Journal of Health and Environmental Research
2022; 8(2): 141-150
http://www.sciencepublishinggroup.com/j/jher
doi: 10.11648/j.jher.20220802.19
ISSN: 2472-3584 (Print); ISSN: 2472-3592 (Online)

Contactless: Concept, Mechanism and Practice in COVID-19 Prevention and Control Under STLC Theory

Lingfu Zhang[1], Hailing Wang[1, *], Yongfang Dou[1, 2]

[1]School of Economics and Management, Xinjiang University, Urumqi, China

[2]Xinjiang Innovation Management Research Center, Xinjiang University, Urumqi, China

Email address:

z_d@stu.xju.edu.cn (Lingfu Zhang), HailingWANG@xju.edu.cn (Hailing Wang), 107552000226@stu.edu.cn (Yongfang Dou)

[*]Corresponding author

To cite this article:

Lingfu Zhang, Hailing Wang, Yongfang Dou. Contactless: Concept, Mechanism and Practice in COVID-19 Prevention and Control Under STLC Theory. *Journal of Health and Environmental Research*. Vol. 8, No. 2, 2022, pp. 141-150. doi: 10.11648/j.jher.20220802.19

Received: February 17, 2022; **Accepted**: June 1, 2022; **Published**: June 16, 2022

Abstract: COVID-19 is spreading rapidly over the world, which has continued to affect economic performance and the lives of residents. To find a scientific theory for controlling the spread of the COVID-19, restoring economic development, improving people's lives, based on the literature, theory and practice analysis, the paper makes the following points. 1. Presenting the concept of contactless, including the definition, characteristics, significance. 2. Constructing a space-time locational correlation theory (STLC) to study the operational mechanism of contactless, (1) based on the definition analysis, the scope of action of contactless is divided into three parts: 1) the spatial surface distance between the subject (A) and the object (B) is zero, 2) the spatial surface distance between A and B is not zero but within the effective direct influence range, 3) beyond its effective direct influence range; (2) exploring the mechanism of contactless of A and B under the different scope of action for the 1) same space, same time, 2) same space, different time, 3) different space, same time, 4) different space, different time, respectively. 3. Building a contactless decision-making model, which considers the subject-object cost, environmental cost and safety cost, to minimize the comprehensive cost, and providing a basis for the selection and application of contactless. 4. Discussing it empirically using the COVID-19 as an example to demonstrate the application value and practical significance of the basic theory and mechanism of contactless. Contactless has already played a significant role in the prevention and control of the COVID-19, but there are still imperfections and future research still needs to improve and expand on them. It is expected that contactless will serve social development better.

Keywords: Contactless, Contactless Foundation Concept, Space-Time Locational Correlation Theory (STLC), Mechanism Analysis in STLC, COVID-19 Prevention and Control Practice

1. Introduction

At the beginning of late December 2019, outbreaks of COVID-19 occurred one after another around the world. In order to control and combat the spread of the virus, means such as controlling the source of infection, isolating patients already sick, cutting off transmission routes, blocking transport and circulation, protecting susceptible populations, evacuating dense, easing movement and decontaminating the environment were used. This has led to the suspension of production, temporary shortages of materials and disruption of trade flows, posing a major challenge to the health of the world economy. The functioning of the world economy is facing a serious crisis.

Looking at the statistics of each country from 2020 to 2021, countries such as the United States, the European Union, India and Brazil are more seriously affected by the epidemic and their GDP declines by 3.49%, 5.94%, 7.96% and 4.06% respectively in 2020 and grows by 5.7%, 5.2%, 9.5% and 4.6% respectively in 2021. China, on the other hand, has taken advantage of its national system to grow its GDP by 2.3% in 2020 and 8.1% in 2021, with the use of contactless means contributing significantly to economic growth during the epidemic. The main contactless measures that enabled the economy to recover and grow were the wearing of masks, unmanned robots, smart factories, online offices, online education, online healthcare and contactless distribution.

There is a growing body of research on contactless, but it has mainly focused on exploring the applications of contactless, with less literature examining its underlying concepts and mechanisms. Although there are some basic studies related to contactless economy, the academic community still does not have a more unified understanding of contactless economy. Wang Dashu and Zhang Hui, Yu Yongda, Zhuo Wuyang considered the contactless economy as an emerging business model, a new achievement of innovation and development during the epidemic, and an economic activity that uses modern information technology means to achieve transactions between people and people, people and things without contact through network platforms, etc [1–3]. Chai Baoyong, Du Liqun, Fang Ying and Wang Fengrong considered the contactless economy as a manifestation of the digital economy, which refers to activities based on modern information technology and indirect contact through platforms such as the Internet to achieve economic interactions between people and things, people and people [4–7]. Overall, there is a lack of basic research content related to contactless. With the application of contactless means during the epidemic, it is more relevant to study the concept and mechanism of contactless and its practice in the prevention and control of the COVID-19 epidemic.

This paper focuses on the concept and mechanism of contactless and its practice in epidemic prevention and control through the following sections. The first part points out the background of the study; the second part reviews the literature on contactless, sorts out the research on contactless and presents the innovation points of the article; the third part defines the concept of contactless and analyzes it theoretically, exploring the characteristics and significance of contactless on the basis of the definition; the fourth part uses the definition as the basis to analyze the operation mechanism of contactless in the spatial and temporal dimensions of the subject and the object; the fifth part analyzes the factors affecting the choice of contactless (or contact) and its application in practice from the subject, object and medium, and designs a model to provide reference for the choice of contactless (or contact); based on a brief analysis of virus transmission, the sixth part, explores examples of contactless epidemic prevention and control means in the same space and same time; the same space and different time; different space and same time; and different space and different time conditions during an epidemic. Finally, it concludes with a summary and outlook on the concept and mechanism of contactless and its practice in epidemic prevention and control.

