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Effects of social exclusion on inhibitory control and working memory—Focusing on hard-of-hearing college students

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Abstract: *As social animals, humans have the basic need to belong, be accepted by society or group, and form positive, stable, and lasting social relationships with others. However, the fulfillment of this basic need is threatened by social exclusion. Many studies have focused on the social impact of social exclusion, i.e., how social exclusion affects the social function of the organism. In contrast, few have studied the cognitive control mechanism behind it. Cognitive control is divided into working memory, inhibitory control ability, and cognitive flexibility, while the research commonly uses working memory and constant control ability. Deaf and hard-of-hearing people are a particular group with a large population. Compared with ordinary people, they are more likely to suffer from social exclusion. Compared with ordinary people, deaf and hard-of-hearing people have different neural mechanisms, such as vision and hearing. Starting from social exclusion, this paper reviews the impact of social exclusion on cognitive control. It introduces the perspective of the hearing-impaired population to provide a new idea for future research and improve the existing theoretical results.*

Keywords: *social exclusion, working memory, inhibition control ability, deaf and hard of hearing people*

1. Introduction

Human beings are social animals. Everyone has the basic need of belonging: the desire to belong to a specific social group, to be accepted by this group, and to form a stable, positive, and lasting social relationship with others in this group. Much evidence shows that the need to belong is essential in satisfying individuals' physical and mental health and maintaining an everyday social life. However, in daily life, fulfilling this need can often be hindered by exclusion from a small group and rejection of a confession. Psychology refers to this phenomenon of being excluded or rejected by a social group or others as social exclusion. More and more psychologists are paying attention to this phenomenon. There have been many studies on social exclusion, but most of them are limited to the social impact of social exclusion on individuals, and few study the mechanism behind it.

In China, deaf and hard-of-hearing people account for 24.16% of the total number of disabled people. In the face of unexpected or innate hearing loss, some deaf and hard-of-hearing people strive for self-improvement, while others are dissatisfied and give up on themselves. Deaf and hard-of-hearing college students can enter the stage of higher education through the national single-enrollment examination for the Deaf or the general college entrance examination. Improving education levels can further stimulate the motivation of deaf and hard-of-hearing college students to integrate into society. However, it is not uncommon for deaf and hard-of-hearing college students to be ostracized in life and work. Deaf and hard-of-hearing college students are more likely to suffer from social exclusion than those without disabilities.

Therefore, this paper reviews the influence of social exclusion on cognitive control and turns the perspective to deaf and hard-of-hearing college students and deaf and hard-of-hearing people to open up ideas for future research and provide social care for deaf and hard-of-hearing people.

2. Social exclusion

The concept of social exclusion originated in sociological research. French scholar Ren Lenoir put it forward in 1974 to define the situation of those groups who are not protected by social security and have difficulty integrating into society. For example, people with mental disorders, physical disabilities, lonely

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elderly, drug abusers, and others who cannot adapt to culture [1]. In the 1990s, with the proposal of the belonging-need [2] and the social gauge theory of self-esteem [3], social exclusion gradually entered the field of view of social psychologists.

Currently, there are various research paradigms of social exclusion in psychological research [4]. According to Wirth's classification, these research paradigms can be summarized into the following three categories: the paradigm of interacting with computer players, the paradigm of interacting with other subjects, and the paradigm of manipulating written materials [5].

One of the most common is the paradigm of interacting with computer players. In this paradigm, subjects are often told that other players are participating in the game online, but in fact, the other players do not exist but are just pre-programmed computer programs [6]. In Cyberball, researchers have participants complete a virtual game of online ball tossing. The instructions presented to the participants indicate that the game is used to train mental visualization skills: Participants need to cooperate with two other players in other LABS to complete the game online. They should try their best to imagine the situation of participating in the game in their mind, such as what kind of person they are playing the game with, what kind of environment the other person is in, and so on. The imagination is as realistic as possible. The researcher induced social rejection by manipulating the number of times participants caught the ball: the acceptance group received the ball about one-third as often as the other players, while the rejection group received a pass from another player only in the first two tosses and then no more in the next game. Due to the simple operation mode of this task, which does not require fake subjects and can control many additional variables, it has become the most commonly used operation method of social exclusion at present and has been widely used in cognitive neuroscience research related to social exclusion [7][8][9][10].

