The Spectator Facing the Cut: A Neurocinematics Review

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Abstract
The cut defined as filmic articulator and how the dialectical conflict of the shot change is assimilated by the spectator were the main topics in the origins of the cinematographic theory in the last century 20s. That theorical production was focused on the event of the cut as semantic articulator of the film. After the neurocinematic discipline, through biometric measurements, we have a new methodological access to the analysis of the cut as cognitive articulator of the filmic message. Nowadays, thanks to techniques such as the electroencephalogram or magnetic resonance, we can study the neuronal reaction to the cut as a way to determine the cognitive processes in the spectator. The study of the shot change by cut has been approached from the neurocinematics as a cognitive gap that the spectator assimilates naturally, analysing the event of the cut from the cinematographic cognitive ecologism, affirming that the cinematographic perception must be analysed in the same way as the perception of reality. However, the theoretical concept of the cut as suture developed by Oudart in the past 60s, as well as defining a first perceptual level that fits perfectly with the proposals of cognitive ecologism, it also adds a symbolic and textual level, which discriminates filmic perception from the perception of reality. Therefore, we believe that the neurocinematics should be developed from the concept of the cut as a suture in order to develop a cinematographic theory based on the cognitive system of the spectator without forgetting its semantic dimension.

Keywords: Neurocinematics, Cut, Edition, Suture, Spectator, Cognitivism

Introduction

Going back to the origins of cinema, due to the viewing of the film *L'Arrivée d'un train en gare de La Ciotat* in the first public exhibition of the Lumière's Cinématographe that happened in the *Salon Indien* of the *Grand Café* in Paris in 1895, it was founded the legend which says that when the spectators watch on the screen the train arriving at the station, stood up and scampered out of the screening room. That legend was recreated, a few years later, in a view made, in 1901, by Robert William Paul, one of the most important british pioneers (belonging to that named by film historian Georges Sadoul -1959- as Brighton School), and that was titled *The Countryman and the Cinematograph*.

In fact, this legend around the Lumiere's view it's a fake. Nobody ran out of the room, because not even this film was projected in this first session, as it is evidenced by the original program of views that was published for this first public session. *L'Arrivée d'un train en gare de La Ciotat* was filmed a year later of this first session, in 1896, and nobody ran out when it was projected to the spectators. However, the fact that the legend has arisen around this event shows the impressive and evocative experience that those spectators lived. Something strong enough happened to originate the legend. The coeval audience who attended this first public film screening, undoubtely, they were not used to manage correctly the emotions produced by the cinematographic projection. This happens with the children in a similar way, who are also not used to the cinematographic experience. It is typical to tell a scared child when they are watching a movie: "Don't worry, it is just a movie...". However, this does not happen with the rest of the arts. Nobody says to a child: "Don't worry, it's just a painting", ."...it's just a sculpture" or "...it's just a song". The same that these spectators experienced in the first cinematic public projection is what happens with children, who are also unaccustomed to the cinematographic experience.

The child's example is used by Joseph D. Anderson (1998) in his book: *The Reality of Illusion: An Ecological Approach to Cognitive Film Theory*, from 1998. What Anderson proposes, in this work, is to approach the film studies from the concept which he called *cinematographic cognitive ecologism*. This concept is based on the spectator's brain processes the inputs generated by the film in the only way that it knows. The brain processes the film stimulus as if they were a stimulus from the reality. The cinema differs from other arts because produces a huge amount of inputs which are collected by different human senses. This fact originates a greater suspension of the feeling of unreality than the rest of the artistic disciplines. This phenomenon, well known from the 18th Century, when the poet Samuel T. Clleridge in his book *Biographia Literaria* (1817) alluded to what he called the *willing suspension of disbelief.* This one it is easier and stronger in the cinematic experience than in many others artistic experiences due to the huge amount of inputs generated by a film. From this theoretical concept of cinematographic ecological cognitivism is that the neurocinematics researches are based on. The fundamental objective of the neurocinematics is to develop a cinematographic theory based on the cognitive system through biometrical measures that give us objective information from the viewer neuronal processes.