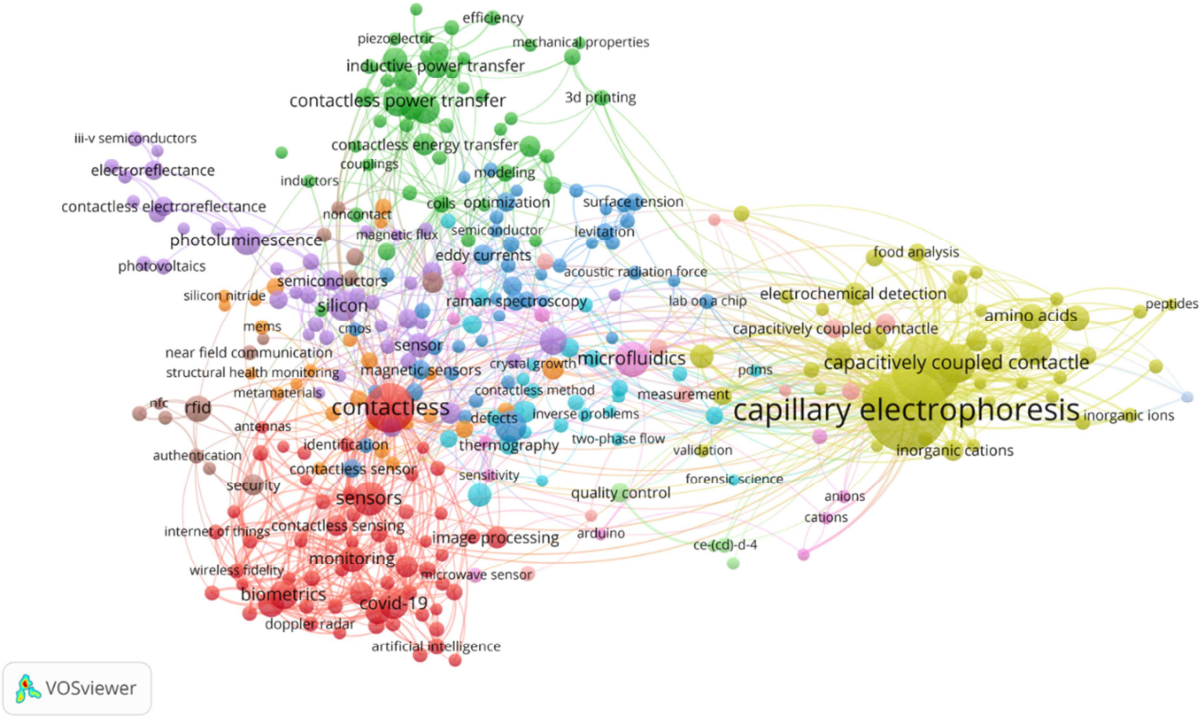

Figure 1. *Visual network diagram with contactless as a keyword.*

*Note: Different colors in the graph represent different fields, and the size of the nodes indicates the number of keyword occurrences. Subsequent graph nodes and colors have the same meaning.

2. Literature Review

There is a long history of contactless development [8]. In this paper, a review of contactless research is conducted based on the Web of Science database. As of April 29, 2022, 7136 English-language documents were obtained on the Web of Science core collection database using "Contactless" as the search field. A visual analysis of the keyword data was conducted (Figure 1). From Figure 1, it is obvious that the keywords "capillary electrophoresis", "contactless", "sensor", "biology", "COVID-19", "RFID", "photoluminescence",

"contactless power transmission" form large clusters. In general, the research is mainly concentrated in natural science fields such as engineering power, physics, materials, biomedicine, etc., and there is a rich cross-section of research, while there is less literature in social science fields.

In order to obtain more complete literature search results related to contactless in the natural sciences and social sciences, advanced searches were conducted using "Contactless" and "Natur*", "Contactless" and "Soci*" as search terms, resulting in 1086 and 529 documents in English respectively, which were presented visually (as shown in Figures 2 and 3), and the results revealed a concentration of research in the natural sciences compared to the social sciences.

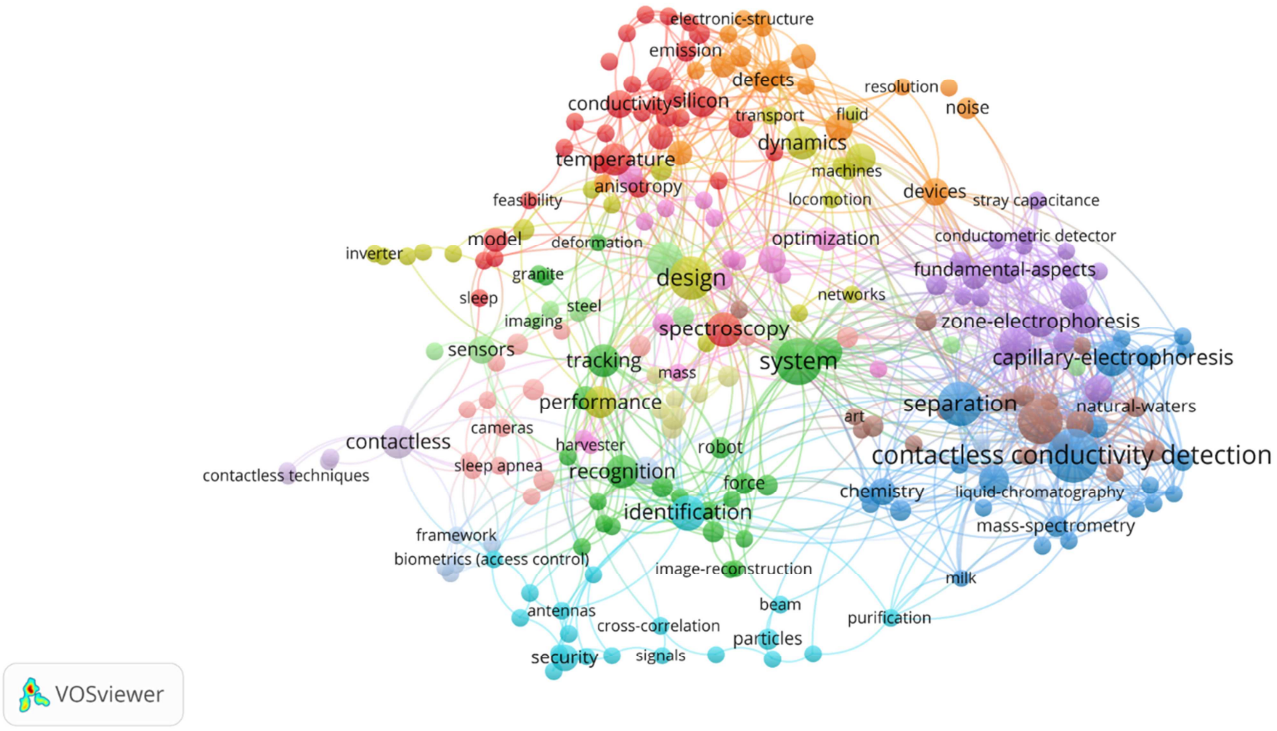

Figure 2. *Visual network diagram with contactless as a keyword in the natural sciences.*

