Theoretical Inquiry into the Affordances of Artificial Intelligence Technology in the Intelligent Media Ecosystem: Postprint

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Abstract

Intelligent media has become the principal trend in the development of future media ecosystems. Artificial intelligence technology, as the primary driving force within this ecosystem, can establish diverse connections across various modalities for all things. The social effects triggered by such seemingly omnipotent technology urgently require corresponding theoretical interpretation. Gibson' s affordance theory reminds us to recognize the inherent properties of the material itself through external configurations such as symbolic labels, thereby enabling its agentive and creative application. This may provide a methodological perspective for interpreting the origins of issues in the application of artificial intelligence technology.

Full Text

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An Exploration of the Affordance Theory of Artificial Intelligence Technology in the Smart Media Ecosystem

Abstract: Smart media has become the dominant trend in the future development of media ecosystems. As the primary driving force in this ecosystem, artificial intelligence technology can establish connections across various modalities for all things. The social effects triggered by such seemingly omnipotent technology urgently require corresponding theoretical interpretation. Gibson' s affordance theory reminds us to recognize the intrinsic properties of materials beyond their symbolic labels and external shaping, and to apply them subjectively

and creatively. This may provide a methodological perspective for interpreting the origins of artificial intelligence technology applications.

Keywords: smart media; artificial intelligence; affordance

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Following concepts such as omnimedia, converged media, and new media, smart media has become Chinese scholars' latest interpretation of the current media ecology and future development trends. Smart media provides new interactive interfaces and modes for humanity' s mediated living environment. Media technology, represented by artificial intelligence, offers continuous impetus for the development of smart media and has gradually triggered qualitative changes in both the methods and content of connections between media and media, media and people, and people and people.

1. Current State of the Smart Media Ecosystem

Smart media refers to a self-strengthening ecosystem based on new technologies such as mobile internet, big data, virtual reality, and human-computer interaction, which fully leverages individuals' cognitive surplus within the sharing economy. It forms diversified and sustainable business and profit models, achieving intelligent matching between information and user needs [1]. Smart media is characterized by three main features: everything-as-media, human-machine integration, and self-evolution [2]. Everything-as-media means that media no longer takes "humans" as the sole core; machines or intelligent carriers relying on various media technologies can all become media. Human-machine integration means that intelligent media terminals can collaborate with subjects to create new operational models for information production, distribution, circulation, and profit. Self-evolution is the core operating mode of smart media, primarily referring to how, with the help of algorithms, media platforms aggregate and analyze usage traces people leave on platforms, thereby gaining increasingly sophisticated understanding of people' s demands and continuously evolving themselves to match users' personalized characteristics.

Media platforms track and analyze users' online behaviors through datafication, thereby discovering user characteristics, perceiving user needs, and guiding user behaviors, gradually transforming into virtual spokespersons for users in cyberspace. This means that users' behaviors on various media platforms are no longer entirely determined by themselves; users' subjective power is gradually decomposed, transferred, and even alienated.

Consequently, media are no longer merely platforms with information production and distribution functions; all media terminals with information recording functions can be called media. Such media have penetrated every aspect of

people' s lives, expanding the boundaries of their socialized behaviors. Big data stores all details of people' s lives as data, and the Internet of Things places people and objects in the same information space for interactive dialogue. Through these and other means, various technologies gradually weave a silent and invisible smart media ecosystem for people, supported by media platforms. People become one of the organic molecules in this ecological environment, and their lives are gradually surrounded by smart media, making it difficult to extricate themselves.

2. Artificial Intelligence Concepts and Media Applications

Artificial intelligence is one of the core technologies in the smart media ecosystem, capable of deconstructing and reconstructing processes such as information production, processing, and distribution. At the 2018 World Artificial Intelligence Conference in Shanghai, Tencent' s Chairman and CEO Ma Huateng stated that digitalization, networking, and intelligence are an inseparable trinity, with artificial intelligence being the winning formula in the "digital toolbox," together with big data and cloud computing constituting new infrastructure [3].

According to OECD documents, there is currently no widely accepted definition of "artificial intelligence." Harvard neuroscientist and AI expert Yarden Katz considers artificial intelligence a rather hybrid concept encompassing big data, machine learning, deep learning, and other meanings, all characterized by using high-cost computers to analyze large-scale centralized data [4]. *Forbes* called 2017 the "first year of artificial intelligence," from which the term "artificial intelligence" gradually gained popularity, a trend largely stemming from the development of technologies such as big data, cloud computing, and machine learning. In fact, the term "artificial intelligence" has existed in Western countries for over 60 years. In 1955, four young mathematicians and computer scientists coined the term while preparing a research proposal for the 1956 Dartmouth Summer Research Project. These four scholars were John McCarthy, Marvin Minsky, Nathaniel Rochester, and Claude Shannon. At this conference, scientists described "artificial intelligence" as computer functions that could perform certain tasks previously only achievable by humans. This description was premised on the assumption that every aspect of human intelligence or learning behavior could be precisely described, as only then could machines systematically imitate and achieve "human-like" intelligence [5].