Some researchers have also examined two essential questions related to this paradigm (Cyberball): First, is the acceptance group in a game a pure, influential control group [11][12]? Second, how long can the effectiveness of social exclusion last [13][14]? For the first question, Dvir, Kelly, and Williams designed a Cybertree task to demonstrate that the acceptance group is the pure control group. For the second question, Buelow et al. adopted the Cyberball game to carry out the rejection operation on the subjects and then asked them to complete the rejection questionnaire and cognitive task at different time points. The results showed that after 55 minutes of the rejection operation, the rejection individuals still scored lower on the rejection questionnaire than the acceptance individuals. They also performed worse on cognitive tasks. Thus, the Cyberball paradigm for operating social exclusion is likely to be effective for at least 55 minutes or so.

Interaction with other subjects paradigm: In this paradigm, the researcher will pretend the matter to contact with the actual subject, and then the researcher pretends the subject will explicitly refuse to continue contact with the actual subject. One of the most common paradigms is the mutual familiarity paradigm, in which real subjects discuss a problem for 15 minutes with the researcher's fake subjects to get them familiar with each other quickly. At the end of the discussion, they were sent to two separate LABS, where they were told they needed a partner. For the exclusion group, no matter how often the subjects requested, they would be told that they were rejected. For the acceptance group, the subject's request was accepted. The advantage of this paradigm is that it is more suitable for the actual life scene, but the disadvantage is that it will be affected by additional variables, such as familiarity with the subjects and the selection of the number of rejectors [15].

Manipulative writing material paradigm: Researchers generally ask subjects to recall their own experiences, especially memories containing rejected experiences, and achieve the state of rejection by strengthening the recall. Some researchers also have participants complete personality questionnaires and then manipulate social exclusion with false feedback.

A commonly used paradigm is future life alone. In this paradigm, researchers generally require subjects to complete some questionnaires, such as Eysenck personality Questionnaire, and then the researchers will give back the accurate inward and external scores measured by the questionnaire (in order to increase the subjects' belief in the experiment). Finally, the subjects were randomly divided into three groups: the future alone condition group, the future belonging condition group, and the misfortune control condition group. For all three groups, the researchers gave false personality feedback: For the future lonely group, the researchers told him that he was likely to have trouble maintaining good relationships and would be lonely in the future; For the prospective group, the researchers said to them that they would have good relationships and a happy life. In the unlucky group, the researchers told them that they were likely to have a lot of accidents, such as a car accidents. The advantage of this paradigm is that it induces a strong sense of rejection, but this is also its disadvantage; that is, what it expresses is not a temporary one-time rejection but a continuous rejection, which is quite different from the social

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exclusion we experience in our daily life [16].

The influence of social exclusion on people has two sides. On the one hand, the social exclusion will cause individuals to show more aggressive behaviors, and the excluded individuals not only offer the tendency to attack the excluded individuals or groups but also have the intention to attack other completely unrelated individuals [17]. On the other hand, many studies have shown that after experiencing rejection, individuals will lead more prosocial behaviors in interpersonal communication in order to satisfy their belonging needs. For example, compared with accepting individuals, rejecting individuals will exhibit more behavior imitation [18] and more opinion selection [19].

3. Cognitive control

Cognitive control is a term similar to executive control, and its specific function is manifested as the advanced mental process that individuals flexibly and dynamically call and allocate their limited cognitive resources to achieve the goal according to the current task objective [20]. Generally speaking, cognitive control contains three core components: inhibitory control, working memory, and cognitive flexibility [21]. Because there is a close relationship between inhibitory control and working memory [22], and cognitive flexibility may function based on inhibitory control and functional memory ability and reach a higher level later in individual development [23][24]; therefore, most studies on the effects of social exclusion on cognitive control have focused on inhibitory control and working memory.

4. Related Research

4.1. Regarding inhibitory control ability

Regarding inhibitory control ability, relevant studies show that social exclusion may affect individuals' inhibitory control ability. Some researchers used classical Go-Nogo task and ERP technology to test the subjects, and the results showed that the rejected individuals showed a more significant N2 effect (the difference wave between NOGO and GO response) [25] and smaller P3 effect (the difference wave between NOGO and GO response) [26]. Since N2 and P3 effects reflected conflict detection and response inhibition, social exclusion promoted conflict detection and inhibited response inhibition. In the classic flanker task, the excluded individuals showed a smaller amplitude of N2 [27]. In the Stroop task, ostracizing individuals induced a larger N450 amplitude [28], indicating that social ostracism had a negative impact on inhibitory control ability.