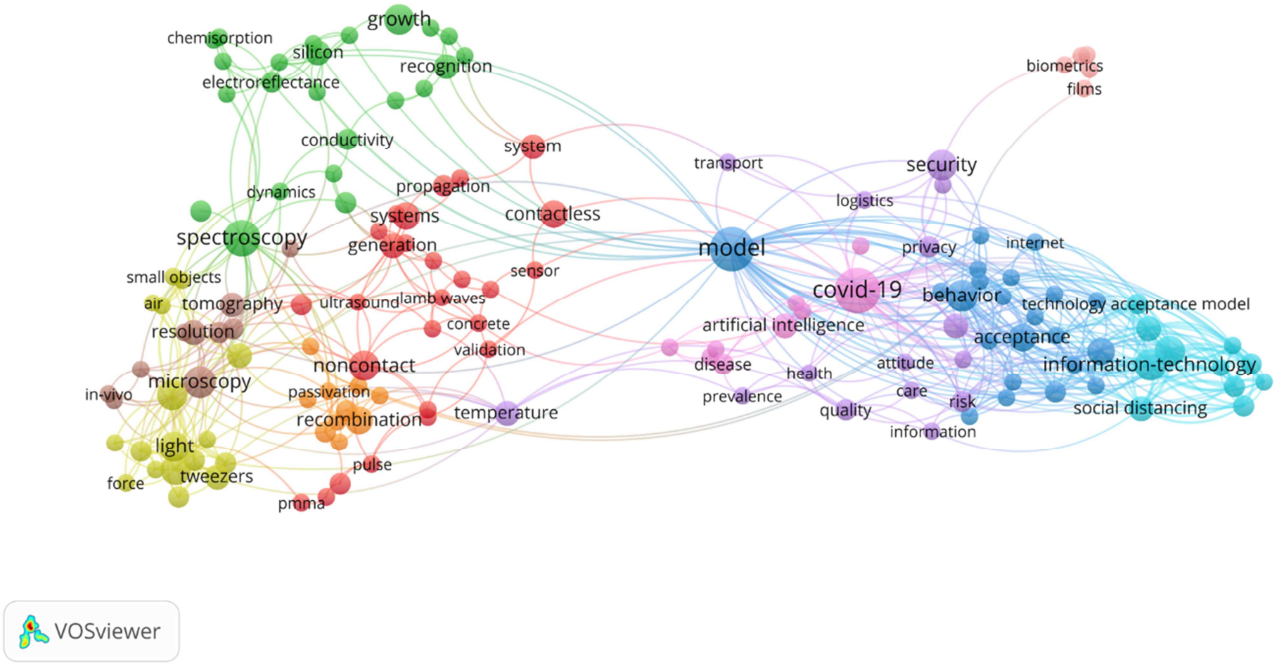

Figure 3. *Visual network diagram with contactless as a keyword in the social sciences.*

The natural sciences are particularly rich in research in the fields of electricity, materials and biology. The keywords

"contactless conductivity detection", "systems", "identification", "spectroscopy" and "silicon materials" form a large cluster. Most of the research focuses on the analysis of practical applications of contactless, but rarely on the basic theory of contactless.

In the field of power, Covic and Boys described the theory and development of inductive power transmission [9]. Madawala and Thrimawithana proposed a novel inductive power transmission technique based on contactless, and verify the effectiveness of the method through model applications and experiments [10]. Hui et al., provided an overview of the magnetic induction activity of wireless power transmission between transmission distance and transmitter coil size [11]. Li and Mi studied the development of wireless transmission technologies in the field of electric vehicles [12].

In the field of materials, Trupke et al., described contactless photoluminescence imaging and discussed its advantages and future developments in photoluminescence imaging using silicon wafers as an example [13]. Nguyen et al., provided a research outlook on the characteristics of new materials (magnetised polymer matrix composites) and their future development [14]. Olabi and Grunwald demonstrated the excellence of magnetostrictive materials in applications based on an analysis of the current development of magnetostrictive materials and their applications [15]. Traxler et al., discussed the importance of magnetostrictive bilayer, the shielding effect of conductive tube materials and the length of the bilayer [16].

In the field of biology, Shafiee et al., suggested two microfluidic control devices based on a contactless cell manipulation method-contactless electrophoresis, and experimentally demonstrated the feasibility of the method [17]. Reese et al., explored the long-term stability of typical polymers under light and combined contactless photoconduction with other techniques to investigate the degradation mechanisms of multiple molecular structures [18].

In other areas, Vandaele et al., reviewed the advantages of the contactless levitation component method and confirm its effectiveness [19]. Biganzoli and Fantoni discussed electrostatic contactless processing [20]. Jiang et al., proposed a contactless microwave method to study the velocity distribution of the wake of hypervelocity shells, and the experiment proved to be effective [21].

Research in the social sciences is relatively fragmented, with clusters formed around key words such as "model" and "COVID-19". However, the majority of studies have focused on exploring contactless in the context of COVID-19, at the model and practice level of analysis. For example, in the context of the COVID-19 epidemic, Lee and Lee analyzed the opportunities and challenges facing contactless healthcare in the late COVID-19 epidemic era [22]. Kim and Im investigated how contactless shopping prevented the spread of COVID-19 epidemic based on the theory of protective motivation [23]. In a model and practice analysis, Leong et al., analyzed the factors influencing the use of NFC-contactless mobile credit cards through models and data [24]. Karjaluoto et al. conducted a study on contactless consumption and payments, using data surveys and model validation to identify factors that influence consumers' use of contactless payment methods [25].

