Research on the Ideological Origin of the Initial Period of Robot Animation in Japan

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Robot animation has played an important role in the development of Japanese animation. Robot animation, as a major pillar of Japanese animation industry, has triggered several changes in Japanese animation industry, successfully guided the dual route of localization and globalization of Japanese animation, and promoted the arrival of the golden age of Japanese animation. In order to reveal the ideological characteristics of robotic animation and the reasons leading the development trend of animation, this paper adopts the historical method, centering on Astro Boy, Mazinger Z and Space Warship Yamato, which are the nodes of animation history, to make a longitudinal investigation and analysis of the initial period of Japanese robot animation. Through this kind of investigation, we can not only make up for the deficiency of the systematic thought research theory of robot animation, but also sort out the development of robotic animation as a whole, and solve the problem of the ideological origin of robotic animation. At the same time, we can also provide a new research perspective for the history of animation communication between China and Japan, which is of great significance to strengthen the communication of animation and cultural exchange between China and Japan.

Keywords: robot animation, initial period, ideological origin

The Production and Characteristics of Robot Animation

“Robot animation” comes from the Japanese loanword “ロボットアニメ”, which is a kind of Japanese animation genre. There is a rule that girls are the main characters in girl animation, and magic is the core part of magic animation. According to this classification method of robot animation, we can get the following definition: robot animation is the general term of animation works, which takes robot as the main role or an important part of the plot, describes the opposition between robot and human, and the opposition and struggle between humans who controls robot.

Japan’s first robot animation was produced in 1963, and it has developed for more than 50 years. Among them, the works of 1960s and 1970s represent the exploration process of robot animation in the immature period. Therefore, this paper defines it as the founding period and investigates its ideological changes. The emergence of robot animation has brought great revolutionary significance to the Japanese animation industry. To investigate this change, we must first examine the situation of Japanese animation before 1963. Japanese animation first
started in 1917. The comic film *the volume of Imokawamukuzou as a gatekeeper* produced by the cartoonist Simogawa Hekoten opened the prelude of Japanese animation. After that, the development of animation industry experienced two stages: pre-war and post-war. Most of the pre-war animations were educational short films, whose audience is children, and the content is mainly natural science knowledge. After the war, the rise of Toei animation ushered in the “classical period” of Japanese animation. Generally speaking, Japanese animation before 1963 was mostly short comics, whose content was to “show the motionless comics in the form of animation”. It was not until the appearance of Toei that it began to make long animation. Because its content is mostly based on classical mythology, it can be called the classical period. This period of animation contents not only use the Japanese classical stories, also absorb Chinese classical stories as the creative contents. For example, the monkey king in *Journey to the West* has appeared as the protagonist for many times. The first full-length work of Toei animation-*the Legend of the White Snake*, was also based on the story of China. The animation of this period has not yet formed the unique artistic style of Japan, and the characteristics of imitation and absorption are distinct, so the domestic animation of Japan was called the pronoun of rough production. In this case, the animation industry needs a new work to break the development mode of classical animation and lead the new era of animation development. Robot animation is produced in this context, charged with the mission of ending the classical era.

Robot animation, as a new force causing changes in the Japanese animation industry, has ended the classical era and opened the beginning of the development period of Japanese animation. In this change, the original robot animation *Astro Boy* plays a guiding role. There are four main changes caused by *Astro Boy*. Firstly, it was the first TV animation in Japan. In the classical period of Japanese animation industry, comic films occupied a dominant position. Comic film is born out of film, but due to technical limitations, it is difficult to make long content, even the powerful Toei animation’s work does not exceed 80 minutes, so it is difficult to tell a complete story in the way of long narrative. The appearance of *Astro Boy* breaks the limitation of the length of comic films, which can tell a complete story in the form of long serial. It broadens the selection range of Japanese animation, jumping out of the classical limit. Secondly, it’s the first limited animation of Japan. Due to the imitation of Disney in Japan before the 1960s, full animation was used in animation production. Full animation not only brings the problem of high production cost, but also increases the production time of animation. Director Tezuka, the producer of *Astro Boy*, saw the disadvantages of full animation and adopted the method of limited animation to make it. With the idea of “we make Japanese animation, not Disney animation”, he made up for the lack of production technology with substantial content. It marks the the improvement, localization stage of Japanese animation. Limited animation technology is widely used in all kinds of animation, which points out the direction of animation production. Therefore, “episodism” which is based on the pursuit of labor-saving system, has become the mainstream of Japanese animation. Thirdly, It was the first TV animation to be exported. The animation before *Astro Boy* is not optimistic by foreign markets because of its classical content, simple plot and limited technology. Even in the Japanese market, these works have been labeled as shoddy works, so they are difficult on sail. *Astro Boy* breaks the shackles of classicality, takes the future world as the stage, and shows many realistic and universal problems in the coming industrial society. Therefore, in the same year of broadcasting, *Astro Boy* was favored by Disney and became the first TV animation exported to the United States. In addition, it is also the ancestor of robot animation, which opened up the boom of robot animation. As a new genre, robot
animation has broken the classical complex and created the binary opposition pattern of human and machine in the industrialized society. This opposition is inherited and developed by later robot animation, which becomes a typical feature of robot animation different from other types of animation. In this sense, it is the thought contained in the opposite mode of robot animation that has played an important and irreplaceable role in transformation.

