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Instituto Universitário de Lisboa

The Influence of Patient Absorptive Capacity and Perception of Technology Characteristics on Patients' Satisfaction with Medical Services in Guangzhou, China: an Affordance Theory based Approach

WU Zijian

Thesis submitted as partial requirement for the conferral of

Doctor of Management

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July, 2018

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Declaration

I declare that this thesis does not incorporate without acknowledgment any material previously submitted for a degree or diploma in any university and that to the best of my knowledge it does not contain any material previously published or written by another person except where due reference is made in the text.

Signed: Date: 2018 - 8 - 31

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作者申明

本人郑重申明：除了论文致谢中明确说明并致以谢意的部分外，所呈交的论文不包含任何他人或作者本人已用于获得任何教育机构的学位和证书而使用过的材料。同时尽我所知，除了文中特别加以标注引用的内容外，本论文不包含任何其他个人或集体已经发表或撰写的成果作品。

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Abstract

Background: Based on the theory of Affordance, this thesis proposes two analytical dimensions of Subjective Affordance (SA) and Behavioral Affordance (BA).The research aims to explore the influence of patients' Absorptive Capacity (AC) and Technology Characteristics Perception (TCP) on their SA and BA of the WeChat client-side app in community hospitals so as to further evaluate the SA and BA influence on patients' satisfaction of medical service (PS).

Research subjects are patients who have used the community hospital WeChat client-side information platform in 28 community health service centers in nine districts of Guangzhou in the South of China. A questionnaire with 4 sections and 44 questions was designed and distributed. The effective questionnaire data were checked for descriptive analysis and a path model with 5 observed variables (AC,TCP, SA,BA,PS). was developed.

Results: 1. A total of 410 questionnaires was distributed, of which 400 have been collected and 387 of them were valid and analyzed. 2. There is a significant difference among variable scores of patients with different ages and educational background. 3. The group of patients who use the information platform more actively have higher scores in the 5 variables. 4. TCP has a direct influence on PS while BA plays an intermediary role. It was found that the mediation effect of SA is not valid. 5. AC has no direct or indirect influence on PS.

Conclusions: Age, educational background, and TCP (evaluation of the innovation characteristics of technology) play an important role in the final implementation of technology application behavior (BA), and the effective application of technology can indeed improve satisfaction with the medical services (PS).

Keywords: affordance; absorptive capacity; technology characteristics; China

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Resumo

Tendo por base a teoria da Affordance, esta tese analisa duas dimensões desta teoria: a Affordance subjetiva (AS) e a Affordance comportamental (AC). A investigação tem por objetivo estudar a influência da Capacidade de Absorção (CA) e da Percepção das Características Tecnológicas (PCT) na AS e na AC dos pacientes estudados em relação à utilização da aplicação Wechat como plataforma de informação e fornecimento de serviços em Centros de Saúde, a fim de avaliar em que medida a AS e a AC influenciam a sua satisfação com os serviços médicos (SP).

Os sujeitos do estudo são pacientes que utilizaram a aplicação WeChat na sua interação com Centros de Saúde. Foi administrado um questionário contendo quatro partes e um total de 44 questões em 28 destes centros localizados em 9 distritos da cidade de Cantão no sul da China. Os dados foram depois analisados tendo sido concebido um modelo com base nas 5 variáveis observadas (AS, AC, CA, PCT e PS).

Resultados: 1. Dos 410 questionários distribuídos recolheram-se 400 dos quais 387 foram considerados válidos para análise; 2. Os resultados revelaram que existe uma diferença significativa entre os pacientes de diferentes idades e diferente formação académica; 3. O grupo de pacientes que mais utiliza a aplicação tem valores mais altos nas cinco variáveis analisadas; 4. A PCT tem uma influência direta na SP enquanto que a CA desempenha um papel mediador. Os resultados demonstraram ainda que o efeito moderador da AS não se verifica; 5. A AC não tem qualquer influência direta ou indireta na SP.

Conclusões: A idade, a formação académica e a PCT (percepção das características inovadoras da tecnologia) desempenham um papel importante na Affordance Comportamental (AC) e a utilização efetiva da tecnologia pode contribuir para melhorar a satisfação dos pacientes com os serviços médicos (SP).

Palavras-chave: affordance; capacidade de absorção; características tecnológicas, China

JEL: N75; I10

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摘　要

背景：本文基于可供性（Affordance）的概念，提出了主观可供性（Subjective Affordance, SA)和行为可供性（Behavioral Affordance, BA)两个分析维度，进一步探讨了启示在AC和PS之间的作用机制。本研究旨在评价社区医院信息技术(社区医院微信客户端app)介入后，社区医院患者吸收能力(AC)和技术特征感知(TCP)对信息技术平台SA和BA的影响，进一步评价SA和BA对患者医疗服务满意度(PS)的影响。

方法：研究对象是在中国南方广州9个区28个社区卫生服务中心使用社区医院微信客户端信息平台的患者。设计并分发了4个部分和44个问题的问卷。对有效问卷数据进行描述性分析，并建立了观察变量(5个观察变量: AC,TCP,SA,BA,PS)的路径模型分析。

结果：1.在发出的410份问卷中，回收了400份问卷，其中387份有效可用于分析。2.不同年龄和教育程度的患者，其变量得分存在显著差异。3.对信息平台使用较积极的患者人群，他们在5个变量的得分均较高。4. TCP对PS有直接影响，BA起中介作用。而SA的中介作用是无效的。5。AC对PS没有直接或间接的影响。

结论：年龄、学历、TCP(技术创新特征评价)对技术应用行为(BA)的最终实施起着重要的作用，技术的有效应用确实可以提高对医疗服务(PS)的满意度。

关键词：可供性；技术吸收能力；技术特征感知能力；中国广州

JEL: N75; I10

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Contents

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List of Tables

List of Figures

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List of Abbreviations

AMGM   Affordance Meaning Generation Model

AST   Adaptive Structuration Theory

AC   Absorptive Capacity

BA   Behavioral Affordance

CAS   Complex Adaptive Systems

ER   Electronic Health Record

HCI   Human Computer Interaction

HIS   Hospital Information System

ICT   Information Communications Technology

IDT   Innovation Diffusion Theory

IT   Information Technology

MTA   Mindfulness of Technology Adoption

PACS   Picture Archiving and Communication Systems

PU   Perceived Usefulness

PEOU   Perceived Ease of Use

PS   Patients Satisfaction (with Medical Services)

TRA   Theory of Reasoned Action

TPB   Theory of Planned Behavior

TAM   Technology Acceptance Model

TTF   Task-Technology Fit

TCP   Technology Characteristics Perception

UTAUT   Unified Theory of Acceptance and Use of Technology

RIS   Radiology Information System

SA   Subjective Affordance

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Chapter 1: Introduction

Since the implementation of the "reform and opening up" policy in 1978, the Chinese government has been paying increasing attention to medical and health services and actively promoting the medical reform. Although certain achievements have been made through preliminary efforts, China's medical and health system is still facing serious problems, as it is widely believed that "expensive medical bills and difficult access to quality medical services" is a real reflection of the current medical and health system in China. "Difficult access to quality medical services" means that there are many obstacles when people get medical services as they cannot be obtained quickly and conveniently. "Expensive medical bills" means that the fees charged by medical institutions are too high and beyond the affordability of some people (including economic and psychological affordability) (Zhang, 2016).

In recent years, the allocation of health care resources in China and its equity have been valued by scholars and, according to Yang (2010) , the allocation of health resources in China is in the form of an "inverted triangle". In other words, more than 80% of health resources are concentrated in tertiary medical institutions, while less than 20% are in primary-level medical institutions. In addition, the vast majority of health resources are concentrated in cities where the number of medical institutions and service quality outperform those in rural areas and medical and health resources are concentrated in a small number of large hospitals. While large hospitals in large cities are overcrowded, small primary-level hospitals lack resources such as personnel, capital and materials and are, therefore, unable to meet the public demands for medical treatment. Affected by the stereotype of Chinese patients that large hospitals are more trustworthy and based on the consideration of word-of-mouth and medical strength, people prefer to go farther to large hospitals and spend more money rather than choose primary-level hospitals even if they are closer to where they live. Under these circumstances China faces great difficulties in implementing hierarchical diagnosis and treatment.

Difficult access to medical treatment and hospitalization in large hospitals, idle

primary-level medical resources and high medical costs have become an urgent concern for the general public in China, which leads to low public satisfaction with medical services. Furthermore, many medical staff and medical institutions are not trusted and recognized by the people and the relationship between doctors and patients has become increasingly tense. This dilemma poses a serious challenge to China, a developing country with a population of nearly 1.4 billion. If not properly solved, it may affect social stability.

The medical reform implemented by the Chinese government has been focused on strengthening primary-level medical care. In 2009, the new medical reform in China proposed the family doctor system which is being promoted throughout China since 2010. However, due to lack of public understanding, low work efficiency of family doctors and backwardness in the informatization of this service, it has not been carried out smoothly and has not produced the expected results (Ji, Tian, & Yu, 2015) .

With the rapid development of internet information technology, it is increasingly realized or felt that internet has advantages in optimizing business processes and integrating information. The development of mobile internet technology further promotes the instant transmission of information and changes the way of living and information exchange. In China, mobile internet medical care is a new trend in the development of the internet medical care and in fact is playing a very good role in the optimization of hospital business processes such as appointment of medical consultations, online payment, and inquiry of inspection/examination results.

Most secondary and tertiary hospitals in China have adopted appointment consultations based on WeChat, a free smart phone application developed in 2011 by Tencent, a leading provider of Internet value added services in China. Started as a free application for instant messaging services, it has become the most popular social networking app in China (Ni, 2013). According to statistics, the amount of its monthly active users had reached 400 million by 2014 (Yu & Tong, 2015). Once getting access to mobile internet, WeChat, which can be downloaded for free, will offer free communication among users, integrating social networking functions such as text messaging, photo sharing, voice chatting, video conversations, diverse payment provisions and much more. On August 18, 2012, WeChat

2

launched its public platform and promoted business cooperation with key media and enterprises, including information release, push, automatic maintenance, and one-on-one communication (Yu & Tong, 2015). Making use of this platform, some hospitals have also provided full-process services before, during and after the consultation and other services such as remote diagnosis and consultation, family doctor service, health monitoring, and doctor-patient communication. Therefore, it is widely believed that the internet is a powerful tool to re-optimize the allocation of medical resources, realize the integration of resources, effectively save time and economic costs, improve efficiency, and enhance the availability of quality medical resources. It is expected that it will solve the difficulties faced by family doctors, thereby enhancing the public medical satisfaction and contributing to improving doctor-patient relationships (Zhang, 2014).

As the public are looking forward to the effectiveness of the mobile "internet + family doctor service" model, research also reveals that the combination of mobile internet information technology and traditional medical treatment does not turn out to be as effective as expected (Luo & Li, 2010; Feng & Yao, 2016; Wang, 2017). Even if information technology is introduced into traditional medical and health care, it will not produce ideal results as expected and the commonly-seen influencing factors are incomplete information provided by software, low degree of data sharing, limited functions and poor user experience (Zhao, 2015; Shu, Chen, Lu, & Liao, 2017), which may affect the development of doctor-patient relationships and the improvement of medical service satisfaction. The key to the success of the innovative information technology model of "mobile Internet + family doctor service" is the acceptance and final utilization behavior of users. In addition to the technical object characteristics and user characteristics, the subjective perception, understanding and assessment of technical objects by users, and integration degree of information and process that can be achieved by information technology play a decisive role (Fichman, 2001; Sherif, Zmud, & Browne, 2006; Jaw, Yu, & Gehrt, 2012).

Scholars believe that information technology users have different perceptions of technological traits, which affects whether users adopt the technology or the satisfaction of technology adoption. Users are more inclined to select and apply technologies that meet their

needs, a problem that requires the attention of technology product developers (Lau, Price, Boyd, Partridge, Bell, & Raworth, 2012; Chen, Qian, & Lei, 2016). Therefore, this study proposes a research model to analyze the adoption and utilization behaviors of internet information technology by users from the perspective of differences in individual characteristics. The model further evaluates the influence of information technology utilization on medical service satisfaction, which is of great significance. The Conceptual Model see Figure 1-1.
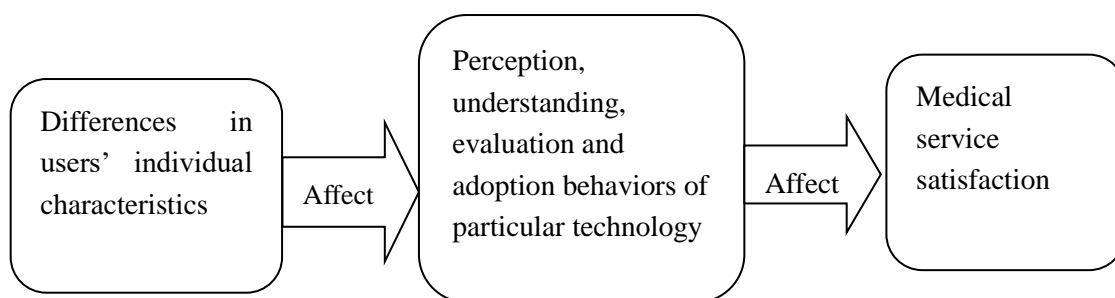
Figure 1-1 The Conceptual Model

1.1 Research Background

1.1.1 Description of Healthcare System in China

Right after the founding of the People's Republic of China in 1949, due to a long period of war, the devastated country urgently needed to be rebuilt, and poverty and hunger still plagued most people. The poor living conditions and sanitary environment led to high frequency of malnutrition, infectious diseases, and parasitic diseases. At that time, the Chinese government still faced problems such as shortage of supplies and insufficient medical personnel and, under these limited conditions, China finally gave up its original intention of implementing a comparatively mature Western medical model. Instead, it established a Chinese medical and health system focusing on prevention, actively carried out health campaigns, and improved public environmental sanitation.

At the same time, a number of primary health care institutions were set up at the grassroots level to strengthen immunization and popularization of health sciences. In spite of limited resources, the health problems of the general public during the early stages of the

founding of the People's Republic of China were resolved efficiently. Then most Chinese were rural residents thus, solving medical problems of rural residents became the focus of the Chinese government's health policy. In the 1950s, China actively promoted a rural cooperative medical system under which rural cooperatives were the units, rural residents carried out self-raised funds and cooperative financing and established a relatively complete management system, which guaranteed the demands of rural residents for disease prevention and common disease treatment.

In 1978, China implemented reform and opening up. With the effective promotion of policies, China witnessed rapid economic development, and the living standard of its people has been increasing. However, coupled with the increase of population, the original health system failed to meet the demands of the general public for health care and, under the background of market economy, the drawbacks of the old system gradually emerged. The resulting contradictions have aroused the attention of the government and China actively started to carry out medical reforms, through which the government investment in health care continued to increase and the number of medical institutions started to grow rapidly. The government has strengthened its main responsibilities and ensured the public welfare nature of public hospitals. For example, in 2015 alone, the State Council of the People's Republic of China issued six policies in succession in response to the "expensive medical bills and difficult access to quality medical service" (Jiang, 2015).

However, these measures have yielded few results. Compared with most foreign countries, the government investment in medical and health service in China is still insufficient and, at the same time, the country is faced with problems such as uneven distribution of medical resources, difficulty in the promotion of hierarchical diagnosis and treatment, and excessive medical expenses. In sum, the demands of the public for medical treatment cannot be met to a large extent (Deng, Lu, Gao, & An, 2014; Du, 2014; Deng et al., 2015).

In recent years, the allocation of health care resources in China and its equity have attracted attention of scholars and various forms of investigation have been carried out. The results of relevant studies show that the total amount of health resources in China continues to

increase, but the distribution according to population is considerably uneven (Nie, Li, Jia, & Sun, 2004; Yi, Zhou, & Ma, 2012). There is a disparity in the distribution among different regions, and the problem of internal unfairness within various regions is the main factor affecting the equity of health resource allocation in China (Zhang, Sun, Li, Wang, & Liu, 2014). Due to the uneven distribution of health resources, China has always been obstructed in promoting hierarchical diagnosis and treatment. Relevant investigations show that some scholars believe that this situation is caused by the rapid growth of migrant population, rapid increase in demand for medical treatment, inverted medical structure, low efficiency of hospital work, impact of stereotypes in medical treatment, poor medical insurance policy guidance, and low capability of community health service institutions (Cao, Fang, Hu, & Yin, 2010).

It is generally believed by the Chinese people that there is still a huge gap in government investment in medical and health services, and hospitals and medical personnel have become profit-seeking in order to increase their income, leading to over-treatment and "expensive medical bills". Zhang (2016) also agrees with this view by pointing out that with the downward trend in China's budget for medical and health care, medical institutions often choose to obtain more economic benefits from drugs and services in order to improve their operational performance. Drug price difference and excessive prescription have evolved into key revenue expansion channels, and patients are often in a passive position in medical consumption. Deng et al. (2014) carried out a comparative analysis of the medical resources and health costs in the "BRICS" and found out that the amount of medical resources in China is at a medium level among the five countries, but both the total health expenditure and the per capita health expenditure are at the top of the list.

1.1.2 Description of Community Hospitals in China

Community health service was initiated relatively late in China. After the implementation of the reform and opening up in 1978, community health service began to take shape in some parts of the country but it was not until 1996 that the Central Government took the development of community medical care as the country's main policy and

development of the community health service speeded up (Bao, 2009). In 1999, the Chinese government specified relevant goals and formulated detailed plans. For example, in 2000, the framework of a community health service system was basically established and in 2010, a more complete community health service system was also established nationwide (Du, 2012).

After years of efforts, great breakthroughs and development have been achieved in the community health service of China. Based on the analysis of the China Health Statistical Yearbook and China Health Statistical Summary, Zhang (2012) found that the total number of community health service institutions in China had increased by 91.1% in 2010 compared with that in 2005, but even if community medical resources were growing rapidly, the geographical distribution was still highly uneven. According to statistics of the geographic variation trend of distribution of health financial resources in China's primary medical institutions, the gap of health financial resources between urban and rural primary medical institutions has widened, and the distribution in different regions is significantly different (Li, 2012). Li (2016) analyzed the resource allocation of primary-level medical institutions in 31 provinces (municipalities) in China, which shows that there are significant differences in primary-level health resources between the developed eastern provinces and the underdeveloped provinces in the central and western regions. Relevant studies have also proved this view, pointing out that the main factor affecting equity of primary health resource allocation in China is the inequality within these regions (Yang, Xiao, Chen, & Ren, 2017). The disparity in the allocation of health and financial resources between urban and rural health care institutions has widened, and the level of allocation in each region has been significantly different (Fu, Liu, Wu, & Hao, 2015). Obviously, the current primary-level medical resource allocation cannot meet the medical demands of the public, which leads to loss of talents in community medical institutions and affects public satisfaction with community medical treatment and intention of receiving medical treatment.

Research shows that the level of job satisfaction of community health technicians is not high, the main complaints being about low welfare benefits, mismatch between income and actual workload, imperfect performance appraisal mechanism, and difficulty in professional title promotion (Guo, Mao, Jiang, Yang, & Yuan, 2008). Affected by factors such as personal

development opportunities and limited economic income, most medical graduates are reluctant to work in community hospitals for a long time. Likewise, the public also has a low satisfaction with community medical services as revealed in a survey conducted with a sample of 650 community residents in Guangzhou in 2013: only 63.6% of the respondents stated to be satisfied with community hospital services and only 38.3% declared to be satisfied with doctors in those hospitals (Yao, Cui, Li, & Zhou, 2016). The awareness rate of community services is also very low, and less than 60% of the respondents are willing to visit a community hospital. Results in the same research show that concern of being misdiagnosed, poor medical environment, low technical level, backward medical equipment, and medical habits are important factors affecting the lack of satisfaction.

In order to further strengthen primary-level medical development, promote hierarchical diagnosis and treatment, and reduce the burden in large hospitals, the Chinese government has learned from the successful experiences of developed countries such as the UK and the US and started to actively promote the system of family doctor services in recent years. In 2009 the State Council issued the Key Implementation Plan of Medical and Health Reform (2009-2011), which clearly stated that a system of resident health records would be gradually established across China from 2009 on and standard management would be implemented (The State Council [TSC],2009). In 2010, Shanghai was selected as a pilot city to experiment the system and, after that, family doctor services were launched in various cities throughout the country. Lu (2012) gave an explanation on the family doctor system closer to the actual situation in China pointing out that the system should be based on primary-level medical institutions with rational use of health resources and appropriate technologies taking health as the center, family as the unit, community as the coverage, and demand as the orientation. It should mainly focus on women, children, the elderly, chronic patients, the disabled and vulnerable groups, aiming to solve and meet the basic health demands of the community, and integrate prevention, medical treatment, health care, rehabilitation, health education, and family planning technical guidance. It should provide families with effective, economical, convenient, comprehensive and continuous primary-level health care services.

China is currently in the early exploration stage of family doctor service and is

encountering considerable difficulties, which also affects the effectiveness of the work (Ji, Tian, & Yu, 2015). This is manifested in a lack of awareness of the family doctor service, low efficiency of family doctors, and backwardness in the application of Information Communications Technology (ICT) in family doctor services. It is understood that at present, family doctor services in most communities in China are experiencing the phenomenon of "easy to sign contracts but difficult to fulfill the contract". Since family doctors are understaffed with heavy workload, most of them are unable to perform substantive tasks such as follow-up visits and many exist in name only.

1.1.3 Development of Medical Informatization in China

In China, informatization of the medical industry has also received increasing attention and has become a hot spot for the development of the industry. At the same time, it has also achieved remarkable results (Chen & Liu, 2016). In retrospect, the development of medical informatization in China in the last century experienced three stages (Liu, Yang, Zhang, & Lu, 2012; Yang, 2016), as follows:

The first stage – In the early 1980s, some medical institutions started to use computers or computer software to assist the work. The medical staff felt that the work became convenient and the effect was remarkable. However, the coverage is narrow, and it is not widely popularized.

The second stage – in the late 1980s, with the establishment of local area networks, hospitals built a network linking different internal departments, and established their database. There were also different kinds of software for different functional requirements, enabling internal information and data sharing and thus improving the management level. Larger hospitals began to try to apply the medical case management software system.

The third stage – in the 1990s, the internet began its rise in China. The interaction among organizations is no longer limited to their boundaries; instead, they can exchange and communicate information with the outside. At this time, the construction of Internet informatization was more focused on the cost management part of the hospital information system, and it was quickly popularized (Chen & Liu, 2016). In the late 1990s, China began to

gradually implement medical information technology in domestic hospitals, and the Hospital Information System (HIS) was set up. In this way, data in domestic hospitals have been effectively integrated and shared (Zhang & Xiao, 2011).

Under the background of the gradual popularization of Internet technology in the beginning of the 21st century, the Chinese government increased investment in infectious diseases and health information systems and actively promoted regional cooperation in medical informatization, which also promoted the development of regional medical cooperation (Wang & Su, 2010). In the past 10 years, the medical information system in China has not only been limited to Electronic Health Records (EHR) but was extended to PACS (Picture Archiving and Communication Systems), RIS (Radiology Information System) and other information systems with various detailed functions that have been adopted by hospitals. Information technology safeguards and promotes medical technology and quality, plays a decision-supporting role for doctors, improves doctor compliance with clinical guidelines, reduces medical errors, and helps take preventive measures in time to reduce the incidence of malignant consequences (Zhang, 2013).

In the 21st century, with the rapid development of mobile internet technology, mobile internet started to gradually penetrate into all areas of people's lives and work. The derivative smart terminals and mobile apps have changed the habits of Chinese internet users (Wang & Wu, 2014). The core of the mobile Internet era is centered on user needs and how to obtain, retain, and activate users has become the most important task for mobile companies (Hu, 2009; Hu, 2016). Hu (2009) points out that, unlike the traditional way of development in the Internet, mobile Internet users started from the grassroots level and developed in a bottom-up way. Therefore, mobile internet technology has the advantages of fast transmission speed and wide public coverage.

In the mobile internet era, Chinese medical service providers (such as medical institutions) no longer take the dominant position in the development of medical informatization. Instead, they gradually resort to a development model centered on medical demanders (Zhang, Ling, & Lin, 2016). The development and application of mobile internet technology has enabled medical services to eliminate time and space limitations, and reduce

transaction costs, disruptively changing the traditional medical service model (Ling, Zhai, Lin, & Zhang, 2016). As regards the impact of mobile internet technology on medical services, Ling et al. (2016) believe that in the mobile internet environment, medical information data and medical resources are shared to effectively solve the problem of isolated medical information, ensure data consistency and service continuity, and realize telemedicine simultaneous diagnosis and treatment, asynchronous diagnosis and treatment and real-time monitoring.

1.1.4 WeChat Platform

In China, currently there are two modes of platforms of mobile internet technology to improve medical services: one is oriented to hospital doctors, known as the B2B mode, which is mainly used for communication among doctors, application of medical knowledge database and commonly used medical tools. The other, known as the B2C mode, is directly oriented to users or patients, and is mainly used in medical consultation, telemedicine, appointment registration, information inquiry and follow-up services. In China, the current platforms to achieve these functions are mainly based on mobile phone apps and the WeChat platform and are widely used with a large number of users and wide coverage (Wang & Wu, 2014).

WeChat is a free smart phone app developed by Tencent in 2011 and has become the mainstream social app in China (Ni, 2013). Statistics show that by 2014, the amount of active users of WeChat per month had reached 400 million (Yu & Tong, 2015). As for traditional short messages, users have to pay for the service and the message is transmitted only in the form of text. However, the WeChat APP platform can be downloaded for free, and users can communicate with each other without any fees as long as they get access to the mobile Internet. In addition, it also provides users with various social networking service functions such as text communication, picture sharing, voice intercom and video conversations. It has developed from an app with simple social functions to one with multi-media communication, multi-dimensional social contact and mobile payment (Yu & Tong, 2015). On August 18, 2012, WeChat opened the WeChat public platform, through which key media and businesses can publish, send and maintain information (Yu & Tong, 2015).

The hospital WeChat public platform is a new medium for hospital service and promotion in recent years, and it mainly includes subscription account and service account. The former is mainly used to release information to the public and is focused on displaying and promotion; the latter mainly offers services such as online registration and self-service payment and is focused on the function of offering services (Zhang, Wang, He, & Shen, 2016). Many of the services that originally required the use of app can be developed through the WeChat official accounts (Ruan, 2016). Medical institutions as well as enterprises and businesses in the medical and health care sector also take advantage of the WeChat public platform to develop medical information service system based on WeChat official account so that patients can enjoy the medical information service of hospitals without going to the hospital (Pang, Wu, & Zhou, 2015). The functions of WeChat medical service model are similar to those of medical apps, but with this model users do not need to install apps and the services are more convenient (Ruan, 2016). The WeChat medical services include appointment registration and treatment, online consultation, health education information push, medical treatment online payment, query of examination results, online purchase of medical products (Chen, 2014; Pang, Wu, & Zhou, 2015; Zhang, Liu, Wu, Wang, & Yang, 2015)

Ma and Xie (2014) carried out a SWOT analysis on medical service models based on micro-media such as WeChat and believe that they bear several strengths:

(1) They are more flexible, individualized and convenient. Users can communicate with doctors in a "person-to-person" manner in any place and at any time for information consultation, mutual communication, information notification or follow-up visits. An initial diagnosis can be made by sending pictures or videos to get medical instruction and relevant information, which has broken the limitation of time and space for medical services.