In summary, there is a wealth of research on the practice and application of contactless in various fields, but there is a lack of basic theoretical research on the concept and mechanism of contactless, and there is no research on the principle and mechanism of contactless practice and application in various fields from the concept and mechanism of contactless, so there is a disconnect between the current practice development and basic theory. In this paper, we start from the definition of contactless and study the mechanism of the action of the subject, object and medium in the contactless system in the spatial and temporal dimensions, to lay a theoretical foundation for the development of contactless and its related practice and fill the gap in the basic theory of contactless system. At the same time, the COVID-19 epidemic is used as an example to explain in detail how contactless plays a preventive and control role during the epidemic, laying the foundation for the development of contactless and its related theoretical and practical applications under the epidemic. It is expected that contactless will serve the economic development better.

3. Concept, Characteristics and Significance of Contactless

3.1. Concept of Contactless

"Contact" and "contactless" have been with humans since the origin of mankind. The seventh edition of the Modern Chinese Dictionary explains "contact" in the following way: to come into contact means to approach, interact or come into conflict (with someone); to come into contact means to come into contact with, touch [26]. But what exactly constitutes "contactless"? How can "contactless" be measured in spatial and temporal terms? There is no precise definition or explanation yet. An accurate definition of the concept of "contactless" is a prerequisite for analysing the development of contactless theory and practice. This paper argues that "contactless is a stage, state and scene in which the subject and the object in a certain environment are not at a surface distance equal to zero or exceed a certain effective direct influence distance in same space and same time; in same space and different time; in different space and different time; and in different space and different time, in which certain functional needs can be met". The use of contactless means that subject and object (subject and subject, object and object) are not in direct contact in any space, at any time and in their combinations, and there are many forms of spatial distance between the two parties, such as the distance that exists between the subject and the object both by itself, and the space-time distance formed through the use of third-party mediums. The evolution of the residence [27], the use and development of unmanned supermarkets, smart delivery cabinets, intelligent robots, online education and online offices are direct presentations of contactless applications.

3.2. Contactless Characteristics

Contactless is a system with the nature and characteristics of a system. However, it has special characteristics in terms of its origin.

3.2.1. Elements

A system is made up of different elements. Contactless is made up of three elements: the subject, the object and the medium. The three elements are interacted, interconnected, distinguished with each other.

3.2.2. Structure of Elemental Relationships

The different combinations of elements form different structures of the system. The subject, the object and the medium form different structures in different spatial and temporal dimensions, under the interconnection, mutual distinction and different combinations of the internal elements. For example, contactless between subject and object (subject and subject, object and object) in same space and same time conditions; contactless between subject and object (subject and subject, object and object) in same space and different time conditions; contactless between subject and object (subject and subject, object and object) in different space and same time conditions; contactless between subject and object (subject and subject, object and object) in different space and different time conditions.

3.2.3. Boundedness

The scope of research and practical application of contactless has certain clear boundaries, and only when the conditions for contactless are achieved, such as the surface distance between the subject and object is not zero or exceeds the effective direct influence distance between the two parties, will contactless between the two parties be formed.

3.2.4. Functionality

Functionality is a reflection of the structure of the elements. Different subjects and objects in the space and time dimension through the two sides of the contactless can achieve and meet the needs of a certain stage, state and scene.

3.2.5. Unity

Contactless is an organic unity formed on the basis of the interaction, interconnection and differentiation of different elements (subject, object and medium) within it, with certain functions and structures.

3.2.6. Development

The theory and application of contactless will evolve with the time and social progress. There is a clear tendency for material contactless to change to non-material contactless, and the application scenarios are diversified, with the development of electronic information technology playing an obvious role in promoting it. The application of information technology is a prerequisite for the realization of contactless practice. The requirements of information technology in the application of contactless are increasing day by day, and the continuous development of information technology into digital technology can also better promote contactless practice. At the same time, the development of electronic technology has led to a rich variety of contactless applications in different spatial and temporal conditions. By extension, through the transformation and application of digital-data-information-intelligence-wisdom, the scenarios of wisdom are becoming more and more abundant, especially in the context of contactless.

3.3. The Significance of Contactless

Within the same space and same time frames, the practical application of contactless promotes intelligent and wisdom operation between the subject and the object through technical means, equipment and other elements, deepening the degree of intelligence in production and manufacturing and enhancing the digitalization, intelligence and wisdom of economic life.

In the same space and different time conditions, contactless applications facilitate the effective allocation of resources, promote the achievement of sustainable development goals and lay a solid foundation for high-quality economic development.

Within different space and same time frames, contactless applications realize the interaction of subjects and objects in different spatial scales, greatly reducing the problems arising in the process of operation and communication, unblocking economic circulation and improving the fluidity of economic development.

The contactless application process reduces many costs between subjects and objects in different spatial and different temporal scopes, realizes the convenience of communication, production and other activities carried out between different subjects and objects, simplifies the cumbersome work and procedures in economic life and greatly improves the facilitation of economic life.

4. A Study of Contactless Mechanisms in Space-Time Locational Correlation Theory (STLC)

This paper assumes that the subject is an object with living characteristics (represented by A), the object is a physical object and others (represented by B), and the medium is a medium that enables and fulfills certain functions between the subject and the object (represented by C). Accordingly, this paper analyzes the principle of action without contact.

The mechanistic relationship diagrams between subject and subject (A_1 and A_2), subject and object (A and B), and object and object (B_1 and B_2) in the same space and same time; same space and different time; different space and same time; and different space and different time conditions are shown in Figure 4, (a), (b), (c), (d) respectively. The diagram shows that the straight line represents time, the circle represents the spatial range, and the serial number represents the time node, such as (1), (2), (3), $(1)_1$ and $(2)_2$ respectively, indicate different time points, where $(1)_1$ and $(2)_2$ denote different

points in time under the same scene respectively.