From naturalism to neurocinematics

The origin of this theoretical perspective can be traced back to the researches made by David Bordwell and Noël Carroll (1996). Between 80s and 90s, Bordwell (1989; 1990; 1992) and Carroll (1992; 1988) analysed the cinema from the concept that they called cognitive naturalism. According to their postulates, the viewer is assumed as an interrogative or interlocutotive agent. As David Bordwell said: "The text is inert until a reader or listener or spectator does something to and with it. (…) The sensory data of the film at hand furnish the materials out of which inferential processes of perception and cognition build meanings. Meanings are not found but made" (Bordwell, 1989, p. 3).

From this premise, Bordwell challenged the prevailing establishment of the interpretive exercise developed within the structuralist and post-structuralist hermeneutic universe, remarking that: "Any interpretive practice seeks to show that texts mean more than they seem to say. But, one might ask, why does a text not say what it means?" (Bordwell, 1989, p. 64-65).

From the postulates defended by Eisenstein (2006) proposing that the cinema should be read as a language and from the postulates defended by another coevals theorists arising from formalist positions, up to these cognitivist expositions self-named postheorist (Bordwell & Carroll, 1996), the movie has usually been considered as a suggestive treasure map, designed on a human scale, without compromising those mechanisms that govern our thinking in order to provide access to the reward that the meaning entails, as all that can be expressed in linguistic terms.

Bordwell claims a humble theoretical performance defending the "piecemeal theorizing" in favour of which Carrol (1996) accepted from an eclectic position, embracing the field of cognitive science, linguistics, anthropology and psychology, endow his hypothesis with a solid empirical substrate. In the same way, at the beginning of the next century this empirical philosophy boarding the cognitive system would be undertaken by the neurocinematics researchers.

Neurocinematics researchs

Neurocinematics is a recent birth scientific discipline. It started in 2008 with the article called *Neurocinematics: The Neuroscience of Film* (Hasson, y otros, 2008). This paper shows the research made by Hasson about the similarities and differences in the neuronal process among different spectators watching the same film though magnetic resonance. Neurocinematics is a scientific discipline which has a clear object of study, which is the film, and a specifically methodology, which are the biometric measurements on the spectator who observes the film. The approach to the cinematographic media takes place through this methodology in an indirect way: through the study of the cognitive system of the spectator who observes the film, the conclusions show the functioning of the film in itself. The neurocinematics has supposed a huge change in the cinematographic research paradigm, giving rise to a new way of accessing to the knowledge of the filmic media, which had already begun to be explored within the scope of Filmology (Cohen-Séat, Gastaut, & Bert, 1954).

In the last 10 years, several researchers have used different methodologies in this discipline. The neurocinematics allow to provide new concepts such as Heimann (2014) and his study about how the activation of mirror neurons varies according to different camera approach techniques or also to revise classic cinematographic theories, like Smith and Henderson (2008) about the concept of invisible edition defined by Bazin (2004) in the 60s or Nakano (2009) about the poetical theory about the blinks by Walter Murch (2001), the editor of the film *Apocalypse now* (Coppola, 1979) or *The English Patient* (Minghella, 1996) among many others moderns classics. The most commonly used methodologies are magnetic resonance (Hasson *et al.*, 2008), electroencephalogram (Heimann, Umiltà, Guerra, & Gallese, 2014) and ocular scanner (Smith, 2012), although there are also interesting experiments through facial recognition, heart rate, breathing rate and galvanic measurements of the skin.

Neurocinematics tries to consolidate a cinematographic theory based on the study of the cognitive system of the spectator. From various researches we can start to build a theoretical corpus. Hasson (2008) defined cinema as a structured and guided audio-visual system of inputs as the essence that differentiated a cinematographic recording from a random scene filmed without a narrative intention. Moreover Gallese and Guerra (2012) proposed a cinematographic perception very close to the concept of diegesis in a cognitive level, based on the fact that the brain can only process the external images of the film through the emotional and motor system from itself as reference, which is called the *Embodied Simulation Theory*.

Zacks (2015) takes the postulates of the cinematographic naturalism and the cinematographic cognitive ecologism further by stating that the perceptual system does not differentiate between real inputs or filmic inputs. Carroll and Seeley (2013) extend this positioning with their postulate of the *Uncluttered Clarity*, affirming that the cognitive system acts more effectively processing a film than processing the reality, because the film supposes a structured and orderly system, and the opposite happens in the perception of reality, which is chaotic with lack of order and categorizing structure.