(2) User information and privacy are well protected so that they can communicate with doctors in a more candid manner about their conditions and cooperate with doctors in interaction.

(3) Medical institutions and individual users must pass real-name authentication, which, to some extent, has enhanced the authority and legitimacy of micro-media medical services.

12

Some scholars believe that the WeChat medical service mode can optimize the hospital information service mode, enhance interaction between doctors and patients, and improve convenience of services. At the same time, through the regular push of hospital information, a stable service mechanism can be established (Zhou, Lu, Lu, & Zhang, 2015). Most studies and reports are positive and optimistic about the mode in which the WeChat platform is applied in community hospital diagnosis and treatment services. Some scholars point out that community diagnosis and treatment is the major medical platform for chronic disease intervention (Xu, Qi, Cai, Liu, & Wang, 2017). The traditional health education and management mode is based on face-to-face communication, so it is limited by time and space, and the information dissemination and feedback efficiency is low, which is not conducive to long-term communication between doctors and patients. In contrast, mobile social media such as WeChat are characterized by the function of instant messaging, various forms of information dissemination as well as tremendous user base, and all these features are conducive to optimization of the management of community chronic disease. Some primary-level hospitals in China attempt to carry out preoperative interview through the WeChat official account. Shen, Chen, Du and Guo (2016) chose 201 patients to get elective surgery as the observation group and give them preoperative interview through the WeChat official account apart from traditional preoperative interview compared with the control group. Results show that the anxiety rating and postoperative satisfaction of the observation group is much better than that of the control group. It proves that this measure can ease preoperative anxiety and tension of patients and reduce workload of the medical staff. Gu and Li (2017) found out that with the application of WeChat group among family doctors in Changning District of Shanghai, the appointment rate, compliance rate and treatment rate have improved significantly and among chronic disease patients, the appointment treatment rate of patients in WeChat groups is significantly higher than those not in the WeChat groups.

1.2 Motivation and Questions

1.2.1 Theoretical Motivation

As the literature review in Chapter II illustrates, scholars have carried out a considerable amount of studies on user technology acceptance, adoption, and application behavior. Relevant theories and models have been developing continuously, involving different disciplines. The American perceptual psychologist Gibson (1977) proposed the word "affordance" when studying how animals perceive the surrounding environment and defined the concept as what is offered, provided, or furnished to someone or something by an object material or immaterial. Norman (1988a) introduced the notion of affordance into the field of human-computer interaction. The word was new to the human computer interaction vocabulary and the concept was approximately novel: an affordance is the design aspect of an object which suggests how the object should be used.

According to the literature review, first, there have been few studies on mobile internet information technologies supporting family doctor service in China and abroad; second, in the past research on human computer interaction, there are few analyses of the concepts of affordance; third, past research on affordance is more restricted to the individual psychological perception and understanding of things, while the formation of behavior (i.e., the realization of affordance) as well as the relationship between the realization of affordance and correlation satisfaction is less studied.

1.2.2 Practical Motivation and Questions

Despite the optimistic and affirmative attitude of various parties who believe that the WeChat official account can improve medical services, some studies in recent years revealed that the results of the application of the WeChat platform have not been satisfactory. Xu and Liu (2017) investigated the establishment, usage and participation of WeChat official accounts in 245 community hospitals in Shanghai through a questionnaire and found that the amount of information push and followers is not satisfactory and the situation in downtown areas is significantly better than in suburban areas. There are problems including insufficient

development of interaction and other functions, tardy information push, low user awareness, and irrational information push form and content. Ge et al.(2017) also reached similar conclusion in their investigation of the application of WeChat platform in community hospitals in Shanghai. They found that there is a huge gap between the amount of information push, reading volume and number of followers among different community hospitals in downtown areas.

There are also some prevalent problems such as mismatch between functions and community service positioning, unclear service positioning and deficient platform management. Li et al. (2015) investigated 32 large public hospitals in Guangzhou and found that their WeChat official accounts mainly involve self-promotion and some online services with no touch upon medical process optimization and reengineering or transformation of traditional medical service mode. Informal conversations held along the last three years with some community hospital staff reveal that the actual use of the WeChat platform only few users actually use it to assist community medical services. To address the dilemma of the application of the community WeChat platform, relevant scholars have carried out some targeted studies and found that the difference in the application of the WeChat platform may be related to attributes of the users including the difference between demand and preference. Zhang et al. (2016) interviewed 2,760 followers of the WeChat official account of the Obstetrics & Gynecology Hospital of Fudan University through a questionnaire and found that users have high demands in "online registration" and "self-service examination report query" and low demands in "self-service payment" and "push of science popularization". The low demand of "self-service payment" is because users feel insecure about online payment. In addition, affected by familiarity of the usage of electronic equipment, only 37.1% of the users over 51 years old have the demand for "self-service payment", which is much lower compared with users in other age groups. As for the reasons why users terminate subscription of the official account, the most frequent one is "repeated push of the same information". Ye (2017) found out in an investigation in Guangzhou that age has a significant influence on adoption intention. To be specific, young and middle-aged users have higher adoption intention toward mobile family doctors than the elderly.

The contrast of this situation raises the following questions: what are the factors affecting the adoption of the community hospital WeChat client app? Is it related to some particular individual factors? Does the difference of individual technology acceptance behavior affect patient satisfaction with medical service？

1.3 Research Significance

This study is expected to probe into the practical application of the community of the WeChat client app and apply the concepts of affordance to further design a model on the basis of previous and specially conducted research to analyze individual affordance in mobile internet technology from the perspective of individual psychological perception, understanding, assessment and utilization behavior, and explore the relationship between specific individual characteristics and application of technology. The research attempts to identify potential factors affecting the effectiveness of system application from specific perspectives and evaluate the impact of system application on medical service satisfaction and doctor-patient relationship so as to identify which demands should the system improve. We hope to develop a relationship framework that may guide the analysis and evaluation of the application effectiveness of new information or electronic services from an individual perspective so that the research may have significant theoretical and practical implications. For example, it might help information technology providers to understand the demands of users more accurately, so that the design and innovation can be better accepted.

Chapter 2: Literature Review

Based on the research problems discussed in this thesis, this chapter reviews literature on innovative technology diffusion and user technology adoption and application behavior as well as literature on affordance as the main theoretical basis for this study. From the perspective of technical cognition, understanding and application behavior by individual users, the study analyzes their impact on the promotion and application of innovative information technologies. These theories contribute to designing the questionnaire, explaining the findings, reaching conclusions and proposing suggestions.

2.1 Research on Individual Technology Adoption Behavior

Research on technology adoption in the 1970s and 1980s was mainly based on the Technology Assessment Act 1972 formulated by the United States (Congress, 1972). The purpose of the Act was to study the impact of technology and to evaluate competitive alternative technologies (new technologies). Results in this period show that the technology adoption behavior is closely related to the profit, performance, and competitiveness of the organization (Wolek, 1975; Worthley, 1980).

With the widespread use of personal computers and mobile phones, more scholars have focused on the technology adoption behavior of individuals (Andrews, Luo, Fang, & Ghose, 2014).The current research focuses on two aspects: technology characteristics and user characteristics (Varma, 2011). Initially, scholars emphasized the predictive function of personal beliefs on the degree of technology acceptance, but in later studies it was found that optimization of technology characteristics can also promote user acceptance and, in essence, it has the same goal as the study of user characteristics (Davis, Bagozzi, & Warshaw, 1989). Research on technology characteristics is based on the analysis of objective beliefs: the quality of the interface and functions of the system determines whether the user adopts it or not, which is more related to system design. The relevant research hopes to promote user

adoption behavior and facilitate technological change by promoting and improving the design philosophy and optimizing the features of the technology products (Madron, 1981; Hartson, 2003; Norman, 2004).

The earliest research on user characteristics was carried out by Davis (1989) who established a research model based on sociological and psychological theories, studied individual technology adoption from the viewpoint of individual user's internal beliefs and transferred the research focus from technology characteristics to the user's perception of these characteristics. These theories emphasize that individual characteristics and individual beliefs have an important influence on the technology adoption behavior of individuals and also restrict the individual's perception of technology, or in other words, the subjective characteristics of individuals affect the technology adoption behavior of individuals. For the research on technology adoption behavior based on user characteristics, Varma (2011) summarized the research orientations as follows: focus on the acceptance of new technology through prediction of adoption behavior; identification of explanatory variables according to influencing factors so as to promote technology adoption behavior; and, most importantly, exploration of additional influencing factors and corresponding explanatory variables to expand and optimize the research model. This study also focuses on individual characteristics and pays attention to the subjective perception ability of individuals so as to analyze their technology adoption behavior.

2.1.1 Theory of Reasoned Action and Theory of Planned Behavior

Theory of Reasoned Action (TRA) is a social psychology theory (Fishbein & Ajzen, 1975). Based on the hypothesis that people behave according to rational consideration and analysis the theory analyzes how individual attitudes consciously affect individual behavior. According to this theory, the attitudes and subjective norms of behaviors determine individual behavioral intention, which in turn can be the predictive factor of any voluntary behavior. To some extent, we can make reasonable predictions of individual behavior through individual behavioral intention (Fishbein & Ajzen, 1975; Ajzen & Fishbein, 1977, 1980). The conceptual model of TRA is shown in Figure 2-1.
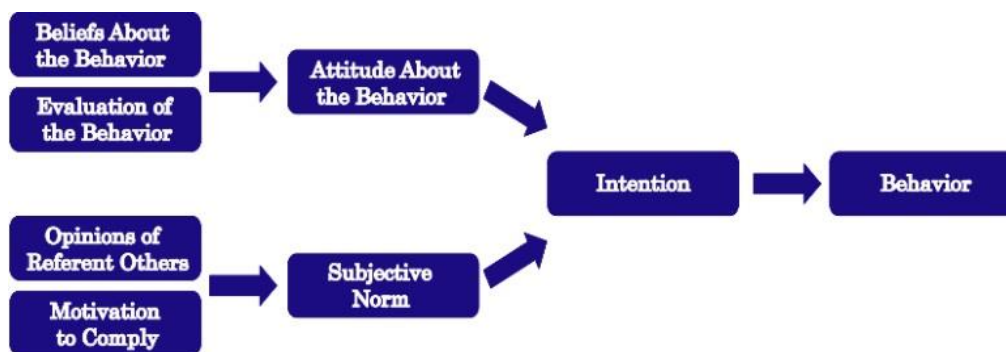
Figure 2-1 Theory of Reasoned Action Model

Source: Fishbein and Ajzen (1975)

Behavioral intention is used to measure whether individuals are going to be engaged in a specific behavior, while attitude is the emotion that individuals hold towards the behavior outcome. The attitude may be positive or negative and is determined by the individual's belief in the outcome of the behavior and the evaluation of the importance of the outcome. Subjective norms refer to the external stress felt by individuals arising from whether or not to take a specific behavior. The sources of stress may be those who have significant influence on them (family, friends, and colleagues). It depends on the individual's trust in the opinions or suggestions of others and the individual's level of motivation to stay consistent with the opinions of others. Based on the above-mentioned factors, individuals develop behavioral intention (propensity) and carry out final behavior (Fishbein & Ajzen, 1975).

As relevant research advances, scholars have found that the model has limitations and faces some challenges as follows (Sheppard, Hartwick, & Warshaw, 1988). First, the target behavior is not completely controlled by the individual will; second, the situation involves a selective problem with no explicit solution; and/or third, in assessment of the intentions of respondents, they are unlikely to hold all necessary information to form a fully affirmative intention. In other words, human behavior is not entirely voluntary, but is also controlled by certain other factors. Some scholars believe that in the TRA theory, attitudes toward specific behaviors affect behavior through intention, but this theory indicates that behaviors are only controlled by intention, which limits behavior to the category of volitional behaviors (Terry, Gallois, & Mccamish, 1993). However, a considerable part of behaviors cannot be formed

without skills, resources or specific opportunities, and these resources are often not freely available, in which case TRA cannot be used for analysis.

Ajzen (1985, 1991) further developed the TRA model and proposed the Theory of Planned Behavior (TPB) as per Figure 2-2. Through the two models we may infer that, based on deliberate considerations of available information, individuals make corresponding decision of behavior (Conner & Armitage, 1998). TPB extends the range of application of TRA as the combination of perceptions of control and behavioral performance is used as an additional predictive factor to predict involuntary behavior (Ajzen, 1985, 1991). The link between intentions and behavior reflects the fact that people tend to engage in behaviors they intend to perform. This relationship suggests that we are more likely to engage in attractive /desirable behaviors we have control over and suggests that we are prevented from carrying out behaviors over which we have no control (Conner & Armitage, 1998).
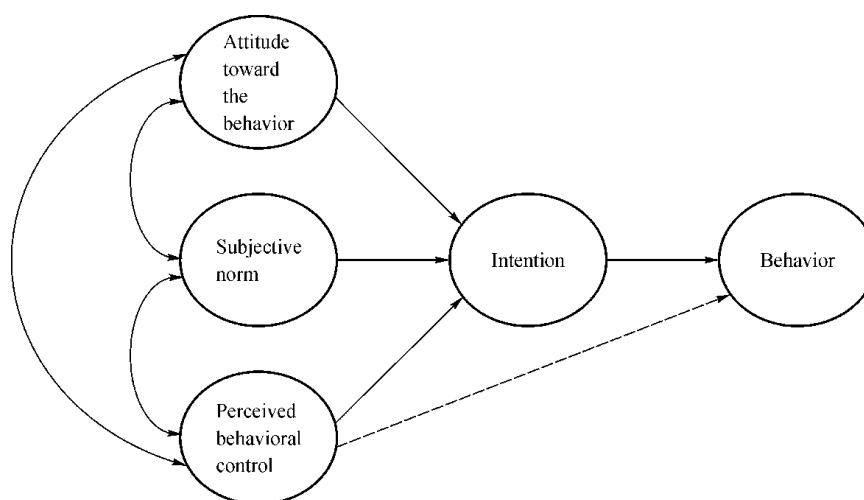
Figure 2-2 Theory of Planned Behavior Model

Source: Ajzen (1985)

Perceived behavioral control (PBC) is the individual's opinion on the difficulty level of behavior or performance. In TPB, behavior is considered as the result of behavioral intentions which are directly influenced by attitude, subjective norms, and perceived behavioral control (Ajzen, 1985, 1991). Many studies prove that TPB is more advanced than TRA, allows a wider range of applications and can be used to successfully predict the performance of behavior and intention in many cases such as the analysis of new software. Some scholars have also carried out a similar experiment by analyzing the difference in prediction of online

20

knowledge transfer behavioral intention by TRA and TPB. Results show that, compared with TRA, TPB offers the most appropriate data and effectively explains the variables accounting for the highest percentage in the online knowledge transfer intention (Fang, Yang, Lin, Yang, & Yu, 2007).

2.1.2 Innovation Diffusion Theory

Rogers (1995) developed the concept of Innovation Diffusion Theory (IDT) and argued that diffusion is the process by which an innovation is communicated over time among the participants in a social system. The process occurs within a specific period of time and includes factors such as precondition (such as making the change), innovation characteristics and resultant conditions (adoption or rejection). Such description of innovation diffusion process was later compiled by other scholars as for example in the model shown on Figure 2-3 (Varma, 2011; Marangunić & Granić, 2015).
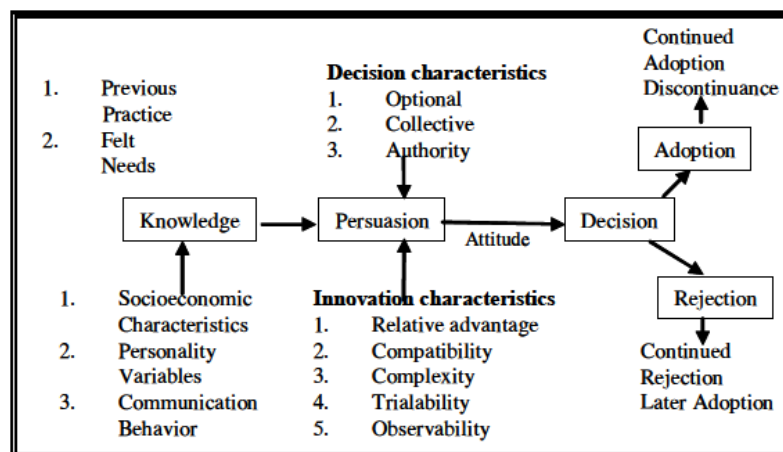
Figure 2-3 The Innovation Diffusion Model

Source: Varma (2011)

The above figure shows that the whole process starts from the individual perception of innovation, which should be based on individual characteristics such as knowledge base and personality. After the stage of perception, the individual needs to analyze the feasibility of innovation adoption based on innovation characteristics, and this stage is defined by Rogers (1995) as persuasion. Rogers (1995) pointed out five significant characteristics of innovation that directly affect the organizational or individual innovation acceptance behavior: relative

advantage, compatibility, complexity, observability, and trialability. In subsequent studies, some scholars also complemented these characteristics.

Research shows that there is significant correlation between perceived innovation characteristics and innovation acceptance (Labay & Kinnear, 1981). At the stage of persuasion, the individual is interested in the innovation and actively seeks related information/details. This stage is the most important as it determines whether the individual accepts the innovation. The perception and cognition of the individual at the persuasion stage will generate a positive or negative emotion which will affect the individual adoption of innovation. In other words, individual attitude toward innovation will ultimately determine whether the innovation will be adopted. As a result, research on individual perception of innovation characteristics is valued in the innovation technology design field as it is considered to be the major approach to understand user demands. In addition, researchers have also found that opinions of potential adopters are also influential (Jaw et al., 2012).

The five innovation characteristics proposed by Rogers (1995) are based on the influence of individual motivation and inertia (intermediary variables) and determine the final adoption intention of E-services, whereas the cognitive competence (including capability, experience and need for individual interaction) of individuals is the direct factor affecting individual adoption intention of E-service. However, there are also different studies showing that the five innovation characteristics proposed by Rogers (1995) have different influences on innovation adoption behavior. For example, Venkatraman (1991) found that only relative advantage has a significant correlation with innovation adoption behavior. Tornatzky and Klein (2013) analyzed the ten innovation characteristics mentioned in the previous literature and results showed that only three innovation characteristics have an influence on innovation adoption behavior. As a result, the original innovation diffusion model has been extended to focus on individual awareness and motivation. Jaw et al. (2012) found that psychological factors such as motivation and inertia of users have significant direct and mediation effect on their innovation adoption behavior. .

The Complex Adaptive Systems (CAS) theory is an agent-based model and is linked to innovation diffusion theory. Proposed by Holland (1995), it is defined as a set of systems

composed of interacting agents described in terms of rules. The agents adapt by changing their rules as experience accumulates (Holland, 1995). Nan (2011) further developed the CAS model and integrate it with IT Use model and used it to analyze user interaction and communication of IT innovation technology. He pointed out that in the social organization environment, innovation diffusion is a bottom-up process and made extensions from which a new model was derived as per Figure 2-4.
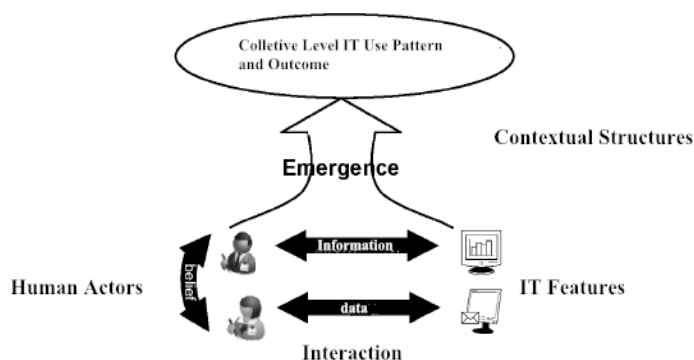
Figure 2-4 The CAS Model of IT Use

Source: Nan (2011)

In 2014, Nan, Zmud and Yetgin (2014) extended the model and found that many innovation characteristics have been proposed in previous research and there are significant differences as to the possibility of innovation being applied in different agents. As for the driving mechanism of agents adopting innovation technology behavior, Nan et al. (2014) believe that it is directly connected with the psychology of agents (users). They interpreted the Awareness-Motivation-Capability (AMC) Framework proposed by Chen and Miller (2012), namely, awareness (of innovation), motivation (to adopt an innovation), and capability (to understand and to apply an innovation) proposing that the three behavioral driving force structure in the AMC Framework well explains the process of innovation adoption: when agents have sufficient awareness of innovation, through assessment of innovation, they will realize the positive expected results brought by innovation and will have sufficient motivation to adopt innovation. In this way, agents (individuals or organizations) will be much more likely to adopt innovation.

2.1.3 Technology Acceptance Model

As human beings come into contact with various technologies in daily life, we play the role of users of different technologies, so we need to understand the reasons why technology is accepted or rejected. There has been in-depth research on this in the field of social psychology. The aforementioned TRA and TPB are important theories for exploring the predictors of individual technology adoption behaviors in the discipline. They and the Innovation Diffusion Theory (IDT) are the origins of the Technology Acceptance Model (TAM) (Varma, 2011; Marangunić & Granić, 2015).
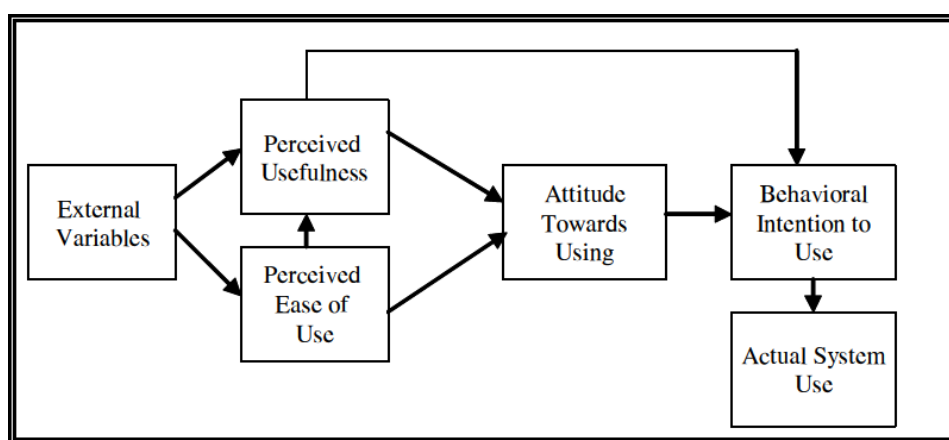
Figure 2-5 Technology Acceptance Model

Source: Davis (1989)

Based on the theoretical models of TRA and TPB, Davis (1989) carried out research on the process of individual technology acceptance. He further developed relevant variables, extended the individual acceptance model and developed TAM (see Figure 2-5) whose focus is on the influence of attitude towards behavioral intentions. To be more specific, if individuals believe that a specified knowledge can help achieve expected goals or improve job performance, they will generate the behavioral intention to use regardless of the attitude (Varma, 2011). The model also includes two influencing factors of attitude: Perceived Usefulness (PU) and Perceived Ease of Use (PEOU). According to TAM, the IT acceptance behavior can be explained by individual faith in PU and PEOU (Davis, 1989). PU is the attitude of believing in the usefulness of technology in work after evaluation (Davis, 1989). PEOU is the attitude of believing in the ease of mastering or operating the technology after

evaluation. Although both PU and PEOU are significantly correlated with behavioral intention to use, Davis (1989) has proved that this is not merely determined by individual attitude, but also affected by PU. TAM has been proved to have good predictive validity as for individual technology adoption behavior and is widely applied in the analysis of various types of information technology.

Research based on TAM shows that results are not completely consistent and clear, so it is believed that the TAM model is yet to be improved with important factors not included in the model (such as human beings and factors related to social change) (Legris, Ingham, & Collerette, 2003). As a result, scholars carry out relevant research, hoping to improve supplementary factors affecting user belief and attitude and further understand mechanism of individual technology acceptance. By proposing additional variables and factors and integrating them into the original model, they further extend the TAM and interpret the predictors in the core part of TAM. Resulting interpretations is the Unified Theory of Acceptance and Use of Technology (UTAUT) (Venkatesh, Morris, Davis, & Davis, 2003).
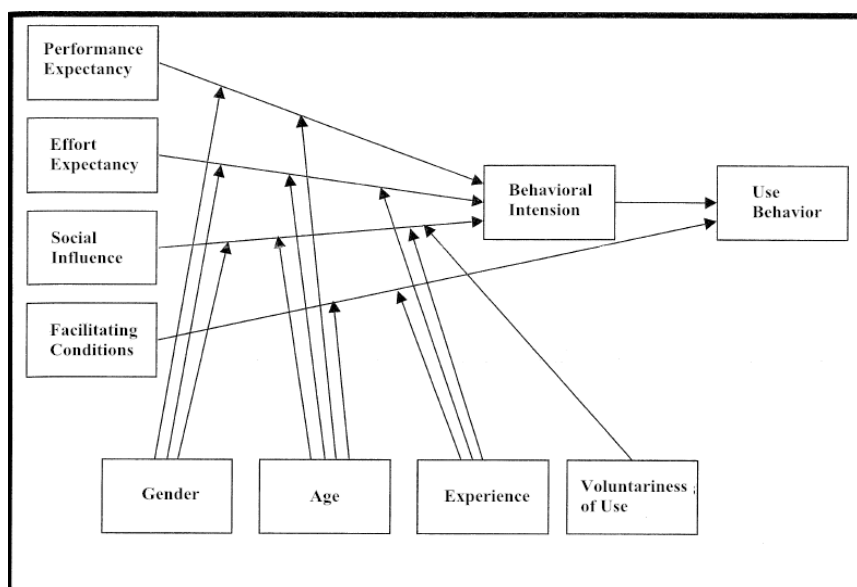
Figure 2-6 UTAUT Model

Source: Venkatesh et al. (2003)

Venkatesh (2000) explored the definition of antecedents of PEOU and proposed that anchors and adjustments are its two major antecedents, both being considered to belong to individual beliefs. Anchors are the general beliefs of computers and usage of computers held

by individuals while adjustments are beliefs about the target system based on direct experience. He reviewed determining factors of antecedents of PEOU from previous research and found out that they include subjective norms, PBC and self-efficacy in TPB as well as individual-related beliefs mentioned in IDT. In 2003, based on all the previous research on technology acceptance, Venkatesh et al. (2003) further extended TAM and proposed UTAUT (see Figure 2-6).

2.2 Research on Affordance

The Affordance Theory was first proposed by Gibson (1979). However, his research subjects were not human beings but animals, and the scope was to understand how animals perceive their surrounding environment. With a rock as an example, he asked why different animals have different ways to use the same object (rock) and interpreted that this is because different animals all believe that rocks are useful, but their perception of how they are useful is different. He believes that animals do not perceive what an object is, but what applications this object can afford. Animals' perception of object applications involves both the environment and the animal. It is a complement of the environment and the animal, and since there is no specific term on this concept, he named it as affordance. His definition of affordance is "what is offered, provided, or furnished to someone or something by an object" (Gibson, 1979). According to Gibson (1979), affordance is one of the properties of an object or the environment, just as solidity is the property of rocks and it enables rocks to smash other things. The property of affordance is offered to animals (users) by the environment or an object and it is objective and independent of users. That is to say, affordance is the behavior that users believe to be possible to be realized.