As there are similarities between A_1 and A_2, A and B, B_1 and B_2 in the process of contactless analysis, the contactless mechanism analysis is only explored with A and B as an example. Based on the definition analysis the contactless action range is divided into three parts: A and B with zero spatial surface distance; A and B with non-zero spatial surface distance but within the effective direct influence range; and beyond their effective direct influence range, and the contactless action principle of A and B is explored under different action ranges respectively.

In the spatial and temporal dimensions, A and B satisfy the condition for contactless realization once they exceed their effective direct influence distance, i.e. the spatial surface distance is not zero and exceeds their effective direct influence distance.

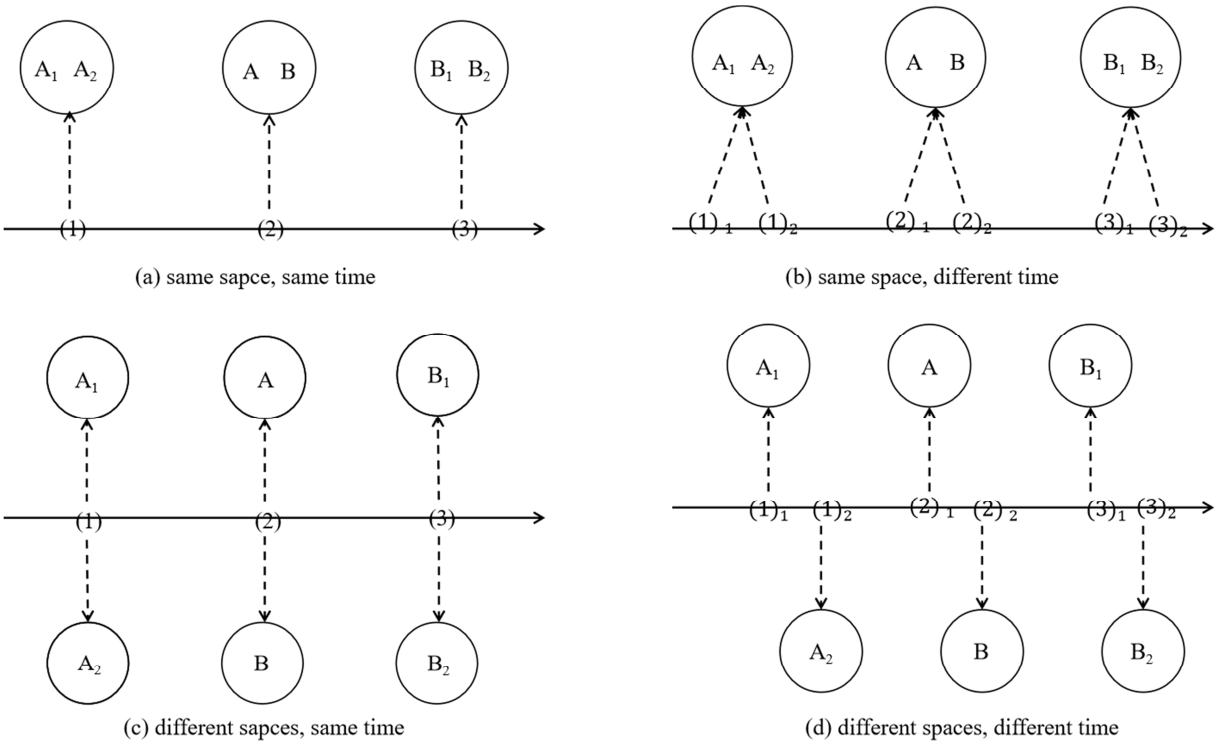

Figure 4. *Schematic analysis of the contactless mechanism between different subjects and objects in the spatial and temporal dimensions.*

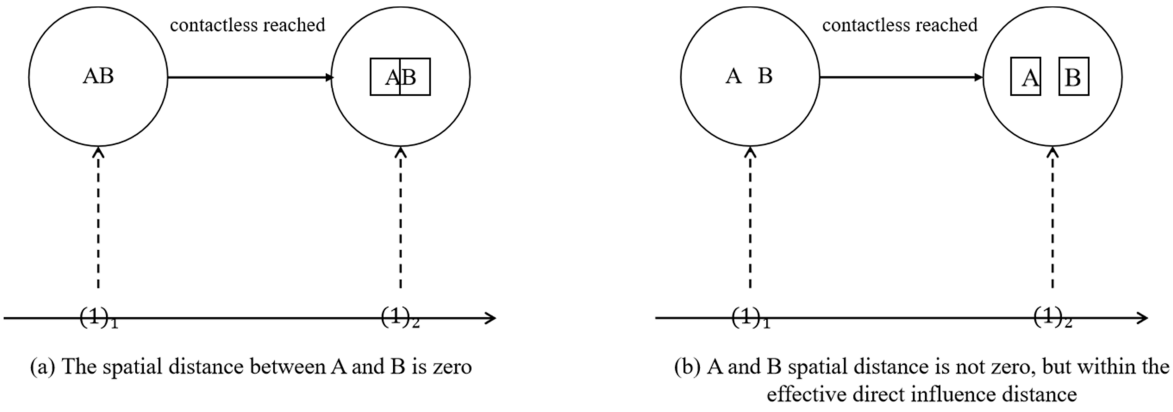

Figure 5. *Mechanistic diagram of A and B in different ranges of action under the same spatial and temporal conditions.*

4.1. Contactless Mechanism Under the Condtions of Same Space, Same Time

In same space and same time conditions, as shown in Figure 5. (1) When the spatial surface distance between A and B is zero, A and B are in contact (carrying items). However, under the condition of adding C, contactless between A and B is achieved. If the handling body is protected (gloves) or the handling object is protected (packaging) during the handling of the item, so that the distance between the surface of A and B is not zero, thus achieving contactless between A and B, as shown in Figure 5 (a). (2) When the spatial surface distance between A and B is not zero, but within its effective direct influence distance, A and B do not form the condition that the spatial surface distance is zero, but the condition that the effective direct influence distance is satisfied. For example,

contactless between A and B (subject and computer) is achieved through the use of C (wireless mouse or wired mouse), as shown in Figure 5 (b).