Regarding the event of the shot change by cut, neurocinematics has focused especially in this topic considering it a gap in the cognitive system that the spectator is able to assimilate with absolute naturalness. For Smith (2012), this cognitive gap is processed in the same way that the brain processes the blindness that occurs during a blink or a saccade. Smith also relates the techniques of invisible editing to get a called *smooth cut* (Reisz & Millar, 1971) with the mechanisms of the change blindness (Simons & Levin, 1997) and the inattentional blindness (Simons & Chabris, 1999). This possibility of masking the cut through strategies of the cognitive system is called edit blindness by Smith and Henderson (2008). Smith (2012) compiled his proposals in an Attentional Theory of Cinematic Continuity.

Heimann (2016) focused on researching what difference are induced in the neuronal processing between a cut considered invisible and an abrupt cut with an axis jump. The results of his research showed that the cut with axis jump is processed in a neuronal level as if it were a syntactic or semantic incongruence of the language, relating the assembly process between shots with the process of decoding and understanding the text.

Ben-Yakov and Henson (2018) concluded that the main responsible area of the brain for processing the shot change is the hippocampus, detecting these results through magnetic resonance. The fact that the hippocampus is fundamental for the processing of the cinematographic cut, it links the strategies to understand the edition in a film with the neuronal processes related with the short and long term memory. Involving in these processes of memorization and recovery mechanisms.

Calbi (2017) focused on researching about the Kuleshov effect (Kuleshov, 1994; Mariniello, 1992), concluding that the shot after the cut must maintain the same emotional valence as the context, in order to not produce perceptual inconsistencies. Specifically, they defined the Kuleshov effect as an incongruence in the emotional valence of the incoming shot before the context, but, as it is a neutral shot, it does not modify the emotional value of the context, so it does not produce variation in the value of the previous emotion, passing this shot to be included in the context without modifying the emotional valence.

Neurocinematics nd Classic Film Theory

The neurocinematics results about the event of the cut mainly reflects neuronal processes located in the hippocampus. The results found are related to processes of short and long term memory (Ben-Yakov & Henson, 2018) and also to semantic memory access (Heimann *et al.*, 2016). It is through memory processes that spatial and temporal perception is generated. Through small memorisations we are able to register the space in which we place ourselves (Eichenbaum, 2017; Olton, Becker, & Handelmann, 1979) and have a feeling of passing time (Eichenbaum, 2014; Howard & Eichenbaum, 2015). In addition, the accesses to semantic memory represent neuronal reaction patterns typically related with the message encoding and decoding processes (Klimesch *et el.*, 1996). These results lead us to inspect the previously existing cinematographic theory, that relates the edition of the film with the generation of the filmic time and the filmic space (Burch, 1969) and also with those theories who defined the cut as a semantic articulator (Eisenstein, 2002).

The results from neurocinematics researches are clearly related with classic cinematographic theories about edition, specifically with the shot change by cut. Burch (1969), Deleuze (1996; 2003) and Tarkovski (2005; 2017) theorized about edition and the cut as articulators and generators of filmic space and filmic time. According to Burch (1969), the cinema is based on the articulation of spatial and temporal *découpage* through the assembly of the shots that are units of continuous space and time. Through the assembly of this units, it is generated in the film the space and time.

In the same theoretical line, Mitry (2002) and Eisenstein (2002; 2006) consider the edition as an articulating axis of the cinematographic discourse. Mitry relates the generation of the cinematographic discourse with the articulation of signifiers, while Eisenstein affirms that it happens by means of the syntactic connections between the units. In the 20s, Soviet theorists such as Eisenstein (2002; 2006) or Sklovsky (1971) theorised about a cinematographic language and specifically put the focus in the cut as a syntactic element. In the 60s, the great debate about the existence of cinematographic language came after the linguistic perspective, from the hand of Jean Mitry (2002), Pier Paolo Pasolini (1972) or Christian Metz (1973; 2002). Whereas

Mitry affirmed the existence of a cinematographic language, Metz denied it, defining that the cinema is an articulation of different languages. Pasolini does not hold that the cinema articulates a language, but an idiolect, from which emanate parables constituted on an essentially abstract cinematographic discourse, but never literal concepts. As Pasolini explains in "Il 'cinema di poesia'" (1976), the cinema has forged a dictionary of its own, a sample of conventions (which, curiously, is stylistic before being grammatical), through which a true and enigmatic "scrittura. della realtà". This discussion has continued whit no resolution until nowadays. It is an essential discussion, because it is a discussion about what is the structural essence of the film.

