The Processing of Affective Concepts by Adolescents in the Context of the Urbanization of China

Liusheng Wang[*1], Xiaoxia Rong[2], Biao Sang[3]
[1,2]School of Education, Nantong University, 999 Tongjing Road, Nantong, Jiangsu, 226007, China
[1,3]School of Psychology and Cognitive Science, East China Normal University, 3663 Zhongshan North Road, Shanghai, 200062, China
[*]Willow76@ntu.edu.cn

***Abstract*- Urbanization can change population structures and improve citizens' quality of life. However, little attention has been paid to whether urbanization influences the psychological development of adolescents as new urban citizens. This research compared the processing of affective concepts by adolescents new to urban life with that by children raised in urban environments, while posing different body postures (sitting upright, slumped over). Sixty-five 7th grade children in China participated; some were new to urban environments (new urban citizens), while the others grew up as urban-dwellers (old urban citizens). The participants were required to make lexical decisions which measured how quickly people can differentiate actual words and pseudo-words. The results showed the main effects of body posture, identity and valence, as well as an interaction effect between identity and body posture, an interaction effect between identity and valence. All participants responded faster while slumped over as opposed to sitting upright, the old urban citizens responded faster than new urban citizens did; and both the old and new urban citizens responded faster when slumped over than when sitting upright; but new urban citizens exhibited significantly greater differences between the two postures. The results indicate that, although urbanization can change people very quickly, a gap in psychological development is still present between new and old urban adolescents, and body posture implicitly influences the processing of affective concepts.**

Keywords*- *Affective Concept Processing; Embodied Cognition; Adolescent; Urbanization

I. INTRODUCTION

Many studies have revealed a difference in psychological development due to demographics, such as living environment [1]. Cognitive and emotional development in adolescents in urban areas differs from those in rural areas. Based on the cognitive ability tests for 95765 children aged from 6 to 15 in China, the children from urban region have higher cognitive ability than those from rural region, including attention, memory, visual and space perception, and reasoning [1]. In general, the material and spiritual conditions of people's lives in urban regions are better than those in rural regions of China. Adolescents in an urban area have more opportunities to acquire new information, enjoy modern science and technology products, and access superior resources for personal development. In addition, parents of adolescents in urban areas often have better social and economic status than their rural counterparts.

In order to narrow the gap between the two areas and improve people's livelihoods, the government of China is devoting itself to urbanization. Increasingly, urbanization is one of the most pronounced changes taking place in China, and it has changed the structure of the population, such as ratio of gender, proportion of residents in different areas. According to the *Statistical Bulletin of National Economic and Social Development (2011)*, the urbanization rate is 51.27%, with 690 million people identifying themselves as urban citizens [2]. The *Annual Conference of China Economics (2012-2013)* cites the urbanization rate at 52.57%, 1.3% higher than for 2011; that means an additional 21.03 million people now live in new cities or towns as new urban citizens [3]. The urbanization of China is narrowing the gap of the physical quality of life between rural and urban regions.

The rapid changes taking place due to urbanization may be influencing the psychological development of adolescents [4]. Urbanization has seen more and more adolescents assume an urban identity instead of a rural identity. However, little research has been conducted on cognitive processing in adolescents as new urban citizens. With improvements in material life, can the cognitive development of new urban citizen adolescents (new to urban environments) catch up with that of old urban citizen adolescents (grew up as urban-dwellers) within a short period of time? Adolescence is the second growth spurt of development, in which adolescents are facing the biological, cognitive and social transitions. They are susceptible to various stimuli in the environment. The social redefinition of adolescent, the time of change in individuals' social roles and status, is of importance for their development [5]. Is it the same cognitive change for two groups under the urbanization or not? It is certainly worth focusing on urbanization construction in China in this regard.