4.2. Contactless Mechanism Under the Condtions of Same Space, Different Time

In the same space and different time conditions, as shown in Figure 4 (b). (1) When the spatial surface distance between A and B is zero, the situation where the spatial surface distance between A and B is zero under different time conditions cannot be realized, so the contactless condition between the two parties is satisfied. Through the use of C (intelligent system), the system (or equipment tool) processing time is preset in advance, it is possible to achieve contactless between A and B in the same space and under different time conditions. (2) When the spatial surface distance between A and B is not zero, but within its effective direct influence distance, the application principle is similar to that of the intelligent system. The contactless of A and B can be achieved by setting different working time through the use of medium C.

4.3. Contactless Mechanism Under the Condtions of Different Space, Same Time

In different space and same time conditions, as shown in Figure 4 (d). (1) Because A and B are not in the same spatial range, thus making the condition that the spatial surface distance between A and B is zero cannot be satisfied, so that A and B achieve contactless at this time. (2) When the surface distance between A and B is not zero, but is within its effective direct influence distance, then there are two adjacent workspaces, workspace 1 and workspace 2 (assuming there are no other interference factors). A_1 in workspace 1 needs to submit material B, but the material B is in workspace 2 and A_2 is inside that workspace. At this point, contactless between A_1 and B is achieved after A_2's processing. Telecommuting, online education and online healthcare are other applications of contactless in different space and under the same time conditions.

4.4. Contactless Mechanism Under the Condtions of Different Space, Different Time

Under different spatial and different temporal conditions, as shown in Figure 4 (d). (1) The conditions that the spatial surface distance between A and B is zero or within its effective direct influence distance are not met, and contactless between A and B can be achieved without the use of any medium. (2) When the effective direct influence distance is exceeded, the use of information technology is used to achieve the development of economic exchange and other activities. The application of other smart devices such as smart homes promotes the realization of spatial interaction between A and B over long distances, satisfying the realization of contactless between A and B in different spatial and temporal scales.

In summary, contact implies that both parties exist within the same spatial sphere, while contactless can either be realized using C within the same spatial sphere, or it can cause both parties to be realized in different space.

5. Model Design and Solution Selection

There are many factors that need to be taken into account in the selection and application of contactless (or contact) methods, such as minimizing costs and maximizing overall benefits. In the current environmental context, the balance between environmental pollution and business development, i.e. the minimization of environmental costs, is a goal that is being explored and practiced by companies and organizations. The impact of the epidemic is also a major concern in terms of how to resume work and production while ensuring the health and safety of the population. Considering the above factors, an optimal decision model with the objective of minimizing comprehensive costs is constructed from three perspectives: cost, environment and safety, to provide a reference for the application of the contactless (or contact) option.

$$\min\left(\mathrm{cost}_{\alpha}\right)=\sum_{i=1}^{m}\left(x_i\right)\left(\alpha=A,\ B,\ C\right) \tag{1}$$

$$\mathrm{f}_{1\_\mathrm{cost}}=\sum_{\alpha=\mathrm{A,\ B,\ C}}\left[\min\left(\mathrm{cost}_{\alpha}\right)\right] \tag{2}$$

In model (1), the cost issues arising from the subject, the object and the medium itself during a contactless (or contact) application are represented respectively. For example, time costs, communication costs, etc. Model (2) represents the sum of the minimization costs of the subject, the object and the medium in the contactless (or contact) application process.

$$\min\left(\mathrm{envior}_{\beta}\right)=\sum_{\mathrm{r}=1}^{\mathrm{d}}\left(\mathrm{x}_{\mathrm{r}}\right)\left(\beta=A,\ B,\ C\right) \tag{3}$$

$$\mathrm{f}_{2\_\mathrm{envior}}=\sum_{\beta=\mathrm{A,\ B,\ C}}\left[\min\left(\mathrm{envior}_{\beta}\right)\right] \tag{4}$$

In model (3), the effects of the subject, object and medium on the environment during a contactless (or contact) application are represented respectively, and model (4) is the minimized sum of the effects of the subject, object and medium on the environment during a contactless (or contact) practice.

$$\max\left(\mathrm{sec}_{\gamma}\right)=\sum_{\mathrm{u}=1}^{\mathrm{h}}\left(\mathrm{x}_{\mathrm{u}}\right)\ \left(\gamma=\mathrm{A,\ B,\ C}\right) \tag{5}$$

$$\mathrm{f}_{3\_\mathrm{sec}}=\sum_{\gamma=\mathrm{A,\ B,\ C}}\left[\max\left(\mathrm{sec}_{\gamma}\right)\right] \tag{6}$$

In model (5), the safety indicator variables that would be involved in the contactless (or contact) application of the subject, object and medium are represented respectively. Model (6) is the sum of the optimal safety performance obtained for the subject, object and medium during the contactless (or contact) application.

On the basis of the above three elements, different weights are assigned to the different influencing factors (i.e, the sum of each weight is 1.) to obtain the integrated cost minimization model (7).

$$F_z = \omega_{cost} f_{1\_cost} + \omega_{envior} f_{2\_envior} + \omega_{sec} f_{3\_sec} \quad (z = 1,\ 2) \tag{7}$$

Model (7) is a comprehensive cost minimization function model obtained by taking the elements of cost, environment and safety as the basis of measurement in the process of contactless (or contact) selection and application, and assigning corresponding weights on the basis of different factors. When z = 1 indicates the application of the choice of contactless means; when z = 2 implies the application of the choice of contact means.