Gibson (1979) once gave an example to illustrate the application possibility of a tool: "An elongated object, especially, if weighted at one end and graspable at the other, affords hitting or hammering (a club). A graspable object with a rigid sharp edge affords cutting and scraping (a knife)". The example shows that affordance is a kind of stimulus information to animals although they have specific properties and sense organ abilities. Animals also need to learn to capture this information, only in this way can we identify whether it is meaningful or

26

has value in use. Gibson (1979) explained the difference between materiality and affordance of an object by pointing out that materiality refers to the size, color, texture, composition and measurements of an object. However, when meeting across objects, what we perceive is their affordance rather than materiality. Materiality can be measured by experiment, but affordance needs attention and perception. Gibson and Pick (2000) further developed the concept of affordance and explained that affordance can be perceived directly by the actor without beforehand synthesis or analysis of relevant information. Because the material out of which an object is made can provide multiple affordances, it is possible that one object can produce multiple outcomes (Treem & Leonardi, 2012).

2.2.1 Controversy about the Nature of Affordance

After Gibson (1979) proposed the concept of affordance, there have been three contradictory views on the concept in the field of ecological psychology. The first view is the natural selection view, which contends that affordance refers to resources in the environment as well as properties of objects and it can be developed by some particular animals (Reed, 1997). The second view is the tendentiousness view, which contends that affordance refers to properties of the environment (Turvey, 1992), and this view has also been recognized by many scholars. They often assume that the environment has the property of usability and attempt to establish an affordance ontology (Chemero, 2003), but the assumption is also controversial, because materiality is independent of human beings, while affordance is not.

People use materiality out of different goal intentions, so their perceptions of affordance differ. Similarly, in the same environment, the affordance of a technology product may change, and people's perception of the affordance of technology products may also change and even believe that the change hampers the realization of their behavioral objectives (Treem & Leonardi, 2012). Chemero (2003) uses direct theories of perception to interpret the assumption of affordance by Gibson (1979). He points out that according to the understanding of direct theories of perception, meaning exists in the environment and perception does not depend on the inferential meaning; for animals, they do not need inference in the perception of meaningful environment since they only collect information from the environment. This

happens to coincide with Gibson (1979) view that affordance is an environmental property. However, it is pointed out that if the environment has meaningful contents (Chemero, 2003), they are unlikely to be only physical properties, which is contradictory to the requirement of direct theories of perception that there should be an ontology. As a result, Chemero (2003) proposed the third view, believing that affordance is not a property of the environment, and the perception of affordances of animals is different from the perceiving properties of objects. He believes that affordance refers to relations between the abilities of organisms and properties of the environment. In other words, Chemero (2003) believes that affordance is not a static property, but a relational property between dynamic organisms and the environment.

2.2.1.1 Affordance: A Perception-Centered Interpretation

Norman (1988a) applies affordance in the design of an object and offers advice for the use of the object. He believes that the perceived and actual property of an object is determined by the fundamental property of how the object could be used, and the experience, knowledge or educational background of the actor as well as whether the object offers a convincing clue to the various possibilities of operation. He also makes a simple example that an individual can easily perceive that interface widgets such as sliders and buttons can produce anticipated behaviors such as sliding, squeezing and rotating. Therefore, based on the theory of Gibson (1979), Norman (1988a) contends that affordance refers to the perceived properties of the things that determine just how they could possibly be used and stresses that affordance is related to the physical property of users and their moral or spiritual properties. He has also enriched the concept of perceived affordance stating that this can tell users which behaviors can be conducted on the object and how (Norman, 2008). Gibson (1979) believes that affordance is a physical property which Norman calls real affordance. Norman (1988a) contends that the property perceived by the actor may or may not be a factual property, but anyway it is an affordance. He agrees with the concept proposed by Gibson (1979) that affordance is physical properties and names it real affordance stressing that perceived affordance is no less important than real affordance arguing that, as for the design of daily necessities, the ultimate goal is that the design can convey understandable and easy-to-use information about affordance. Therefore, to designers, they should focus more on user

perception rather than the reality.

In fact, Gibson (1979) had also mentioned that the realization of affordance requires perception by the actor, and described it as perceptual information about an affordance. Mcgrenere and Ho (2000) analyzed the differences between the two previous researchers in their explanation of affordance and concluded that, for affordance exists independently from the experience and culture of the actor and is mainly based on action capability of the actor. In contrast, Norman (1988a) integrates affordance with the past knowledge and experience of the actor and is mainly based on the mental and perceptual ability. The fundamental difference lies in the fact that Gibson (1979) focuses on the possibility of action, while Norman (1988a) stresses that the possibility of action is as important as the way the possibility is conveyed and showed to the actor. Gibson (1979) is interested in how we perceive the environment, while Norman (1988a) is more interested in manipulating or designing the environment to make it easier to be perceived (Zhao, Liu, Tang, & Zhu, 2013).

Based on Gibson's and Norman's research, Gaver (1991) carried out further research on affordance by considering affordances in design as an approach to study technology strength and weakness and analyzing the possibility of the technology being adopted by users. He also extended the original conceptual model and found that one or multiple groups of affordances can generate a series of complicated actions under the alternation of time and space. He also found how, with the passage of time, affordances present themselves and make users take actions. Gaver (1991) argues that the direct perception of affordance is the result of direct link between perception and action. This link can help users to understand the affordance given by an object. With a doorknob as an example, he illustrates the difference between behaviors based and not based on affordance. To understand that a doorknob can be pulled does not need cognitive resources, but to understand that a lock can only be locked by rotating the key does need. Mcgrenere and Ho (2000) concluded three basic properties of affordance: first, the existence of affordance is linked to the disposing capacity of a particular actor; second, the affordance is independent from the perception capability of the actor; third, the affordance will not change with the change of the demands and goals of the actor. They strongly suggest that affordance should be separated from perception and believe that this separation can help

researchers better identify the practicability of the design of an object (its affordance) and the usability of the design of an object (information reflecting affordance).

Hartson (2003) further identified four types of affordance: physical affordance, cognitive affordance, sensory affordance, and functional affordance. Physical affordance is the design feature that supports or promotes physical behavior, cognitive affordance is the design feature that supports thinking or learning, sensory affordance is the design feature that supports or facilitates user perception, functional affordance is at a higher level compared with physical affordance and is the design feature that supports physical action to realize some functional use.

2.2.1.2 Affordance: An Activity-Centered Interpretation

Chemero (2003) believes that affordance is closer to the concept of feature placing according to which what people perceive is not the properties of objects, but the whole situation with specific characteristics. He points out that it is wrong to consider affordances as properties of any object as they are relations between animals and properties of situations. Stoffregen (2003) also proposed similar views, contending that affordance should be an "animal-environment" system rather than the environment only. Klaus and Trettvik (2002) proposed their unique view, which is centered on affordance interaction. They recognized the positive role of affordance in the field of human-computer interaction (HCI) as it can improve the intelligibility and usability of artifacts (especially the part of user interface), but they contended that the affordance defined by Gibson (1979) failed to realize dichotomy of psychology and philosophy, focusing too much on the emotional part while neglecting the activity of the organism as a largely implicit precondition. They pointed out that affordance is not a property of the environment, but it can help understand the common points between users and their environment.

The affordance of an artifact is not the property of this artifact and is not only the relationship between user and the object. Instead, it is the complementarity and interaction between user and object as well as user and environment. It is an inseparable "user-environment" system, which coincides with Stoffregen (2003) view. In this context, affordance is the interaction between organism and objects in a particular environment. In this

environment, when users interact with the environment, there will appear affordance. The users proactively take part in the interaction with the artifact and constantly make explanations on relevant situations, constructing or reconstructing its significance.

2.2.2 Application of Affordance in Human-Computer Interaction (HCI)

As a novel concept, affordance can help explain why people can carry out different work practices with the same technology as well as optimize the design of technology products and strengthen the humanized concept (Norman, 2004). Since the concept of affordance is widely used in daily life, its research scope has been extended from the nature to artifacts.

According to a number of studies on Information System, affordances hold promise for a relational middle ground between technological determinism and social constructivism (Barley, 2010; Robey, Anderson, & Raymond, 2013; Stendal, Thapa, & Lanamaki, 2016).

Affordance has been widely applied in the field of HCI (Vyas et al., 2006), and became popular after Norman (1988a) published his monograph. He argues that the concept of affordance can be used in the design of daily objects and introduces the ecological view of Gibson to the design and application of HCI (Hartson, 2003). Norman (1988a) believes that when affordances are taken advantage of, the user knows what to do just by looking: no picture, label, or instruction is required. In this way, affordances offer a powerful clue to the operation of objects and can be used as the design specifications. Norman (1988a) proposed a new concept named "signifier", which is defined as some sort of indicator, some signal in the physical or social world that can be inherited meaningfully.

However, it is Gaver (1991) who started to explore the concept of affordance in a systematic way. Based on the relationship between affordance and perceived information, he identified three types of affordances, namely, visible, hidden and false affordances. He also analyzed the hierarchical relation time-dependent relation among simple affordances, and further proposed the concepts of nested and sequential affordances. You and Chen (2007) redefined how to apply affordance in design and stressed that the concept of product semantic – the study of the symbolic qualities of man-made forms in the cognitive and social context of their use and application of this knowledge to industrial design (Krippendorff & Butter, 1984)

– is an important term in product design.

Kaptelinin and Nardi (2012) concluded from Gibson (1979) research that the fact that technology conveys the possibility of meaningful action to users is key to the design of interactive systems. Kaptelinin and Nardi (2012) pointed out that technology can be considered as an intermediate instrument, by which people can interact with objects in the environment. The possibility of a technology to provide action involves two aspects: first, the possibility of interaction with technology (handling affordance) and second, the possibility to apply technology and work on the object (effecter affordance). Under the background of interaction design, the user perception and physical and sensory action need affordance to support each other. He defines affordance as an instrument for focusing on links in design among the user, the actions, and the artifacts.

By identifying the perceived affordances of users, Seet and Goh (2012) further explore how they affect user adoption of a collaborative learning system in e-reader devices and found out that there are five major affordances affecting user adoption of the system, namely, mobility affordance, support affordance, connectivity affordance, immediacy affordance, and collaborative affordance. Some scholars even use the affordance to study how robots carry out complex tasks (Kammer, Schack, Tscherepanow, & Nagai, 2011).

More recently there appeared a new concept of technology affordance defined as the action potential (Carr, 2000; Majchrzak & Markus, 2012), that is, what an individual or organization with a particular purpose can do with a technology or information system. The proposition of this concept stresses the status of the affordance theory in the research on individual or organizational technology use and further applies it to study how information systems affect individuals, organizations and their performance (Pigni, Pozzi, & Vitari, 2014).

2.2.3 Affordance and Social Media

The new generation instrument of computer mediated communication (CMC) is often called social media, with the functions of information diffusion, relationship development, and establishment of conversation and connection (Kietzmann, Hermkens, Mccarthy, & Silvestre, 2011). Some scholars define social media as socio-technical systems, websites or

applications built on Web 2.0 technologies to provide space for social interaction, communication, collaboration, and community formation" (Zhao et al., 2013). In recent years, social media have been put into practice widely and rapidly in the form of blogs, Wikipedia, social networking sites, social tagging and micro-blogs, which have been developing at a stunning rate (Treem & Leonardi, 2012). As an innovative technology, social media have been the focus of the academia and it has been found that although having fixed features, their affordances take on social structure features (Leonardi & Barley, 2008). Junglas, Goel, Abraham and Ives (2013) believe that hedonistic tendencies are an important factor of information system adoption and acceptance. Information technology has wide social connotations (sociability) and users can use it to exchange with others, which promotes socialization joy, improves interpersonal relationships, and generates happy and positive emotions. This conclusion coincides with the notion of socio-materiality which means that objects, technology (Leonardi & Barley, 2008), individuals and organizations have no fixed meaning, boundary or property (Dolling, 2010). That is to say, technology, individuals and organizations are not viewed as mutually independent entities, they affect each other through interaction (Orlikowski & Scott, 2008). Scholars have proposed a new concept—social media affordance to designate the affordance property of social media, the definition of which is described as the potential possibility of activities where users and social media can interact with each other (Cabiddu, Carlo, & Piccoli, 2014).

Studies on social media affordance are mostly focused on the activities that may be realized by social media in organizational practice. It is believed that the use of social media has created an opportunity to promote knowledge sharing, so that in the workplace within the organization, knowledge sharing transforms from intermittent and intensive knowledge management to continuous online knowledge dialogue with strangers, unexpected interpretations and re-uses and dynamic emergence (Majchrzak, Faraj, Kane, & Azad, 2013). Some stress that social media can support knowledge creation and their affordance can produce new behavior types (communication inside the organization is carried out with computers as the medium), which is conducive to supporting knowledge inside the organization (Wagner, Vollmar, & Wagner, 2014). There is also research in which technology

affordance is used to analyze how social media promote external communicative practice and create common values (Monu, 2015; Wang, Li, & Suomi, 2016).

In addition, based on the concept of social media affordance, many scholars have carried out research with social media as the research purpose and some have combined it with healthcare. Sun, Fang and Zou (2016) proposed a new concept of Mindfulness of Technology Adoption (MTA), developed TTF (Task-Technology Fit) framework and integrated it into a cognitive change model so as to describe how MTA affects user adoption mechanism and continuous usage of technology. They use this model to study the usage of wiki system by students and results show that mindful adopters can better perceive the usability of technology and are more likely to choose the technology that is proved to be suitable. According to Von and Ohno-Machado (2012), from 2007 to 2011, visits to Wikipedia for health information surged dramatically and Wikipedia has become a widely-used instrument of reference. Laranjo et al. (2014) evaluated the effectiveness of using social networking sites (SNSs) to change health behaviors. Results show that the SNS interventions have a positive influence on health behaviors. Some scholars conclude that social media play a positive role in promoting user health status (Merolli, Gray, & Martin-Sanchez, 2013).

2.2.4 Significant Progresses in Research on Affordance

In recent years, on the basis of previous research, scholars have carried out multifaceted research and exploration on the concept of affordance and have established innovative research models by integrating other mature theories and further extending the application scope of affordance. Through literature review, there are several main innovations in research on affordance of information technology applications as it is described below.

2.2.4.1 Actability Theory and Affordance

Goldkuhl (2009) argues that, in practice, users do not always have visibility in the process of human-computer interaction. He recognizes the statement that user interface is the intermediary between designers and users proposed in the Activity Theory (Bdker, 1987; Nardi, 1998) and the Actability Theory (Ågerfalk, 2003) and compares the Actability Theory with the concept of affordance.

Actability stresses that IT artifacts are applied in the work practice context, indicating that IT systems often mean structural communication between different users. Actability is defined as an information system's ability to perform actions, and to permit, promote and facilitate the performance of actions by users, both through the system and based on information from the system, in some business context (Ågerfalk, 2003; Cronholm, Ågerfalk, & Goldkuhl, 1999), and it has similarities with the definition concept of pragmatic duality which means that the interaction of a user includes two parts, namely, interaction with IT artefact as well as communication with other people (Sjöström & Goldkuhl, 2004). The Actability Theory distinguishes three types of communication patterns in human computer interaction (Goldkuhl, 2009): (1) users interpret the designer's thinking of implementation and communication through user interface, (2) users can read information that stems from others, (3) users can display communicative behavior through IT artefact, that is, IT artefact disseminate information to others in line with predefined rules and HCI situation. The different social roles of a user interface are described in Figure 2-7.
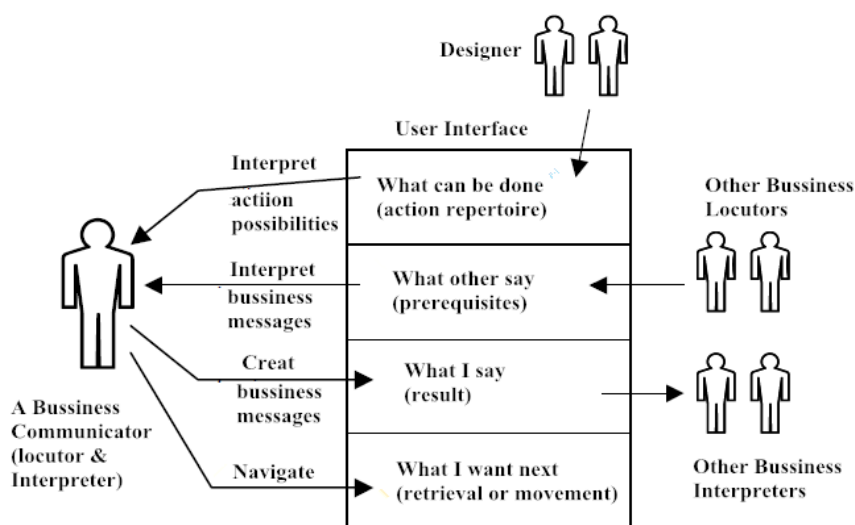
Figure 2-7 A communicative perspective on user interfaces

Source: Sjöström and Goldkuhl (2004)

Ågerfalk , Goldkuhl and Cronholm (1999) contends that actability is an information system's "ability to perform actions, and to permit, promote and facilitate the performance of actions by users". Goldkuhl (2009) concludes that actability is the correlation property of the following situations: (1) the behavior of an information system itself, (2) the behavior of

users implemented under system support. He believes that the Actability Theory can be viewed as a typical purposeful practical theory used for IT artefact design and assessment, and this view is similar to Mead's understanding of act (Mead, Morris, Brewster, Dunham, & Miller, 1938). Mead et al. (1938) divided act into phases: a perceptual phase, a manipulatory phase and a consummatory phase. In the first perceptual phase, actors try to understand the situation and the possibility of the behavior provided by it. In the second phase, actors get involved and change something. In the third phase, participants consume influence of behaviors including assessment of behaviors and their results and effects. Goldkuhl (2009) pointed out that this interpretation fully stresses the importance of perception in the whole behavior, and the perceptual phase and the consummatory phase is what constitutes perception. Based on Giddens (1984) activity theory, he pointed out that in the manipulatory phase, the actor monitors the world he acts upon, performs the corresponding behavior and implements the appropriate intervention just like the driving process of a driver, so it is important to add that the active manipulatory phase also includes perception. Goldkuhl (2009) further adjusted the three phases to pre-assessment, interactive and post-assessment, and identified a cyclic model of human action (see Figure 2-8).
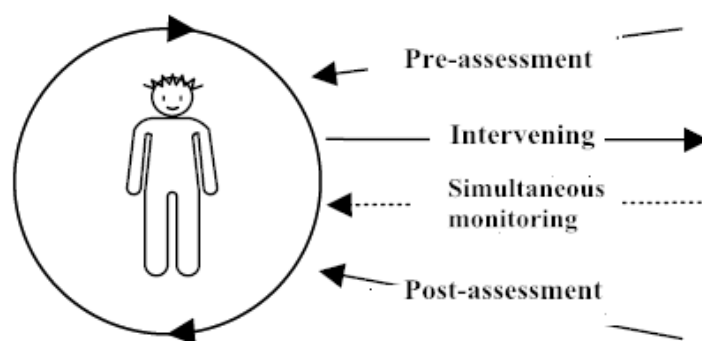
Figure 2-8 A cyclic model of human action

Source: Goldkuhl (2009)

Actability focuses on the human-to-human communication. According to Ågerfalk, (2003), there are three IT usage situations in the actability theory: interactive usage situation, automatic usage situation and consequential usage situation (see Figure 2-9). Interactive usage situation is a typical HCI situation where users can have interaction with IT systems and

36

obtain information of each other when communicating with the system, whereas the information belongs to a consequential usage situation. The behavior implemented by the system is considered to be action and this is the automatic usage situation. According to Goldkuhl (2009), the three situations involve three different relations between users and the system. Automatic usage situation is the internal situation of IT; interactive usage situation is the external situation and is directly related to users; consequential usage situation is also external but is only indirectly related to system.
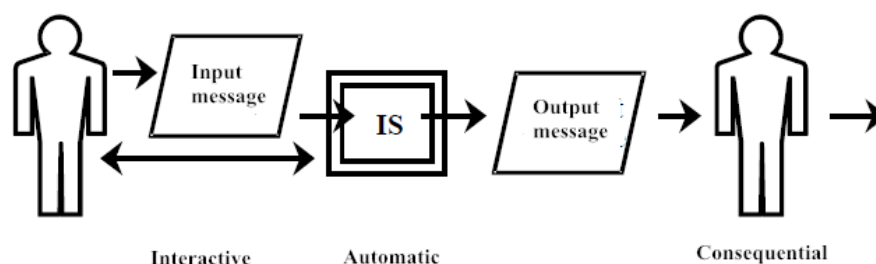
Figure 2-9 Types of actions related to three IT usage situations

Source: Goldkuhl and Ågerfalk (2002)

As for the relationship between actability and affordance, Goldkuhl (2009) argues on the basis of Gibson (1979) views that the key points of affordances are that they must be perceivable. The core of the issue of affordance is not whether affordances exist or are real, but whether information can be effectively perceived by actors. He contends that an actor does not only demand the possibility for action, but rather demands easiness for action. The affordances should be appropriate in relation to comfort and other human values. Therefore, affordance of things is what makes them actable, which coincides with the concept of actability. Goldkuhl (2009) stressed that an object is actable if it has executable and informative properties. In other words, there must be sufficient action possibilities which are visible, comprehensible and accessible.

2.2.4.2 Activation of Affordance-Meaning Pathway

Lu and Cheng (2013) made innovations on human–affordance interactions and established an innovative conceptual framework for human and human design. They began by reviewing the Product–Affordance–User model, which describes interaction between human

and computer, proposed by Galvao and Sato (2005) (see Figure 2-10) and focused on the application of artifacts suggesting that developers of artifacts should take into consideration affordances in three aspects: (1) affordance exists in products and is independent of human perception; (2) some properties of affordance can be perceived; (3) as long as users react, affordance will take shape.
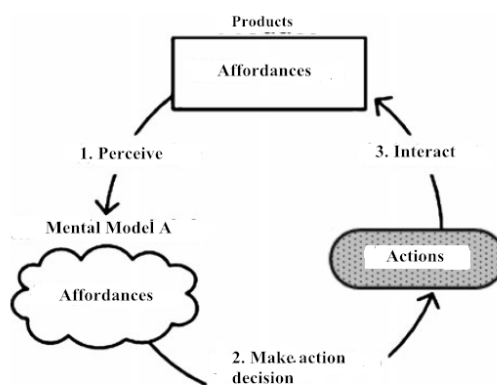
Figure 2-10 Product–Affordance–User model

Source: Galvao and Sato (2005)

However, Lu and Cheng (2013) believe that there is no in-depth discussion on the details at every stage of the affordance occurrence mechanism and while affordance exists in product architecture, it is not duly valued. As a result, they introduced two concepts of perceptual probability of affordance and perceptual threshold of affordance. Perceptual probability of affordance can be described as the possibility of someone to feel an inspiration (for instance: if the perceptual probability of affordance of an object is 80%, it means that 80% of the people can perceive the affordance). Lu and Cheng (2013) believe that perceptual probability of affordance has the following characteristics: first, the perceptual probability of affordance of an object may change in different situations; second, in different situations, different people may have different perceptual probability of affordance on the same object. In other words, perceptual probability of affordance is determined by three aspects: physical structure of an object (natural probability), how it is perceived in some situations (situational probability), and property of the perceived individuals. These authors also contend that designers should change their focus from functional design to functional expression and this kind of change can promote users to implement product functions. Therefore, perceptual threshold of affordance

38

refers to the threshold level of affordance perceived by individuals. When detecting the same affordance of one object, people may have different threshold levels.

In addition, Lu and Cheng (2013) pointed out the importance of the situation in the realization of affordance noting that the situation is not regarded as an important factor in any of the existing affordance models in practical application. An object provides a function, people have the ability to achieve it, but in some special situations, the behavior may not be implemented, and the meaning of the product may not be expressed. Therefore, they do not recognize the view that the relationship between the situation, human, and object is serial, and believe that once the situation and properties of the object are directly linked, the above three are in a parallel relationship, independent of each other and interacting with each other, forming a system of triangular relationship.
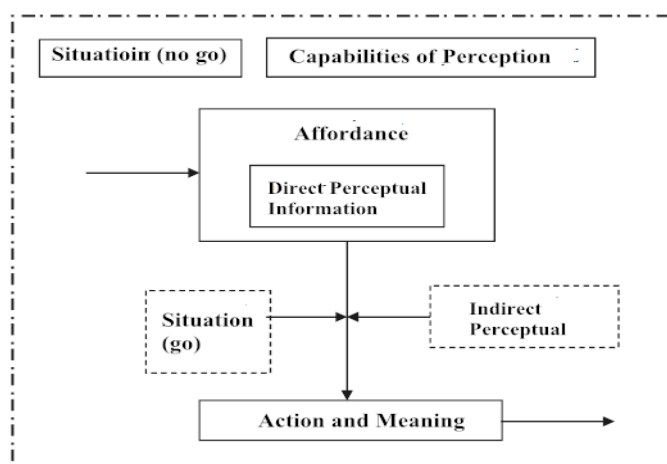
Figure 2-11 Affordance–Meaning–Generation Model

Source: Lu and Cheng (2013)

Based on the above-mentioned concept and analysis, Lu and Cheng (2013) defined affordance as functional meaning between objects and humans, where meaning is attained by perceiving and interacting with affordances, and proposed the Affordance Meaning Generation Model (AMGM) to explain the process of people extracting meaning from affordances shown in Figure 2-11. In the model, it is believed that individuals should first be able to perceive information from the object. In addition, whether an object can provide a certain functional meaning should be tested by human practice. The sudden change of environmental situations will cause the threshold of specific affordances to be extremely high

or low, which will break the permanent state of the perceptual system, prevent the indirect perceptual information from producing behaviors and affect the perception and realization of affordance.
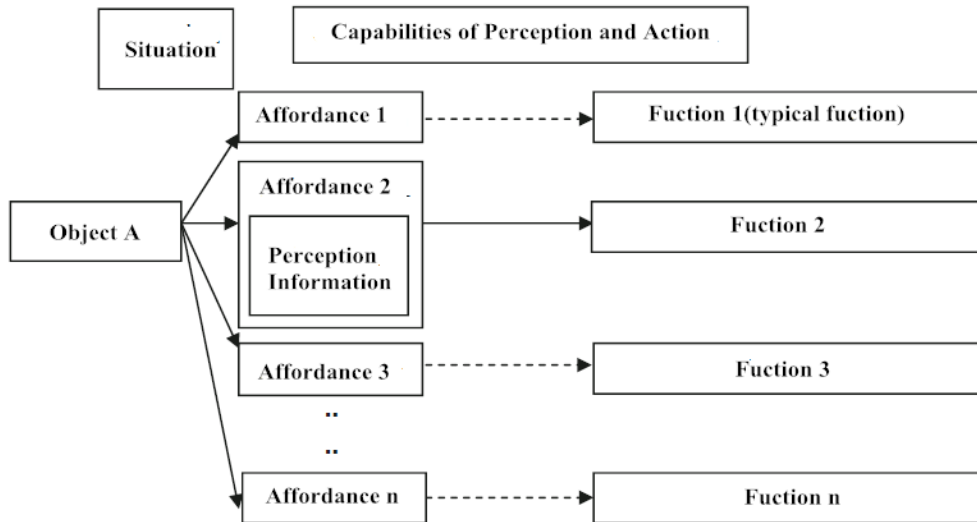
Figure 2-12 Activation of Affordance-Meaning Pathway

Source: Lu and Cheng (2013)

Lu and Cheng (2013) further explained the pathway of achieving the functional meaning of affordance by asking how people can perceive a simple object if it contains complex affordances. They illustrated such question based on the example of usage of a doorknob proposed by Gaver (1991) and contended that after acting on an affordance, some information as media will reveal the next affordances and make them perceptible. As a result, they believe that affordance is a sequential process and later proposed the activation of an affordance-meaning pathway: in a normal status, an object presents the dispositional state of object function, and the sequence of affordance is dependent on its perceptual threshold. As shown in Figure 2-12, affordance 1 has the highest probability of perception, and affordance 1 points to function 1. Affordance1 – function1 is the dispositional pathway which will be realized, while the other pathways will not be perceived (Lu & Cheng, 2013). If the perceptual information is altered, it will lower the perception threshold of affordance 2 and activate affordance2–function2 pathway, and the generated competitiveness of perception will restrain the affordance1–function1 pathway.