In the field of information communication, artificial intelligence' s most significant function is making automatic content production possible. Various "news writing robots" have been deployed both domestically and internationally, such as Xinhua News Agency' s "Kuai Bi Xiao Xin," *Southern Metropolis Daily*' s "Xiao Nan," and the Associated Press' s "WordSmith" [6]. Additionally, AI technologies such as image recognition, speech recognition, and emotion recognition have also revolutionarily innovated media processes from gathering and editing to broadcasting and distribution. Xinhua News Agency' s first robot reporter "iSi" conducted its first interview at the 2017 Two Sessions, a project

that later won first prize at the 2017 Wang Xuan News Science and Technology Awards. Subsequently, iSi appeared at the Two Sessions in 2018 and 2019 with more thoughtful, logical, and humorous questioning, raising subjectively reflective questions such as: "iSi is one year old this year; what civil rights will I have when I turn six?" and "When more robots like me appear in the future, when will civil law include robots' rights?" This provided more imagination for human-machine collaboration in future media content production. Furthermore, the third-generation intelligent robot "Jia Jia" developed by the University of Science and Technology of China added emotion observation and self-expression change functions on the basis of its first two generations, adding authenticity and intimacy to human-robot interaction experiences.

From a technological perspective, the AI community believes that artificial intelligence development requires three stages: first, computational intelligence relying on computing and storage capabilities; second, perceptual intelligence relying on perception technologies that extend human senses; and third, cognitive intelligence aiming to enable machines to conduct human-like understanding and thinking [7]. From the above cases, we can see that the global news communication industry has been involved in all three types of intelligence, with computational intelligence being primary and perceptual and cognitive intelligence secondary.

3. Affordance Theory and Its Media Presentation

Affordance theory was originally proposed by cognitive psychologist James Gibson in 1978. Gibson believed that animals have the ability to selectively perceive information in the environment because this information is closely related to their survival [8]. Here, Gibson focused on the possibilities and impossibilities of how specific environments help an organism achieve certain needs, emphasizing that environmental affordances and organisms' perceptual abilities are relatively independent.

In 1988, designer Donald Norman introduced this theory to design psychology, interpreting "affordance" as a design element of an object—the fundamental characteristics that determine how an object can be used [9]. Here, Norman focused on users' perceptual understanding of design elements contained in objects. In 2015, Mireille Hildebrandt used the term "affordance" to express her pluralistic understanding of information and communication infrastructure, arguing that the affordances of information environments built by technology and corresponding infrastructure are more important than actors' perceptual abilities. That is, in the affordance relationship, the stimulating effect of environmental affordances on people' s perceptual abilities, rather than the reverse stimulating relationship, occupies a more dominant position [10]. Although people can also creatively utilize environmental affordances based on the affordances of materials, the premise of such utilization remains the prior existence of these affordance qualities themselves.

In recent years, affordance theory has mainly been applied in research fields such as law, society, and technology, referring to the opportunities and constraints that a technology provides for possible social actions. The application of affordance theory in China' s communication studies is relatively rare. In current literature, only Pan Zhongdang, in a dialogue with others about new media research, proposed introducing affordance theory into communication studies, arguing that affordance theory could provide new perspectives and methodologies for new media research. He advocated observing the affordances of new media across three dimensions: information production affordance, social affordance, and mobile affordance [11].

In the current smart media ecosystem, various media interfaces contain two organic existences: actors and platform mechanisms. Various information technologies provide platforms with various design possibilities and implementation methods for interface functions and back-end operations, such as social media based on Web 2.0 technology, "robot writing" based on artificial intelligence technology, and personalized information push formed by data mining technology based on algorithmic recommendation.

Users can also choose different platform functions according to their needs based on platform affordances to achieve information production, social interaction, and other demands. While adapting to platforms' existing functional provisions, users can often creatively explore platforms' potential functions according to their affordances. For instance, on both Sina Weibo and Twitter, users can form a topic consensus through the "#" hashtag, thereby attracting interested people to gather quickly under this tag without necessarily following each other as friends. Users can discuss the tagged topic by posting their own tweets or commenting on others' tweets, and other users interested in this topic can simply use this tag to observe such information.

This function represents users' spontaneous inventive use of Weibo platforms' affordances. It first appeared in 2007 on Twitter with the topic discussion group marked by "#netneutrality#." The group' s initiator, Chris Messina, believed that this practice of adding specific tags to topics formed a default agreement among Twitter users, thereby enabling coordinated topic grouping in virtual space. Although such functionality was not actively provided by the Twitter platform, it was invented by its users based on Twitter' s affordances. In China, the Sina Weibo platform also exhibits such user-autonomous topic aggregation indexing phenomena. For example, as of March 30, 2019, the topic page named "#Spring Festival Gala#" aggregated all Weibo posts using this tag, gathering 150 million discussions and over 6.4 billion readings. The topic page named "#Cherry Blossoms#" aggregated text, images, and video information about cherry blossoms from China, Japan, and Washington posted by Weibo users, gathering 250,000 discussions and over 150 million readings. Such online phenomena originate from users' autonomous behaviors based on platforms' affordance environments and their own needs, also providing new possible paths for user behavior research from an affordance perspective.