**On the thought of Astro Boy**

*Astro Boy*, as the first robot animation, creates a dual opposition mode between human and machine. This opposition is a kind of cognition of man to machine, and also a criterion for man to deal with the relationship between man and machine. In *Astro Boy*, this opposition is shown in the relationship between astro boy and the people around him, as well as the establishment process of astro boy’s cognition of human beings as a robot. At first, like all robots, astro boy felt inferior when facing human beings because of his robot identity. For example, after astro boy was kidnapped by the head of the robot circus, he could completely escape on his own after sufficient energy, but he did not choose to do so. This is nothing more than a sense of inferiority to human beings. He believed that man was the creator, so he had to obey his orders, even if the man was not morally good. In addition, at the beginning of being made, astro boy was made according to the standard of human modeling. That is to say, his prototype is Dr. Tenma’s son who died in a traffic accident. Therefore, the uneasiness of astro boy when he was reprimanded by Dr. Tenma for his inability to grow up shows astro boy’s sense of inferiority to human beings to the extreme field. This inferiority complex gradually decreased after astro boy was adopted by Dr. Cha Shui. In robot Island, astro boy protested to Dr. Huihu in order to save the robot abused by Dr. Huihu. From this episode we can see that astro boy began to produce the idea of equality with human beings. In other words, even if humans are the creator of robots, they can’t abuse robots. But this thought appeared only when robots are abused by humans. In other words, such abuse is regarded as absolute evil and must be resisted. This is consistent with Astro Boy’s theme of persuading good and punishing evil.

After the rescue of the robot, although astro boy’s sense of inferiority has weakened, it can not be eliminated. For example, after rescuing a pair of father and daughter who were arrested for forced labor, astro boy fell in love with human girl Lumi, so he didn’t want to let the girl know that he was a robot. After being beheaded by pirates to protect Lumi, Lumi thought that astro boy was dead. Astro boy took the opportunity to get up and repeatedly told Lumi’s father not to say his robot identity before leaving. It can be seen from astro boy’s hazy love that he still has a sense of inferiority towards human beings and thinks that robots can’t become lovers with human beings. Something that can gradually eliminate this inferiority complex is the opposition between astro boy and Atlas. Atlas, as astro boy’s brother, thinks that human beings should be ruled by himself. So, he constantly launched attacks on human beings. It was astro boy who saved mankind from Atlas. Through several duels with Atlas, astro boy’s understanding of human beings has changed, and his inferiority complex has gradually disappeared. Finally, he is proud of himself as a robot.

If astro boy’s cognition of human beings has gone through a process from inferiority to equality, human cognition of robots has also gone through this process. At first, humans regarded robots as alien, just used them as tools. They didn’t believe that robots would do evil or lie. After the astro bomb incident, human beings have gradually established the idea of respecting robots and coexisting harmoniously with robots. Even British detective Shylock, who is full of strong hostility to robots, has changed his view on robots because of the
appearance of astro boy. When he was transformed into a robot, he completely eliminated his hostility to robots and is proud to be a robot. This points out the direction of integration and symbiosis for the opposition between machine and human.