We pay special attention to the concept of suture developed by Oudart (2005), assuming the cutting concept overcomes the event of shot change as a cognitive gap or an articulation between units, to project the shot further away, invoking the dynamics of duplication and the overlapping that come by activating the absence and performance of our memory.

According to Oudart (2005), the experience of the subjective cinema happens through the shot change by cut as a suture, where the cut implies absence. Thus, the cut generates an empty space that is projected onto the incoming shot, constituting itself as a signifier from this projection of the previous shot when it is displaced. Consequently, the shots around a cut are superimposed from the absence of the previous shot, producing a semantic change between the present frame and that one that is already absent. From the concept of suture, the space between the characters is in a cognitive level eliminated through the reverse shot, giving rise to a virtual space purely filmic, impossible to be in reality. In addition, the absent character remains present despite of having stopped being contained in the frame.

Conclusions

The neurocinematics has supposed a change of paradigm in the way of accessing to the filmic knowledge. When a new paradigm emerges (as was explained by Thomas S. Kuhn -1962-, in the 60s of the past century) it involves on the one hand to review the previous theorization to verify its adjustment to the current methodologies and on the other hand, it starts to create an own theoretical corpus. The neurocinematics has begun an approach to classical theories such as the Kuleshov effect or the invisible edition, given scientific explanations about them. Neurocinematics had based on the human cognitive system to understand why definite structures, schemes and technical characteristics produced a determined effect on the viewer. On the other hand, neurocinematics has begun to develop its own filmic theorization that proposes a new point of view of the cinematographic media through the film-spectator relationship that is established through the premises proposed by the cinematographic naturalism and the cinematographic cognitive ecologism about how relates the viewer with the film.

Nowadays, the shot change by cut is one of the main focuses of attention of the neurocinematics, analyzing the cut as a cognitive gap that is perfectly assimilated by the spectator and also analyzing as a sequential combination between different units. Based on the perceptual system proposed by the cinematographic cognitive ecologism, neruocinematics propose the analysis of the perception of the shot change from a

mechanical and linear cognitive mechanism, relating it to the way in which we perceive the reality that surrounds us.

In our opinion, the concept of the cut as suture of Oudart is interesting to propose a suggestive and productive starting point for overcoming a neurocinematic theory based on a mechanical cognitive system, inviting us to research into a more complex neurological processes previously treated by psychology. The relationships between the shots that are established in the cut as a suture are based on the filmic spatiality, which, as the cognitive naturalism affirms (Anderson, 1998), can be processed in a cognitive level in the same way that it happens with reality, but which is also decoded in a symbolic and textual level, situation that does not happen perceiving the reality. This incidence on the symbolic and textual level that happens during the film, differencing it to the reality perception, make the suture proposal by Oudart, an ideal point to advance in the development of the neurocinematic theorization about the shot change by cut.

References

Anderson, J. (1998). *The reality of illusion: An ecological approach to cognitive film theory.* Illinois, U.S.A.: SIU Press.

Bazin, A. (2004). *¿Qué es el cine?* Madrid, Spain: Ediciones Rialp.

Ben-Yakov, A., & Henson, R. (2018). The hippocampal film-editor: sensitivity and specificity to event boundaries in continuous experience. *bioRxiv, 38*(47), 273409. doi:10.1523/JNEUROSCI.0524-18.2018

Bordwell, D. (1989). A Case for Cognitivism. *Iris, 9*, 11-40.

Bordwell, D. (1989). *Making Meaning: Inference and Rhetoric in the Interpretation of Cinema.* Cambridge, U.S.A.: Harvard University Press.

