

Cognitive science in popular film: the Cognitive Science Movie Index

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HAL 9000. Morpheus. Skynet. These household names demonstrate the strong cultural impact of films depicting themes in cognitive science and the potential power of popular cinema for outreach and education. Considering their wide influence, there is value to aggregating these movies and reflecting on their renderings of our field. The Cognitive Science Movie Index (CSMI) serves these purposes, leveraging popular film for the advancement of the discipline.

Introduction

Cinema is an immensely captivating medium; one that has the uncanny ability to impel an audience to entertain new ideas and imagine themselves in a completely new world. As Ingmar Bergman wrote, ‘No form of art goes beyond ordinary consciousness as film does, straight to our emotions, deep into the twilight room of the soul’ [1]. In this way, popular films are not merely cultural artifacts, but also cultural vehicles for public awareness. Considering the large number of films related to cognitive science, and their sizeable impact, it is useful to reflect on these movies and their renderings of the field.

With or without cognitive scientists’ endorsement, popular films related to cognitive science frequently dramatize our research and often attract curious minds to our discipline. A review of cognitive science student associations and undergraduate clubs finds that nearly all of them host ‘movie nights’ to entertain and recruit new members. The public is similarly intrigued by cognitive science topics in film; for example, in the two weeks following the July 2010 release of *Inception*, web traffic to the Wikipedia page on ‘Dreams’ more than doubled (<http://dumps.wikimedia.org/other/pagecounts-raw/>). Members of other fields have made attempts to aggregate, examine, and leverage popular film for the advancement of their disciplines (e.g., biology [2], archaeology [3], communications [4]) and a similar effort exists for cognitive science.

CSMI (<http://www.indiana.edu/~cogfilms>) is an online collection of movies showcasing various themes in cognitive science. In its 8 years, CSMI has rendered an extrinsic reflection of research topics in our field and provided an accessible and entertaining avenue towards the

interdisciplinary study of the mind. More than 130,000 unique visitors from over 160 countries have browsed through the list, which spans the first cinematic depiction of robots (*Metropolis*, 1927) to the recent deluge of big-budget brain–computer interaction flicks (e.g., *Matrix*, 1999; *Avatar*, 2009; *Pacific Rim*, 2013), currently totaling about 200 movies with cognitive science-relevant themes.

Since its launch in 2005, CSMI has collected online ratings for these movies. Visitors are invited to evaluate the films on three different scales: general quality (‘Overall, how good is the film?’), accuracy (‘How accurately does the film portray a theme in cognitive science?’), and relevance to our field (‘How “cognitive sciencey” is the film?’). CSMI recently collected its 10,000th rating, as volunteered by about 2800 anonymous unique visitors, and the top 10 movies along these three scales appear in [Table 1](#).

In this article, I discuss the films showcased in CSMI and consider the issue of verisimilitude, whether a film accurately portrays the science of cognitive science, in the context of the potential for popular outreach, but also the potential for popular misinformation. Ultimately, I argue that good ‘cognitive science films’ feature creativity couched in believability and that these should not be seen as mutually exclusive.

Cognitive science films

If you squint sufficiently, nearly every movie can be seen as being related to cognitive science. Any film dealing with growth, emotion, motivation, invention, social dynamics, or several other issues – or simply the cinematic expression of a thought or idea – might be viewed as an example of a cognitive science-related theme, but this all-inclusive view would be useless. Yet, imposing artificial criteria (e.g., robots \cup brains \cup artificial intelligence) might exclude movies that hold high status on CSMI (e.g., *Rashômon*, 1950). Thankfully, we know from cognitive psychology that such strict category boundaries are unnecessary. Instead, I recommend defining cognitive science films by the centrality of a specific cognitive-science research question to the plot of the movie (e.g., [5]; see <http://www.indiana.edu/~cogfilms/about.html>).

Although many of the titles in CSMI are fictional, cognitive-science films do not constitute a subgenre of science fiction films. Such classification would be unfair to those few realistic depictions of mental processes that have gained popular and critical acclaim on the big screen. Dramatic portrayals of anterograde amnesia (*Memento*, 2000), false memories during eyewitness

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Table 1. Top movies ranked by average user rating^a

Top quality (ranking/title)	
1	<i>Solaris</i> (1972)
2	<i>Blade Runner</i> (1982)
3	<i>A Clockwork Orange</i> (1971)
4	<i>La Cité des Enfants Perdus</i> (1995)
5	<i>Moon</i> (2009)
6	<i>Eternal Sunshine of the Spotless Mind</i> (2004)
7	<i>One Flew Over the Cuckoo's Nest</i> (1975)
8	<i>Rashômon</i> (1950)
9	<i>Being John Malkovich</i> (1999)
10	<i>2001: A Space Odyssey</i> (1968)
Top accuracy (ranking/title)	
1	<i>Fast, Cheap, and Out of Control</i> (1997)
2	<i>Awakenings</i> (1990)
3	<i>One Flew Over the Cuckoo's Nest</i> (1975)
4	<i>Rashômon</i> (1950)
5	<i>Memento</i> (2000)
6	<i>A Beautiful Mind</i> (2002)
7	<i>Koyaanisqatsi</i> (1983)
8	<i>The Diving Bell and the Butterfly</i> (2007)
9	<i>Moon</i> (2009)
10	<i>Rain Man</i> (1988)
Top relevance (ranking/title)	
1	<i>Das Experiment</i> (2001)
2	<i>Memento</i> (2000)
3	<i>Moon</i> (2009)
4	<i>Kôkaku Kidôtai</i> (1995)
5	<i>Awakenings</i> (1990)
6	<i>Rashômon</i> (1950)
7	<i>A Beautiful Mind</i> (2002)
8	<i>Eternal Sunshine of the Spotless Mind</i> (2004)
9	<i>Solaris</i> (1972)
10	<i>Transcendent Man</i> (2011)