At the same time, in the opposite pattern of machine and human, Astro Boy also contains the elements of super system and real system robot. For example, the image of giant robot and the style of demon robot strengthen the fighting function of robot and lay the foundation for the image of super robot in the next period. Atlas, which is made from the same design drawing with astro boy, has a strong sense of justice and selfless spirit compared with Astro Boy, which embodies the desire and reasonable thinking of a real person. If astro boy represents the “God” of machines created by Japanese worship of machines, Atlas is more like a machine “man” with real colors. Astro boy and Atlas’s adversary mode is inherited by the real robot’s adversary mode. It can be seen that the robot animation in the founding period pointed out the direction for the subsequent theme, and made ideological preparation for the differentiation of super and real robot animation.

To sum up, Astro Boy led the creative trend of thought in the robot animation period of the 1960s, and created a pattern of opposition between man and machine, in which various ideas were inherited by the later era. Astro Boy has also become synonymous with robot animation, which lays the foundation for the development of robot animation.

**Mazinger Z and Super Robot Animation**

If the 1960s led by Astro Boy represents the childhood of robot animation, it is the adolescence of robot animation led by Mazinger Z. This period can be said to be the second transformation period of Japanese animation, and also the period of internal differentiation of robot animation theme. As mentioned above, Astro Boy already contains the elements of super giant robot and real robot, but it has not formed a clear differentiation. In 1972, as the ancestor of the super robot series, Mazinger Z created a new type of “vehicle” robot, which is different from Astro Boy. In contrast to Astro Boy’s self-discipline, Mazinger Z is a tool robot that can’t think by itself and has no self-consciousness at all. It needs the operation of the driver to move. Although there are already giant robots in Iron Man 28, which was broadcast in the same year as Astro Boy, iron man is a toy robot operated by remote control, and there is no express of super system in the work. Therefore, as the originator of super robots, Mazinger Z triggered the upsurge of super robots in the 1970s, which led to the emergence of such works as the Brave Rydin, the Great Mazinger Z, Super Electromagnetic Robot Bortez V and many other super series robot animation works have formed the “friendship, effort, victory” mode that continues until now. At the same time, 1974’s Space Battleship Yamato and its follow-up work Goodbye, Yamato are favored by young audiences as works to promote the appearance of “otaku”. At the same time, the mode of warship tour plot created by Yamato has become the pioneer of warship style works in the later realistic robot animation. The tragic aesthetics and the opposition mode between the earth and the universe have played an important leading role in the later realistic robot animation represented by Mobile Suit Gundam.

Mazinger Z was broadcast in 1972. It mainly describes the story of Kouji Kabuto driving the super robot Mazinger Z made by his grandfather to fight against the evil scientist Dr. Hell’s mechanical animal corps to defend the earth. The word “super robot” was first seen in the opening song of Mazinger Z, but the work does not make a clear explanation for the super system. Combined with the characteristics of super robot animation, the
author makes the following definition. The super robot animation is an animation focusing on giant robots and starting with protecting the production and manufacture of such robots. It depicts the main characters fighting with enemy forces (mostly non-human robots such as alien or monster). The giant robots appearing in these animations are called super robots. Although the super robot animation realizes the separation of human and computer, it needs the driver to enter the cockpit to operate the robot, because the display of the superiority of the robot exists as the main plot, the driver becomes the auxiliary factor to make the robot move. Therefore, the mode of opposition between machine and human inherited by Mazinger Z is shown as the opposition between Mazinger and mechanical beast. Mazinger is the symbol of power and justice, and mechanical beast is the symbol of evil and invaders. The victory of Mazinger defeating mechanical beast is the victory of justice defeating evil, and also the victory of human beings defeating machines. Justice here is defined as absolute justice, that is, “crossing over the common feelings of history, culture, religion and ethnic groups”, which is also “our justice”. Because of the universality and collectivity of justice, evil is bound to be defeated. This kind of absolute justice, as a remarkable feature of super robots, was a pre-modern element with the complex of persuading goodness and punishing evil, but it played positive significance in the animation industry at that time.

Although Astro Boy has created a new situation in the animation industry, robot animation is still in the exploration period, and all aspects are not perfect. In addition, in the early 1970s, “personal life centrum quickly penetrated into all sectors of Japanese society”. As a result, the animation industry was affected by it, and due to the talent shift, there was a temporary downturn. In order to break this downturn, we need an idea to bring hope. Absolute justice at this time can be said to be the best choice. The following super robot animation boom is the victory of hope brought by this concept of absolute justice.