40

2.2.4.3 Functional Affordances and Symbolic Expressions

Desanctis and Poole (1994) carried out research with the goal to understand the influence of IT on group behavior (for example, to promote members to take part in or improve decision-making) and found that effects of system use are varied and cannot be explained solely by technology. They based on Giddens (1979) research, further proposed social technology, meaning that technology has structures in its own right, but social practices moderate their effects on behavior. They also proposed the concepts of social structures embedded in technology and social structures in action and contended that the two are interactive. The social structures embedded in technology are defined as structural features and spirit, as shown in Table 2-1.

Table 2-1 Definitions of Structural Features and Spirit

Names	Definitions
structural features	specific types of rules and resources, or capabilities, offered by the system
spirit	the general intent with regard to values and goals underlying a given set of structural features

Source: Desanctis and Poole (1994)

Desanctis and Poole (1994) concluded that the influence of technology on human behavior depends on social practice and established the Adaptive Structuration Theory (AST) which assumes that there is a link connecting IT effects and embedded structure (Jones & Karsten, 2008). Before the development of innovative technology, the structure such as reporting hierarchy, organizational knowledge and standard operational process identified in institutions and organizations will be integrated into technology by technical architects in technical design. Although advanced information technology may not be completely sure to realize the expected results, they might be triggered, and it is based on this reason that technical architects want to bring effects to the organization (Markus & Silver, 2008). The structural feature and spirit of an advanced technology constitute its structural potential, and through interaction between people and technology, particular social structure will come into being, which is users' appropriation of technology (Desanctis & Poole, 1994). IT artifacts and human actors are understood to exert equal influence on the results of technology use (Jones

& Karsten, 2008).

However, AST is also criticized by supporters of Giddens' structuration theory. Giddens (1979) believes that social structures are not independent of human behaviors and are not material objects, and describes social structures as traces in the mind existing only in human behavior. Jones and Karsten (2008) argued that AST is not in line with the above views, which affects application and promotion of AST in the academia. Markus and Silver (2008) extended and improved relevant concepts based on the concept of affordance and the concepts of structural properties and spirit proposed by Desanctis and Poole (1994) so as to explain the possible usage of IT artifact and its application. They proposed three innovative concepts: technical objects, functional affordances and symbolic expressions.

Functional affordance is defined as the possibilities for goal-oriented action afforded to specified user groups by technical objects (Markus & Silver, 2008). It is a relationship between technical object and specified user (or user group). Markus and Silver (2008) believe that functional affordances are different from structural features since the latter is a conceptualization of technology properties while the former is a conceptualization of the relationship between an object and a particular group of users. They also believe that functional affordances are different from the concept of appropriation moves since the latter refers to the actual use of an IT artifact while the former refers to potential use. Markus and Silver (2008) pointed out the limitation of functional affordances as they focus only on matters concerning technical functionality and not support analysis of value-oriented artifacts. Therefore, they proposed another concept of symbolic expressions as a supplement.

Markus and Silver (2008) first raised a question: What about if an IT artifact may enable its users to make interpretations of "the system's" (or its designers') values and intents? They assumed that there's something in an IT artifact that can help understand the information system and proposed the concept of symbolic expressions which is defined as the possibility of a technical object offering communication to a specified user group. If functional affordance is the bridge connecting IT artifact and what users do with them, then symbolic expression is the bridge connecting IT artifact and how users may interpret them. Therefore, symbolic expressions involve the designer idea contained in the IT artifact. Markus and Silver

(2008) believe that one artifact can offer various symbolic expressions to specified user group, and this is because it can support various functional affordances. Functional affordances and symbolic expressions connect technical objects with specified users or user groups as shown in Figure 2-13.
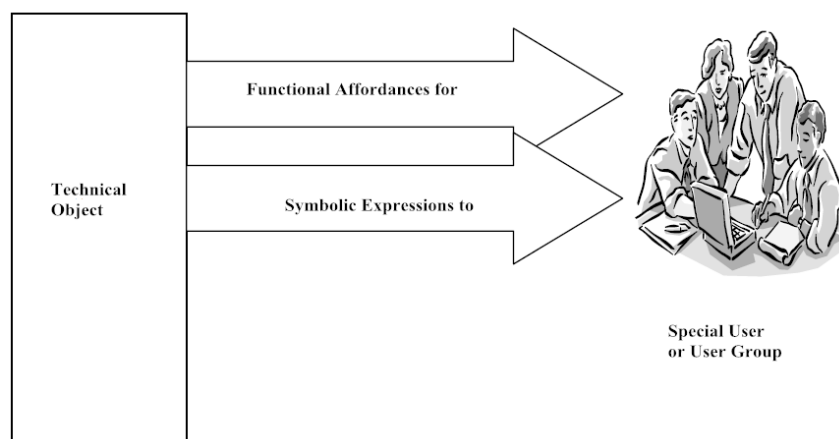
Figure 2-13 Functional Affordances and Symbolic Expressions Relate Technical Objects to Specified Users or User Groups

Source: Markus and Silver (2008)

Grgecic, Holten and Rosenkranz (2015) based on the viewpoint of Markus and Silver (2008), believe that the social structure of technology is the template of planned behavior of human beings, and pointed out that in research on technology adoption, viewed as a component of cognition, beliefs are generated when people collect, process and analyze IT information and are often used in evaluation of IT use. They analyzed the concept of structuration proposed by Giddens (1979) and argued that structuration is a process of making and reshaping social structure, in which the action and belief of human agent are formed. Social structure, in turn, will be shaped by the behavior of human agents. AST is used to measure the interaction between advanced technology, social structure and human action and interpret the structural potential of IT System affecting beliefs.

According to these authors, social structure directly affects the actions of users and, in turn, the relationship between technical object and users through functional affordances and symbolic expressions. They point out that one object can support multiple affordances and that symbolic expressions consist of communication of values and communication of meaning.

Communication of values has a positive influence on function so that users can extend the scope of functional affordances, while communication of meaning enhances user awareness and perception, and helps them further understand how the meaning affects functional affordances.

2.2.4.3 Affordance Actualization

Lu and Cheng (2013) pointed out that existing research on application of affordance in HCI focuses mostly on user perception and understanding of affordances or on optimization of technical design. However, few studies focus on the implementation behavior of users or whether users would use the technology. If users do not take adoption behaviors and only generate affordance from interaction with the object, the affordance of the object will be meaningless. That is to say, we should also pay attention to affordance actualization.

Chemero (2003) considers that affordance is one form of realism about meaning; Galvao and Sato (2005) also believe that affordance is a function-based interaction, including perception of function and instantiation of function and, in turn, Lu and Cheng (2013) argue that affordance includes fulfillment of meaning, namely affordance actualization.

The aforementioned sequential affordance and activation of affordance-meaning pathway proposed by Lu and Cheng (2013) well explain affordance mechanism. The research of Strong et al. (2014) on organization-EHR affordance also offers another explanation for affordance actualization. They carried out retrospective research on the EHR system of many medical groups and found that the existing theories are not as suitable as the concept of affordance to analyze user behavior.

Strong et al. (2014) define actualization as the actions taken by actors as they take advantage of one or more affordances through their use of the technology to achieve immediate concrete outcomes in support of organizational goals. When information technology is applied in an organization, individual behaviors are all driven by purposes, and ultimately the behavior transforms to reality, targeting at the immediate concrete outcome. This is defined as the actualization of particular expected results, such as standardization or coordination. Individual behaviors generate immediate concrete outcomes which, in turn,

offer feedback to individuals and adjust the following behaviors (Strong et al., 2014), a process these authors called an individual journey. In the actualization of affordance, every user carries out purpose-oriented behaviors with different experience, and each individual may come across many obstacles in the actualization, so the process is not linear.

There are three factors affecting users to have different actualization actions: (1) individual ability and preference; (2) system feature (such as user interface); and (3) work environment (Strong et al., 2014). The former two factors not only form affordance, but also affect the process of actualization. If the two factors are handled properly, the individual actualization journey will become smoother. As for the third factor, some scholars believe that finite existence of others will inevitably affect the environment and, in turn, affect the generation of affordance (Michael, 2000; Bloomfield, Latham, & Vurdubakis, 2010). As for the organizational level actualization journey, whether the organizational goal can be achieved is dependent on three evaluation indicators: consistency, extent and alignment (Strong et al., 2014).

Strong et al. (2014) argue that a new Electronic Health Record (EHR) system and a medical organization can generate various affordances which are correlative and can be called a bundle of affordances. In an organization, affordances are generated by simultaneous implementation of many individual journeys. In the meantime, every individual is facing multiple affordances which may be interrelated to each other in different ways.

2.3 Summary

This chapter reviews the relevant literature to serve as a reference for the research design in Chapter 4 and includes research and theory related to technology adoption behavior, the concept of Affordance and relevant research on IS integration. The literature reveals that the application and promotion of emerging technologies such as the information technology is often affected by the individual factors of technology users, and these factors affect the individual perception and judgment of the characteristics or effects of the technology. Previous models such as TAM, UTAUT, and TPB tend to analyze the influence of individuals

on technology adoption from the differences of individual characteristics (including age, experience, and beliefs), with no in-depth research on the difference among individuals in their perception, assessment, and application of technology before adoption, and the influence of these differences on technology adoption is not taken into consideration. The application of the concept of Affordance in research on technology adoption behavior has made up the deficiency and helped understand the differences of individual subjective thinking toward technology from the field of biological psychology and behavioral psychology so as to further explore their differences in technology adoption behavior. As for factors affecting the ability or degree of technical affordance, previous studies have focused on the analysis of individual factors, which are often limited to traditional factors such as individual demographics and personal beliefs, with little research on the relationship between technology-related individual factors (differences in innovation ability, technology perception capability) and affordance. Therefore, this study attempts to make explorations from this aspect. In addition, few previous studies involve the realization of affordance, that is, the affordance that can finally achieve specific behavior, its relationship with individual factors, and the realization mechanism, but as this has become the focus of the academia recently, it becomes necessary to understand the relationship between the realization of individual affordance and related satisfaction, which is also explored in this research.

Chapter 3: Research Hypothesis

By reviewing the relevant literature on the adoption behavior of innovative technologies, it is understood that users play a decisive role in the diffusion and application of innovative technologies, and the descriptions of users by different scholars are not exactly the same. As in the concept of affordance, Gibson (1977) and Norman (1988a) use the term human, actor or human agency. In TAM and TPB, it is identified as a user or individual (Ajzen, 1985; Davis, 1989).In the CAS theory, Holland (1995) describes it as an agent. There are other names such as human actor (Nan, 2011) and adopter (Fichman, 2001). Although the names described are different, it is found that in many previous theoretical or research models (including the concept of affordance), individual users, as the main body of technology application technology, are considered as the major factor affecting technology adoption and application behavior.

3.1 Absorptive Capacity (AC)

Affected by differences in individual characteristics, individual users are different from each other in their adoption capacity of innovation. This capacity is named Absorptive Capacity (AC) and used as an independent variable in this research model. Kedia and Bhagat (1988) are the first to define the Absorptive Capacity (AC), but the contribution of Cohen and Levinthal (1990) is more widely accepted. They define AC as the capacity of a business to acknowledge the value of new information from the external environment and absorb and apply it for a commercial purpose. Since then, as a key concept in the academia, AC has witnessed the development of many relevant theories on its basis from the emphasis of psychology on cognition and learning, to the economic perspective of innovation and competition and to the sociological orientation of co-evolution (Volberda, Foss, & Lyles, 2010). It is pointed out by some scholars that the AC of an organization toward innovation has three processes, namely, recognition, assimilation and utilization (Lane, Salk, & Lyles,

2001).

In previous studies, AC is more often used to analyze the absorption and application of innovative technologies by organizations, but Davis and Silva (2011) claim that it can also be applied in the individual level. The absorptive capacity of an organization is dependent on the absorptive capacity of its individual members (Liu, Feng, Hu, & Huang, 2011). Cohen and Levinthal (1990) define individual absorptive capacity as an individual ability to acknowledge the value of new information and understand and apply it for a commercial purpose. Ko, Kirsch and King (2005) argue that individual absorptive capacity refers to the ability of an individual to recognize the importance and value of external knowledge and absorb and apply it.

Research from the psychological perspective verifies that individual personality traits affect individual absorptive capacity. As a result, personal-related factors are the major factors affecting individual absorptive capacity. Differences in individual absorptive capacity are resulted from individual characteristics such as prior knowledge, experience, skill, motivation and belief (Davis & Silva, 2011; Seo, Chae, & Lee, 2015). Volberda et al. (2010) emphasize that the professional knowledge level, training mode and background characteristics of users will affect their absorption of innovative knowledge (Löwik, 2013).

Relevant research shows that one of the indicators measuring individual potential absorptive capacity is his or her creative performance, or individual creativity, which is basically consistent with the concept of Personal Innovativeness In Technology (PITT) (Davis & Silva, 2011; Seo et al., 2015). PIIT is proposed by Agarwal and Prasad (1998) , who based on the IDT theory, believe that individuals can form a belief in new technologies by integrating information from multiple media, and as a symbol of the tendency of some people to take risks and make attempts, PIIT is not possessed by every individual. They conceptualize PIIT as a personal trait that reflects the willingness of individuals to try any new technology. PIIT, or individual creativity, is determined by personal-related characteristics. Davis and Silva (2011) point out that individual characteristics such as relevant skills, relevant knowledge and motivation can strengthen or weaken the innovativeness and innovation performance of an individual.

3.2 Technology Characteristics Perception (TCP)

The influence of individual perception and evaluation of specific technology innovation characteristics on technology adoption and application is also verified in relevant research (Adesina & Zinnah, 1993; Aleksandrov, 2012; Jaw et al., 2012; Li, Lu, & Qiao, 2017). According to Jaw et al. (2012) , users' psychological perceptions are correlated with their capability, previous experience and individual interaction needs and exert different influence on adoption intention of electronic service innovation. Aleksandrov (2012) finds out that farmers' perception of technical characteristics is crucial to the selection of rice to grow and it is further proved that the views of farmers on the characteristics of communication technology tools affect the category and usage intensity of the tools they select. Adesina and Zinnah (1993) use the Tobit model to carry out a sampling study and reach similar conclusion that farmers have a subjective preference for technological characteristics and play a dominant role in technology adoption. They also point out that when analyzing the determinants of application decision-making in early research on technology adoption, scholars overlooked individual evaluation of specific technology attributes, which might lead to bias in research results. Therefore, they strongly recommend that evaluation of technology adoption must take into consideration individual views on the specific technology attributes. Li et al. (2017) find out through research based on the Probit model that the cognition degree of farmers towards the water-saving irrigation technology has a significant influence on their adoption of water-saving irrigation technology. As a result, the individual difference in technology characteristics perception should be analyzed as an important variable.

3.3 Subjective Affordance and Behavioral Affordance

Affordance is defined in this study as the individual perception and understanding of the function and connotation borne by information technology and/or the possibility to materialize it through applied behavior. Based on literature review, this research believes that affordance can be divided into two variables for analysis: Subjective Affordance (SA) and Behavioral Affordance (BA).

Analytical theories and models of individual technology adoption behavior such as TAM, UTAUT, and CAS emphasize the importance of individuals to subjective interactions with technology. Although Gibson (1986) believes that affordance is an attribute of object and is objective, he also argues that affordance needs perception and attention of actors. The scholars pioneered by Norman (1988a) emphasize the importance of individual perception to affordance. In contrast to Gibson (1986) real affordance or physical affordance, the perceived affordance proposed by Norman (1988a) is more valued by the academia. From the previous literature review, it is known that in the interaction of individuals with technology or technology products, perception is only at the initial level. In the CAS theoretical model, technical or technical products include structural features and spirit, which is functional affordance and symbolic expression. It requires individuals to understand and make personal interpretations in the constant interactions with IT artifacts based on their perception. On the basis of understanding and personal interpretation, individuals will analyze and evaluate the technology or technology products. The PU and PEOU in TAM, job relevance in TAM2, and the five innovation characteristics in IDT are good cases in point. Therefore, the subjective thinking generated by the interaction between individuals and the technology is a comprehensive process, and is named subjective affordance. It is defined as the possibility of individuals to perceive, understand and evaluate the functions or connotation offered by information technology during the interaction between individuals and information technology.

In the previous analysis of affordance-actualization, it is learned that individual affordance of specific IT objects focuses more on individual perception and subjective evaluation of the objects. However, recently scholars have proposed that individual perception and evaluation of IT objects is only a stage of affordance. If affordance is only limited to this stage with no affordance-actualization or the final adoption and application behavior, technology intervention will not be successful. Therefore, analysis of affordance-actualization is extremely important. Based on previous literature, the behavior of affordance-actualization is called behavioral affordance which is defined as the actual use of information technology by individual users, and the realization of its intended use in a specific field, or the possibility

even to change the behavioral pattern of individuals in life and work. It is revealed in relevant research that BA is the next stage of affordance based on SA, which means the realization of BA is based on realization of SA.

3.4 Relationship between AC, TCP and Affordance

According to Aleksandrov (2012), farmers recognizing the application advantages of ICT will have more comprehensive perception of ICT, and the intensity and frequency for them to apply ICT to assist agricultural cultivation will be higher. Adesina and Zinnah (1993) found that marginal changes in the specific characteristics of the perceived technology increase the probability of adoption of the rice varieties. Li et al. (2017) reached similar results that one level increase of the cognition of water-saving irrigation by farmers means 3.97% increase of their possibility to adopt water-saving irrigation technology; one level increase of acceptance of government technology promotion by the farmers means 83% increase of their adoption of water-saving irrigation technology.

Based on the theory of Gibson (1977) ,some scholars propose that whether an affordance can trigger action depends not only on the characteristics and performance offered by technology artifacts, but on the actor's ability to perceive the action (Abhari, Davidson, & Xiao, 2016).Ever since Norman (1988a) introduced the concept of affordance to Human-Computer Interaction, it has become an important theoretical basis to analyze individual perception of technology and their behavior. Norman (1988a) used to point out that affordance is closely related to the past knowledge and experience of actors. In addition, affordance is also related to the physical attributes as well as the moral or mental attributes of users such as objectives, expectations, values and existing knowledge and experience, and these individual attributes reflect the degree of individual AC. Agarwal and Karahanna (2000) pointed out that PIIT affects individual's application of innovative technology, because those who are more inclined to apply innovative technology are more likely to experience and recognize innovative technologies. They also added PIIT, the individual difference variable, as a new variable in the original TAM model, and verified that individuals with higher PIIT levels will be more active in evaluating the advantages, usability, and compatibility of

innovative technologies. According to the Componential Theory, creativity is most likely to occur when people's skills overlap with their strongest intrinsic interest – their deepest passion (Seo et al., 2015).

3.5 Relationship between AC, TCP and Satisfaction of Patients to Medical Services (PS)

In this research, PS mainly refers to patients' evaluation of medical service after the intervention of specific information technology, and it is evaluated from the two dimensions of medical service and doctor-patient relationship.

The patients' satisfaction with the medical service refers to their subjective evaluation of the improvement of the medical service under the influence of the information technology intervention. The patients' satisfaction with the doctor-patient relationship refers to their subjective evaluation of the improvement of the doctor-patient relationship under the influence of information technology intervention.

The impact of medical informatization on the doctor-patient relationship has been proved in different studies. Broom (2005) explored the impact of information technology application on patients and found that access to information in the internet and online treatment service exert far-reaching impact on prostate cancer patients, because the limitations and embarrassment of traditional treatment are avoided as face-to-face communication between patients and doctors is no longer necessary. Investigation indicates that most patients believe that application of internet technology has a positive impact on doctor-patient relationship. The advantages of internet reported by patients involve speed, convenience and privacy. It is acknowledged by many patients that they will resort to internet to confirm information, especially doctors' advice and suggestions (Brotherton, Clarke, & Quine, 2002). They also argue that the increasing use of internet by patients and their family members should not be considered as a problem, but an opportunity to deal with doctor-patient relationship. It is scientifically verified that application of information technology has an impact on doctor-patient relationship.

The relationship between AC and user satisfaction has been explored in previous research. An empirical study verifies that the improvement of knowledge absorptive capacity is conducive to improving the customer satisfaction (Xiao, 2016). Nimrod (2008) explored the relationship between innovation intention and life satisfaction of the retired and found that innovators had significantly higher life satisfaction than non-innovators. According to Lian and Yen (2017), personal general innovativeness has a significant positive influence on entrepreneurial satisfaction.

The relationship between individual TCP and satisfaction has also been explored in previous research. Amaral, Mota, Freitas and Junior (2013) investigate the perceived innovation of customers in the services context as a predictor of satisfaction and loyalty, and results show that there are strong bonds between perceived innovation, satisfaction, and loyalty. It is found by some scholars that the perceived technology attributes (control, enjoyment, reliability, speed, and ease of use) have positive effects on customer satisfaction (Dolen, Dabholkar, & Ruyter, 2007). According to Back and Chang (2016), smart car technology directly related to safety improves customer satisfaction.

3.6 The Mediating Role of Affordance in AC, TCP and PS

In ecological psychology, affordance is more commonly understood as the attribute of an object or relationship between object and actors, or as an opportunity of action (Stoffregen, 2003; Hutchby, 2004). According to the affordance interaction centered view (Klaus & Trettvik, 2002), the affordance of an artifact is the interaction between users and objects as well as the environment. The Activation of Affordance-Meaning Pathway indicates that through the interaction between users and technology objects, the users will constantly reinterpret and decode the affordance information conveyed by the objects so as to better understand and actualize affordance (Cheng, Fu, & Vreede, 2017). Therefore, an intermediate process is needed for the technology to be recognized, understood and ultimately applied by individuals, and even for the final application effects of technology or technology objects to be evaluated, and in this process, the actor and the object will have a close relationship and interaction, so we can try to use the concept of affordance for explanation.

In the early days, the concept of affordance was applied more in the design field (including the design of technology or technology products), and the affordance-based methods emphasized satisfaction of user demands. Therefore, the designers strive to improve the object functional affordance and the individual's affordance to the object, with an aim to improving the application and expansion of technology so as to improve satisfaction. Research of Cai and Chau (2015) suggests that cognitive affordance (detailed product information, writing hints and word count feedback) is positively correlated with task participation and learning satisfaction in virtual world contexts. The results reflect that individuals' effective cognition (namely SA) of and implementation (namely BA, the ultimate adoption of technology) of technology affordance contribute to improvement of satisfaction.

There are few previous studies on the mediating role of affordance in AC, TCP and PS, but we can find support in the study of Strong et al. (2009). They used the grounded theory and a critical realist perspective to conduct a longitudinal study of the implementation of an Electronic Health Record (EHR) system in a clinic. They developed a mid-level process theory to illustrate how the treatment achieves the affordance brought by EHR. They finally validated the model and came to the conclusion that the two independent variables—features of the EHR and characteristics and capabilities of potential EHR users and their context—exert positive influence on satisfaction (patients) through two progressive mediating variables of affordances (potentials for actions afforded to potential users by the EHR) and activated affordances.

3.7 Research Hypotheses and Path Analysis with Observed Variables

The literature leads to specific hypotheses about the structure of a path model linking AC, TCP, SA, BA and PS. These variables are used as observed variables in this study to construct the research model of this study. The objective of this research is to explore and validate the causal relationship between observed variables through path analysis, namely Path Analysis with Observed Variables. Observed variables, also known as manifest variables, are variables that can be observed directly, such as an individual's score of a scale item (Wang, 2014). In the observed variable path analysis model, the latent variables are not considered, the

variables being analyzed are all observed variables, and the concepts that are of interest to the research are measured variables that can be specifically observed.. The measured variables of this study include the independent variables AC and TCP, the dependent variable PS, and the mediating variables SA and BA. The mediating variables are affected by the independent variable, and the independent variable affects the dependent variable through the mediating variable. As the model contains the mediating variable, the research model constructed in this study is an observed variable path analysis model.

Based on the previous research foundation and the objectives of this research, we construct the research path model by integrating the relevant theoretical basis from the literature review as shown in Figure 3-1. The proposed research hypotheses are as follow：

H1 There is a positive correlation between patient AC and PS.

H2 There is a positive correlation between patient TCP and PS.

H3 There is a positive correlation between patient AC and their SA of specific technology.

H4 There is a positive correlation between patient TCP and their SA of specific technology.

H5 There is a positive correlation between patient SA of specific technology and their BA of technology.

H6 There is a positive correlation between patient AC and their BA of specific technology.

H7 There is a positive correlation between patient TCP and their BA of specific technology.

H8 There is a positive correlation between patient SA of specific technology and their PS.

H9 There is a positive correlation between patient BA of specific technology and their PS.

H10a   Patient SA of specific technology plays a mediating role in the positive correlation between AC and PS.

H10b   Patient BA of specific technology plays a mediating role in the positive correlation between AC and PS.

H10c   Patient SA and BA of specific technology plays a progressive mediating role in the positive correlation between AC and PS.

H11a   Patient SA of specific technology plays a mediating role in the positive correlation between TCP and PS.

H11b   Patient BA of specific technology plays a mediating role in the positive correlation

between TCP and PS.