Bordwell, D. (1990). A Case for Cognitivism: Further Refleciotns. *Iris, 11*, 107-112.

Bordwell, D. (1992). Cognition and Comprehension: Viewing and Forgetting in Mildred Pierce. *Journal o Dramatic Theory and Criticism, 6*(2), 183-198.

Bordwell, D., & Carroll, N. (1996). *Post-Theory. Reconstructing Film Studies.* Madison: The University of Wisconsin Press.

Burch, N. (1969). *Praxis du cinéma.* Paris, France: Gallimard.

Calbi, M., Heimann, K., Barratt, D., Siri, F., Umilta, M., & Gallese, V. (2017). How context influences our perception of emotional faces: a behavioral study on the Kuleshov effect. *Frontiers in psychology, 8*, 1684. doi:10.3389/fpsyg.2017.01684

Carroll, N. (1988). *Mystifying Movies: Fads and Fallacies in Contemporary Film Theory.* New York, U.S.A.: Columbia university Press.

Carroll, N. (1992). Cognitivism, Contemporary Film Theory, and Method: A Response to Warren Buckland. *Journal of dramatic theory and criticism, 6*(2), 199-219.

Carroll, N. (1996). Prospects for Film Theory: A Personal Assessment. In D. Bordwell, & N. Carroll, *Post-Theory. Reconstructing Film Studies* (pp. 37-68). Wisconsin, U.S.A.: The University of Wisconsin Press.

Carroll, N., & Seeley, W. P. (2013). Cognitivism, psychology, and neuroscience: Movies as attentional engines. In A. P. Shimamura, *Psychocinematics: Exploring cognition at the movies* (pp. 53-75). Oxford, U.K.: Oxford University Press.

Cohen-Séat, G., Gastaut, H., & Bert, J. (1954). Modification de l'EEG pendant la projection cinématographique. *Revue Internationale de Filmologie, 5*(16), 27-28.

Coleridge, S. (1817). *Biographia Literaria.* London: Rest Fenner.

Coppola, F. (Director). (1979). *Apocalypse Now* [Motion Picture]. U.S.A.: Zoetrope Studios.

Deleuze, G. (2003). *La imagen-movimiento. Estudios sobre cine 1.* Barcelona, Spain: Ediciones Paidós ibérica.

Deleuze, G. (1996). *La imagen-tiempo: Estudios sobre cine 2.* Barcelona, Spain: Paidós.

Eichenbaum, H. (2014). Time cells in the hippocampus: a new dimension for mapping memories. *Nature Reviews Neuroscience, 15*(11), 732. doi:10.1038/nrn3827

Eichenbaum, H. (2017). Time (and space) in the hippocampus. *Current opinion in behavioral sciences, 17*, 65-70. doi:10.1016/j.cobeha.2017.06.010

Eisenstein, S. (2002). *Teoría y técnica cinematográfica.* Madrid, Spain: Ediciones Rialp.

Eisenstein, S. (2006). *La forma del cine.* Madrid, Spain: Siglo Veintiuno.

Gallese, V., & Guerra, M. (2012). Embodying movies: Embodied simulation and film studies. *Cinema: Journal of Philosophy and the Moving Image, 3*, 183-210.

Hasson, U., Landesman, O., Knappmeyer, B., Vallines, I., Rubin, N., & Heeger, D. (2008). Neurocinematics: The neuroscience of film. *Projections: The journal for movies and mind, 2*(1), 2-26. doi:10.3167/proj.2008.020102

Heimann, K., Uithol, S., Calbi, M., Umiltà, M., Guerra, M., & Gallese, V. (2016). "Cuts in Action": A High-Density EEG Study Investigating the Neural Correlates of Different Editing Techniques in Film. *Cognitive Science, 41*(6), 1-34. doi:10.1111/cogs.12439

Heimann, K., Umiltà, M., Guerra, M., & Gallese, V. (2014). Moving mirrors: A high-density EEG study investigating the effect of camera movements on motor cortex activation during action observation. *Journal of cognitive neuroscience, 26*(9), 2087-2101. doi:10.1162/jocn_a_00602

Howard, M., & Eichenbaum, H. (2015). Time and space in the hippocampus. *Brain research, 1621*, 345-354. doi:10.1016/j.brainres.2014.10.069

Klimesch, W., Doppelmay, M., Pachinger, T., & Ripper, B. (1996). Theta band power in the human scalp an the encoding of new information. *NeuroReport, 7*(7), 9-12. doi:10.1097/00001756-199605170-00002

Kuhn, S. (2011). *La estructura de las revoluciones científicas.* Mexico D.F., Mexico: Fondo de cultura económica.