Concept processing through a lexical decision task might reveal the cognitive functioning of adolescents. It is useful and effective for lexical decision task to examine the cognitive processing, in particular, concepts and language processing. Lexical decision task became the common tool for language processing experiment [6, 7]. In the research by Kissler and Koessler, behavioral reactions were the fastest following all positive stimuli and most accurate for positive words through lexical decision task. In order to better explore the processing of concepts by adolescents, body posture was introduced into the design

to implicitly reveal the inner mental presentation which is relative to embodied cognition. Classic theory indicates that core knowledge representations in cognition are modal data structures that are processed independently for the brain's modal systems for perception, action and introspection [8]. However, embodied cognition theory proposes that modal simulations, bodily states and situated action underlie cognition [9]. The notion that mental access to concepts is based on the internal creation of embodied experiences is supported by recent brain research which shows that motor and pre-motor cortex areas associated with specific body parts (i.e., the hand, leg and mouth) become active in response to motor language referring to those body parts [10]. Though some adolescents have the same urban identity as old urban citizens after the urbanization, there still exist different experiences of growth between new and old urban citizens, which grounded in system for perception, action and introspection according to the embodied cognition theory.

Some studied whether evidences demonstrating the body postures can influence mental processing [11-13], supporting the embodied cognition theory. Leung's research showed that the physical body postures could embody the abstract concept processing (e.g., a moral outlook the people endorse), with a hugging posture activating the particularistic code and an upright posture activating the universalistic code. With regard to the power concepts processing, participants posing expansive postures reported had more powerful feeling, chose riskier gambles, and experienced elevated testosterone and decreased cortisol levels compared with participants in constricted body postures [14]. Some researchers also found adopting an expansive body posture affected participants' sense of power and associated action tendencies [15]. One classic experiment investigated how the facial posture influenced the affective response by lexical task. Participants were required to evaluate cartoons while holding a pen in their teeth (which produced a partial smile) or holding a pen in their lips (which produced a partial frown). Although they were unaware of the link between their facial postures and cartoon judgments, participants were found to rate the cartoons as funnier if they held the pen in their teeth as opposed to if they held the pen in their lips, and holding a pen in the mouth in a way that activates the muscles associated with smiling leads to more intense humor responses [16]. When participants did the lexical decision task while holding such facial postures, the facial postures influenced words processing [17].

Therefore, research questions in the current study include: (1) Can affective concept processing be affected by body posture? (2) How do the effects of body posture on affective concept processing differ among new and old urban adolescent citizens? To answer these questions, we designed a 2×2×2 mixed experiment with body posture, identity and valence of words as the independent variables, and with reaction times as a dependent variable. Participants were required to perform lexical decision tasks which measured how quickly people classified stimuli as actual words or pseudo-words. Based on the literature and embodied cognition theory, the hypotheses can be predicted as follows: (1) the adolescents' reaction time in sitting upright is different from that in slumped over in the concept processing; (2) the reaction time gap between two body postures for adolescents of old urban citizens is different from that for adolescents of new urban citizens.

II. METHOD

A. Participants

There were 65 participants composed of new urban citizens (11 males, 15 females) and old urban citizens (19 males, 20 females), all of whom were in the 7th grade of middle school aged from 12 to 13, with normal or corrected-to-normal vision and signed agreements of consent. Two group participants had the same experiences of using computer. Participants as new urban citizens were new to urban environments, while participants as old urban citizens grew up as urban-dwellers. None of the participants reported a history of psychiatric disorder.

B. Materials

Stimuli were 40 Chinese words selected from Chinese Affective Words System [18], in which each word consisted of two Chinese characters. Half had positive valence (mean = 6.76, SD = .23), and half negative valence (mean = 3.08, SD = .26). There was a significant difference in valence, $t(38) = 48.13$, $p < .001$. Familiarity of words was taken into consideration, with a mean = 5.16, SD = .06 for familiarity of positive valence words, and a mean = 5.16, SD = .05 for familiarity of negative valence words. The difference in familiarity of words was not significant, $t(38) = 0.375$, $p > .05$. Moreover, 20 pseudo-words were used as interference stimuli. All the stimuli were produced using E-prime software.

C. Procedure

The experiment consisted of two conditions (sessions) with an interval time of four weeks. Each participant assumed one of two body postures, either sitting upright or slumped over, while doing the first session of the experiment, sitting in the other posture during the session stage as shown in Fig. 1. The order of body postures was counterbalanced. The 4-week interval between the two sessions was intended to avoid the interference of practice effect.