In the test of inhibition control ability, except for classic Go-Nogo, flanker, and other programs, visual search tasks have been a standard paradigm in response suppression research in recent years. The details are as follows: It includes six rings equidistant from the center point of the screen (viewing Angle 9.2°), which contains a horizontal or vertical gray line. Among the six rings, one ring is dark yellow, another circle is red, and the remaining four rings are green. Where dark yellow is the target color, red is the distraction color, and green is the non-target color (neither the target nor the distraction). The circles of the target, distraction, and non-target randomly appear in one of the six positions, resulting in three position conditions: target and lateral distractor (LTLD) are both lateral target and lateral distractor (LTLD), the target is the lateral target and lateral distractor (MTLD), In the lateral target (lateral target and midline distractor (LTMD)), subjects were required to react according to the target, ignoring distracts and non-targets.

4.2. Working memory ability

With regard to working memory ability, only a few behavioral studies have examined the influence of social exclusion on working memory, mainly finding that social exclusion can hinder working memory [29][30]. Still, other studies have found that social exclusion does not affect working memory [31][32]. Different working memory paradigms and different aspects of working memory may cause this difference. Common working memory paradigms include classic n-back paradigms, etc. Different paradigms may get different results, which depends on the emphasis of paradigms. Some paradigms focus on the breadth of working memory, while others focus on the capacity of working memory. The standard ERP components of working memory include p2 and lpp, among which p2 reflects the allocation of attention resources in the early coding stage of working memory. When more attention resources are invested in the coding stage, a larger amplitude of the p2 component will be induced [33][34]. Lpp is a late positive component, which reflects the allocation of resources during the extraction of matching and

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mismatching information in the late stage. Note that the more resources consumed, the larger the amplitude of the Lpp component [35].

In recent years, regarding the influence of social exclusion on working memory, more people have adopted the unilateral change detection paradigm, which is detailed as follows: color bars with different orientations (horizontal, vertical, left-leaning 45°, right-leaning 45°) are presented simultaneously on both sides of the fixation point as memory items. The memory stimuli on both sides were presented in a rectangular area of 4°×7.6°, and the distance between the rectangular bars of the unilateral memory item was at least 2°. The number of targets and distractions was precisely the same on both sides, except for the orientation and spatial location of the stimuli. The subjects were asked to remember the direction of the red rectangle on the side of the central fixation point and ignore the green rectangle).

5. Specificity of hearing-impaired people

At present, the influence of social exclusion on cognitive control is mainly limited to the average population and less focused on deaf and hard-of-hearing college students. Deaf and hard-of-hearing college students are eager to be accepted by the general population, but in most cases, they have communication barriers with ordinary people and often lack a sense of belonging when they get along. Studies have shown that deaf and hard-of-hearing college students have a higher sense of self-alienation, family alienation, and social isolation than ordinary college students [36]. However, there are more than 20 million deaf and hard-of-hearing college students in our country.

Deaf and hard-of-hearing college students can enter the stage of higher education through the national single-enrollment examination for the Deaf or the general college entrance examination. Improving education levels can further stimulate the motivation of deaf and hard-of-hearing college students to integrate into society. However, it is not uncommon for deaf and hard-of-hearing college students to be ostracized in life and work. Deaf and hard-of-hearing college students are more likely to suffer from social exclusion than those without disabilities.

And under the adverse effects of social exclusion, their physical and mental health is impaired as well as their education suffers. In addition, the hearing-impaired group has a different working mechanism of working memory. The hearing impaired cannot receive auditory stimuli and can only convey information through sign language. Different from general visual information, sign language expresses its ideas through actions to achieve the purpose of communicating with others, and it has an expression level similar to spoken language [37]. Studies have shown that due to this particular information transmission mode, hearing-impaired groups have developed a "sign language-based retelling loop," a working memory structure corresponding to the speech loop of everyday people, which is mainly responsible for the storage and processing of speech information [38].

6. Summary

Erp technology has the characteristics of high time resolution, can capture the brain millisecond level dynamic changes, and can effectively study the neural mechanism behind the behavior.