Kuleshov, L. (1994). *L'art du cinéma et autres écrits.* Levier, Francia: L'Age d'Homme.

Lumière, A., & Lumière, L. (Directors). (1896). *L'Arrivée d'un train en gare de La Ciotat* [Motion Picture]. France: Lumière.

Mariniello, S. (1992). *El cine y el fin del arte. Teoría y práctica cinematográfica en Lev Kuleshov.* Madrid, Spain: Col. Signo e Imagen. Ed. Cátedra.

Metz, C. (2002). *Ensayos sobre la significación en el cine.* Barcelona, Spain: Ediciones Paidos Ibérica.

Metz, C. (1973). *Lenguaje y cine.* Barcelona, Spain: Planeta.

Minghella, A. (Director). (1996). *The English Patient* [Motion Picture]. U.S.A.: Miramax.

Mitry, J. (2002). *Estética y psicología del cine.* Madrid, Spain: Siglo Veintiuno.

Murch, W. (2001). *In the blink of an eye: A perspective on film editing.* Los Angeles, EEUU: Silman-James Press.

Nakano, T., Yamamoto, Y., Kitajo, K., Takahashi, T., & Kitazawa, S. (2009). Synchronization of spontaneous eyeblinks while viewing video stories. *Proceedings of the Royal Society of London B: Biological Sciences*.

Olton, D., Becker, J., & Handelmann, G. (1979). Hippocampus, space, and memory. *Behavioral and Brain Sciences, 2*(3), 313-322. doi:10.1017/S0140525X00062718

Oudart, J.-P. (2005). La sutura. In A. De Baecque, *Teoría y crítica del cine. Avatares de una cinefilia* (pp. 52-68). Barcelona, Spain: Paidós Comunicación. Ediciones Paidós.

Pasolini, P. (1972). *Empirismo eretico.* Milan, Italy: Garzanti.

Pasolini, P. (1976). The cinema of poetry. In B. Nichols, *Movies and Methods* (pp. 542-558). London, U.K.: Ed. Bill Nichols.

Paul, R. (Director). (1901). *The Countryman and the Cinematograph* [Motion Picture]. U.K.: Paul's Animatograph Works.

Reisz, K., & Millar, G. (1971). *The technique of film editing.* Oxford, U.K.: Elsevier.
Sadoul, G. (1959). *Histoire du cinéma mondial: des origines à nos jours.* Paris, France: Flammarion.

Simons, D., & Chabris, C. (1999). Gorillas in our midst: Sustained inattentional blindness for dynamic events. *Perception, 28*(9), 1059-1074. doi:10.1068/p281059

Simons, D., & Levin, D. (1997). Change blindness. *Trends in cognitive sciences, 1*(7), 261-167. doi:10.1016/S1364-6613(97)01080-2

Sklovski, V. (1971). *Cine y lenguaje.* Barcelona, Spain: Anagrama.

Smith, T. (2012). An attentional theory of cinematic continuity. *Projections, 6*(1), 1-50. doi:10.3167/proj.2012.060102

Smith, T., & Henderson, J. (2008). Edit Blindness: The relationship between attention and global change blindness in dynamic scenes. *Journal of Eye Movement Research, 2*(2), 1-17. doi:10.16910/jemr.2.2.6

Tarkovski, A. (2005). *Esculpir en el tiempo.* Madrid, Spain: Ediciones Rialp.

Tarkovski, A. (2017). *Atrapad la vida. Lecciones de cine para escultores del tiempo.* Madrid, Spain: Errata naturae.

Zacks, J. (2015). Précis of Flicker: Your Brain on Movies. *Projections, 9*(1), 1-22. doi:10.3167/proj.2015.090102

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