Participants were required to conduct the lexical decision task in each condition. Participants identified the word displayed on the computer as an actual or pseudo-word as quickly and accurately as possible, pressing the left or right key on the response box accordingly. Response keys corresponding to actual or fake words were counterbalanced. Each trial began with a 1000 ms fixation, followed by the stimulus presented, which was then replaced by a 1000 ms blank screen. The stimulus remained on the screen until a response was made as shown in Fig. 2. All the stimuli were presented randomly. An additional

four trials were provided as practice prior to the experiment. Participants kept their faces and eyes toward the center of screen in two body postures.

Fig. 1 Body postures, left: sitting upright; right: slumped over

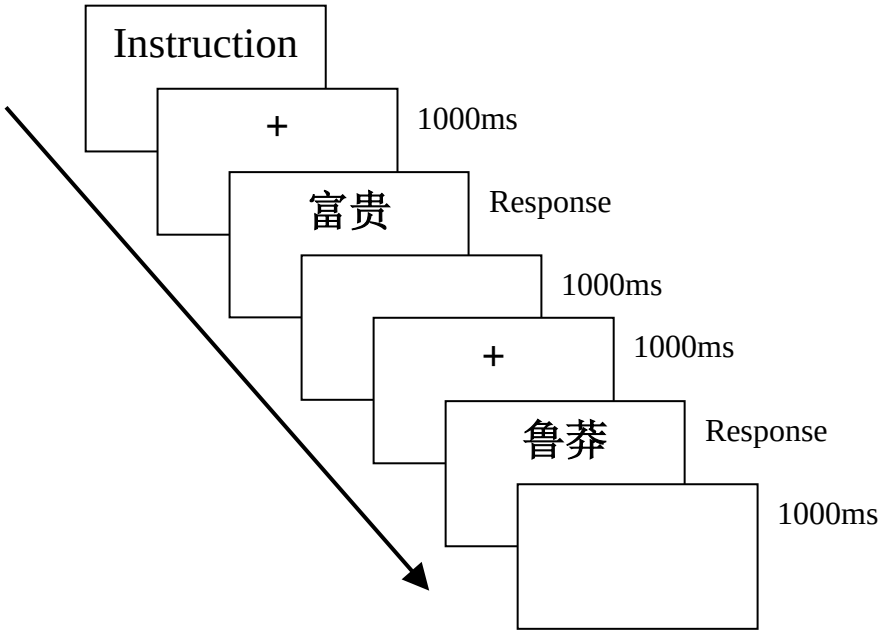

Fig. 2 Illustration of the experimental procedure

III. RESULTS

Responses to pseudo-words and incorrect responses to actual words were not analyzed. The criterion for an extreme reaction times was less than 150 ms or more than 2000 ms [19]. Any further data were dealt with as 3 SD criteria. As such, 11.6% of the completed Rts data was removed.

Body posture (sitting upright vs slumped over) × identity (new urban citizen vs old urban citizen) × valence of word (positive vs negative) for repeated measures analysis of variance (ANOVA) was conducted. The results showed a main effect of body posture, $F(1, 63) = 51.73$, $p < .001$, $\eta 2 = .451$. The participants responded faster when slumped over ($M = 660.73$ ms, $SE = 10.20$) than when sitting upright ($M = 761.83$ ms, $SE = 16.98$), indicating a significant role for the body in the processing of concepts. There was a main effect of identity, $F(1, 63) = 92.243$, $p < .001$, $\eta 2 = .594$. The participants as old urban citizens ($M = 594.96$ ms, $SE = 15.32$) responded faster than did new urban citizens ($M = 827.61$ ms, $SE = 18.76$). There was also significant main effect of valence, $F(1, 63) = 15.197$, $p < .001$, $\eta 2 = .194$. The participants responded faster to positive words ($M = 698.72$ ms, $SE = 11.95$) than to negative words ($M = 723.85$ ms, $SE = 13.09$).

In addition, the result showed an interaction effect between the body posture and the identity of the participants as shown in

Fig. 3, F (1, 63) = 20.63, p < .001, $\eta 2$ = .247. Further simple effect analyses revealed that old urban citizens responded faster when slumped over than when sitting upright, F (1, 63) = 4.39, p < .05; and, new urban citizens also responded faster when slumped over than when slumped over, F (1, 63) = 57.37, p < .001 as shown in Table 1 and Fig. 4). There was also interaction between valence and the identity of the participants, F (1, 63) = 4.29, p < .05, $\eta 2$ = .064. Further simple effect analyses revealed the new urban citizens responded faster to positive words than to negative words, F (1, 63) = 14.85, p < .001; however, there was no significant valence effect for old urban citizens when processing the words, F (1, 63) = 2.09, p > .05 as shown in Table 2 and Fig. 4).