For the sake of uniformity in data research quantification, the impact of the subject, object and medium on the environment during contactless (or contact) practice was measured as environmental cost, respectively, to obtain the model (8), (9). Similarly, the safety indicator variables of the subject, object and medium during contactless (or contact) use are measured as safety costs to obtain the model (10), (11). Where x_i, x_r, x_u denote the factors influencing the subject, object and medium under the categories of cost, environment and safety in a contactless (or contact) application process respectively.

$$\min(envior\_cost_\delta) = \sum_{r=1}^{d} (x_r)(\delta = A,\ B,\ C) \tag{8}$$

$$f_{2\_envior\_cost} = \sum_{\delta = A,\ B,\ C} [\min(envior\_cost_\delta)] \tag{9}$$

$$\min(sec\_cost_\varepsilon) = \sum_{u=1}^{h} (x_u)(\varepsilon = A,\ B,\ C) \tag{10}$$

$$f_{3\_sec\_cost} = \sum_{\varepsilon = A,\ B,\ C} [\min(sec\_cost_\varepsilon)] \tag{11}$$

$$F_{z\_1} = \omega'_{cost} f_{1\_cost} + \omega_{envior\_cost} f_{2\_envior\_cost} + \omega_{sec\_cost} f_{3\_sec\_cost} \quad (z = 1,\ 2) \tag{12}$$

The final mathematical model (12) with the objective of minimizing the combined cost (i.e, the sum of the weights is 1.) is obtained.

Ditto. When z = 1 indicates the application of the contactless means of choice; when z = 2 implies the application of the contact means of choice.

By importing data from the above model and solving it analytically. It is then possible to measure the combined cost minimization of using contactless (or contact) means on the basis of the optimal value. When $F_{1\_1}<F_{2\_1}$, it means that a contactless approach will minimize the overall cost; when $F_{1\_1}>F_{2\_1}$, it means that the contact approach will be more favorable; when $F_{1\_1}=F_{2\_1}$, the model is integrated and variants are made based on the above factors and other influencing factors, in order to adapt to changing situations and conditions and to provide model guidelines for more rational decisions.

6. Contactless Practice in COVID-19 Prevention and Control Under STLC Theory

There are many examples in life of coping with virus prevention and control through contactless means, and here only the practical application of A and B under the spatial and temporal dimensions is used as an example for explanation and analysis. In the spatial and temporal dimensions, when the spatial distance between A and B exceeds its effective direct influence distance, virus transmission is mainly manifested in the form of environmental transmission, and its means of virus prevention and control are mainly achieved through spatial distance, environmental disinfection or protection from A and B, such as opening windows and ventilation, maintaining air flow, disinfecting the subject and object such as the people, objects and places to be contacted, and other environmental. The use of information technology allows normal activities to be carried out during an epidemic, reducing the chances of transmission of the virus on the subject and object, thus ensuring a contactless process and strengthening the containment and hindrance of the virus transmission process. Further, the situation where the distance between the spatial surfaces of A and B is zero cannot be achieved under different spatial conditions. It is assumed that when the virus is attached to A (or B), none of the subjects (or objects) are infected with the virus, except for the few that are already infected. On this basis, the practical application of contactless between A and B in the spatial and temporal dimensions in the prevention and control of COVID-19 is analyzed.

6.1. Contactless Practice Under the Condtions of Same Space, Same Time

In the same spatial and same temporal conditions, virus transmission is mainly in the form of virus attachment to A (or B).

When the spatial surface distance between A and B is zero, it means that A and B achieve direct contact, i.e. when the virus attaches to A (or B), it is very easy for the host to become the source of infection (virus transmission intermediary) to other A (or B) through the contact between the two sides, giving rise to the spread of the virus. At this point, the use of items such as disposable masks, medical gowns and disposable medical gloves have played a huge role in economic communication and daily activities, effectively enabling A and B to be contactless in same space and same time. The use of the COVID-19 vaccine further ensures that the contactless process is achieved from A itself.

When the spatial surface distance between A and B is not zero, but within their effective direct impact distance, A (or B) carrying the virus can act as a transmission agent to spread the virus to other A (or B) if no protection is provided to the

contactor and the contactee; even if protection is provided to the contactor and the contactee, some degree of spatial proximity or effective direct impact distance will also allow the virus to transmitted and spread. The use of self-service code payment in the shopping process enables A and B to be contactless in the same space and same time, effectively reducing the frequency of contact between A and B and ensuring the safety of A and B during an epidemic.

6.2. Contactless Practice Under the Condtions of Same Space, Different Time

Under same spatial and different temporal conditions, virus transmission is mainly in the form of environmental transmission and transmission by attachment to B.

When the spatial surface distance between A and B is zero and when the spatial surface distance is not zero, but within its effective direct influence distance, the virus is very easy to spread by means of air, aerosols and other media in the form of environmental transmission, constantly spreading to other A (or B), forming a cross-infection. In this case, contactless between A and B can be achieved without the use of any medium C. The prevention and control of the epidemic can be further ensured by means of environmental disinfection. For example, disinfection of the workplace and the equipment used at different time can be carried out to promote the absence of contact between A and B in the same space and different time, reducing the probability of virus transmission. In addition, the probability of the virus attaching to B and spreading to other A (or B) increases significantly in a cold environment. At this time, the main means of epidemic prevention and control is in the form of environmental disinfection and personal protection, such as frequent hand washing, alcohol disinfection and the use of disposable gloves during contact.

6.3. Contactless Practice Under the Condtions of Different Space, Same Time

In different spatial and same temporal conditions, the main route of virus transmission is in the form of environmental transmission.

When the spatial surface distance between A and B is not zero, but within its effective direct influence distance, the virus is very easy to spread by means of air, aerosols and other media in the form of environmental transmission, constantly spreading to other A and B, forming cross-infection. By adding media and protection (e.g. disposable gloves, uninfected plastic film, surface environmental disinfection, etc.) to the surfaces of A and B, the prevention and control of epidemics in different space and under the same time conditions is promoted.

6.4. Contactless Practice Under the Condtions of Different Space, Different Time

In different spatial and different temporal conditions, the main route of virus transmission is in the form of environmental transmission.

When the distance between the spatial surfaces of A and B is not zero, but within the effective direct impact distance, the virus can easily spread by means of air, aerosols and other media in the form of environmental transmission, constantly spreading to other A and B, resulting in cross-infection. A and B are not in contact with each other. In this case, prevention and control of the epidemic is mainly carried out by means of environmental decontamination.

7. Result and Discussion

Based on the analysis of existing research, this paper analyzes the concept, theory and practice of contactless in different degrees, clarifies the basic concept of contactless and its characteristics and significance, explains the principle of contactless in the same space, same time; same space, different time; different space, same time; different space, different time, and sorts out how contactless is applied during epidemic prevention and control, and discusses the basic theory of contactless through examples of contactless applied during epidemic prevention and control.

