

Film content, editing, and directing style affect brain activity, neuroscientists show

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Using advanced functional imaging methods, New York University neuroscientists have found that certain motion pictures can exert considerable control over brain activity. Moreover, the impact of films varies according to movie content, editing, and directing style. Because the study, which appears in *Projections: The Journal for Movies and Mind*, offers a quantitative neuroscientific assessment of the impact of different styles of filmmaking on viewers' brains, it may serve as a valuable method for the film industry to better assess its products and offer a new method for exploring how the brain works.

The study's authors are: Uri Hasson, Barbara Knappmeyer, Nava Rubin, and David Heeger, who hold appointments in NYU's Department of Psychology and Center for Neural Science, as well as Ohad Landesman, a doctoral candidate in the Department of Cinema Studies at NYU's Tisch School of the Arts, and Ignacio Vallines, a research scientist at the University of Munich.

The researchers relied on two methodological tools in their study: functional magnetic resonance imaging (fMRI) and inter-subject correlation (ISC) analysis. fMRI utilizes a magnetic resonance imaging (MRI) scanner—like that routinely used for clinical evaluation of human anatomy. But it is reprogrammed to get a time-series of three-dimensional images of brain activity. In a typical fMRI experiment, a time-series of brain activity images is collected while a stimulus or cognitive task is varied. ISC analysis is employed to measure similarities in brain activity across viewers—in this case, it compared the response

in each brain region from one viewer to the response in the same brain region from other viewers. Because all viewers were exposed to the same films, computing ISC on a region-by-region basis identified brain regions in which the responses were similar across viewers.

"In cinema, some films lead most viewers through a similar sequence of perceptual, emotional, and cognitive states," the researchers wrote.

"Such a tight grip on viewers' minds will be reflected in the similarity of the brain activity—or high ISC—across most viewers. By contrast, other films exert—either intentionally or unintentionally—less control over viewers' responses during movie watching. In such cases we expect that there will be less control over viewers' brain activity, resulting in low ISC."

To stimulate subjects' brain activity, the researchers showed them three motion picture clips: thirty minutes of Sergio Leone's "The Good, the Bad and the Ugly"; an episode of Alfred Hitchcock Presents "Bang! You're Dead"; and an episode of Larry David's "Curb Your Enthusiasm." To establish a baseline, subjects viewed a clip of unstructured reality: a 10-minute, unedited, one-shot video filmed during a concert in New York City's Washington Square Park.

The results showed that ISC of responses in subjects' neocortex—the portion of the brain responsible for perception and cognition—differed across the four movies:

- The Hitchcock episode evoked similar responses across all viewers in over 65 percent of the neocortex, indicating a high level of control on viewers' minds;
- High ISC was also extensive (45 percent) for "The Good, the Bad and the Ugly";
- Lower ISC was recorded for "Curb Your Enthusiasm" (18 percent) and for the Washington Square Park, or unstructured reality, clip (less

than 5 percent)

"Our data suggest that achieving a tight control over viewers' brains during a movie requires, in most cases, intentional construction of the film's sequence through aesthetic means," the researchers wrote. "The fact that Hitchcock was able to orchestrate the responses of so many different brain regions, turning them on and off at the same time across all viewers, may provide neuroscientific evidence for his notoriously famous ability to master and manipulate viewers' minds. Hitchcock often liked to tell interviewers that for him 'creation is based on an exact science of audience reactions.' "

However, the researchers emphasized that low and high ISC does not necessarily imply that the viewers were not attentive to or not engaged with the events in those films.

"ISC measures only the ability of the filmmaker to evoke similar responses across all viewers," they wrote. "Similar brain activity across viewers, or high ISC, can be taken as an indication that all viewers process and perceive the movie in a similar manner. Variability in the brain activity across viewers—that is, low ISC—can be due to either a less engaged processing of the incoming information, which occurs when daydreaming, or due to an intensely engaged but variable processing of a movie sequence."

For example, they add, an art film may demand an intense intellectual effort from viewers that differs from one viewer to the next, resulting in differences in neural activity.

Apart from the findings, the study points to a new method—inter-subject correlation (ISC) of brain activity—for measuring the effect of films on viewers' minds, which may pave the way to an innovative approach the researchers label "neurocinematic" studies. While they add

that a cognitive science analysis of film is not new, functional imaging methods may be of use to both film theorists and the film industry by providing a quantitative, neuroscientific assessment of viewers' engagement with a film.

Source: New York University

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