^aNotes: See CSMI (<http://www.indiana.edu/~cogfilms/>) for more information about these movies, ratings data, and CSMI's inclusion/exclusion criteria. Only movies that received ten or more votes at time of analysis were included in these top user rankings.

testimony (*The Thin Blue Line*, 1988), locked-in syndrome (*The Diving Bell and the Butterfly*, 2007), and clinical science (*Awakenings*, 1990; *Free the Mind*, 2012), for example, demonstrate the popular appeal of our field and interests in modern, realistic settings. These titles were not produced because of some philanthropic desire among filmmakers to educate the public; on the contrary, real, present-day, authentic cognitive science-related topics can yield a fascinating film. The theme of 'mind' is not one that necessarily requires exotic futuristic civilizations, imagined surgical manipulation of neural architecture, contrived synthetic intelligences, or other fantasies to captivate an audience – but it helps.

To be fair, the corpus of cognitive science films is overwhelmingly dominated by 'sensuous extrapolations' of reality [6], continuing the science fiction literary tradition that aims to 'domesticate the impossible hypothesis' [7]. Marvelous stories dreamed up with robots, brain-computer interaction, and mind control are brought to life with film, providing compelling explorations of the distant limits of what it means to be human and the distant limits of human imagination [8,9].

Verisimilitude

It is easy, particularly for *bona fide* cognitive scientists, to be critical of the sensuous extrapolations envisioned by science fiction filmmakers exploring themes in our field. Can popular films reasonably serve as public ambassadors of our science when the science is not depicted accurately?

It should be noted that, even in a film market dominated by fantasy and spectacle, science fiction filmmakers must strike a delicate balance between marvel and believability. The artificial intelligence film *Eagle Eye* (2008), for example, received scornful reviews because it seemed to entirely disregard the realities of technology and nature; noted film critic Roger Ebert gave it two of four stars, saying 'the word "preposterous" is too moderate to describe *Eagle Eye*' (Chicago Sun-Times, September 25, 2008). The 'science' in science fiction demands that these films operate according to principled rules, allowing some semblance of authenticity in the storyline. Not all films are created equally and some fail to uphold this tacit contract of verisimilitude, but others allow us to explore principled universes that extend the realistic possibilities of cognitive science (Figure 1).

In this way, the appeal of fictional renderings of cognitive science does not stem from a rejection of reality, but rather from a persuasive examination of a world where our current scientific limitations have been overcome.

Of course, there are some freedoms entitled to the cinematic arts (including the employment of spectacular special effects in recent decades), but great science fiction films, including many titles in CSMI, manage to balance verisimilitude with imagination [9] – and this is a good thing. Cinema is art and its entertainment value should not be bound to the rigorous standards of scientific accuracy. For our part, scientific interests are not merely served by strict realism, as evidenced by the National Academy of



Figure 1. Still from *The Brain that Wouldn't Die* (1962), a movie about a scientist who keeps his wife's head alive following a car accident. The concept of an isolated brain has made many appearances in popular film, including *Donovan's Brain* (1953), *Colossus of New York* (1958), and *The Man With Two Brains* (1983), usually with gross neglect of any relevant science but advancing the cultural intrigue of issues related to medical technology, identity, and mind. Public domain image, courtesy of the Internet Archive (<http://archive.org>).

Science's Science & Entertainment Exchange Program and the National Science Foundation's Creative Science Studio, which represent efforts at science outreach through cinema. Considering the uncertainty of public funding of scientific research and the need to increase the number of undergraduates majoring in science [10], it is possible that cognitive science, as a scholarly enterprise, benefits from a populace intrigued by the mind and attracted by imaginative possibilities, even at the occasional cost of some small amount of veracity in today's science [11].

Film accuracy and quality

Since its launch, any visitor to CSMI can easily submit ratings for any movie and sort the index by these ratings. Table 1 summarizes the top-ranked films for measures of quality, relevance, and accuracy (only for films receiving ten or more votes) and even at a quick glance, there is clearly substantial overlap between the top-ten films along these three scales. Indeed, films with high marks for accuracy and relevance are, without exception, also given high marks for quality. However, it is not the case that low accuracy or relevance is necessarily an indictment of quality. Quality benefits from but does not hinge entirely on accuracy. There are some exceptional titles that have low marks for accuracy and/or relevance but relatively high quality scores (e.g., *Being John Malkovich*, 1999; *La Cité des Enfants Perdus*, 1985; *The Manchurian Candidate*, 1962; *Tron*, 1982; *Young Frankenstein*, 1974). It would seem that CSMI's audiences do have an appetite for whimsical renderings of cognitive science themes, movies that creatively extend our notions of what might be possible.

Concluding remarks

Why does CSMI exist? Considering the drawing power of popular film, it was originally developed in an effort to construct a lighthearted hub for the cognitive science subdisciplines, because movies might help to bridge the divide between otherwise specialized areas [12]. In this way, CSMI's original authors envisioned the list serving educational purposes [13–15], providing a useful reference for cognitive science student movie nights and facilitating cognitive science outreach through cinema.

As our field continues to pioneer new methods and produce new discoveries, the future is bright for cinematic examination of the mind and CSMI's ongoing collection of these films will continue to bridge subdisciplines and popularize our science.

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