Regarding the different reaction times between the two postures, new urban citizens (164.94 ms) experienced significantly greater changes than old urban citizens (37.27 ms), t (128) = 5.876, p < .001.

TABLE 1 MEAN REACTION TIMES AS A FUNCTION OF IDENTITY AND BODY POSTURE (MS)

Identity	***Body posture***	***M***	***SE***	***F***
New urban citizen	Sitting upright	910.08	26.30	57.37***
	Slumped over	745.14	15.80	
Old urban citizen	Sitting upright	613.59	21.47	4.39*
	Slumped over	576.32	12.90	

Note: *** $p < .001$, * $p < .05$.

TABLE 2 MEAN REACTION TIMES AS A FUNCTION OF IDENTITY AND VALENCE (MS)

Identity	***Valence***	***M***	***SE***	***F***
New urban citizen	Positive	808.37	18.51	14.85***
	Negative	846.85	20.29	
Old urban citizen	Positive	589.06	15.11	2.09
	Negative	600.85	16.56	

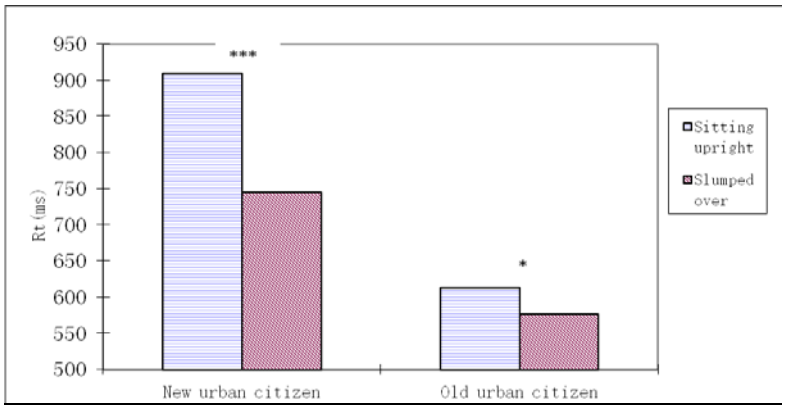

Fig. 3 Interaction effect between identity and posture (ms)

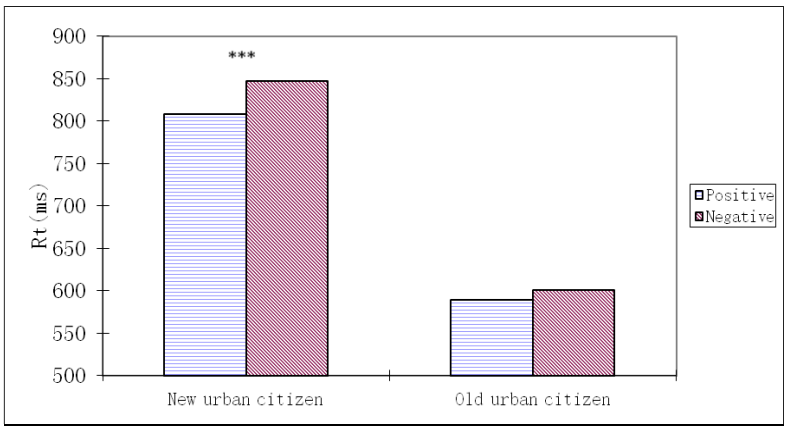

Fig. 4 Interaction effect between identity and valence (ms)