In addition, absolute justice can be regarded as a transitional period when Japanese began to walk out of machine worship and attach importance to the return of human nature. The just side is the Mazinger Z operated by Kouji and the evil side is the unmanned artificial intelligence robot. In the plot of the battle for the protection of the photon force institute, Dr. Hell, the creator of the mechanical beast, had to analyze the reasons for the failure due to repeated failures. Thus, he came to the conclusion that the strength of the Mazinger Z lies in both robot and its driver, which fully affirmed the necessity of the driver. Later, he created a mechanical beast that needed a driver and ordered Baron Asura to drive it to fight against Mazinger Z. However, due to the problems of Baron Asura’s driving skills, Dr. Hell’s plan ended in failure. It can be seen that human beings with absolute justice are bound to defeat unmanned machines.

If Astro Boy’s persuasion of goodness and punishment of evil in the last era reflected that machines were superior to human beings, then the relationship between man and machine began to turn upside down in this period. In other words, man’s absolute justice was superior to machines. However, the hero does not fight the machine with empty hands, but drives the giant robot to fight. This shows that the means for human beings to defeat machines is still machines, and human beings only act as brain parts of giant robots. Therefore, the opposition between human and machine of super robot has not completely reversed the relationship between them. It is only a transitional stage, and it is also a requirement to highlight the performance of super robot. The reason is also the natural implication “in the post-modern high-tech society, the object replaces the subject”.

The reason for Mazinger Z to be regarded as the ancestor of the super robot, is not only because of the representative of absolute justice, but also related with the courage and friendship it brings. Different from Astro
Because the drive and the robot are separated, the driver must enter the robot to exercise absolute justice. In other words, once the driver encounters a crisis, the robot will not be able to move. Astro boy has 100,000 horsepower and seven magic powers. As long as the energy is not exhausted, he will not face the crisis of death. Therefore, it can rely on its own strength to exercise justice and save mankind. But Kabuto is a human. His body is not so hard as a robot. He will always face the threat of death set by the enemy. So, courage plays a big role. Through the use of their wisdom in the crisis to defeat the enemy has become the key to reverse the battle. When Kabuto was not proficient in the operation of Mazinger Z, he was in a coma due to the attack of the mechanical beast. At that time, Cabuto’s heart is echoed by the encouragement from his dead grandfather. This kind of encouragement eventually turned into a weapon, making Kabuto successfully going through the crisis. In face to the armored army sent by Baron Asura, Kabuto also faced many crises. But he successfully played a super combat and won the battle. In this way, in the face of danger, how to use courage and wisdom to reverse the disadvantage has become the essential spirit of super robot.

At the same time, as the partner of Cabuto, another robot called Diyaana plays an important auxiliary role in the battle with the mechanical beast. Since the battle of Mazinger Z is mostly carried out around defending research institute, the guiding role of Professor Bow of the research institute can not be ignored. Therefore, it can be said that the victory of Mazinger Z is not just the victory of Kabuto, but the victory of the photon force research institute group. It can be seen that friendship, courage and collectivism, as the auxiliary of absolute justice, constitute the invincible image of the super system. In the 1970s, this kind of image rose the upsurge of super robot and became the synonym of robot animation. It also reflects the author’s attempt to break the “fixed theme represented by weak young people”.

The Revolution of Space Battleship Yamato

Space Battleship Yamato is a robot animation directed by Reiji Matsumoto. It was broadcast in 1974. As “the beginning of the genre about doomsday”, the work told the story of the crisis that human beings are on the verge of extinction due to the attack of the travelling star bomb of the Gamaris people from other planets. In order to get back the cosmic cleaner and purify the earth’s environment, the warship Yamato, which surpasses the speed of light, sailed to the distant planet Iskandar, and finally saved the earth’s crisis. As a pyramid in the history of Japanese animation, Yamato has aroused otaku’s enthusiasm for animation. When the sequel Goodbye, Yamato was premiered in 1978, the frenzied queuing phenomenon aroused sociologists to study the otaku’s phenomenon. The reason why this work can stimulate the fanaticism of otaku lies in its realistic narrative style and the application of tragic aesthetics. The realistic plot has laid the foundation for the subsequent real robot animation, and created the opposition mode between the earth and the universe. Tragedy aesthetics vividly displays the spirit of sacrifice for faith and righteousness, increases the realness and heaviness of the story, and causes the audience’s reflection and resonance on the meaning of life. The followings mainly analyzes the ideas of the works from these two aspects.