H11c   Patient SA and BA of specific technology plays a progressive mediating role in the positive correlation between TCP and PS.
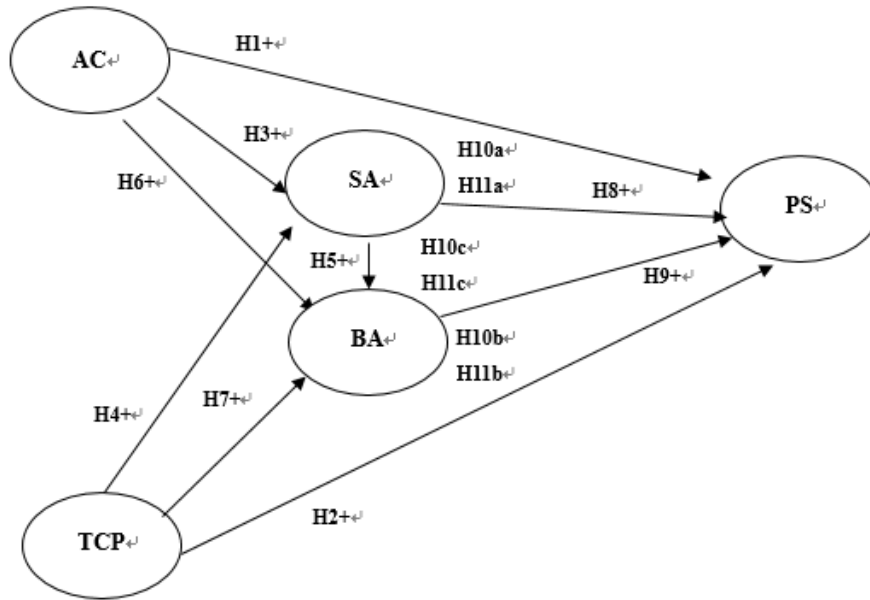
Figure 3-1 Hypothesized Model (Observed Variable Path Model)

Chapter 4: Research Method

As a cross-sectional survey conducted in Guangzhou, Guangdong Province, this study obtains the data from results of the scale. With elaborately designed items, the semi-structured scale has been improved through pre-test. After data collection, a statistical analysis will be carried out to verify the research framework and related hypotheses mentioned above. This chapter will introduce the research methods adopted in this survey.

4.1 Population Description

The respondents of the survey are adult patients (≥18 years old) who use the community hospital WeChat service platform client side in China, and must have had experience in applying community hospital WeChat client side to assist treatment. In this study, functions of the community hospital WeChat client side include online appointment, online consultation, designated-institution contract signing, and information query by patients through WeChat official account; payment of community medical expenses through WeChat wallet; online communication with doctors through WeChat platform; and inquiry and understanding of medical information. The criteria of the respondents are as follows:

According to the China Health and Family Planning Yearbook 2017 (Chinese Ministry of Health [CMH] , 2017), by the end of 2016, there were 8,918 community health service centers in China, the total population of China had reached 1.38 billion (including 240 million floating population), and the ratio of male to female is 1.05. The total number of patient visits (not patients) to the Chinese community health service centers in 2016 was about 460 million person-times. According to the Yearbook, in 2013, the National Bureau of Statistics of China organized a nationwide sample survey and identified that the rate of resident visits to community health service centers was 8.6% (14.6% in urban areas and 2.6% in rural areas).

According to the Guangdong Health and Family Planning Yearbook 2017 (Health and

Family Planning Commission of Guangdong Province [HFPCGD] ,2017), by the end of 2016, there were 1,082 community health service centers in Guangdong Province (including 154 in Guangzhou, the capital of Guangdong Province), accounting for 12.1% of the total number of China. The permanent population of Guangdong Province is about 91 million (including 8.7 million in Guangzhou). In 2016, the total number of patient visits (not patients) to community health service centers in Guangdong Province was about 110 million person-times (including 23 million person-times in Guangzhou), accounting for 23.9% of the total number in China.

4.2 Samples Description and Selection Procedure

The afore-mentioned background information indicates that Guangdong Province occupies a considerable proportion in the Chinese community health care system, as its number of community health service centers accounts for more than 10%, and the amount of community medical treatment volume accounts for nearly a quarter. In addition, as the bellwether of China's reform and opening up policy and one of the major foreign trade provinces, Guangdong has been China's wealthiest administrative province for nearly half a century. Economic prosperity has boosted technological innovation. In 2017, the regional innovation capability of Guangdong ranked first in China, the output value of high-tech products reached 6.6 trillion yuan, and the number of applications for invention patents and PCT international patent applications increased by more than 50% (Long, 2018). As the capital of Guangdong Province, Guangzhou is currently one of the three national medical centers in China. Its achievements in primary-level and comprehensive health care development are unparalleled in Guangdong Province and even China (He, 2017). The relationship between Guangzhou and WeChat is also very close, as WeChat is based in Guangzhou. Early in 2014, nearly 60 hospitals in Guangzhou had implemented WeChat appointment for registration (Da, 2014).

Due to the representativeness of community health service in Guangzhou, this research selects community hospitals in Guangzhou as the sample. According to the online search statistics of WeChat, there are about 100 Guangzhou community hospitals having established WeChat service platform, and only public community hospitals have launched WeChat

service client sides. Guangzhou consists of 11 administrative districts, including four central urban districts (Liwan, Yuexiu, Haizhu, and Tianhe) and seven suburban districts. More than 60 community hospitals in the central urban districts have launched the service platform, but in the suburban districts the number is only about 30. In particular, there are only three community hospitals in total launching the WeChat platform in two suburban districts of Zengcheng and Conghua.

The study plans to select 28 community hospitals in the nine administrative districts of Guangzhou for investigation, and the distribution of the selected community hospitals is shown in Table 4-1. For each hospital, the researchers randomly select patients meeting the criteria in the clinical and prevention and healthcare department so that the sample size can meet the requirement.

Table 4-1 Distribution of Investigated Hospitals in Different Districts of Guangzhou

Administrative Districts	Amount of Investigated Hospitals
Liwan	8
Yuexiu	6
Haizhu	5
Tianhe	3
Baiyun	2
Panyu	1
Huangpu	1
Nansha	1
Huadu	1

The scales are distributed in two approaches: (1) Printed questionnaires are distributed to respondents to fill them out and the investigators will collect the questionnaires after checking the validity. If the missing items reach 20% or more, the questionnaires will be considered invalid and will not be collected. (2) Before implementing the investigation, the research assistants compile the electronic version of the scale through an online questionnaire website (https://www.wenjuan.com/), and generate the QR code of the scale. The respondents can get access to the online questionnaire by scanning the QR code. After they complete the questionnaire in the mobile phone, the data will be automatically saved and uploaded to the server of the website, and can later be exported.
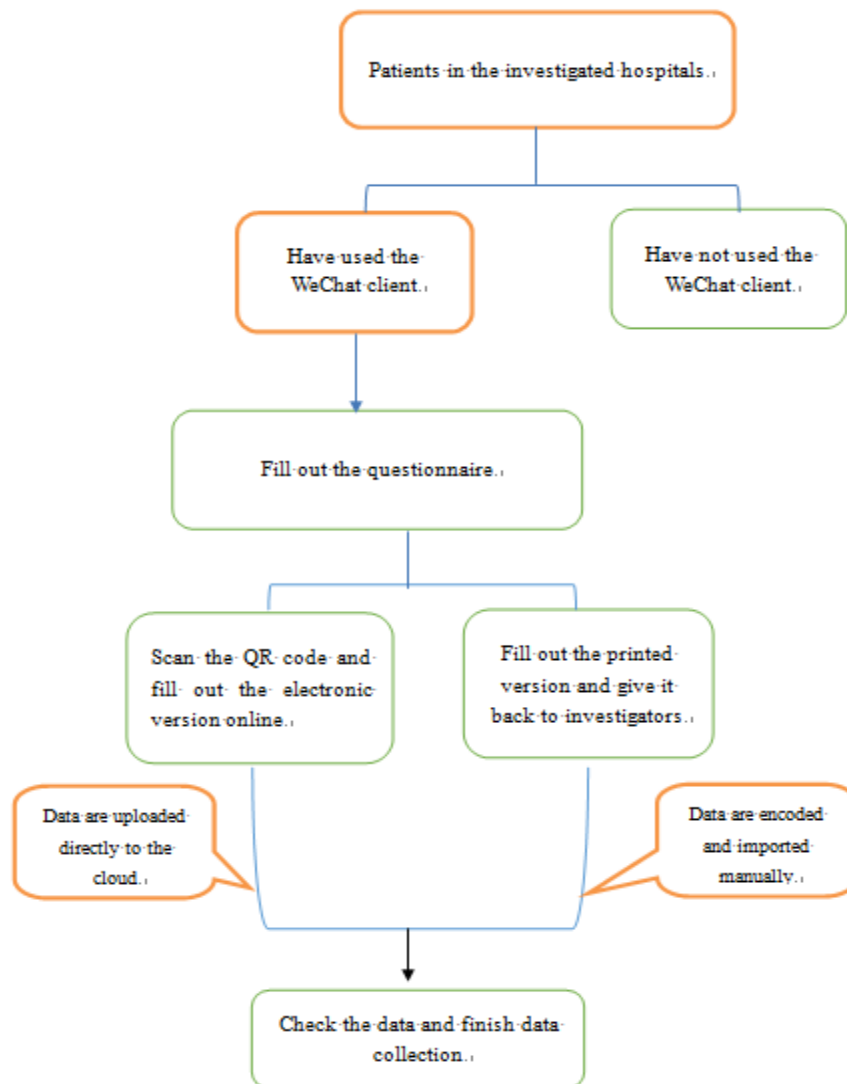
Figure 4-1 Sample Collection Flow Chart

In order to ensure the quality of the e-version questionnaire, we double-check the contents to make sure that the e-version questionnaire is consistent with the printed version. When compiling the questionnaire, we add the prompt that "the questionnaire cannot be submitted because items are left out" and establish standardized requirement of "format of the contents" and "word limit" in the open-ended questions to ensure that the questionnaires collected are completely filled out and the contents are in line with the requirement. After the electronic version is compiled, the research assistants have used multiple mobile terminals to test it at different times, and it is officially released after we make sure that the filling-out process is smooth, the filling-out method is in line with the expected settings, and the data is effectively uploaded. The sample collection process is shown in Figure 4-1.

Collect preliminary information about the community hospitals and respondents, carry out preliminary communication work and make preparations to establish investigation team

Design questionnaire, test questionnaire, analyze reliability and validity and identify the final version.

Establish an investigation team of six medical graduates and divide them into 2-3 groups. Before investigation, the team receives centralized training.

Each group is responsible for investigation of one community hospital in every 1-2 days. 2-3 weeks after the investigation, the team meets to exchange feedback of progress, problems and difficulties, discuss the future steps and explore problem solutions. The investigation starts in June 2018, and ends in July.

When the investigation is finished, the team summarizes the results, reorganize and type in the data and prepare for statistical analysis.

Figure 4-2 Investigation Implementation Process

In order to promote the investigation, we established an investigation team of six members who are mainly medical college graduates or interns. Before the investigation was implemented, the team received two standardized investigation trainings successively offered by professional market research consultants from a market information consulting company in Guangzhou. The training mainly involves identification of tasks and objectives, division of responsibilities, standardized operating procedures, access criteria for survey respondents, investigation process, questionnaire collection standards and matters needing attention. In

addition, through preliminary communication, our investigation has obtained permission and support of the leaders and department heads of the community hospitals. Patients who meet the inclusion criteria are fully informed of the purpose of the survey by the investigators and under the positive advice of community doctors, they are willing to cooperate. The whole investigation implementation process is shown in Figure 4-2.

4.3 Instrumentation

4.3.1 Literature Retrieval and Review

Based on review of relevant literature, we analyze the concept and meaning of the hypothesis variables, and through literature analysis, we establish an index set to evaluate the dimensions or indicators of each variable and understand the influencing factors among different variables.

4.3.2 Retrieval Strategy

This research chooses Baidu Xueshu search system, and retrieves literature on this topic. The retrieval words include absorptive capacity, technology characteristics, innovation diffusion, innovation diffusion theory, affordance, affordance realized and patient satisfaction. In addition, we also retrieve the Chinese versions of the above key words, and the references of some core literature are also retrieved.

4.3.3 Variable Indexes and Measurement

According to the description of hypotheses in Chapter 3, the core observed variables in this research include AC, TCP, SA, BA and PS. In addition, literature review shows that the factor of individual characteristics also affects AC, TCP, SA and BA and it may also affect PS. Therefore, these factors are considered as the variables of the observation. The definitions, measurement tools and measurement methods of the variables are as follows:

4.3.3.1 AC

As for the measurement of AC, we adopt the evaluation tool of PIIT by Agarwal and

Karahanna (2000) and refer to relevant research on AC (Jansen, Bosch, & Volberda, 2005; Martelolandroguez & Cegarranavarro, 2014). Based on the research background, we compile five measurement items: ① I always try to use new phone Apps. ② I always pay attention to and collect information related to new phone Apps in my life. ③ I would try to use the latest and most popular phone Apps every now and then. ④ I would use phone Apps to deal with whatever can be done with phone Apps. ⑤ I can quickly grasp the usage of new phone Apps.

The answers of the items are presented in the form of Likert seven-point scale, with seven items from "completely disagree" to "completely agree". Positive items are graded from one point to seven points from "completely disagree" to "completely agree"; and negative items are graded from one point to seven points from "completely agree" to "completely disagree". After screening the items by reliability and validity test, the average score of all the selected items is used to reflect the overall AC. Patients with higher score have more ideal innovation acceptability.

4.3.3.2 TCP

Some scholars have used the five characteristics of the IDT theory to evaluate the individual TCP (Adesina & Zinnah, 1993; Yunus, 2014), and definitions of the five indexes are presented in Table 4-2.

Considering that the Instrument to Measure the Perceptions of Adopting an Information Technology Innovation established by Moore and Benbasat (1991) is authoritative and relevant items have been proved with high reliability, their scale is viewed as the basis of the research and based on the research background we compile the measurement items of TCP: ① I think using WeChat client side to deal with community hospital affairs is better than other methods. ② I think using WeChat client side to deal with community hospital affairs can improve the quality of visiting the hospital. ③ I think it is easy to use WeChat client side to deal with community hospital affairs. ④ I think the using WeChat client side to deal with community hospital affairs fits my habits. ⑤ I think I would try the new features of WeChat client side to help me deal with the procedures of visiting a hospital. ⑥ I can see that people are using WeChat client side to deal with community hospital affairs everywhere in the

community hospital. ⑦ I can easily see that after using WeChat client side to deal with community hospital affairs, positive changes have taken place on the conditions of the community hospital and the patients. ⑧ It is easy to use WeChat client side to deal with community hospital affairs. ⑨ I think using WeChat client side to deal with community hospital affairs can shorten the time spent on making appointments and actual visits. ⑩ Many relatives and friends of mine are using WeChat client side to deal with community hospital affairs. ⑪ My doctor expects me to use WeChat client side to deal with community hospital affairs. ⑫ I do not think it would take much time to learn how to use WeChat client side to deal with community hospital affairs.

Table 4-2 Definitions of Five Evaluation Indexes of Technology Characteristics Perception

Indexes	Definitions
Relative Advantage	the degree to which an innovation is perceived as better or superior than ever before
Complexity	the degree to which an innovation is perceived as consistent with the existing values, past experiences, and needs of potential adopters
Compatibility	the degree to which an innovation is perceived as consistent with the values whose mother, past experiences and needs of potential adopters
Trialability	the degree to which an innovation can be tested within a certain limit
Observability	the degree to which an innovation may be experimented with on a limited basis

Source: Rogers (1997)

The answers of the items are also presented in the form of Likert seven-point scale, with seven items from "completely disagree" to "completely agree". After screening the items by reliability and validity test, the average score of all the selected items is used to reflect the overall TCP. Patients with higher score have higher recognition of the innovative characteristics of the information platform.

4.3.3.3 SA

The SA of observed variables in this research originates from the concept Functional Affordance. Therefore, in the measurement of SA, we refer to the tools evaluating functional affordance proposed by Grgecic et al. (2015). Based on the research background and the

actual functions of the software, we compile eight measurement items: ① Based on my condition, I think it is easy to use WeChat client side to make an appointment with the doctor I want to see successfully. ② Based on my condition, I think it is easy to use WeChat client side to appoint the wanted diagnosis time successfully. ③ Based on my condition, I think it is easy to appoint the department to visit successfully. ④ Based on my condition, I think it is easy to pay all medical bills successfully. ⑤ Based on my condition, I think it is easy to access all of my medical examination reports and medical records successfully. ⑥ Based on my condition, I think it is easy to consult doctors at any time. ⑦ Based on my condition, I think it is easy to communicate with other patients at any time. ⑧ Based on my condition, I think it is easy to ask medical workers questions through WeChat client side at any time.

The answers of the items are also presented in the form of Likert seven-point scale, with seven items from "completely disagree" to "completely agree". After screening the items by reliability and validity test, the average score of all the selected items is used to reflect the overall SA. Patients with higher score have more ideal perception of the functions of the information platform.

4.3.3.4 BA

In the measurement of BA, we refer to the evaluation of BA by Venkatesh, Thong and Xu (2012), and based on the research background and actual situation of the software, we compile six measurement items: ① I am basically using WeChat client side to make appointment with doctors every time I go to community hospitals. ② I am basically using WeChat client side to pay medical bills every time I go to community hospitals. ③ I am basically using WeChat client side to access my medical examination reports and medical records every time I go to community hospitals. ④ I am basically using WeChat client side to communicate with the doctors I want to consult every time I go to community hospitals. ⑤ I am basically using WeChat client side to communicate with other patients every time I go to community hospitals. ⑥ I am basically using WeChat client side to ask medical workers questions every time I go to community hospitals.

The answers of the items are also presented in the form of Likert seven-point scale, with seven items from "completely disagree" to "completely agree". After screening the items by

reliability and validity test, the average score of all the selected items is used to reflect the overall BA. Patients with higher score have more ideal actual application of the information platform.

4.3.3.5 PS

As for the variable of PS, we evaluate from the two perspectives of medical service and doctor-patient relationship. With reference to the scales measuring patient perceptions of physician behavior (Wolf, Putnam, James, & Stiles, 1978), we adopt the measurement items corresponding to cognitive and affective indexes. We also refer to the scale evaluating the relationship of patient satisfaction with care and clinical outcomes compiled by Kane, Maciejewski and Finch (1997), adopting the measurement items corresponding to the indexes of time and treatment results. Based on the research background, we compile the measurement items as follows: ① The doctor encourages me to ask questions. ② The doctor would fully answer my questions. ③ I can understand the explanations given by the doctor. ④ The doctor is very considerate. ⑤ The doctor makes me feel at ease when I talk about my condition. ⑥ I feel that the doctor is very familiar with my medical records. ⑦ I am very satisfied with the diagnosis time. ⑧ I am very satisfied with the time spent on waiting in the hospital. ⑨ I am very satisfied with the total time spent on this visit to the hospital. ⑩ My illness has been treated properly. ⑪ I have gained better understanding of my condition after seeing the doctor. ⑫ I feel much less worried about my condition after communicating with the doctor. ⑬ I think the treatment plan chosen by the doctor is the most suitable one for me.

The answers of the items are also presented in the form of Likert seven-point scale, with seven items from "completely disagree" to "completely agree". After screening the items by reliability and validity test, the average score of all the selected items is used to reflect the overall PS. Patients with higher score are more satisfied with the medical service and doctor-patient relationship.

4.3.3.6 Individual Characteristics

Regarding individual characteristics, based on the results of the aforementioned literature

review, this study adopts the characteristics including gender, age, educational background, and the frequency to use the community hospital WeChat client side in the past year, and the details are as follows:

① Gender: multiple choice: male or female.

② Age: gap-filling. The respondents fill in their actual ages and the ages are divided into four levels: 30 and below, 31-40, 41-50 and 51 and above.

③ Educational background: multiple choice: primary school education, junior school education, high school education, college degree, bachelor's degree, master's degree and PhD degree.

④ The frequency to use the community hospital WeChat client side in the past year: gap-filling. The respondents fill in the actual usage frequencies.

4.3.4 Establishment of Index System

Table 4-3 Research Framework

Variables	Dimensions	Index	Sources
Absorptive Capability		PIIT	Agarwal and Karahanna, (2000), Jansen et al. (2005), Martelolandroguez and Cegarranavarro (2014)
Technology Characteristics Perception		Relative Advantage	Moore and Benbasat, (1991)
		Complexity Compatibility Trialability Observability	
Subjective Affordance		Functional Affordance	Grgecic et al. (2015)
Behavioral Affordance		Use	Venkatesh et al. (2012)
Satisfaction (Patients)	Doctor-Patient Relationship, Medical Service	Cognitive, Affective, Time, Treatment Results	Wolf et al. (1978), Kane et al. (1997)

We establish the preliminary dimensions and indexes of the scale. Table 4-3 is the research framework compiled based on literature review.

(1) Absorptive Capacity (AC) variable: one evaluation index of PIIT.

(2) Technology Characteristics Perception (TCP) variable: five evaluation indexes including relative advantage, complexity, compatibility, trialability, and observability.

(3) Subjective Affordance (SA) variable: one evaluation index of functional affordance.

(4) Behavioral Affordance (BA) variable: one evaluation index of use.

(5) Patients' Satisfaction (PS) variable: two dimensions including doctor-patient relationship and medical service, and four indexes including cognitive, affective, time and treatment results.

4.3.5 Informal Interview

As the scale is targeted at patients of community hospitals in China, in order to verify the preliminary dimensions and indexes summarized in the literature, we randomly selected six patients meeting the inclusion criteria from two community hospitals in Liwan District of Guangzhou. We did face-to-face informal interviews with them without revealing some hidden measurement indexes. The interviews mainly involved their daily application of information technology, their evaluation of the community hospital WeChat client side, their application of specific functions of community hospital WeChat client side, and their evaluation of community hospital services. The interview results indicated that the screened dimensions and preliminary indexes can well reflect the investigation objectives of the research.

4.3.6 Pre-test

Based on the established dimensions and index system as well as the literature review, we integrate the items that meet the research design objectives and establish the items pool (excel table). Three medical information system PhDs with rich research experience are entrusted as experts to classify and sort the items with Q-sort method and analyze the validity.

1. We designed a Microsoft Excel book with two sheets. Sheet 1 simply introduces the standard set of definitions of relevant variable dimensions, and sheet 2 lists the items pools compiled by the researchers. The three experts were asked to sort the items and classify them into the corresponding variables or dimension structures. When an expert judged that an item cannot be classified into the corresponding structure, it would be labeled as "Not Available". If the experts were highly consistent in terms of the classification, the item was considered to have high validity. In the process of sorting, we actively communicated with experts, recorded their questions or opinions, and gave responses and solutions.

2. In the first two rounds of sorting, the sorting and classification results of the three experts were partially inconsistent. Analysis indicated that it was because definitions of some variables and dimensions in sheet 1 were not clearly explained and the expression of some measurement items was ambiguous. After adjustment, the definition of each variable and dimension was further clarified, and the ambiguous items were also modified or deleted. In the third round of Q-sort, the three experts basically reached a consensus as for the sorting and classification, and items with good validity were screened out to form the preliminary scale.

3. After the preliminary scale was formed, we invited six patients who had used the WeChat client side to fill out the scale based on the characteristics of Chinese community hospitals as well as the application of the software, and asked them to give feedback. Based on their feedback, we learned that some of the items in the preliminary scale were not in line with the actual situation of the research background, and some still had expressions difficult for the respondents to understand. As a result, we further revised these items, deleted the questions that were not applicable and finalized the official version of questionnaire. The questionnaire mainly consisted of closed ended questions in the 7-point Likert form (1 = strongly disagree; 7 = strongly agree).

4.3.7 Questionnaire Coding and Translation

We coded the items in the questionnaire in the form of "acronym of the hypothesized variable of the item + item serial number". For instance, the variable of absorptive capability has five corresponding measurement items, and they are coded as AC1, AC2, AC3, AC4 and

AC5.Variables and the corresponding items are shown in Appendix A.

Part of the measurement items in the questionnaire are from literature in English, so the preliminary questionnaire is compiled in English (see Appendix B). However, since the survey is conducted in China, we invite a bilingual translator who is familiar with Mandarin and English to translate the preliminary English-version questionnaire into Chinese (see Appendix C), and then invite another bilingual translator to translate the Chinese-version preliminary questionnaire into English, so as to make sure that both the English and Chinese versions are highly accurate.

4.4 Data Analysis Method

4.4.1 Statistical Analysis Method

SPSS 20.0 and Mplus 7.4 are adopted for statistical processing.

(1) The SPSS 20.0 is used for the following data processing:

Data entry: Two research assistants enter the investigation data into the social science statistical software SPSS 20.0 to establish a database. The data of some open-ended questions need to be encoded and converted to a digital format, which is convenient to be processed by SPSS. The data entry and data sorting is performed with dual-person examination and check to ensure the data accuracy.

Reliability analysis: This study adopts the Cronbach's α coefficient to analyze the reliability of the questionnaire and assess the consistency and credibility of the measurement results. In general, if the Cronbach's α coefficient exceeds 0.70, the reliability of the questionnaire is considered to be good.

Validity analysis: This study uses the factor analysis method to analyze the validity of the questionnaire. First, we use the KMO test and Bartlett's test of sphericity to evaluate whether the scale has the premise of factor analysis. In general, if the KMO value exceeds 0.70, the Bartlett's test of sphericity P<0.05, the scale can be considered to satisfy the premises for factor analysis. The factor analysis is used to evaluate the structural validity of the subscales

of each observed variable, and the items that do not meet the requirements are deleted. The validity analysis is conducted again after the modification of items.

Statistical description: For measurement data subject to normal distribution, we use (mean ± standard deviation) for statistical description. If the measurement data does not obey the normal distribution, the median (interquartile range) is used for description. For the enumeration data, the frequency is used for statistical description.

Correlation analysis: We use the Pearson correlation analysis methods to evaluate the correlation between the two variables.

Difference analysis: For the difference test of measurement data, we first analyze whether it obeys the normal distribution. If it does and the variance is homogeneous, we analyze it by t test or variance analysis; if it does not obey the normal distribution test, then we will perform nonparametric test analysis on the data.

(2) The Mplus 7.4 is used for the following data processing:

After the subscales corresponding to the observed variables are verified by factor analysis, the corresponding items are deleted and optimized, and the total score of each observed variable is calculated. According to the research model, the path model graph of each observed variable is drawn in the software, and the path model is established. The total score of the observed variables is imported into the corresponding variables in the graph, and the effect coefficients between the variables are analyzed through calculation. In addition, we also evaluate the mediating effects of the mediating variables between the independent and the dependent variables.

This study involves the hypothesis relationship verification of multiple variables, and there are mediating variables which need to evaluate the mediation efficiency. The SPSS can operate the regression analysis model, but does not have the function to establish path analysis model. If we use SPSS to establish the model for statistics, the operation will be more complicated. Therefore, we select Mplus7.4 to construct path analysis model to verify the hypothetical relationship between the variables in this study. Mplus 7.4 is a statistical modeling tool that provides researchers with a flexible tool to analyze data. It offers

easy-to-use graphical interface and models estimates and algorithms that present data analysis results. It functions well in the most basic and common analysis that researchers need, including linear structural equation models (i.e. simple linear regression analysis, latent regression analysis, confirmatory factor analysis, path models, and mediation analysis); SEM models for measuring variability and change (latent state analysis, auto-regressive models, latent growth curve models);multilevel regression analysis and latent class analysis (Geiser, 2012).