IV. DISCUSSION

The results of this study indicate the significant role of body in the processing of affective concepts, depending on whether adolescents were new or old urban citizens. Body posture affected affective concept processing, wherein adolescents responded faster while relaxed (slumped over) than while stiff (sitting upright). This is consistent with the founding of some experiments in which the physical body posture can affect the concepts processing [11, 15]. When adolescents posed in these two body postures, they experienced different tension in sensory-motor systems, and were therefore in different bodily states. Embodying stiffness and relaxation triggers the respective emotional experience in individuals. The stiff posture activates the solemnness, caution and prudence which are fostered in reality when individuals made decision seriously, leading to longer reaction times; and the slumped-over posture activates the relaxation, easy when individuals are leisure and stressless, leading to shorter reaction times. That is consistent with the statement that the reaction time is shorter when muscle fiber is in relaxation than that when muscle fiber is contraction or in tension [20]. This is supporting evidence for the embodiment of concepts. It has been confirmed that body posture would cause neuroendocrine and behavioral changes: high-power posers experienced elevations in testosterone, decreases in cortisol, and increased feelings of power and tolerance for risk; low-power posers exhibited the opposite pattern, suggesting that embodiment extends beyond mere thinking and feeling, to physiology and subsequent behavioral choices [14]. More evidences could be found that the link from motor system to language systems was shown be effective in TMS studies in which magnetic pulses were injected in different parts of the motor system, thereby modulating the processing of arm and leg words differentially, in investigations of the effects of action execution on the processing of language and by patient work [21]. Although adolescents conducted explicitly lexical decision tasks, they did not perceive the effects of body posture on the tasks, and their reaction times in different bodily states (body postures in different states of relaxation) were not the same when processing the affective concepts. Consequently, body posture implicitly influences concept processing. Representations of the perception of external and internal states (emotions, introspection) as well as actions constitute a concept and thus play a functional role in conceptual thinking [22]. Concepts are assumed to be embodied in the sense that interactions with other individuals and with objects lead to the formation of their respective conceptual memory traces in modality-specific brain areas, which typically process the corresponding sensory and action-related information [22]. Embodied cognition holds the view that the cognitive system utilizes the environment and the body as external informational structures that complement internal representations.

The current study also discovered the gap between two groups of adolescents in affective concept processing, and the interactive effect showed the valence effect only for new urban citizens. Although adolescents as new urban citizens had already become immersed in urban life, they responded more slowly when processing concepts, regardless of whether they were sitting upright or slumped over. The difference between new and old urban citizens was similar to the difference between rural and urban adolescents [1]. This indicates the tendency of affective concept processing in adolescents as new urban citizens after urbanization.

One observation indicates that the gap in reaction times between the two body postures for adolescents as new urban citizen was larger than that of their counterparts. Adolescents as new urban citizens experienced significantly greater changes and transformations than old urban citizens did. The result is expected based on embodied cognition theory in which body constitutes an important carrier of mental process, for example, cultural values and imperatives in Leung's study [11]. The body posture could be furnished with a rich nexus of psychological meanings through its association with certain experiences. The fact that a certain experience (e.g., identity change) was more dominant in one group (new urban citizens) than others (old urban citizens) suggests that associated action (e.g., sitting upright) may tend to embody psychologically meaningful injunctions in the former, while the fact that a certain experience (e.g., identity unchangeable) was more dominant in one group (old urban citizens) than others (new urban citizens) suggests that associated action (e.g., slumped over) may tend to embody psychologically meaningful injunctions in the former. In addition, although physical life was basically similar between the two groups, adolescents as new urban citizens were more sensitive to the changing internal state and the external environment. They had more spare time after school, and had more freedom to do what they want to do. However, adolescents as old urban citizens had experienced and received more consistency and stricter educational guidance. Their parents kept an eye on their children most of the time, both at school and after school. Adolescents as old urban citizens were busy with various after-school programs. As such, adolescents in different groups felt and perceived different levels of stress in schooling and daily life. This inner and outer stress gradually becomes associated with perceptions, actions and introspection, and it eventually has the potential to influence mental processing.

ACKNOWLEDGMENT

This research was supported by Ministry of Education grants 11YJC1900025 and 10JJDXLX001, and Jiangsu Educational Science Planning grant C-a/2011/01/23. The authors thank Ministry of Education of P. R. C. and Jiangsu Educational Science Planning Office for the supports to the research.

REFERENCES

[1] Q. Dong and C. Lin, Children and teenagers psychological development characteristics in contemporary China, Beijing: Science Press, 2011.

[2] State Statistics Bureau, Statistical Bulletin of National Economic and Social Development, http://www.stats.gov.cn/tjgb/ndtjgb/qgndtjgb/t20120222_402786440.htm2011.