The realistic complex of Yamato is mainly reflected in the aspect that it abandons the traditional mode of opposition between machine and human, and creates the dual opposition mode between the earth and the universe. The earth and the universe in the works symbolize two different cultures, and they are also typical representatives of “a large plot that can be shared by the audience”. As the hometown of human beings, the earth symbolizes
traditional culture while the universe, as an unknown field, symbolizes emerging and external culture. In this way, the previous era of robot animation with the opposition between machines and people as the main content is transformed into the opposition between people. The story begins with the battle between the Earth Defense Army and Gamaris army in the universe. This pattern of the beginning of the universe heralds a new era. As the plot unfolds, it gradually reveals that the Gamaris’ entity is similar to the earth’s human beings, thus opening the mode of opposition between human beings. If director Matsumoto can further elaborate and explain the external culture of the universe, this work can break away from the tradition of absolute justice of super robot and become a real robot work. However, he did not jump into the real system, but positioned the unknown external culture as the aggressor. From the beginning of the story, the space defense war clearly defined the image of Gamilas as the aggressor. Although the description of Gamilas is the same as human beings on earth, it does not reduce the color of aggressor of Gamilas. For example, the Gamaris people regarded the earth people as research materials, and the earth people regarded the Gamaris captives as wild animals. Space migration plan of Gamaris’ president includes making use of radioactive energy to exterminate the earth people. These plots all regard the cosmic culture as aggressive and evil in an absolute sense. Therefore, the opposition between people here actually continues the mode of the opposition between absolute justice and evil in super robot animation. However, this opposition mode between the earth and the universe creates an opportunity for the works of reality represented by *Gundam* works, which still has its pioneering significance in its tragic aesthetics.

The tragic aesthetics of Yamato permeates all aspects of the story. It refers to the complex of Japanese culture regarding sadness as aesthetic consciousness. As described in the tragedy of samurai Shura represented in *The Tale of Heike*, the desolation and sadness when things are going to perish exist in literary works as the decisive factor of Japanese culture. The application of this tragic aesthetics in robot animation can be said to be the key factor for the audience to resonate with *Yamato*. The beginning of the story is a heroic tragedy. In the battle between the Earth Defense Forces and Gamilas, the earth forces are in a disadvantage condition. In order to cover the retreat of the flagship, the ancient warship Yukikaze attracted the firepower of all the enemy ships and was bravely sunk by them. As the captain of a warship, Mamoru Kodai’s attitude of holding to the last moment and surviving together with the warship caused the first heroic tragedy in the works. In order to break through Yaosai Island, Shinda and Kodai, who sneaked into the interior of the island for destruction, were captured in the deepest part by defense machinery. After accepting the mechanized transformation of hands and feet, Shinda asked Kodai to cut off his hands and feet as a detonating device, so that Kodai could escape quickly. As the hands and feet of Shinda were made by bombs, he had to stay at the entrance of the fortress to detonate. This means that it is possible for Shinda to sacrifice. After confirming the safe evacuation of Kodai, Shinda resolutely pressed the detonating button in his sleeve. For the sake of friendship and victory, the spirit of sacrifice makes Shinda’s action full of heroic tragedy. Although Shinda was rescued in the end, it did not affect the expression of this heroic tragedy complex.

At the same time, the tragic aesthetics in the works is not only expressed in the positive characters, but also in the negative characters. For example, after Pluto’s front base failed to block Yamato, commander Cyrus fought with Yamato until death. Death is a kind of fate for the villain, but in the final resistance, commander Cyrus’ courage and belief, as well as the suicidal assault to Yamato for honor, all show his respectability as an enemy. In addition, general Dumel’s final battle with Yamato in the seven color star cluster brought the hero tragedy of the
villain to a climax. In the first half of the showdown, general Dummel was always in the lead. However, due to the wisdom and efforts of the whole Yamato staff, the Dumel fleet was destroyed. As the captain and commander, Dummel chose to end the battle by self exploding with Yamato. In the moment before the explosion, Dummel communicated with the captain of Yamato. He expressed his strong sense of mission and dignity as a soldier to hinder the progress of the Yamato. With the blessing of his motherland Gamaris and the earth, he pressed the self explosion button. Thus, the belief from fighting to the end has something in common between the protagonist and the enemy. It’s not because of hatred, but because of faith. The enemy’s fatalistic tragedy is the best way to express this belief. In addition, at the end of the work, the death of captain Okinata of Yamato brings the tragic aesthetics of the work to the peak. When the cosmic cleaner was successfully obtained and Yamato reached the earth, Captain Okitatook a final look at the earth and passed away quietly. The final death of the hero who saved the earth makes the tragedy aesthetics of the whole work to reach the peak.