Compared to another well-known modeling software AMOS, Mplus has its own unique advantages. With a graphical user interface, AMOS can set the model by means of construction, but when the model involves many variables, it is inconvenient in terms of both operation and aesthetics. The biggest feature of the Mplus command is that it can express complex models with simple language and it is easy to understand at the same time. The command statements of Mplus are very concise and many parameters have been set to the default settings in the background. In most cases, complex relationships can be expressed by very short statements. In contrast, the relationship needs complicated settings in other similar analysis software such as AMOS (Wang, 2014).

4.4.2 Path Analysis of Observed Variables

The method of path analysis has been explained in many previous studies and relevant research has also adopted this method to verify the hypothetical relationship of the variables. Path analysis is a statistical method that allows researchers to put the hypothetical relationship between the variables into the planned model structure for verification (Curtis, Scarlett, Erb, & White, 1988). A path model is a descriptive model which is a hypothesis of the nature and magnitude of the relationships being studied. Bean (1982) emphasizes that path analysis can be used to assess the direct and indirect influences of variables in a system, and this causal relationship has already been established. Inan and Lowther (2010) point out that path analysis is an advanced statistical technique used to test the variables of a model to reveal the relative impact of each variable on other variables in the model. Path analysis starts with a theory bound approach revealed with the construction of an explicitly formulated structural

model (path diagram) that provides a pictorial representation of relationships among variables.

With a simple model as an example, Martin and Meek (1986) explain the nature of path analysis model and its advantages over traditional regression analysis models. To analyze the causal effect between variables by establishing path analysis model is in fact a series of hierarchical multiple regressions, and the path coefficients are estimated by logistic regression. That is to say, path analysis can be viewed as the total set of multiple regression analysis (Curtis et al., 1988). For the verification of causality between variables, the path model analysis operation can eliminate the cumbersome implementation of multiple regression analysis. In addition, the regression results of path model can be investigated under a weak causal ordering of factors. The analysis results include not only the rationality of one variable affecting another, but also the known or assumed biological and temporal relationships between variables.

In the path model, paths with justification (based on literature, biological plausibility, personal experience or relationships inherent in the data) and paths corresponding to new hypotheses to be tested are drawn. The arrow indicates the influence direction between the hypothetical path and the two variables. The path coefficients are obtained using regression analysis. In the mapped path graph, each variable is regressed on the previous variable, which has a direct path to it (Curtis et al., 1988). The calculation of path verification yields the degree and direction of influences of a series of variables, and the influences are assumed to exist among the variables.

Path analysis allows people to identify direct, indirect, and total (direct plus indirect) causal effects, as well as eliminate any false effects that may exist. The direct effect suggests the relationship between the two variables without the mediating (intervening) variable. The direct causal effect is represented by the standardized regression coefficient (beta).The indirect effect indicates the influence of the independent variable on the dependent variable through one or more mediating variables, and the indirect effect is calculated by the sum of the direct effects of the intervening variables in the model. The total effect is the sum of the direct effect and the indirect effect. This effect is considered as a causal relationship, but in

the path model, the verification result of the causal relationship is not limited to this effect result. In addition, path analysis is often more powerful than traditional data regression statistical analysis in terms of weak relationship in which there is no assumed causal order (Martin & Meek, 1986; Inan & Lowther, 2010).

This study verifies the hypothetical relationship of each observed variable in the research model by establishing an observed variable path analysis model. There are no potential variables in the observed variable path analysis model, the variables involved in the analysis are all observed variables, and there are measured variables that can be specifically observed. The scores of the various scales are added before a single one is obtained. The higher the score, the stronger the intensity measured by the variable.

Chapter 5: Results

5.1 Sample Description

In this survey, a total of 410 questionnaires were distributed to patients, and 400 were collected, with a collection rate of 97.5%. Among the questionnaires collected, 387 were valid, with an overall valid rate of 94.4%. The survey mainly involves basic information such as gender, occupation, visiting department, and use of WeChat as well as the community hospital WeChat client side.

According to Table 5-1, among the sample of patients surveyed, 174 are men, accounting for 45%; and 213 are women, accounting for 55%. 212 patients visit the general treatment department (such as traditional Chinese medicine, western medicine, and rehabilitation), accounting for 54.8%; 175 patients visit the prevention and healthcare department, accounting for 45.2%. From the distribution of the educational background of the patients surveyed, there are 15 masters, accounting for 3.9%, 98 undergraduates, accounting for 25.3%, 129 college graduates, accounting for 33.3%, 91 high school graduates, accounting for 23.5%, 43 junior high school graduates, accounting for 11.1%, and11 primary school graduates, accounting for 2.8%.

Table 5-2 shows that the sample patients selected in this survey are distributed at various age levels, covering young people who have just turned 18 years old and the elderly over 60 years old. According to the survey results, the average time spent in using WeChat by the sample patients is about 216.87 minutes (3.6 hours) per day, which reflects the fact that people spend relatively long time using WeChat in the daily life and the popularity degree of WeChat is high. The average number of visits to the community hospitals over the past year is less than five, reflecting that usually people do not visit community hospitals too often. In addition, application of the community hospital WeChat client side by the sample patients is also limited over the past year, which indicates that its popularity degree is not satisfactory.

By analyzing the frequencies of using the functions of the community hospital WeChat client side by the sample patients over the past year, we found out that 187 patients had not use any of the functions of the community hospital WeChat client side over the past year, and

they are defined as the "Inactive Group"; 200 patients had used the information platform (one of the functions was used more than once), and they are defined as the "Active Group".

Table 5-1 Basic Information of the Sample Patients

	Classification	Amount	Percentage
Gender	Male	174	45.0
	Female	213	55.0
Occupation	Self-employed	83	21.4
	State-owned enterprise employees	66	17.1
	Non-public enterprise employees	21	5.4
	Farmer	7	1.8
	Others	55	14.2
	Private company employees	101	26.1
	Foreign company employees	32	8.3
	Government employees	22	5.7
Educational background	Master's degree or above	15	3.9
	Bachelor degree	98	25.3
	College degree	129	33.3
	High school degree	91	23.5
	Junior high school degree	43	11.1
	Primary school degree	11	2.8
Visiting department	Prevention and healthcare	175	45.2
	General treatment	212	54.8
The first time to use WeChat	2011	54	14.0
	2012	65	16.8
	2013	69	17.8
	2014	96	24.8
	2015	72	18.6
	2016	28	7.2
	2017	1	.3
The first time to use community hospital client side	2012	1	.3
	2014	3	.8
	2015	2	.5
	2016	108	27.9
	2017	227	58.7
	2018	43	11.1

The chi-square test is used to compare the gender and educational background of the two groups of patients. Table 5-3 shows that there is no significant difference in gender distribution, but there is a difference as for their educational background. Compared with the inactive group, the proportion of people with high academic qualifications is relatively high, and the proportion of people with high school degree or lower degrees is relatively low.

Results show that most of the patients in the "Active Group" are highly-educated, and patients in the "Inactive Group" are relatively with poorer educational background

Table 5-2 Measurement Data Results

	N	Mean	Median	Std. Deviation	Min	Max
The daily average minutes of WeChat use by every person	387	216.87	180.00	80.051	55	720
Visits to the community hospital in the recent year	387	4.91	5.00	2.712	1	15
Total minutes of the most recent treatment in the community hospital	387	65.57	60.00	26.864	5	300
Frequency to use community hospital WeChat client side for online registration over the past year	387	1.87	0.00	2.849	0	10
Frequency to use community hospital WeChat client side for payment over the past year	387	2.66	0.00	3.184	0	10
Frequency to use community hospital WeChat client side for laboratory report and medical record inquiry over the past year	387	0.25	0.00	.923	0	8
Frequency to use community hospital WeChat client side for doctor consultation over the past year	387	2.44	0.00	3.823	0	20
Frequency to use community hospital WeChat client side for access to medical information	387	2.42	0.00	3.216	0	15

.

Table 5-3 Comparison of the Basic Information of Patients in Inactive Group and Active Group

Classification			Active group	Inactive group	In Total	Pearson Chi-square Sig
				Group		
Gender	Male	N	92	82	174	>0.05
		Percent age %	46.0	43.9	45.0	
	Female	N	108	105	213	
		Percent age %	54.0	56.1	55.0	
Educational background	Bachelor degree or above	N	81	32	81	<0.01
		Percent age %	40.5	17.1	40.5	
	College degree	N	79	50	79	
		Percent age %	39.5	26.7	39.5	
	High school degree or below	N	40	105	40	
		Percent age %	20.0	56.1	20.0	

We performed a normal distribution test on the age distribution of the two groups of patients as shown in Table 5-4. As the sample size is greater than 50, we refer to the Shapiro-Wilk test which suggests that the significance is less than 0.01, meaning that the ages of the patients are normally distributed. As a result, the T test or variance analysis is not suitable for the difference comparison of the two groups. Therefore, we performed Mann-Whitney U test on the age, and results are displayed in Table 5-5. As shown in the table, there is a significant difference in the median of age between the two groups. The median age of the active group members is smaller than that of the inactive group members, which reflects that patients in the active group are younger than those in the inactive group.

Table 5-4 Normal Distribution of Age in the Two Groups

| | Group | Shapiro-Wilk | | |
		Statistic	df	Sig.
Age	Active	0.950	200	<0.01
	Inactive	0.971	187	<0.01

Note. a. Lilliefors significance correction

Table 5-5 Median and Standard Deviation of Age of Inactive Group and Active Group

Group	Median	Standard Deviation	Z	Sig（two side）
Active group	33.5	6.320	-8.30	<0.01
Inactive group	44.0	9.987		

5.2 Questionnaire Reliability and Validity Analysis

5.2.1 Reliability Analysis Method

As a questionnaire using the Likert scale scoring method, its reliability can be tested by Cronbach α coefficient method which is commonly used in social science. We performed the reliability test on the data of the entire questionnaire and the measurement items of each variable. If the reliability coefficient is above 0.9, the reliability of the questionnaire is relatively high; if the coefficient is above 0.8, the reliability is good; in general, the coefficient is reasonable and acceptable within 0.5~0.9; if the coefficient is lower than 0.5, the results of

the questionnaire are not reliable.

5.2.2 Questionnaire Validity Analysis

5.2.2.1 Evaluation of Content Validity through Expert Consultation Method

Validity reflects the effectiveness of the questionnaire results, or the accuracy and usefulness of the results measured by the questionnaire as a measurement tool. Higher validity of the questionnaire means higher fidelity of the questionnaire results.

The evaluation questions in this questionnaire are compiled based on the literature review as well as the results of informal interviews with some patients meeting. We invite scholars with rich research experience as experts to use the Q-Sort method to conduct multiple rounds of classification and screening of the questions so as to form the first draft of the questionnaire. Then we invite some patients who meet the inclusion criteria to fill out the questionnaire and give their opinions and suggestions, so that we can modify the questionnaire items and form the final questionnaire. The face validity, criterion validity and content validity of the questionnaire are guaranteed to some extent.

5.2.2.2 Evaluation of Validity by Factor Analysis

The questionnaire is designed based on the five observed variables of the research hypothesis model and is divided into five parts, namely: (1) survey of questions corresponding to the AC variable: the daily use of mobile phone APPs by patients; (2) survey of questions corresponding to the TCP variable: the cognition of the innovative characteristics of the community hospital WeChat client-side by patients; (3) survey of questions corresponding to the SA variable: the cognition and evaluation of the specific functions of the information platform by patients; (4) survey of questions corresponding to the BA variable: the practical application of the information platform by patients; (5) survey of questions corresponding to the PS variable: patient satisfaction with diagnosis and treatment and doctor-patient relationship.

Factor analysis is carried out on the corresponding measurement items of these five parts. The maximum variance method is adopted for orthogonal rotation of the factors. According to

the results of 25 times of iterative convergence, the principal components with eigenvalue greater than one are extracted as common factors, and each common factor retains three to six measurement items for the modeling analysis in the next step. The extracted measurement items will be deleted if any one of the following criteria is met:

(1) The factor load value of each measurement item is no less than 0.4.

(2) Each factor contains at least three measurement items, and for factors with less than three items, all the items under the factor are be deleted.

(3) We also delete measurement items whose load is more than 0.4 in multiple factors at the same time.

(4) We also delete items that are inconsistent with the meaning of the corresponding factor or other items under the factor.

Before using the factor analysis method, an adaptability test is needed to determine whether the survey data are suitable for factor analysis. Tests show that the KMO values of the questionnaire are all greater than 0.9, and the Barlett's Test of Sphericity has been passed with a significance level of 0.05, indicating that the measurement scope and content of the questionnaire have reached the measurement requirements. The details are demonstrated in Table 5-6.

Table 5-6 Results of Scale and Sub-Scale Factor Analysis Adaptability Test

	AC	TCP	SA	BA	PS	The Entire Scale
KMO Value	0.857	0.934	0.811	0.836	0.943	0.941
Barlett's Test of Sphericity	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01

5.2.3 Reliability and Validity of the Subscale Corresponding to the AC Variable

As shown in Table 5-6, the KMO value of the AC subscale is 0.857>0.70, the Barlett's Test of Sphericity result $P<0.01$, which complies with the conditions for factor analysis. The AC variable subscale has five items in total. There is only one factor in the subscale with an eigenvalue greater than one, so the hypothetical variable AC requires only one factor to represent it and does not require orthogonal rotation, which is consistent with the single

dimension set in the original scale. This factor is named "Technology Acceptance Ability" and its component matrix load values, name, and corresponding measurement items are shown as per Table 5-7.

Table 5-7 AC Variable Subscale Component Matrix Load Values and Factor Name

Factor Name	Measurement Items	Component 1
Technology Acceptance Ability	AC1	0.921
	AC2	0.920
	AC3	0.916
	AC4	0.914
	AC5	0.885

Note. Extraction method: principal component analysis.

One component has been extracted.

A reliability analysis is carried out on the AC variable subscale containing 5 items and results show that the Cronbach's α is 0.949>0.70, indicating that the reliability analysis result of the AC variable subscale is comparatively good.

5.2.4 Reliability and Validity of the Subscale Corresponding to the TCP Variable

As shown in Table 5-6, the KMO value of the TCP subscale is 0.934>0.70, the Barlett's Test of Sphericity result P<0.01, which complies with the conditions for factor analysis.

Table 5-8 shows that the λ values of the first two principal components are greater than one, that is, the variances of the two principal components are greater than one. Two principal components can be extracted from items in this part, and the variance explained of the two principal components accounts for 73.292%. Therefore, it is believed that the two principal components extracted are ideal in terms of fully extracting and explaining the information of the original variable. After the principal component analysis extraction and rotation, the measurement items are clustered into two factors which are named technology advantage and diffusion effect respectively. The factor rotation matrix load value is shown in Table 5-9.

A reliability analysis is carried out on the TCP variable subscale and results show that the Cronbach's α is 0.928>0.70, indicating that the reliability analysis result of the TCP variable subscale is comparatively good.

Table 5-8 Variance Explained of the TCP Variable Subscale

Component	Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	6.95	57.916	57.916	4.684	39.029	39.029
2	1.857	15.476	73.392	4.124	34.363	73.392

Table 5-9 TCP Variable Subscale Rotation Matrix Load Value and Names of Corresponding Factors

Factor Name	Measurement Items	Component	
		1	2
Technology Advantage	TCP4	0.876	
	TCP1	0.876	
	TCP2	0.875	
	TCP3	0.837	
	TCP5	0.811	
	TCP9	0.736	
Diffusion Effect	TCP6		0.857
	TCP7		0.813
	TCP10		0.811
	TCP8		0.774
	TCP11		0.735

Note. Extraction method: principal component analysis.

Rotation method: Varimax with Kaiser normalization.

a. Rotation converged in three iterations.

5.2.5 Reliability and Validity of the Subscale Corresponding to the SA Variable

As shown in Table 5-6, the KMO value of the SA subscale is 0.811>0.70, the Barlett's Test of Sphericity result P<0.01, which complies with the conditions for factor analysis. Table 5-10 shows that two principal components (the eigenvalues of the first two principal components are greater than one) can be extracted from this part of items, and the variance explained of the two principal components accounts for 61.732%. Therefore, it is believed that the two principal components extracted are ideal in terms of fully extracting and explaining the information of the original variable.

Table 5-11 shows that through the principal component analysis extraction and rotation method, the measurement items can be clustered into two factors, but one measurement item in the second factor appears cross-factor load, and since items with cross-factor load often

have undesirable performance in the factor analysis, so this item is deleted. After deletion of the item, there are only two measurement items left, and the factor will be unstable, which is not conducive to statistical analysis, so we delete the second factor. Another exploratory factor analysis is carried out and results show that the KMO value is 0.794, and the population variance contribution rate is 68.493%. One factor is extracted and the factor measurement items are identical with the items of the first component in Table 5-11, so it is named as functional assessment. Table 5-12 lists the corresponding extracted items of this factor.

Table 5-10 Variance Explained of SA Variable Subscale

| Component | Extraction Sums of Squared Loadings | | | Rotation Sums of Squared Loadings | | |
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	3.551	44.384	44.384	2.951	36.891	36.891
2	1.388	17.348	61.732	1.987	24.841	61.732

Table 5-11 SA Variable Subscale Rotation Matrix Load Value

| Measurement Items | Component | |
	1	2
SA2	0.858	
SA3	0.821	
SA1	0.817	
SA5	0.623	
SA8		0.856
SA6		0.795
SA4	0.413	0.54

Note. Extraction method: principal component analysis.

Rotation method: Varimax with Kaiser normalization.

a. Rotation converged in three iterations.

Table 5-12 SA Variable Subscale Extracted Factor Name and Measurement Items

Factor Name	Measurement Items
Functional Assessment	SA2
	SA3
	SA1
	SA5

A reliability analysis is carried out on the SA variable subscale containing four measurement items and results show that the Cronbach's α is 0.84>0.70, indicating that the reliability analysis result of the SA variable subscale is comparatively good.

5.2.6 Reliability and Validity of the Subscale Corresponding to the BA Variable

As shown in Table 5-6, the KMO value of the BA subscale is 0.836>0.70, the Barlett's Test of Sphericity result P<0.01, which complies with the conditions for factor analysis. The BA variable subscale contains six items, and there is only one factor with an eigenvalue greater than one in this subscale, so the hypothetical variable BA only needs one factor to represent it, and no orthogonal rotation is needed, which is consistent with single dimension set in the original scale. The factor is named practical application, and its corresponding extracted measurement items are shown in Table 5-13.

Table 5-13 BA Variable Subscale Component Matrix Load Value and Factor Name

Factor Name	Measurement Items	Component
		1
Practical Application	BA4	0.86
	BA6	0.858
	BA2	0.809
	BA5	0.766
	BA3	0.714
	BA1	0.698

Note. Extraction method: principal component analysis.

a. One component has been extracted.

A reliability analysis is carried out on the BA variable subscale containing six items and results show that the Cronbach's α is 0.875>0.70, indicating that the reliability analysis result of the BA variable subscale is comparatively good.

5.2.7 Reliability and Validity of the Subscale Corresponding to the PS Variable

As shown in Table 5-6, the KMO value of the PS subscale is 0.943>0.70, the Barlett's Test of Sphericity result P<0.01, which complies with the conditions for factor analysis. Table 5-14 shows that two principal components (the eigenvalues of the first two principal components are greater than one) can be extracted from this part of items, and the variance

explained of the two principal components accounts for 68.713%. Therefore, it is believed that the two principal components extracted are ideal in terms of fully extracting and explaining the information of the original variable. Table 5-15 shows that after the principal component analysis extraction and rotation, the measurement items are clustered into two factors that are named doctor-patient communication and consultation hours respectively.

Table 5-14 Variance Explained of the PS Variable Subscale

Component	Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	8.374	59.816	59.816	5.444	38.889	38.889
2	1.246	8.897	68.713	4.175	29.824	68.713

Table 5-15 PS Variable Subscale Rotation Matrix Load Value and Factor Name

Factor Name	Measurement Items	Component	
		1	2
Doctor-patient Communication	PS2	0.847	
	PS1	0.837	
	PS5	0.762	
	PS3	0.687	
Consultation Hours	PS9		0.913
	PS10		0.905
	PS8		0.723

Note. Extraction method: principal component analysis.

Rotation method: Varimax with Kaiser normalization.

a. Rotation converged in three iterations.

A reliability analysis is carried out on the PS variable subscale and results show that the Cronbach's α is 0.890>0.70, indicating that the reliability analysis result of the PS variable subscale is comparatively good.

According to factor analysis, the subscales corresponding to each hypothetical variable can extract common components to form factors by clustering, and the factor classification or meaning falls into the variable conceptual category, and the rotated factor loadings of all factors are greater than 0.6.

5.2.8 Reliability and Correlation of Factors

As per Table 5-16, we test the reliability of the factors and the Cronbach's α of all the factors is over 0.8 and the overall Cronbach's α is over 0.7, which reflects that the data measured by the corresponding subscales of each factor are reliable.

Table 5-16 Factor Reliability Test Results

Factor Name	Cronbach's α	Overall Cronbach's α
Technology Acceptance Ability	0.948	
Technology Advantage	0.94	
Diffusion Effect	0.896	0.747
Functional Assessment	0.83	
Practical Application	0.872	
Doctor-patient Communication	0.869	
Consultation Hours	0.899	

Next, a correlation analysis is conducted on the factors and it is proved as per Table 5-17 that they have a significant correlation.

5.3 Evaluation Results of Subscales Corresponding to Observed Variables

The overall scores of the subscales in this study are: the sum of the measured values of the items in all the corresponding scales after factor analysis, and the results are shown in Table 5-18.

5.3.1 AC Subscale Score Description

As shown in Table 5-19, the highest score of the patient's AC subscale is 7.00 and the lowest score is 1.00, with an average score of 4.42 ± 1.44. Among the items, AC 5 has the highest score (4.99), and AC 2 has the lowest score (3.90). The higher the score, the more recognized the respondents are on the evaluation of this item.

Table 5-17 Pearson's correlation of Factors (N=387)

	Technology Acceptance Ability	Technology Advantage	Diffusion Effect	Functional Assessment	Practical Application	Doctor patient Communication	Consultation Hours
Technology Acceptance Ability	1						
Technology Advantage	.312**	1					
Diffusion Effect	.307**	.565**	1				
Functional Assessment	.164**	-.136**	-.304**	1			
Practical Application	.172**	.431**	.788**	-.213**	1		
Doctor-patient Communication	.199**	.361**	.433**	-.135**	.404**	1	
Consultation Hours	.201**	.625**	.639**	-.255**	.593**	.564**	1

Note. **. Correlation is significant at the 0.01 level (2-tailed).

Table 5-18 Scores of AC, TCP, SA, BA and PS of the Surveyed Patients

Scale	Item	N	Min	Max	Mean	Standard Deviation
AC	5	387	1.00	7.00	4.42	1.44
TCP	11	387	1.62	6.30	4.13	1.20
SA	4	387	3.50	7.00	6.31	0.70
BA	6	387	1.00	7.00	3.02	1.35
PS	7	387	1.92	7.00	4.16	0.99

Table 5-19 AC Subscale Scores

Measurement Items	N	Min	Max	Mean	Standard Deviation
AC1	387	1.00	7.00	4.42	1.50
AC2	387	1.00	7.00	3.90	1.61
AC3	387	1.00	7.00	4.04	1.71
AC4	387	1.00	7.00	4.74	1.56
AC5	387	1.00	7.00	4.99	1.55

5.3.2 TCP Subscale Score Description

As shown in Table 5-20, the highest score of the patient's TCP subscale is 7.00 and the lowest score is 1.00, with an average score of 4.13 ± 1.20. Among the items, TCP 3 and TCP 5 have the highest score (4.99), and TCP 10 has the lowest score (2.67). The higher the score, the more recognized the respondents are on the evaluation of this item.

Table 5-20 TCP Subscale Scores

Measurement Items	N	Min	Max	Mean	Standard Deviation
TCP1	387	1.00	7.00	4.57	1.68
TCP2	387	1.00	7.00	4.49	1.69
TCP3	387	1.00	7.00	4.99	1.54
TCP4	387	1.00	7.00	4.81	1.73
TCP5	387	1.00	7.00	4.99	1.50
TCP6	387	1.00	7.00	3.11	1.56
TCP7	387	1.00	7.00	3.82	1.58
TCP8	387	1.00	7.00	4.26	1.53
TCP9	387	1.00	7.00	4.73	1.64
TCP10	387	1.00	6.00	2.67	1.43
TCP11	387	1.00	7.00	3.65	1.53

5.3.3 SA Subscale Score Description

As shown in Table 5-21, the highest score of the patient's SA subscale is 7.00 and the lowest score is 1.00, with an average score of6.31 ± 0.70. Among the items, SA 5 has the highest score (6.39), and SA 3 has the lowest score (6.24). The higher the score, the more recognized the respondents are on the evaluation of this item.

Table 5-21 SA Subscale Scores

Measurement Items	N	Min	Max	Mean	Standard Deviation
SA1	387	3.00	7.00	6.29	0.81
SA2	387	4.00	7.00	6.33	0.79
SA3	387	4.00	7.00	6.24	0.84
SA5	387	1.00	7.00	6.39	0.98

5.3.4 BA Subscale Score Description

As shown in Table 5-22, the highest score of the patient's BA subscale is 7.00 and the lowest score is 1.00, with an average score of 3.92 ± 1.35. Among the items, BA 2 has the highest score (3.93), and BA 5 has the lowest score (2.02). The higher the score, the more recognized the respondents are on the evaluation of this item.

Table 5-22 BA Subscale Scores

Measurement Items	N	Min	Max	Mean	Standard Deviation
BA1	387	1.00	7.00	3.53	1.93
BA2	387	1.00	7.00	3.93	1.93
BA3	387	1.00	7.00	2.14	1.46
BA4	387	1.00	7.00	3.38	1.67
BA5	387	1.00	7.00	2.02	1.46
BA6	387	1.00	7.00	3.10	1.85

5.3.5 PS Subscale Score Description

As shown in Table 5-23, the highest score of the patient's PS subscale is 7.00 and the lowest score is 1.00, with an average score of 4.16 ± 0.99. Among the items, PS 3 has the highest score (4.60), and PS 1 has the lowest score (3.80). The higher the score, the more

recognized the respondents are on the evaluation of this item.

Table 5-23 PS Subscale Scores

Measurement Items	N	Min	Max	Mean	Standard Deviation
PS1	387	1.00	7.00	3.80	1.19
PS2	387	1.00	7.00	4.36	1.17
PS3	387	1.00	7.00	4.60	1.17
PS5	387	1.00	7.00	4.09	1.26
PS8	387	1.00	7.00	4.14	1.17
PS9	387	1.00	7.00	4.09	1.36
PS10	387	1.00	7.00	4.09	1.45

5.4 Correlation of Variables

After the factor analysis test, some measurement items in the observed variables are deleted, and we use the Pearson's analysis method analyze the correlation of variables. Table 5-24 presents a correlation matrix of all critical constructs. Results show that there is significant correlation between the variables. To be specific, AC has a significant positive correlation with TCP, SA, BA and PS, and SA has a significant negative correlation with TCP, BA and PS.