4. An Affordance Interpretation of Artificial Intelligence Technology

When examining the practical scenarios of artificial intelligence technology through affordance theory, we find that when people interact with AI technology and corresponding platforms, they often develop cognitive expectations based on their knowledge reserves and actual situations. Due to its human-like characteristics, artificial intelligence technology provides people with more concrete expectation spaces, and such expectations are continuously experienced and updated in social actors' participation in using corresponding technological interfaces. People' s cognition of corresponding media carriers is accordingly in dynamic adjustment.

This aligns closely with Gibson' s interpretation of affordances. Gibson particularly emphasized the importance of people' s cognition of material nature, hoping they would perceive objects in a de-labeled, de-categorized, personalized manner: "If you can perceive an object and know how to use it, you can call it whatever you want and assign it different attributes, but this does not mean you can avoid learning how to use this object" [12]. Thus, Gibson advocated for a back-to-basics approach to engaging with objects, believing that subjects' cognition of various objects in the environment and their subjective utilization of objects' various qualities based on this cognition are the premise and core for subjects to fully explore and utilize various materials' affordance elements.

Below, based on Gibson' s proposition and combining Pan Zhongdang' s three affordances of new media—information production affordance, social affordance, and mobile affordance—we will specifically interpret the affordances of artificial intelligence technology.

4.1 Information Production Affordance

With the support of artificial intelligence technology, both the sources of information generation and production speed can be optimized. First, under the effect of "everything-as-media,"various objects serve as both information carriers and information sources for media. Objects' roles have diversified. Various information terminals equipped with sensors can collect previously unimaginable spatiotemporal information for humans (environmental information in extreme weather such as tsunamis and storms; human health information; crowd flow information), greatly enriching the breadth, depth, and accuracy of media information content.

Second, AI-based information production represented by writing robots has greatly accelerated information production speed. As early as 2015, a reporter from National Public Radio in the United States had a writing competition with the Associated Press' s writing robot Wordsmith. After a catering company' s financial report was released, both writers simultaneously wrote a short news piece. The result: the reporter and the robot took 7 minutes and 2 minutes respectively to complete the report. Although the former' s article quality was

superior to the latter' s, it lagged far behind in speed. The robot' s victory stemmed from its ability to quickly produce short news from data and existing templates.

4.2 Social Affordance

Driven by artificial intelligence technology, media sociality is no longer limited to interaction between people but extends to broad connections between people and objects, and people and services. This connection has brought about the era of "big sociality," where all people, objects, or matters carrying information will become members of people' s social circles.

For example, smart homes in the Internet of Things establish personalized connections between people and objects in the family, providing humanized services. Communication between family members and human-machine interaction between family members and appliances such as refrigerators, air purifiers, water heaters, and vacuum cleaners make information at different levels—both family-unit-based and individual-member-based—stereoscopic, multi-layered, and visualizable. Various smart home devices are not only facilitators of life convenience but also carriers of emotional communication among family members. For instance, one spouse can turn on the water heater in advance for the other who returns home late or command the vacuum cleaner to clean the floor even when away from home.

4.3 Mobile Affordance

Pan Zhongdang believes that mobile affordance in the new media environment includes four elements: portability, accessibility, locatability, and compatibility [13]. Portability refers to the portability of smart devices; accessibility means information content can be searched and (cloud) stored; locatability means the trajectories of people or objects can be discovered and recorded; compatibility refers to the presentability of various information texts and forms across different platform interfaces and terminals. In the future, this affordance of artificial intelligence is most likely to appear in the Internet of Vehicles. The interaction between vehicles and people, vehicles and vehicles, and vehicles and all other public information systems in the local environment will cause people' s social interfaces to break through existing mobile phone or other mobile terminal screens to in-vehicle screens. The maturation of autonomous driving technology will help make the sociality of the Internet of Vehicles more operable.

As information technology becomes more advanced, the media ecosystem becomes increasingly intelligent. In the smart media environment, technology' s monitoring of audience behavior reaches unprecedented levels. As people' s dependence on smart terminals represented by mobile phones becomes more severe, their behaviors become increasingly unable to be autonomous and self-governed. By collecting, analyzing, and categorizing users' online behavioral traces, artificial intelligence technology can summarize users' virtual character-

istics, discover users' hidden needs, guide users' future behaviors, and gradually become users' virtual spokespersons. While we see the convenience smart media brings to people' s lives, we must also be alert to its invasion of people' s private spaces—media platforms can intervene in users' media usage behaviors and participate in users' communication processes at any time, and such behavioral involvement is often conducted in ways that users are unaware of or cannot easily perceive. Through the affordance theory perspective, we can dissect and discover the ways and logic by which artificial intelligence technology participates in human life, helping us to better examine and use this invisible meta-mechanism foundational element in future social operation processes from a more dialectical standpoint.

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Note: Figure translations are in progress. See original paper for figures.