As a large number of particular groups, the deaf and hard of hearing want a life like ordinary people. However, in daily life, the deaf and hard of hearing always feel excluded, whether unconsciously or intentionally, and it is difficult for them to integrate into a big family. This feeling of rejection affects the daily work and study of deaf and hard-of-hearing people and their correct reactions and decisions. These are all caused by the influence of social exclusion on the working memory and inhibitory control ability of deaf and hard-of-hearing people.

In order to better help the deaf and hard of hearing people integrate into their daily life, focus on the deaf and hard of hearing people, study the influence of social exclusion on the working memory and inhibitory control ability of the deaf and hard of hearing people, and analyze the neural mechanism behind it. Finding ways to solve the rejection of the hearing impaired and improve their inhibition and control ability and working memory ability can not only improve the living standard and quality of the hearing impaired but also reflect the care and social responsibility for the hearing impaired in the new era, effectively improve the life satisfaction of the hearing impaired and contribute to social harmony.

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References

[1] Morgan C, Burns T, Fitzpatrick R, et al. Social exclusion and mental health: conceptual and methodological review[J]. The British Journal of Psychiatry, 2007, 191(6): 477-483.
[2] Baumeister R F, Leary M R. The need to belong: Desire for interpersonal attachments as a fundamental human motivation[J]. Interpersonal development, 2017: 57-89.
[3] Leary M R, Tambor E S, Terdal S K, et al. Self-esteem as an interpersonal monitor: The sociometer hypothesis[J]. Journal of personality and social psychology, 1995, 68(3): 518.
[4] CHENG S, LIU L, ZHENG Y. Research paradigms and theoretical models of social exclusion[J]. Advances in Psychological Science, 2011, 19(6): 905.
[5] Banki S, O'Reilly J. Social exclusion: Psychological approaches to understanding and reducing its impact[M]. Springer International Publishing, 2016.
[6] Letia A. Methods for Investigating Cyber Crime[J]. Social Science Electronic Publishing, 2013.
[7] Williams K D, Cheung C K T, Choi W. Cyberostracism: effects of being ignored over the Internet[J]. Journal of personality and social psychology, 2000, 79(5): 748.
[8] Williams K D, Jarvis B. Cyberball: A program for use in research on interpersonal ostracism and acceptance[J]. Behavior Research Methods, 2006, 38(1):174-180.
[9] Weed K, Nicholson J S. Differential social evaluation of pregnant teens, teen mothers and teen fathers by university students[J]. International Journal of Adolescence & Youth, 2015, 20(1):1-16.
[10] Hartgerink C H J, Van Beest I, Wicherts J M, et al. The ordinal effects of ostracism: A meta-analysis of 120 Cyberball studies[J]. PloS one, 2015, 10(5): e0127002.
[11] Xu X, Li J, Chen Z, et al. Oxytocin reduces top-down control of attention by increasing bottom-up attention allocation to social but not non-social stimuli–a randomized controlled trial[J]. Psychoneuroendocrinology, 2019, 108: 62-69.
[12] Xu M, Qiao L, Qi S, et al. Social exclusion weakens storage capacity and attentional filtering ability in visual working memory[J]. Social cognitive and affective neuroscience, 2018, 13(1): 92-101.
[13] Park J, White A, Stevinson C, et al. Validating a new non-penetrating sham acupuncture device: two randomised controlled trials[J]. Acupuncture in medicine, 2002, 20(4): 168-174.
[14] Simard V, Dandeneau S. Revisiting the Cyberball inclusion condition: Fortifying fundamental needs by making participants the target of specific inclusion[J]. Journal of Experimental Social Psychology, 2018, 74:38-42.
[15] Chester D S, Dewall C N. Combating the sting of rejection with the pleasure of revenge: a new look at how emotion shapes aggression[J]. Journal of personality and social psychology, 2017, 112(3): 413.
[16] González-García D A, Acuna L. Social acceptance and rejection of people with different body size [J]. DE PSICOLOGÍA, 2014, 31(1): 58-70.
[17] Lakin J L, Chartrand T L, Arkin R M. I Am Too Just Like You[J]. Psychological Science, 2008, 19(8):816-822.
[18] Pishnamazi M, Nojaba Y, Ganjgahi H, et al. Neural correlates of audiotactile phonetic processing in early-blind readers: an fMRI study[J]. Experimental Brain Research, 2016, 234(5):1263-1277.
[19] Buelow M T, Okdie B M, Brunell A B, et al. Stuck in a moment and you cannot get out of it: The lingering effects of ostracism on cognition and satisfaction of basic needs[J]. Personality & Individual Differences, 2015, 76:39-43.
[20] Zadro L, Boland C, Richardson R. How long does it last? The persistence of the effects of ostracism in the socially anxious[J]. Journal of Experimental Social Psychology, 2006, 42(5):692-697.
[21] LIU X, NAN W, WANG K, et al. Modular organization of cognitive control[J]. Advances in Psychological Science, 2013, 21(12): 2091.
[22] Krosnick J A. Survey research[J]. Annual review of psychology, 1999, 50(1): 537-567.
[23] Gratton G, Cooper P, Fabiani M, et al. Dynamics of cognitive control: Theoretical bases, paradigms, and a view for the future[J]. Psychophysiology, 2018, 55(3): e13016.
[24] Wais P E, Gazzaley A. The impact of auditory distraction on retrieval of visual memories[J]. Psychonomic Bulletin & Review, 2011, 18(6): 1090-1097.
[25] Jamieson J P, Harkins S G, Williams K D. Need threat can motivate performance after ostracism[J]. Personality and social psychology bulletin, 2010, 36(5): 690-702.
[26] Baumeister R F, Dewall C N, Ciarocco N J, et al. Social Exclusion Impairs Self-Regulation[J]. Journal of Personality and Social Psychology, 2005, 88(4):589-604.
[27] Anderson J E, Holcomb P J. An electrophysiological investigation of the effects of coreference on word repetition and synonymy[J]. Brain & Language, 2005, 94(2):200-216.
[28] Iffland B, Sansen L M, Catani C, et al. Rapid heartbeat, but dry palms: reactions of heart rate and skin conductance levels to social rejection[J]. Frontiers in Psychology, 2014, 5: 956.
[29] Baumeister R F, Twenge J M, Nuss C K. Effects of social exclusion on cognitive processes:

ISSN 2706-6827 Vol. 5, Issue 2: 79-84, DOI: 10.25236/IJFS.2023.050214

anticipated aloneness reduces intelligent thought.[J]. J Pers Soc Psychol, 2002, 83(4):817-827.
[30] Buelow M T, Okdie B M, Brunell A B, et al. Stuck in a moment and you cannot get out of it: The lingering effects of ostracism on cognition and satisfaction of basic needs[J]. Personality & Individual Differences, 2015, 76:39-43.
[31] Cho E K, Sung J E, Sim H S. The Effects of Working Memory Capacity on Language Performance in Children with Cochlear Implants[J]. Communication Sciences & Disorders, 2012, 17(1): 79-91.
[32] David J. Hawesa, Lisa Zadroa, Elian Finka, Rick Richardsonb, Kathleen O'Moorea, Brendan Griffithsa, Mark R. Daddsb & Kipling D. Williamsc. The effects of peer ostracism on children's cognitive processes[J]. European Journal of Developmental Psychology, 2012, 9(5):599-613.*
[33] Montoliu T, Hidalgo V, Salvador A. The relationship between loneliness and cognition in healthy older men and women: The role of cortisol[J]. Psychoneuroendocrinology, 2019, 107: 270-279.
[34] Wilson R S, Krueger K R, Arnold S E, et al. Loneliness and Risk of Alzheimer Disease[J]. Archives of General Psychiatry, 2007, 64(2):234-240.
[35] Zadro L, Boland C, Richardson R. How long does it last? The persistence of the effects of ostracism in the socially anxious[J]. Journal of Experimental Social Psychology, 2006, 42(5):692-697.
[36] Adibsereshki N, Vernosfaderani A M, Movallali G. The effectiveness of life skills training on enhancing the social skills of children with hearing impairments in inclusive schools[J]. Childhood Education, 2015, 91(6): 469-476.
[37] Wilson M, Bettger J G, Niculae I, et al. Modality of language shapes working memory: Evidence from digit span and spatial span in ASL signers[J]. Journal of Deaf Studies and Deaf Education, 1997: 150-160.
[38] Harris M, Moreno C. Deaf children's use of phonological coding: Evidence from reading, spelling, and working memory[J]. Journal of Deaf Studies and Deaf Education, 2004, 9(3): 253-268.