Table 5-24 Pearson's Correlation of Variables

	AC	TCP	SA	BA	PS
AC	1				
TCP	0.349^{**}	1			
SA	0.164^{**}	$-.0234^{**}$	1		
BA	0.172^{**}	0.658^{**}	-0.213^{**}	1	
PS	0.226^{**}	0.643^{**}	-0.217^{**}	0.558^{**}	1

Note. **. Correlation is significant at the 0.01 level (2-tailed).

5.5 Difference of Observed Variables under the Influence of Individual Characteristics

We carry out normal distribution tests on the data of each hypothesis variable, and find through the Shapiro-Wilk results that significance of each variable is less than 0.01, indicating

that the data do not obey normal distribution. The results are shown as per Table 5-25. Therefore, we use non-parametric tests to explore the difference of the scores of the observed variables of patients with different individual characteristics (including gender, age, and educational background).

Table 5-25 Normal Distribution Test of Variables

	Shapiro-Wilk		
	Statistics	df	Sig.
AC	.968	387	0.000
TCP	.939	387	0.000
SA	.870	387	0.000
BA	.952	387	0.000
PS	.988	387	0.002

Note. a. Lilliefors significance correction

5.5.1 Influence of Gender on the Variables

As shown in Table 5-26, it is found through K-S test that the difference in scores of the observed variable subscales between male and female patients is not statistically significant ($p \geq 0.5$), reflecting the difference in scores between male and female patients is not significant.

Table 5-26 Kruskal-Wallis Test of Gender and Variables

	Gender	N	Mean Rank	Chi-square	P
AC	Male	174	198.97	.626	.429
	Female	213	189.94		
TCP	Male	174	191.72	.131	.717
	Female	213	195.86		
SA	Male	174	183.18	3.118	.077
	Female	213	202.84		
BA	Male	174	181.68	3.841	.050
	Female	213	204.06		
PS	Male	174	184.71	2.183	.140
	Female	213	201.59		

5.5.2 Influence of Age on the Variables

We divide the age into different levels by setting 30 years old and under as level 1, 31 to 40 years old as level 2, 41 to 50 years old as level 3, and 51 years old and above as level 4. Then the K independent samples non-parametric test method is used to analyze the influence of different age levels on the variables.

Table 5-27 Kruskal-Wallis Test of Age and Variables

	Age Level	N	Mean Rank	Chi-square	P
AC	30 and under	87	284.63	176.137	< 0.01
	31 to 40	158	228.24		
	41 to 50	97	113.73		
	51 and above	45	71.59		
TCP	30 and under	87	240.35	125.715	< 0.01
	31 to 40	158	242.97		
	41 to 50	97	121.12		
	51 and above	45	89.57		
SA	30 and under	87	198.95	26.567	< 0.01
	31 to 40	158	163.86		
	41 to 50	97	213.42		
	51 and above	45	248.41		
BA	30 and under	87	220.89	48.080	< 0.01
	31 to 40	158	225.18		
	41 to 50	97	149.15		
	51 and above	45	129.21		
PS	30 and under	87	220.02	54.727	< 0.01
	31 to 40	158	229.06		
	41 to 50	97	141.29		
	51 and above	45	134.23		

We carry out median test and K-S test on age and overall score of the observed variables respectively as per Table 5-27 and Table 5-28, and results show the scores of the variables are significantly different in the distribution of different age levels. Apart from the SA variable, in all the other variables most of those aged 40 and below give relatively high score (higher than the median), while those over 41 years old give lower scores (lower than or equal to the median). The situation of the SA variable is just the opposite. The scores of those aged 40 and below toward the SA variable are mostly low (especially those aged from 31 years old to 40

years old), while the scores of those aged over 41 years old are higher (especially those aged over 51 years old).

Table 5-28 Median Test of Age and Variables

		Age Level				Median	P
		30 and under	31to 40	41to 50	51 and above		
AC	> median	74	90	15	2	22.00	< 0.01
	<= median	13	68	82	43		
TCP	> median	54	112	22	3	49.00	< 0.01
	<= median	33	46	75	42		
SA	> median	39	52	49	32	26.00	< 0.01
	<= median	48	106	48	13		
BA	> median	50	105	23	8	17.00	< 0.01
	<= median	37	53	74	37		
PS	> median	47	98	25	9	30.00	< 0.01
	<= median	40	60	72	36		

5.5.3 Influence of Educational Background on the Variables

We divide the educational background into different levels by setting bachelor's degree or above as level 1, college degree as level 2, and high school degree or below as level 3. Then the K independent samples non-parametric test method is used to analyze the influence of different educational backgrounds on the variables.

We carry out median test and K-S test on educational background and the overall score of the observed variables respectively as per Table 5-29 and Table 5-30, and results show the scores of the subscales are significantly different in the distribution of different educational backgrounds. Apart from the subscale corresponding to SA variable, in all the other subscales most of the respondents with college degree and bachelor's degree or above give relatively high score (higher than the median), while those with high school degree or below give lower scores (less than or equal to the median). The situation of the subscale corresponding to the SA variable is just the opposite. The scores of those with college degree and bachelor's degree or above are mostly low, while the scores of those with high school degree or below are high.

Table 5-29 Kruskal-Wallis Test of Educational Background and Variables

	Educational Background	N	Mean Rank	Chi-square	P
AC	Bachelor's degree or above	113	242.08	80.341	< 0.01
	College degree	129	225.18		
	High school degree or below	145	128.79		
TCP	Bachelor's degree or above	113	253.92	94.255	< 0.01
	College degree	129	219.13		
	High school degree or below	145	124.95		
BA	Bachelor's degree or above	113	223.37	25.517	< 0.01
	College degree	129	209.14		
	High school degree or below	145	157.64		
SA	Bachelor's degree or above	113	174.53	12.229	< 0.01
	College degree	129	183.39		
	High school degree or below	145	218.61		
PS	Bachelor's degree or above	113	225.19	43.301	< 0.01
	College degree	129	220.90		
	High school degree or below	145	145.76		

Table 5-30 Median Test of Educational Background and Variables

		Educational Background			Median	P
		Bachelor's degree or above	College degree	High school degree or below		
AC	> median	74	72	35	22.00	< 0.01
	<= median	39	57	110		
TCP	> median	83	73	35	49.00	< 0.01
	<= median	30	56	110		
BA	> median	71	68	47	17.00	< 0.01
	<= median	42	61	98		
SA	> median	41	53	78	26.00	< 0.05
	<= median	72	76	67		
PS	> median	63	74	42	30.00	< 0.01
	<= median	50	55	103		

5.6 Comparison of Difference of Subscale Scores between Patients in the Active Group and the Inactive Group

We compare the scores of the variables between the active group and the inactive group through the non-parametric test method. According to Table 5-31 and Table 5-32, the scores of the two groups are significantly different in all the subscales. Apart from the SA variable,

most patients in the active group give high scores (higher than the median) to the subscales, while most patients in the inactive group give low scores (less than or equal to the median). As for the SA variable subscale, most patients in the active group give low scores, while most patients in the inactive group give high scores.

Table 5-31 Comparison of Variables between Patients of the Two Groups (Kruskal-Wallis Test)

	Group	N	Mean Rank	Chi-square	P
AC	Active Group	200	223.44	28.736	< 0.01
	Inactive Group	187	162.51		
TCP	Active Group	200	283.06	262.554	< 0.01
	Inactive Group	187	98.75		
BA	Active Group	200	276.96	228.051	< 0.01
	Inactive Group	187	105.28		
SA	Active Group	200	158.04	45.065	< 0.05
	Inactive Group	187	232.46		
PS	Active Group	200	263.03	157.972	< 0.01
	Inactive Group	187	120.17		

Table 5-32 Comparison of Variables between Patients of the Two Groups (Median Test)

		Group		Median	P
		Active Group	Inactive Group		
AC	> median	120	61	22.00	< 0.01
	<= median	80	126		
TCP	> median	182	9	49.00	< 0.01
	<= median	18	178		
BA	> median	170	16	17.00	< 0.01
	<= median	30	171		
SA	> median	60	112	26.00	< 0.05
	<= median	140	75		
PS	> median	150	29	30.00	< 0.01
	<= median	50	158		

5.7 Establishment of Path Model and Verification of Hypotheses

Path analysis is a form of multiple regression statistical analysis used to evaluate causal models by examining the relationships between a dependent variable and two or more independent variables. Using this method one can estimate both the magnitude and significance of causal connections between variables. The main purpose of path analysis is to

test whether there is a causal relationship between variables, understand the direct causal relationship between variables, and identify the indirect causal relationship through intermediary variables, so as to verify the variable relationship hypothesized in this study. We calculate the total value of the items of each variable after factor extraction, establish the variable path model (Figure 5-1) through the statistical software Mplus 7.4 for analysis and use the Bootstrap (N=5000) estimation method to perform parameter estimation and mediation effect test.
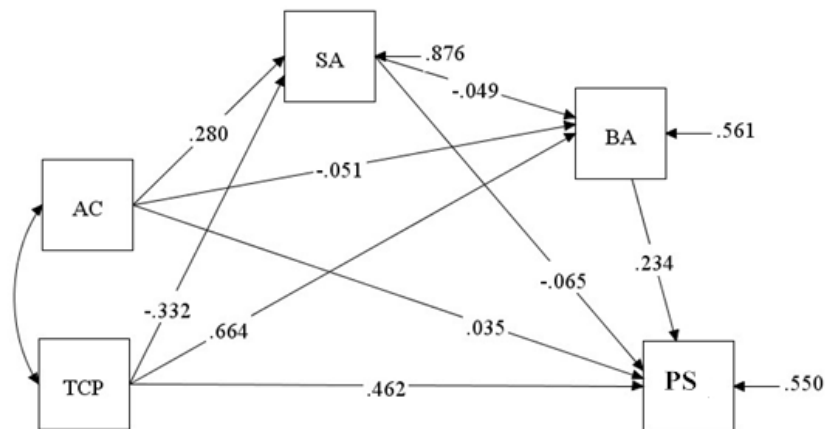
Figure 5-1 Path Model

Table 5-33 Path Coefficient Estimation Table (Bootstrap=5000)

Path	Standardized Coefficient	Standard Error	t	p
PS （R²=0.450）				
AC→PS	0.035	0.050	0.708	0.479
TCP→PS	0.462	0.061	7.589	0.000
SA→PS	-0.065	0.043	-1.508	0.132
BA→PS	0.234	0.060	3.902	0.000
BA （R²=0.439）				
AC→BA	-0.051	0.041	-1.245	0.213
TCP→BA	0.664	0.036	18.684	0.000
SA→BA	-0.049	0.045	-1.094	0.274
SA （R²=0.124）				
AC→SA	0.280	0.044	6.302	0.000
TCP→SA	-0.332	0.045	-7.380	0.000

Table 5-33 shows that in the whole sample, AC (β=0.035, p=0.479) and SA (β= -0.065, p=0.132) have no significant direct influence on PS (H1 and H8 false). AC(β = -0.051, p=0.213) and SA (β = -0.049, p=0.274) have no significant direct influence on BA (H5 and H6 false). However, TCP (β=0.462, p <0.001) and BA (β=0.234, p<0.001) have significant direct positive influence on PS (H2 and H9 true). TCP (β =0.664，p<0.001) has a significant direct influence on BA (H7 true). AC (β = 0.280, p < 0.001) has a significant direct positive effect on SA (H3 true), while TCP (β = -0.332, p < 0.001) has a significant direct negative effect on SA (H4 false). The coefficient of determination of PS (R^2=0.450) and BA (R^2=0.439) is close to 0.5, meaning that the model has a relatively high predictive effect on PS and BA. The coefficient of determination of SA (R^2=0.124) is slightly lower, indicating that the model has a relatively weak predictive effect on SA.

Table 5-34 Direct Effect, Indirect Effect and Total Effect Estimation Table

Path	Standardized Effect	Standard Error	95%CI	
			Lower Limit	Upper Limit
AC→PS				
AC→PS(Total Effect)	0.002	0.049	-0.093	0.099
AC→PS(Direct Effect)	0.035	0.050	-0.058	0.138
AC→PS(Total Indirect Effect)	-0.033	0.017	-0.069	-0.004
AC→SA→PS	-0.018	0.013	-0.047	0.004
AC→BA→PS	-0.012	0.011	-0.038	0.005
AC→SA→BA→PS	-0.003	0.003	-0.011	0.002
TCP→PS				
TCP→PS(Total Effect)	0.642	0.037	0.566	0.711
TCP→PS(Direct Effect)	0.462	0.061	0.333	0.571
TCP→PS(Total Indirect Effect)	0.181	0.045	0.097	0.271
TCP→SA→PS	0.021	0.015	-0.005	0.053
TCP→BA→PS	0.156	0.043	0.076	0.244
TCP→SA→BA→PS	0.004	0.004	-0.003	0.013
AC→BA				
AC→BA(Total Effect)	-0.065	0.039	-0.138	0.012
AC→BA(Direct Effect)	-0.051	0.041	-0.131	0.030
AC→SA→BA	-0.014	0.013	-0.039	0.011
TCP→BA				
TCP→BA(Total Effect)	0.681	0.032	0.613	0.741
TCP→BA(Direct Effect)	0.664	0.036	0.592	0.731
TCP→SA→BA	0.016	0.015	-0.013	0.048

As a variable, the mediator is a variable accounting for the relation between a predictor and a dependent variable (Tsai et al., 2008). There are hypothetical mediating variables in this research, and we verify the dependent and independent variables. As shown in Table 5-34, the mediating effect of SA in AC, TCP and BA is not significant. Based on the direct effect results of the variables described in Table 5-33, it is known that AC has no direct influence on BA or indirect influence on it through SA, while TCP has a direct influence on BA. Further test shows that the mediation effect of SA and BA between AC and PS is not valid whether they are alone or in a sequential relationship (SA→BA), and the total mediation effect is not valid either. The result indicates that the AC has no direct or indirect influence on PS. That is to say, SA has no mediating effect in AC and PS (H10a false), BA has no mediation effect in AC and PS (H10b false), and SA and BA have no sequential mediation effect on AC and PS (H10c false). The mediation effect of BA between TCP and PS is significant, and the mediating effect of BA accounts for 24.3% of the total effect, indicating that BA has partial mediation effect between TCP and PS (H11b true).SA and (SA→BA) have no significant mediation effect in TCP and PS, indicating that SA has no mediation effect in TCP and PS (H11a false), and SA and BA have no sequential mediation effect in TCP and PS (H11 c false).

5.8 Hypothesis Testing Results

From the above analysis, we reach the following results as shown in Table 5-35. The Model is modified according to the hypothesis testing results as per Figure 5-2.

Note: *p<0.001
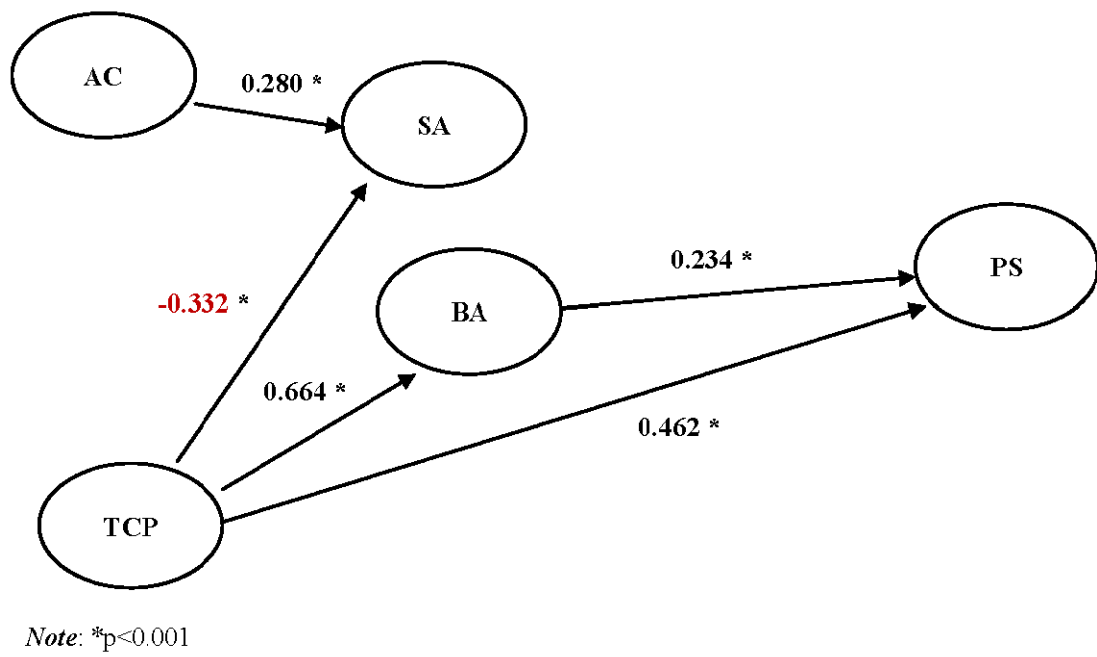
Figure 5-2 Final Model

Table 5-35 Hypothesis Testing Results

No.	Contents	Testing Result
H1	There is a positive correlation between patient AC and PS.	False
H2	There is a positive correlation between patient TCP and PS.	True
H3	There is a positive correlation between patient AC and their SA of specific technology.	True
H4	There is a positive correlation between patient TCP and their SA of specific technology.	False
H5	There is a positive correlation between patient SA of specific technology and their BA of technology.	False
H6	There is a positive correlation between patient AC and their BA of specific technology.	False
H7	There is a positive correlation between patient TCP and their BA of specific technology.	True
H8	There is a positive correlation between patient SA of specific technology and their PS.	False
H9	There is a positive correlation between patient BA of specific technology and their PS.	True
H10a	Patient SA of specific technology plays a mediating role in the positive correlation between AC and PS.	False
H10b	Patient BA of specific technology plays a mediating role in the positive correlation between AC and PS.	False
H10c	Patient SA and BA of specific technology plays a progressive mediating role in the positive correlation between AC and PS.	False
H11a	Patient SA of specific technology plays a mediating role in the positive correlation between TCP and PS.	False
H11b	Patient BA of specific technology plays a mediating role in the positive correlation between TCP and PS.	True
H11c	Patient SA and BA of specific technology plays a progressive mediating role in the positive correlation between TCP and PS.	False

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Chapter 6: Discussion

In this chapter, we briefly summarize the findings of this study, further discuss the theoretical and practical implications, analyze the limitations and offer suggestions for future research.

6.1 Discussion of Research Results

6.1.1 Relationship between Age, Educational Background and the Variables

Through analysis of the survey data, it is learned that patients in the active group and inactive group of the community hospital WeChat client side have differences in age and educational background. To be specific, the active group has lower mean value of age and higher level of educational background. Further analysis shows that both age and educational background exert significant influence on the hypothetical variables of this study, and the scores given by patients with different age levels and educational background to the measurement items of variables are different. Based on the above results, we infer the following arguments:

(1) Among adult patients, younger or more highly-educated ones have stronger technology innovation ability (AC) and higher satisfaction (PS), they are more inclined to recognize the innovative characteristics of the community hospital WeChat client side (TCP), and it is easier for them to realize application of the information platform (BA).

(2) Older patients have more ideal cognitive level (SA) of the functions of community hospital WeChat client side.

Results of previous studies generally reflect individual differences in age and educational background affect the degree of technology acceptance, and the findings of this study are basically consistent with the previous conclusions. Therefore, we suggest that factors such as the age and educational background of patient user groups should be paid attention to by

information platform developers and designers.

6.1.2 Variable Difference of the Two Groups of Patients

By comparing the scores given by patients in the active group and the inactive group to the variables, it is found that most of the patients in the active group give high scores to the AC, TCP, BA, and PS variables, while the situation of the patients in the inactive group is just the opposite. Patients in the active group have stronger technology innovation ability (AC) and higher satisfaction (PS), they are more inclined to recognize the innovative characteristics of the community hospital WeChat client side (TCP), and it is easier for them to realize application of the information platform (BA). Based on the comparison of the scores of SA variables given by the two groups of patients, we can infer that although patients of the active group have more ideal performance in the application of the community hospital WeChat client side, they do not perform as well as the patients of the inactive group as for the cognitive level (SA) of the functions supported by the information platform.

6.1.3 Relationship between AC, TCP and SA

Compared with patients in the inactive group, those in the active group generally have higher scores in AC, but relatively low scores in SA. However, the results of the final modeling analysis show that the AC difference between the patient groups exerts a positive impact on their SA degree of the technology. In this study, based on the theoretical support identified through literature review, we use PIIT as an evaluation index for the individual AC of patients. Dutta, Gwebu and Wang (2015) verify the influence of individual PIIT on his or her perceived feasibility and perceived desirability. According to Agarwal and Karahanna (2000), personal innovativeness has a positive effect on cognitive absorption with an information technology. In other words, individuals born with technological innovation tendencies may be more inclined to experience the cognition and absorption of technology, and it is easier for them to experience and perceive innovative technologies. The higher the patient's PIIT level is, the more active he or she will be to understand the specific functions of the technology platform, so they have a better grasp of the specific functions that can be realized by technology.

Table 6-1 Affordance Type and Definition

Affordance type	Description
Cognitive affordance	Design feature that helps users in knowing something
Physical affordance	Design feature that helps users in doing a physical action in the interface
Sensory affordance	Design feature that helps users sense something (especially cognitive affordances and physical affordances)
Functional affordance	Design feature that helps users accomplish work (i.e., the usefulness of a system function)

Source: Hartson (2003)

Through modeling results analysis, it is found that the TCP level of patients is negatively correlated with their SA of technology, which echoes the comparison results of the two variables between the two groups. This is an interesting finding, because according to past research results, individuals with a more ideal evaluation of the innovation characteristics of a specific technology will have higher acceptance of technology innovation (Stachewicz, 2011). However, it is found in this research that the individual recognition degree of the innovative characteristics of technology is inversely proportional to the actual functional evaluation of the technology. By reviewing Hartson (2003) discussion of the concept of affordance, we understand that the design of an object's functions is purposeful and directional, and it provides an affordance to help or aid the user in doing something. This is called functional affordance, which is consistent with the concept of SA in this research. However, the effective implementation of functional affordance cannot be accomplished at one stroke. In other words, willingness to the basic technology by users does not mean that they are bound to fully or correctly recognize the functions. Instead, it is also related to the object design as well as cognitive affordance, physical affordance and sensory affordance as per Table 6-1. According to Grgecic et al. (2015), realization of functional affordance needs the object to provide communication of values and meaning, which is similar to the functional affordances and symbolic expressions proposed by Markus and Silver (2008). Therefore, even if an individual recognizes the technology innovation, it does not necessarily exert a direct impact on his or her SA of the technology or technology products. On the contrary, it may be because the designers of the technology products (Community WeChat Client Information Platform) pay too much attention to the innovative characteristics of technology, so they ignore the

105

importance attached to the above several affordances, hindering the product to effectively communicate its values and meaning to the users, thereby weakening or restricting the individual functional affordance to the technology products.

Relevant research shows that some people are anxious about innovative technology, and their anxiety will affect their attitude towards technology adoption and the ultimate application behavior. This concept is known as Technology Anxiety (Meuter & Ostrom, 2003; Yang & Forney, 2013). Based on the UTAUT Model, Yang and Forney (2013) verified whether there is a causal relationship between consumers' technology anxiety levels and their mobile shopping decisions. Results show that for consumers with lower levels of technology anxiety, the effect of facilitating conditions on both utilitarian and hedonic performance expectancies has a greater impact on technology adoption, but consumers with higher levels of technology anxiety are less likely to be affected by the above factors. As a result, the level of technology anxiety of consumers is the main factor that restricts the application of technology. The results of Meuter and Ostrom (2003) also show that respondents with higher levels of technology anxiety have less online consumption, and technology anxiety also affects overall consumer satisfaction and willingness to use it again. Shih and Tsai (2006) pointed out that technology anxiety is mainly manifested in people's fear of and resistance to the use of innovative technology, including their pressure to use the technology and frustration after using the technology. Based on the above studies and the results of this study, we cannot rule out the possibility that a considerable number of patients in this survey may have relatively high levels of technology anxiety. The higher their cognitive awareness and recognition of technology innovation, the higher resistance they may generate towards the technology, which may have a restrictive effect on the specific functional perception that the WeChat platform can load. However, since the technology anxiety factors of the patient group are not analyzed in this study, the technology anxiety levels of the respondents are not evaluated. Therefore, the possibility of the influence of technology anxiety factors needs further research and verification.

6.1.4 Relationship between AC, TCP and BA

The survey results show that the AC difference of the patient groups is not significantly related to their BA of technology. In this study, we use PIIT as an evaluation index of individual AC, and results show that even if patients have more positive inclination to experience emerging technology products or have more active contact with the information technology, they may not be able to apply the technology in daily life in a successful or normalized manner. In fact, the individual PIIT trait is an attitude towards the behavior generated under the influence of behavior beliefs and an attitude towards the acceptance and application of emerging technologies. According to the analysis of the TPB theoretical model, attitude towards the behavior can only affect actual behaviors when it is combined with subjective norm and perceived behavioral control to jointly affect the behavior intention. As for the gap between attitude and actual behavior, Kaaronen (2017) also carries out an analysis in his research and proposes the concept of attitude-action gap. Based on research on affordance, he further develops Norman (1988a) views and analyzes the gap. Norman (2002) argues that there are two gulfs separating internal mental states from being complemented by external physical ones: one is gulf of execution, and the other is gulf of evaluation (Table 6-2). Therefore, there is a gap between individual attitude towards technology and actual action, if the gap cannot be bridged (unable to effectively evaluate the technology or match the intention), it will be impossible to realize correct cognition and, in turn, affect actual action.

The survey results show that the TCP difference of the patient groups has a positive impact on their BA of technology. The more the patients recognize the innovation of the community hospital WeChat client side, the more likely it will be for them to apply the information platform. It is also found that users attach importance to innovation characteristics of technology which is an important factor affecting their application behavior. The results are basically consistent with previous findings. It suggests that information technology product designers should pay attention to the innovation characteristics of technology products, which is conducive to the promotion and application of technology.

Table 6-2 Gulf of Execution and Gulf of Evaluation

Concepts	Definition
Gulf of Execution	It exists when the actions provided by a system do not match those intended by a person, or when a system does not allow a person to execute the intended actions directly and without significant effort
Gulf of Evaluation	It exists when a system does not provide physical representations that can be directly perceived and interpreted in terms of intentions and expectations of a perceiver

Source: Norman (1988b)

6.1.5 Relationship between SA and BA

In literature review, based on research on TPB and affordance, it is learned that the individual implementation of affordance (BA) goes through a processing procedure that involves the object itself. Individuals' contact and communication with the object leads to changes of their psychological beliefs and, in turn, the final usage behavior. When applying the affordance theory in HCI, also points out that the interaction between the individual and the computer is a stage-of-action process, in which the user needs to perform cognitive, physical and sensory behaviors and needs corresponding assistance. However, results of this research show that although there are differences in the scores of the SA variable between the two groups of patients, the path model verification analysis indicates that there is no significant correlation between patients' SA and BA of the information platform. Therefore, individuals' SA and BA of a specific technology may be different stages of a process, but there is not necessarily a causal relationship.