[3] Q. Xue, Annual conference of China economics open, Chinese Social Sciences Press, 01-28. http://www.csstoday.net/Item/46128.aspx, Beijing 2013.

[4] B. Sang and X. Deng, "Emotion development of Chinese adolescents under the social change," Psychological Development and Education, vol. 26, pp. 549-553, 2010.

[5] L. Steinberg, Adolescence, New York: McGraw-Hill, 2005.

[6] H. A. Barber, et al., "Concreteness in word processing: ERP and behavioral effects in a lexical decision task," Brain and Language, vol. 125, pp. 47-53, 2013.

[7] J. Kissler and S. Koessler, "Emotionally positive stimuli facilitate lexical decisions—an ERP study," Biological Psychology, vol. 86, pp. 254-264, 2011.

[8] L. W. Barsalou, "Grounded cognition: past, present, and future," Topics in Cognitive Science, vol. 2, pp. 716-724, 2010.

[9] L. W. Barsalou, "Cognitive and neural contributions to understanding the conceptual system," Current Directions in Psychological Science, vol. 17, pp. 91-95, 2008.

[10] B. Bergen and J. Feldman, "Embodied concept learning," in Handbook of Cognitive Science: An Embodied Approach, P. Calvo and T. Gomila, Eds., ed San Diego: Elsevier Science, pp. 313-331, 2008.

[11] A. K. Y. Leung, "Embodied cultural cognition: how culture is carried by our bodily experiences," Doctor of Philosophy in Psychology, Department of Psychology, University of Illinois, Urbana, 2005.

[12] T. T. Brunyé, et al., "Body-specific representations of spatial location," Cognition, vol. 123, pp. 229-239, 2012.

[13] K. N. Rotella and J. A. Richeson, "Body of guilt: using embodied cognition to mitigate backlash to reminders of personal & ingroup wrongdoing," Journal of Experimental Social Psychology, 2013.

[14] D. R. Carney, et al., "Power posing: Brief nonverbal displays affect neuroendocrine levels and risk tolerance," Psychological Science, vol. 21, pp. 1363-1368, 2010.

[15] L. Huang, et al., "Powerful postures versus powerful roles: Which is the proximate correlate of thought and behavior?" Psychological Science, vol. 22, pp. 95-102, 2010.

[16] F. Strack, et al., "Inhibiting and facilitating conditions of the human smile: a non-obtrusive test of the facial feedback hypothesis," Journal of Personality and Social Psychology, vol. 54, pp. 768-77, May 1988.

[17] J. Zhang and W. Chen, "Study on embodiment of emotion comprehension: was James-Lange wrong," Psychological Research, vol. 3, pp. 46-51, 2010.

[18] Y. Wang, et al., "The pilot establishment and evaluation of Chinese affective words system," Chinese Mental Health Journal, vol. 22, pp. 608-612, 2008.

[19] C. Wang and D. Peng, "The roles of surface frequencies, cumulative morpheme frequencies, and semantic transparencies in the processing of compound words," Acta Psychologica Sinica, vol. 31, pp. 266-273, 1999.

[20] M. Zhang, "The factors analysis influencing speed," Track & Field, pp. 53-54, 2004.

[21] Z. Shebani and F. Pulvermüller, "Moving the hands and feet specifically impairs working memory for arm- and leg-related action words," Cortex, vol. 49, pp. 222-231, 2013.

[22] M. Kiefer and F. Pulvermüller, "Conceptual representations in mind and brain: theoretical developments, current evidence and future directions," Cortex, vol. 48, pp. 805-825, 2012.

Liusheng Wang was born in Jiangxi, China in August, 1976. He is an associate professor in the School of Education, Nantong University, Nantong, China, and a doctoral student in the School of Psychological and Cognitive Science, East China Normal University, Shanghai, China. His research interests are on the cognitive psychology and adolescent development.

Xiaoxia Rong was born in Jiangsu, China in November, 1989. She received a B.A. degree in psychology from School of Education, Nantong University in 2012.

Biao Sang was born in Zhejiang, China. He is a professor in School of Psychology and Cognitive Science, East China Normal University, Shanghai, China, and received a Ph.D. degree in psychology from this university. His research interests are on the social and cognitive development of children and adolescents.