The COVID-19 epidemic as a major health emergency has caused significant harm to the economy and livelihoods, and contactless has played an important role in the prevention and control of the COVID-19 epidemic and the recovery and development of the economy. Whether contactless can play a significant role in ensuring economic security and healthy living of the population under major health emergencies still needs to be empirically analyzed. Future research will be based on theoretical analysis, data and models to make assertions about the application of contactless in emergencies and to explore its practicality and generalizability in emergencies.

Also, do current day-to-day economic activities take place in the same space and same time? Or do they unfold in the same space and different time? Or do they take place in different space and same time? With the development of information technology, economic activities in different space and same time have become a reality. Is it feasible for daily activities to take place in different space and different time? With contactless as a guide, many realistic questions and practical extensions need to be discussed.

Acknowledgements

This study was supported by the Research Projects on National Social Science Foundation of China (20BGL015) and the Shanghai Cooperation Organization (SCO) Science and Technology Partnership Program and International Science and Technology Cooperation Program (2019E01009).

References

[1] Dashu W, Hui Z. The contactless economy: a “flash in the pan” or a trend. *People’s Forum* 2020; (18): 12–15.

[2] Yongda Y. How “no contact” can deeply expand the space of social governance. *People’s Forum* 2020; (18): 38–41.

[3] Wuyang Z. Contactless economy helps China’s economy gain new vitality. *People’s Forum* 2020; (26): 98–99.

[4] Baoyong C. From “no contact” to “zero distance”, national governance has great potential. *People’s Forum* 2020; (18): 35–37.

[5] Liqun D. The evolutionary logic of the no-touch economy in the wake of the epidemic. *People’s Forum* 2020; (18): 16–18.

[6] YIng F. Future trends and development challenges of contactless economy. *People’s Forum* 2020; (18): 30–31.

[7] Fengrong W. Industrial change in the contactless economy: picture, logic and outlook. *People’s Forum* 2020; (18): 25–27.

[8] Xinqiao P. The “contactless economy” stimulates new vitality of economic development. *People’s Forum* 2020; (14): 24–26.

[9] Covic GA, Boys JT. Inductive Power Transfer. *P IEEE* 2013; 101 (6): 1276–1289.

[10] Madawala UK, Thrimawithana DJ. A Bidirectional Inductive Power Interface for Electric Vehicles in V2G Systems. *IEEE T Ind Electron* 2011; 58 (10): 4789–4796.

[11] Hui S, Zhong W, Lee C. A Critical Review of Recent Progress in Mid-Range Wireless Power Transfer. *IEEE T Power Electr* 2014; 29 (9): 4500–4511.

[12] Siqi Li, Mi CC. Wireless Power Transfer for Electric Vehicle Applications. *IEEE J Em Sel Top P* 2015; 3 (1): 4–17.

[13] Trupke T, Bardos RA, Schubert MC, Warta W. Photoluminescence imaging of silicon wafers. *Appl Phys Lett* 2006; 89 (4): 044107.

[14] Nguyen VQ, Ahmed AS, Ramanujan RV. Morphing Soft Magnetic Composites. *Adv Mater* 2012; 24 (30): 4041–4054.

[15] Olabi AG, Grunwald A. Design and application of magnetostrictive materials. *Mater Design* 2008; 29 (2): 469–483.

[16] Traxler S, Kosel J, Pfützner H, Kaniusas E, Mehnen L, Giouroudi I. Contactless flow detection with magnetostrictive bilayers. *Sensors and Actuators A: Physical* 2008; 142 (2): 491–495.

[17] Shafiee H, Sano MB, Henslee EA, Caldwell JL, Davalos RV. Selective isolation of live/dead cells using contactless dielectrophoresis (cDEP). *Lab Chip* 2010; 10 (4): 438.

[18] Reese MO, Nardes AM, Rupert BL, Larsen RE, Olson DC, Lloyd MT, et al. Photoinduced Degradation of Polymer and Polymer-Fullerene Active Layers: Experiment and Theory. *Adv Funct Mater* 2010; 20 (20): 3476–3483.

[19] Vandaele V, Lambert P, Delchambre A. Non-contact handling in microassembly: Acoustical levitation. *Precision Engineering* 2005; 29 (4): 491–505.

[20] Biganzoli F, Fantoni G. Contactless electrostatic handling of microcomponents. *Proceedings of the Institution of Mechanical Engineers, Part B: Journal of Engineering Manufacture* 2004; 218 (12): 1795–1806.

[21] Jiang B, Yang X, Ma P, Chen B, Tian J, Shi A, et al. Contactless Measurement of Hypervelocity Projectile Wake Velocity Distribution. *IEEE Access* 2019; 7: 28968–28972.

[22] Lee SM, Lee D. Opportunities and challenges for contactless healthcare services in the post-COVID-19 Era. *Technological Forecasting and Social Change* 2021; 167: 120712.

[23] Kim N L, Im H. Do liberals want curbside pickup more than conservatives? Contactless shopping as protectionary action against the COVID‐19 pandemic. *Int J Consum Stud* 2021, 46 (2): 589–600.

[24] Leong L-Y, Hew T-S, Tan GW-H, Ooi K-B. Predicting the determinants of the NFC-enabled mobile credit card acceptance: A neural networks approach. *Expert Syst Appl* 2013; 40 (14): 5604–5620.

[25] Karjaluoto H, Shaikh AA, Leppäniemi M, Luomala R. Examining consumers’ usage intention of contactless payment systems. *IJBM* 2019; 38 (2): 332–351.

[26] Chinese Academy of Social Sciences Institute of Linguistics Dictionary Editorial Office. *Modern Chinese Dictionary (7th ed.)*. The Commercial Press, 2016 https://book.douban.com/subject/26893148/ (accessed 8 Oct 2021).

[27] Xiaohua L. The evolution of residence: from shelter to “home economy” and “no-touch economy.” *Seeking* 2020; (4): 164–170.