components that go into its finished product, plays a uniquely significant role in challenging the categorization of these segmented ideas of aesthetic and authorship that have defined mainstream Hollywood filmmaking for so long. As motion capture technology has bridged the divides between different forms of media because of its crossover nature, its debate-raising ambiguity has become important for serving as a reflective lens onto these questions of discrete definition of film 'traditions' and forms of media in the digital age. "By capturing live movement as raw computer data, [motion capture] exists as an unprecedented amalgam of both recorded and synthetic cinema," and has exposed flaws in segmented authorship of modern filmmaking as 'everyone from actors to visual effects artists, studios to labor unions…have attempted to claim the technology as their own" (Freedman 38). This refusal of discrete categorization affects not only the production and reception of the films that employ the technology then, but suggests the need for a reevaluation of this ever-evolving digital, perhaps "hyper-unreal" filmic age as well. Director/producer Robert Zemeckis suggests even that "motion capture represents a wholly new form of filmmaking, one that cannot and should not be limited by our previously held definitions of synthetic versus recorded cinema" (Freedman 38).

The question of authorship and agency raised by motion capture's formative ambiguity (in which data is recorded, but must be manipulated to arrive at the final filmic image) provokes the fracturing of the division between live action as realist and animation as nonrealist. With motion capture – now 'performance capture' – and the accompanying VFX making up so much of the physical substance of the modern blockbuster filmic image, how 'much' of a film like *Beowulf* (2007) or even *Avengers: Endgame* (2019) is 'live action', and how much is 'computer animation'? The scope of motion-capture's ambiguity is signified by the Academy of Motion Picture Arts and Sciences' 2010 declaration that its Animated Feature category would only consider entries "in which movement and characters' performances are created using a frame-by-frame technique", with the addition that "Motion capture by itself is not an animation technique"

(Freedman 40). Producers in the industry validate the uniqueness of the contextual element's ambiguity to contemporary filmmaking, and the difficulty it creates in a system that often divides credit between actors and animators: While Zemeckis contends that motion capture "is a completely novel approach to making movies", Steve Starkey (producer of *The Polar Express* and *Beowulf*) states that "the movies we make don't fit into a genre…it defies categorization" (Freedman 42). Brad Bird's comment about how "the technology would often overshadow the frame-by-frame animation done in the same scenes" refers to New Line's promotion of Gollum for *The Lord of the Rings*, in which the studio ignored animation work on the character and pushed Andy Serkis' performance as the entirety of the finished product, even though motion capture's ambiguity of credit often creates difficulties of recognition and compensation for both animators and actors (Freedman 44).

These ambiguities of motion capture's technical, aesthetic, and industrial status give a greater understanding of the competing realist/non-realist and organic/inorganic influences in modern special-effects driven cinema when examined in regards to two films in particular, Peter Jackson's *King Kong* (2005) and James Cameron's *Avatar* (2009). For *King Kong*, Jackson worked with Andy Serkis, who had become a sort of spokesperson for motion capture, to use this technology to create the film's protagonist, Kong himself. Rather than following the model of previous Kong adaptations, Jackson and Serkis released a copious amount of video diaries detailing the process behind the making of the film, including the promotion of the motion capture approach being used for the title character (Allison 325). Tanine Allison argues that these ancillary materials "introduce discourses of realism and authenticity that influence how viewers respond to a judge the value of the film", and that by breaking with older notions of realism that kept the production methods secret, Jackson and his team "were able to frame motion capture in terms of authenticity and reference to the real world" (Allison 326). The production of *King Kong*, then, had been clearly influenced by the intra-industry discourse surrounding motion capture's disputed place as a cinematic tool in between notions of realism and unreality, and the material surrounding the film's making suggests a confrontation of these ambiguities and effort to reconcile them with the audience. This shifting

contradiction within motion capture's nature can therefore, through films like *King Kong*, reflect "the heterogeneity of digital visual culture, which both draws from the traditions of older media and transforms them with the computer's enhanced capacities for automation and manipulation" (Allison 326).

Because the motion capture process in the production of *King Kong* still necessitated additional manipulation after the translation of Serkis' performance for the character, the realism of the character – as informed by an actor – was enabled by motion capture's significant evolution up to this point, but also necessitated an organic post-process touch. Motion capture's status as a promotional selling point also acted as a vehicle upon which Jackson's team could execute the unrealism of the title character, while insisting on "the film's grounding in reality rather than its genesis in imaginative fantasy", with video diaries emphasizing an "adherence to reality, rather than crafting illusion" (Allison 328, 334). Even Serkis' statements of the "newness" of motion capture use the language of characterization and psychology in the tradition of stage and film acting. The collaboration of cutting-edge computer-generated 'plastics' and traditional realistic 'organics', then, in *King Kong*'s conversation around the use of motion-capture shows the mid-2000's effects of the technology's ambiguities that provoke reflection on the filmmaking process, but also offer an embrace of the element's crossover status, situating it's nonrealist characters within a realist filmic tradition.

James Cameron's *Avatar* (2009) similarly confronts and embraces the seemingly-contradictory impulses informing motion capture's creations, but goes a step further than *King Kong* by contributing to the technology's own innovation. Cameron used motion capture to create fully computer-generated characters, within a virtual world, with the addition of specialized head rigs to capture actors' facial performances (Popular Mechanics). *Avatar*'s use of motion capture contributed to its physical capabilities and served as a precedent for the continued innovation of the element and its media crossover capabilities. Cameron coined the technology's upgrade as "performance capture", since in previous films, "the process of motion capture served only as a starting point for animators, who would finish the job with digital brush strokes;" as Weta Digital effects master Joe Letteri stated, "King Kong was a third or so straight

performance capture…[i]t was never automatic" (Popular Mechanics). This new focus on capturing facial motion meant that the combination of emphasis on raw actor performance and innovative motion capture advances contributed to the technology's reputability as a justified addition to the filmic craft and facilitator of the heightened visually-realist, virtually-unrealist aesthetic increasingly employed in contemporary Hollywood blockbusters, suggesting an embrace of the divides in the industry illuminated by motion capture's own aesthetic ambiguity. Motion capture's own contradictions position it both as a revolution within film history and an expected result of the history's own contextual ambiguity itself, defining and redefining the notion of aesthetic categorization. In *Avatar*, motion capture – or "performance capture" – "takes the scene out of mise-en-scene and relocates it to the computer…the actors must perform as if in an imagined mirror, one that will be realized digitally" (Landay 133). Although this loss of indexicality between a virtualized performance and the audience transforms the nature of acting and directing, motion capture still "brings the director back to a kind of intimacy that actors and directors only know when they're working in live theater" (Landay 133).

Therefore, although motion capture remains important for continuing the historical precedent of cinema's technology and aesthetic existing in a feedback loop of contradictory and cooperative influence, the contextual element's significance is solidified as an asset to the increasingly-intermeshed realist and nonrealist approaches informing the aesthetics, production, and authorship of contemporary Hollywood blockbuster cinema. The technology, since its inception and growing with each successive innovation, has functioned in a unique position to provoke a reflexive discourse on the filmmaking process in terms of the discrete categorization of aesthetics and segments of the industry, and as a lens through which cinematic 'realism' can be analyzed as a concept more reconcilable with digital innovations than previously thought. As a signifier of digital cinema's revolution, motion capture's provocative ambiguity reveals not only this interdependent relationship between realist and nonrealist impulses in spectacle-based filmmaking, but the contemporary intertextual interconnectedness of filmic processes with the modern media landscape itself.

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