To sum up, this period represented by *Mazinger Z* and *Yamato* can be seen as the transition period of robot animation from the founding period to the prosperous period. Among them, the concept of absolute justice of super robots and the warship tour scenario guided by *Yamato* mark the arrival of the boom period of robot animation, and create conditions for the emergence of real robot animation.

The Ideological Characteristics of Robot Animation

Through the above investigation and analysis of the founding period of robot animation, we can see the ideological characteristics of robot animation, which are summarized as follows.

(1) Unique and distinct opposition mode. Most of the robot animation takes battle as the theme, so the opposition mode is more distinct than other animation types. This opposition mode is unique in the aspect that it is the opposition between machines and people, the opposition between people driving machines and machines, and the opposition between people driving machines. At the same time, this kind of opposition is not only limited to the simple opposition between justice and evil, as well as the opposition between the enemy and friend, but also involves the opposition between many different value orientations. This constitutes a unique world view of robot animation different from other types of works.

(2) The plot composition of multiple perspectives. Due to the opposition in robot animation and the relative justice in conflict, the multiple perspectives are integrated into the plot. In addition to the perspective of the protagonist, we can also observe the whole work from the perspective of the supporting actor or even the enemy character. Especially with the setting of multi protagonists, the viewpoint becomes more colorful. The ideological analysis and interpretation of the works provide an opportunity for the audience to observe each work from the perspective of the characters they are concerned about. Even the super robot works with the color of absolute justice are composed of multiple perspectives. In this way, it constitutes the openness and cosmopolitanism of robot animation plot.

(3) The rational use of tragic plot. Because the background of robot animation is mostly set as war, in order to reappear the cruelty of war, tragic plots are used in different degrees. It is clear that in the age of *Astro Boy*, there are tragedies in some plots. This concept of tragedy aesthetics runs through all aspects of the development of robot animation, and refines all categories of tragedy aesthetics. Through various forms, such as hero tragedy, villain hero tragedy, villain repentance tragedy and the common tragedy of both positive and negative characters,
it conveys a kind of aesthetic of “fetishism and sorrow”, which combined the aesthetic consciousness of Japanese traditional culture with robot animation skillfully.

**Conclusion**

By revealing the above characteristics of robot animation, we can see the relationship between robot animation and Japanese traditional culture. For example, the multi perspectives and interaction with other types of animation originate from the multi-cultural characteristics of Japan while the setting of tragedy complex represents the application of tragedy aesthetics in Japanese culture, and the description of adversity originates from the crisis consciousness and sincerity of Japan. In short, the ideological merit of robot animation lies in the creation of a mode of thinking in which machines and people are opposed. This is due to the Japanese reflection on instrumental rationality and value rationality of the multi polar world pattern in the period of industrial civilization. Because of the concrete thinking mode of Japanese culture, the Japanese abstract thinking is not developed. So it is easy to have the tendency of blind worship for new things. This phenomenon was very common in the past agricultural civilization era. For example, the popular Buddhist politics was established as a standard pattern of politics while Confucianism was established as an official ideology. Foreign guns were widely used in the battlefield once they were handed down, etc. These phenomena can be attributed to the Japanese’s “fetishism” tendency towards foreign things to varying degrees. This kind of blind worship in the performance of industrial civilization is for machinery. Blind worship to machine, reflected in the robot animation, is *Astro Boy*’s omnipotent and super robot’s giant, heroic shape. Therefore, in the early robot animation, the role of human is excluded, and the performance of the machine is always the main factor. Even if there is a trend of separation between human and machine, human is also the character supporting role of machine performance. From this point of view, we can see that the reflection of instrumental rationality and value rationality is the root of the opposite mode and the ideological source of robot animation.

**References**