In previous studies, the realization of affordance is affected by many factors, and the process is complex and not linear. Based on the Activation of Affordance-Meaning Pathway proposed by Lu and Cheng (2013) and the view of immediate concrete outcome proposed by Strong et al. (2014), we understand that to realize affordance, individuals must have a clear objective, the realization of behavior needs to bring about ideal expected results, and it is affected by personal ability and even environmental factors. Grgecic et al. (2015) also point out that the object communicates values and meaning to the user, forms functional affordance,

and affects actors' actions and beliefs. This process is time-dependent, and without the cumulative effect of time, it might be impossible to form such a progressive relationship. As mentioned before, Norman (1988b) points out that there are gulfs of execution and evaluation when individuals get in touch with technology. Definitions of the two concepts also indicate that even though individuals can step over the gulf of evaluation, but if the technology does not satisfy the individual's intention or requires a lot of effort, they may still be unable to step over the gulf of execution, and ultimately implement the actual application behavior.

Therefore, the individual's BA of technology is not generated merely by his or her cognition and correct evaluation of the technology functions. Instead, it is limited by many factors. The two are not necessarily related, as there may be other intermediaries involved, and the specific mechanism remains to be further explored in the future. This finding also explains to some extent why some emerging technologies or technology products may not be applied well although their functional characteristics are recognized and understood by users.

6.1.6 Relationship between AC, TCP, SA, BA and PS

Results show that the TCP of patients exerts a direct positive impact on PS without mediation effect, which suggests that even if patients' implementation of the affordance of the information platform is unsatisfactory, their perception and recognition of the innovation characteristics of the information platform can also help to the improve patient satisfaction. Perhaps with the intervention of innovative information technology, the promotion of community hospital service processes and doctor-patient communication by technology or technology products can make some patients recognize the platform even if these patients are not involved in the practical application of technology. This further reveals the importance of the characteristics of technological innovation being recognized by the user community.

It is learned in previous literature that stronger individual AC (PIIT) is conducive to his or her adoption and application of innovative technologies, which is, in turn, conducive to the improvement of PS. However, the results of this study show that AC of patients has no direct or indirect significant influence on PS. Based on the results of the afore-mentioned analysis that patient AC has a positive influence on SA, and AC has no significant influence on BA,

we believe that even if the AC of patients is ideal, without good contact and interaction with the information platform, their satisfaction with the medical service after the information intervention will not be significantly improved. Even if they have a good understanding of the functions of the information platform, with no ideal adoption and application, there will be no positive influence on medical satisfaction.

Through analysis of the survey results, it is verified that the patients' BA of the WeChat client side has a significant positive impact PS, which is consistent with our expected hypothesis, and also reflects that the implementation of the information platform application behavior has a certain correlation with the improvement of patient satisfaction. The information platform is expected to further improve patient satisfaction by promoting application of patients through optimization and improvement. However, SA has no significant influence on PS, which reflects that if individuals stay at the functional cognition level of information technology with no implementation, there will be no influence on medical service satisfaction.

6.1.7 Mediating Effect of BA between TCP and PS

Results show that the patients' actual application (BA) of the community WeChat client side plays a mediating role between TCP and PS, which is consistent with our expected hypothesis. The analysis results also suggest that the mediating effect of BA between TCP and PS accounts for 24.3% of the total effect and the influence of TCP on PS is mainly direct. Among patients with better TCP, some have frequent practical application of the information platform and have experienced the improvement of medical services and doctor-patient relationship, thus improving the overall satisfaction of medical services. However, there are quite a few patients with better TCP who have do not use the information platform at present but may have a good application experience previously or have relatively high recognition of the innovative features after the intervention of information technology, and their overall satisfaction with medical services is still ideal.

6.2 Theoretical Implications

To explore the influencing factors of individual technology adoption behavior based on the concept of affordance has attracted attention of increasingly more scholars, and research from different perspectives has mushroomed, especially in the field of HCI. There is still much potentially unknown room for the discussion of affordance, but the influence of individual factors has been widely recognized. Previous studies have focused more on the basic characteristics of age, experience, and educational background, but this research attempts to explore from the perspective of individual cognitive and acceptance ability of innovative technology on the basis of mature technology adoption behavior theories such as Absorptive Capability and IDT, and understand the influence of these differences on affordance, which makes new explorations for the theoretical research.

In addition, there has been a new focus in the field of affordance research in recent years. Scholars have been based more on Gibson's theory in the early days, focusing on the simple affordance (cognition, understanding, and evaluation) generated by individuals in their interaction with the object. Recently, the research focus has been shifted to the implementation of affordance, that is, the effective generation of application behavior. Based on the previous research results, this study focuses on the implementation of affordance (BA), explores the correlation between BA and technology functional affordance (SA) in the process of communication between individuals and the specific technology as well as application of the technology, and further discusses the impact of technology BA on satisfaction. Research on the relationship between these variables is innovative to a certain degree, and it is also a meaningful complement to research on affordance with relatively complex mechanism. The conceptual framework constructed in this study offers a starting point and implications for the future empirical research.

6.3 Practical implications

With the continuous advancement of information technology, all the industries are

actively trying to use information technology to assist or optimize management and business processes. Medical service is a key project of people's livelihood, and it meets the needs of the public for medical treatment as well as the requirement to advance with the times to explore how to improve medical service quality through information technology. However, in reality, whether the introduction of information technology achieves the expected results is closely related to the technology adoption behavior of the individuals. Many previous studies have explored the relevant influencing factors of technology acceptance and diffusion through TAM, UTAUT, IDT and other mature theories, which provides a lot of support and help for the design optimization or promotion management of information technology products. This study focuses on the concept of affordance and explores it from a newer perspective. Through the survey results, we understand that the individual age, educational background, and their evaluation of the innovation characteristics of technology play an important role in the final implementation of technology application behavior, and the effective application of technology can indeed improve satisfaction. These findings prove the positive role of information technology intervention in the improvement of medical services, enhance the confidence of medical informatization development, and further remind the information technology developers or product designers of paying more attention to understand users' evaluation of and needs for technological innovation in the process of technology development and design, so as to promote technology and enhance user acceptance of technology, realize the goal to improve medical services and provide beneficial guidance for the development of medical informatization.

6.4 Limitations

There are still certain limitations in this research as follows:

(1) Data of the research are obtained through questionnaire. Although the survey covers community health service centers of all the districts of Guangzhou, due to limited research team resources, only one to two centers are selected for survey in the suburban districts. In addition, the sample size of the survey is also slightly insufficient, which may affect the data representativeness to some extent.

(2) According to Markus and Silver (2008), an artifact provides a number of different symbolic expressions to a specific user or groups of users, because these expressions convey different functional affordances. In other words, different users or groups of users may experience different symbolic expressions for a specific technology product and form different functional affordances. This research is targeted at patients who use the community hospital WeChat client side, and the results are more focused on the situation of the patients in a particular information platform. However, due to time and resource constraints, community doctors, the other group of users of the community hospital WeChat client, are not included, so the research may have certain limitations.

(3) As mentioned earlier, according to previous studies, it is a complex process from individual perception and evaluation of technology to influence on beliefs and actual actions, and this process is based on time accumulation. This thesis is a cross-sectional study in which the data are collected in a relatively short period of time. Due to this limitation, there is no vertical comparison of evaluation variables and indexes to explore changes over time.

6.5 Suggestions for Future Research

Based on the research findings and limitations, we propose several suggestions for future research:

(1) If conditions and resources permit, in the next stage, it is suggested to enlarge the sample size, conduct in-depth research in wider areas, further test the hypothesis of this study, and elaborate the aspects not explored in this study so as to make the research more objective and scientific.

(2) It is suggested to conduct research on different user groups or different information platforms based on the framework of this research to evaluate different groups of people, or the difference and influencing factors of technology application behaviors in different technology platforms so as to explore relevant mechanisms of affordance in a broader and more comprehensive manner.

(3) In the field of HCI, there are still many potential gaps in the current research on

individual affordance, especially the behavioral implementation mechanism of affordance. Both the environmental factors and individual specific factors may affect the mechanism, and instrumentation of the current investigation and analysis still needs to be further improved and supplemented. Therefore, in order to better understand the specific situation of the user group, individuals, their environment and technology behavior, it is necessary to carry out a well-designed and well-prepared in-depth case study. Analysis of the interview results can help to understand the factors in a more comprehensive manner and promote the improvement of evaluation methods.

6.6 Conclusions

The application of information technology in medical services has been widely favored, and the information technology developers have also developed different information application platforms according to different links of medical treatment, with an attempt to help improve medical work. This move is particularly important urgent in the improvement of primary-level medical treatment. It is found in this research that the patients' age, educational background, and their recognition of technological innovation characteristics are important factors affecting their application of technology. The effective application of the information platform also plays a positive role in the improvement of satisfaction. Therefore, the informatization development of medical services is worthy of advocacy and promotion. However, while attaching importance to technological innovation, technology developers should also pay attention to the differences in individual characteristics and needs of different user groups, so as to better promote technology application to serve the public.

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Appendix A: Table of The Scale Measures Items and Corresponding Codes

Table 1   The Scale Measures Items and Corresponding Code（AC）

No.	Items
AC1	I always try to use new phone Apps.
AC2	I always pay attention to and collect information related to new phone Apps in my life.
AC3	I would try to use the latest and most popular phone Apps every now and then.
AC4	I would use phone Apps to deal with whatever can be done with phone Apps.
AC5	I can quickly grasp the usage of new phone Apps.

Table 2   The Scale Measures Items and Corresponding Code（TCP）

No.	Items
TCP1	I think using Wechat client side to deal with community hospital affairs is better than other methods.
TCP2	I think using Wechat client side to deal with community hospital affairs can improve the quality of visiting the hospital.
TCP3	I think it's easy to use Wechat client side to deal with community hospital affairs.
TCP4	I think the using Wechat client side to deal with community hospital affairs fits my habits.
TCP5	I think I would try the new features of WeChat client side to help me deal with the procedures of visiting a hospital.
TCP6	I can see that people are using Wechat client side to deal with community hospital affairs everywhere in the community hospital.
TCP7	I can easily see that after using Wechat client side to deal with community hospital affairs, positive changes have taken place on the conditions of the community hospital and the patients.
TCP8	It's easy to use Wechat client side to deal with community hospital affairs.
TCP9	I think using Wechat client side to deal with community hospital affairs can shorten the time spent on making appointments and actual visits.
TCP10	Many relatives and friends of mine are using Wechat client side to deal with community hospital affairs.
TCP11	My doctor expects me to use Wechat client side to deal with community hospital affairs
TCP12	I do not think it would take much time to learn how to use Wechat client side to deal with community hospital affairs.

Table 3   The Scale Measures Items and Corresponding Code（SA）

No.	Items
SA1	Based on my condition, I think it's easy to use WeChat client side to make an appointment with the doctor I want to see successfully
SA2	Based on my condition, I think it's easy to use WeChat client side to appoint the wanted diagnosis time successfully
SA3	Based on my condition, I think it's easy to appoint the department to visit successfully
SA4	Based on my condition, I think it's easy to pay all medical bills successfully
SA5	Based on my condition, I think it's easy to access all of my medical examination reports and medical records successfully
SA6	Based on my condition, I think it's easy to consult doctors at any time
SA7	Based on my condition, I think it's easy to communicate with other patients at any time
SA8	Based on my condition, I think it's easy to ask medical workers questions through WeChat client side at any time

Table 4   The Scale Measures Items and Corresponding Code（BA）

No.	Items
BA1	I am basically using WeChat client side to make appointment with doctors every time I go to community hospitals
BA2	I am basically using WeChat client side to pay medical bills every time I go to community hospitals
BA3	I am basically using WeChat client side to access my medical examination reports and medical records every time I go to community hospitals
BA4	I am basically using WeChat client side to communicate with the doctors I want to consult every time I go to community hospitals
BA5	I am basically using WeChat client side to communicate with other patients every time I go to community hospitals
BA6	I am basically using WeChat client side to ask medical workers questions every time I go to community hospitals

Table 5   The Scale Measures Items and Corresponding Code（PS）

No.	Items
PS1	The doctor encourages me to ask questions.
PS2	The doctor would fully answer my questions.
PS3	I can understand the explanations given by the doctor.
PS4	The doctor is very considerate.
PS5	The doctor makes me feel at ease when I talk about my condition.
PS6	I feel that the doctor is very familiar with my medical records.
PS7	I am very satisfied with the diagnosis time.
PS8	I am very satisfied with the time spent on waiting in the hospital.
PS9	I am very satisfied with the total time spent on this visit to the hospital.
PS10	My illness has been treated properly.
PS11	I have gained better understanding of my condition after seeing the doctor.
PS12	I feel much less worried about my condition after communicating with the doctor.

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Appendix B: Questionnaire (English Version)

Questionnaire for the Study of Patients' Usage, Assessments and Application Results of WeChat Client-Side in Dealing Community Hospital Affairs

This research will study such WeChat client-side features in dealing with community hospital affairs as Public Accounts of community hospitals opened for making appointments, consulting, signing contracts with family doctors, accessing personal health information, Wallet applied in paying medical bills, WeChat communication platform convenient for doctor-patient communication, Search used in reading and searching for medical information .

Questionnaire number:
Name of the community hospital:_____
Name of the doctor you visit:_____

Date:　_____ (month) _____ (day), 2018

Respected Patient,

　　Thank you for participating in this doctoral thesis questionnaire survey. Data collected by this questionnaire will be used only for the doctoral thesis research, and our statistical analysis of the data will study the overall results of all questionnaires without storing or analyzing personal data of any individual.Therefore, please answer all of the following questions according to your personal experience, feelings or indirect observations.
This questionnaire consists of 4 parts: 1) Background Information, 2) Patients' ability about Information Technology, 3) Patients' Assessments of the Features and the Usage of WeChat Client Side in Dealing with Community Hospital Affairs, 4) Patients' Satisfaction Level. It takes about 15 minutes to complete this questionnaire. Thank you very much for supporting this doctoral thesis.In order to express our gratitude, a gift will be given to you after you completing this questionnaire.

　　If you have any questions related to this questionnaire survey, please contact Wu Zijian, the author of this doctoral thesis from Southern Medical University
Tel: 13728042745　　　　　　　WeChat: 13728042745

Part I: Background Information

Please provide the following background information of yours for us to better understand your medical needs and your usage of WeChat client side to deal with community hospital affairs.

a.   Which department are you visiting this time? _____ (e.g. the Department of General Practice, the Department of Vaccine Inoculation, the Department of Children Healthcare)

b.   Your gender: ___Male___Female

c.   Your age:_____

d.   You're now working in/as:
    ___the Government,____State-owned enterprise,____Private enterprise, ____Foreign company, Private-run enterprise,___Self-employed worker,___Farmer,___Others (please specify):_____

e.   Your highest education level attained:
    ___Master or above,___Bachelor,___Professional school,___Senior high school,___Junior high school,___Primary school

f.   When did you start using personal WeChat? The year of_____(e.g. The year of 2015)

g.   The average time you spend on WeChat everyday:___hour(s)___minute(s)

h.   When did you start WeChat client side to deal with community hospital affairs? The year of_____

i.   When did you come to this community hospital for the first time? The year of_____

j.   How many times have you visited this community hospital in the past year? _____time(s)

k.   Out of the total amount of time(s) you answered in the last question, how many time(s) have you used WeChat client side to do the following things?
(1) Making appointment registration for_____time(s);
(2) Paying medical bills for_____time(s);
(3) Accessing your medical examination reports or medical records for_____time(s);
(4) Consulting the doctors for_____time(s);
(5) Reading or searching for medical information (such as health education information, information about vaccine, introductions of doctors) for_____time(s).

Part Ⅱ Patients' Ability about Information Technology

Please circle the number that represents your agreement degree to the following statements (all the statements are to be rated on a scale of 1 to 7, in which 1 stands for "strongly disagree" and 7 represents "Very Much Agree"). There is no standard answers to all of the questions, sso please rate according to your experience, feelings and observations.

2.1 Patients' usage of phone Apps

		Strongly disagree						Very much agree
a.	I always try to use new phone Apps.	1	2	3	4	5	6	7
b.	I always pay attention to and collect information related to new phone Apps in my life.	1	2	3	4	5	6	7
c.	I would try to use the latest and most popular phone Apps every now and then.	1	2	3	4	5	6	7
d.	I would use phone Apps to deal with whatever can be done with phone Apps.	1	2	3	4	5	6	7
e.	I can quickly grasp the usage of new phone Apps.	1	2	3	4	5	6	7

2.2 Patients' opinions about using WeChat client side to deal with community hospital affairs

a.	I think using Wechat client side to deal with community hospital affairs is better than other methods.	1	2	3	4	5	6	7
b.	I think using Wechat client side to deal with community hospital affairs can improve the quality of visiting the hospital.	1	2	3	4	5	6	7
c.	I think it's easy to use Wechat client side to deal with community hospital affairs.	1	2	3	4	5	6	7
d.	I think the using Wechat client side to deal with community hospital affairs fits my habits.	1	2	3	4	5	6	7
e.	I think I would try the new features of WeChat client side to help me deal with the procedures of visiting a hospital.	1	2	3	4	5	6	7
f.	I can see that people are using Wechat client side to deal with community hospital affairs everywhere in the community hospital.	1	2	3	4	5	6	7
g.	I can easily see that after using Wechat client side to deal with community hospital affairs, positive changes have taken place on the conditions of the community hospital and the patients.	1	2	3	4	5	6	7
h.	It's easy to use Wechat client side to deal with community hospital affairs.	1	2	3	4	5	6	7
i.	I think using Wechat client side to deal with community hospital affairs can shorten the time spent on making appointments and actual visits.	1	2	3	4	5	6	7
j.	Many relatives and friends of mine are using Wechat client side to deal with community hospital affairs.	1	2	3	4	5	6	7
k.	My doctor expects me to use Wechat client side to deal with community hospital affairs	1	2	3	4	5	6	7
l.	I do not think it would take much time to learn how to use Wechat client side to deal with community hospital affairs.	1	2	3	4	5	6	7

Part Ⅲ Patients' Assessments of the Features and the Usage of WeChat Client Side in Dealing with Community Hospital Affairs

3.1 Based on my condition, I think it's easy to use WeChat client side to do the following things related to community hospital affairs. — Strongly disagree ... Very much agree

n.	Successfully making an appointment with the doctor I want to see	1	2	3	4	5	6	7
o.	Successfully appointing the wanted diagnosis time	1	2	3	4	5	6	7
p.	Successfully appointing the department to visit	1	2	3	4	5	6	7
q.	Successfully paying all medical bills	1	2	3	4	5	6	7
r.	Successfully accessing all of my medical examination reports and medical records	1	2	3	4	5	6	7
s.	Consulting doctors at any time	1	2	3	4	5	6	7
t.	Communicating with other patients at any time	1	2	3	4	5	6	7
u.	Asking medical workers questions through WeChat client side at any time	1	2	3	4	5	6	7

3.2 I am basically using WeChat client side to do the following things basically every time I go to community hospitals.

a.	Making appointment with doctors	1	2	3	4	5	6	7
b.	Paying medical bills	1	2	3	4	5	6	7
c.	Accessing my medical examination reports and medical records	1	2	3	4	5	6	7
d.	Communicating with the doctors I want to consult	1	2	3	4	5	6	7
e.	Communicating with other patients	1	2	3	4	5	6	7
f.	Asking medical workers questions through WeChat client side	1	2	3	4	5	6	7

Part Ⅳ Patients' Satisfaction Level

Strongly disagree ... Very much agree

a.	The doctor encourages me to ask questions.	1	2	3	4	5	6	7
b.	The doctor would fully answer my questions.	1	2	3	4	5	6	7
c.	I can understand the explanations given by the doctor.	1	2	3	4	5	6	7
d.	The doctor is very considerate.	1	2	3	4	5	6	7
e.	The doctor makes me feel at ease when I talk about my condition.	1	2	3	4	5	6	7
f.	I feel that the doctor is very familiar with my medical records.	1	2	3	4	5	6	7
g.	I am very satisfied with the diagnosis time.	1	2	3	4	5	6	7
h.	I am very satisfied with the time spent on waiting in the hospital.	1	2	3	4	5	6	7
i.	I am very satisfied with the total time spent on this visit to the hospital.	1	2	3	4	5	6	7
j.	My illness has been treated properly.	1	2	3	4	5	6	7
k.	I have gained better understanding of my condition after seeing the doctor.	1	2	3	4	5	6	7
l.	I feel much less worried about my condition after communicating with the doctor.	1	2	3	4	5	6	7
m.	I think the treatment plan chosen by the doctor is the most suitable one for me.	1	2	3	4	5	6	7

Thank you very much for your support and help!

Appendix C: Questionnaire (Chinese Version)

社区医院微信客户端患者评估、使用及结果研究调查问卷

在本研究中，社区医院微信客户端功能：包括通过社区医院的微信公众号实现预约、在线咨询、定

点签约、查询信息；患者通过微信钱包支付社区医疗费用；医患双方通过微信平台在线沟通；查询和了

解医疗资讯等。

调查问卷编号：   社区医院名称：_____就诊医生姓名：_____

调查问卷日期：2018年___月___日

尊敬的患者：

谢谢您参与本博士论文调查问卷研究。本调查问卷收集的数据纯用于博士论文研究目的，我
们的数据统计分析是基于所有问卷的综合结果，不会对任何个人数据进行分析存储。因此，请您根据您
自己的亲身经验、真实感受或者间接观察回答所有问题。

这份问卷包括四部分:1）背景信息，2）患者信息技术相关能力，3）患者对医院微信客户端性能及
使用评估，4）患者对就医过程的满意度。问卷填写大约需要15分钟。非常感谢您对我的博士论文的支
持和帮助。为了表达对您回答问卷的感谢心意，您完整填写问卷后，我们将为您提供一份礼品。

联系人：吴子健，南方医科大学博士论文，联系电话：13728042745   微信：13728042745

第一部分： 研究背景

请提供以下您的背景信息以帮助我们更好的了解您的就医需求和使用医院微信客户端患者具体情况:

a.您这次在这家社区医院看病的科室（如全科、免疫接种、儿保等）：_____

b.您的性别：__男 __女

c.您的年龄：_____

d.您的职业：___政府 ___国企 ___私企 ___外企 ___民营企业 ___个体户___农民

___其他（请注明）：_____

e.最高学历：___硕士或以上___本科___大专___高中___初中___小学

f.您最早开始使用个人微信的时间（例如 2015 年）：_____ 年

g.您平均每天使用个人微信的时间大约是：_____小时 ___ 分钟

h.您最早开始使用社区医院微信客户端是哪一年: _____年

i.您第一次到此社区医院就医是哪一年：_____年

j.您最近一年到这家社区医院看病多少次？：_____次

k.在您上题填写的看病总次数中，您应用这家社区医院微信客户端做一下事情大概有多少次:

    (1).预约挂号____次；(2).付费____次；(3).查询化验报告和病历____次；(4).咨询医生____次；

    (5).查询和了解医疗资讯（如健康科普信息、疫苗信息、医生简介等）____次

第二部分: 患者信息技术相关能力

请画圈选择一个数字来表示您对以下每一个陈述句的同意程度（1代表十分不同意，7代表十分同意）。评分没有客观答案或标准，请根据您的经验、感受和观察进行判断估计。请回答所有问题。

2.1 手机APP使用

		十分不同意						十分同意
a.	我经常下载尝试新的手机APP	1	2	3	4	5	6	7
b.	我经常在生活中关注和收集新的手机APP相关信息	1	2	3	4	5	6	7
c.	每隔一段时间，我会寻找发现最前沿和流行的手机APP	1	2	3	4	5	6	7
d.	只要能用手机APP做的事情，我现在都会应用手机APP来完成	1	2	3	4	5	6	7
e.	我能够很快的学习和理解新的手机APP	1	2	3	4	5	6	7

2.2 对社区医院微信客户端的看法

a.	我觉得使用社区医院微信客户端做看病的安排，能比其他方式更好	1	2	3	4	5	6	7
b.	我觉得使用医院微信客户端，可让我看病质量有显著提高	1	2	3	4	5	6	7
c.	我觉得医院微信客户端用起来很简单	1	2	3	4	5	6	7
d.	我觉得使用社区医院微信客户端符合我的习惯	1	2	3	4	5	6	7
e.	我想我会尝试应用社区医院微信客户端新功能，帮助我处理看病手续	1	2	3	4	5	6	7
f.	我在社区医院，可以看到到处都有人使用社区医院的微信客户端	1	2	3	4	5	6	7
g.	我能轻易地感受到：在使用社区医院微信客户端后，社区医院及患者状态产生了积极的改变	1	2	3	4	5	6	7
h.	社区医院微信客户端使用很方便	1	2	3	4	5	6	7
i.	我觉得使用社区医院微信客户端，我能节省预约和实际看病用的时间	1	2	3	4	5	6	7
j.	我周围很多亲朋都在使用社区医院微信客户端	1	2	3	4	5	6	7
k.	我的医生期望我使用社区医院微信客户端	1	2	3	4	5	6	7

1.	我觉得学习如何使用社区医院微信客户端不需要花太多时间	1	2	3	4	5	6	7

第三部分：患者对社区医院微信客户端性能及使用评估

3.1 基于我的病情，我认为使用社区医院微信客户端，可以很容易地在网上...

		十分不同意					十分同意	
a.	预约到我想要看的医生	1	2	3	4	5	6	7
b.	预约到我想要的看病时间	1	2	3	4	5	6	7
c.	预约到我想要的看病医院地点	1	2	3	4	5	6	7
d.	支付看病相关的所有费用	1	2	3	4	5	6	7
e.	查看我的所有化验报告和病历	1	2	3	4	5	6	7
f.	随时和医生互动咨询	1	2	3	4	5	6	7
g.	随时与其他患者交流	1	2	3	4	5	6	7
h.	随时通过短信问医务人员问题	1	2	3	4	5	6	7

3.2 我现在到社区医院看病，基本上都是用社区医院微信客户端...

a.	预约医生	1	2	3	4	5	6	7
b.	支付医疗相关费用	1	2	3	4	5	6	7
c.	查看化验报告和病历	1	2	3	4	5	6	7
d.	跟我想要咨询的医生在网上随时互动咨询	1	2	3	4	5	6	7
e.	与其他患者交流	1	2	3	4	5	6	7
f.	通过短信问医务人员问题	1	2	3	4	5	6	7

第四部分：满意度

		十分 不同意					十分 同意
a.	医生鼓励我问问题						
b.	医生会充分地回答我的问题						
c.	我能理解医生给予的解释						
d.	医生对我很体贴						
e.	医生让我很自如地讨论我的病情						
f.	我感觉医生对我的医疗历史很了解						
g.	我对医生给我的会诊时间很满意						
h.	我对在医院等待的时间很满意						
i.	我对这次看病所花的总时间很满意						
j.	我的病症得到了恰当的治疗						
k.	在看过医生之后，我对我的病情有更好的了解						
l.	在跟医生交流之后，我对我的病情感觉好很多						
m.	我觉得医生选择的治疗方案，对我而言是最合适的。						

非常感谢您对我们研究课题的支持和帮助！