



Age-related differences in the effects of autistic traits on processing a linguistic operator of interpersonal relation

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INTRODUCTION

Emotional reactions to the other's linguistic expressions change among individuals, which could cause interpersonal miscommunication. In East Asian languages, sentence-final particles (SFPs) indicate a wide range of the speaker's attitude and feeling towards the proposition of the sentence. Japanese SFP *-ne* is one of the most important linguistic operator of interpersonal relation, since this typically indicates empathy towards the other [1].

Autistic traits manifest lower mentalizing ability [2]. A previous study [3] utilizing event-related potentials (ERPs) of electroencephalography (EEG) has reported that typically-developed (TD) younger adults with higher autistic traits yielded greater early posterior negativity (EPN) to atypical usages of SFP *-ne* in comparison with the typical *-ne*. It is plausible that TDs with lower mentalizing ability are hypersensitive to atypical usages of the empathy-arousing SFP *-ne*, due to their stereotypical understanding of variability of linguistic operators concerning interpersonal relation.

Ageing is also suggested to contribute to changing the comprehension of SFP [4]. Little is, however, known of how aging and autistic traits interact to affect the perception of SFPs.

The present study compared the EPN differences between younger and older TD in response to sentences with and without *-ne*, and examined the correlation of the EPN with the degree of individual autistic traits.

MATERIALS and METHODS

[Participants] Healthy right-handed 32 younger (aged 19-27 years, 16 male) and 32 older (aged 65-82 years, 17 male) TD native Japanese speakers (Table 1).

[Materials] 60 Japanese sentences indicating an instruction with and without *-ne* like (1).

(1) *Kono yooshi ni kinyuusi-te (kudasai)-ne.*
Kono yooshi ni kinyuusi-te (kudasai).
'(Please) fill out this form.'

[Procedure] During EEG recording, participants briefly replied to auditorily-presented sentences spoken by hypothetical conversational partners appearing on a computer screen (Fig. 1). ERP onset was triggered at the beginning of *-ne*, or at the end of sentence without *-ne*.

[Data acquisition, preprocessing, analysis] The EEG signal was recorded from 21 passive Ag-Cl electrodes at positions of the international 10-20 system using a QuickAmp (Brain Products, Gilching, Germany). The acquired data was preprocessed and analyzed with EEGLAB [5] in Matlab (Mathworks, Natick, MA, USA). The analysis of individual ERP differences was conducted with the lme4 [6] and lmerTest [7] packages in R version 3.5.2.

Table 1. Properties of participants

	Older adults (n = 32)	Younger adults (n = 32)	t (df = 31)	p
Year of Education	13.72 (1.91)	16.09 (1.28)	-6.201	0.000
AQ	17.28 (7.14)	19.78 (6.20)	-1.667	0.106
VCI-WAIS-III (scaled)	114.63 (11.84)	119.97 (8.14)	-1.959	0.059
PSI-WAIS-III (scaled)	119.09 (12.12)	115.69 (15.93)	0.909	0.371
GDS-15	3.50 (3.12)	4.03 (2.87)	-0.777	0.443
Flanders-Handedness	9.88 (0.41)	9.34 (1.80)	1.567	0.127
HHIA	119.75 (8.27)	121.75 (3.92)	-1.254	0.219

Notes: Values in parentheses indicate standard deviations. AQ: autism-spectrum quotient, VCI: verbal comprehension index, :WAIS: Wechsler Adult Intelligence Scale, PSI: processing speed index, GDS: geriatric depression scale, HHIA: Hearing Handicap Inventory for Adults.

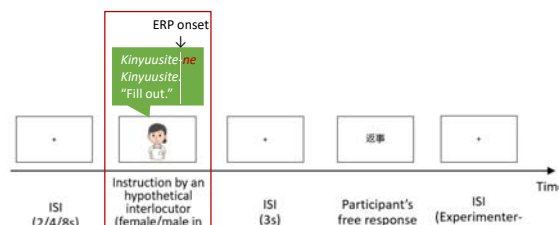


Figure 1. Procedure of experimental trial

RESULTS

Age comparison: The EPN, arising between 100 and 250 ms in the occipito-parietal region was found in response to sentences without *-ne* than those with *-ne* ($p < 0.05$ with FDR correction, Figs. 2,3).

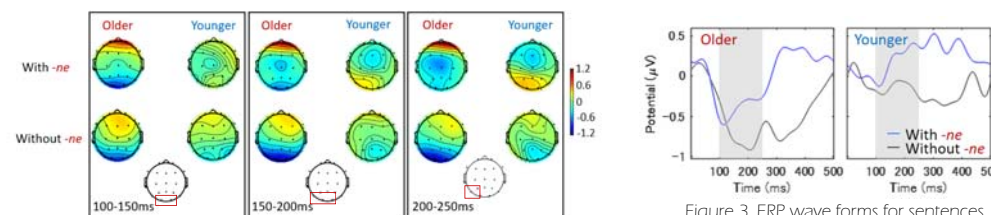


Figure 2. ERP topography for sentences with and without *-ne* ($p < 0.05$, FDR)

Correlation between the EPN and AQ: The linear mixed effects modeling including SFP, Age group, sex, and AQ (Channel and Participant included as random variables) indicated that older men with higher AQ showed the opposite effect of the EPN ($\beta = -0.586$, 95%CI = 0.252 - 0.921, $p < 0.001$), compared with the above general tendency. Their negativity was greater for sentences with *-ne* than those without *-ne* (Fig. 4).

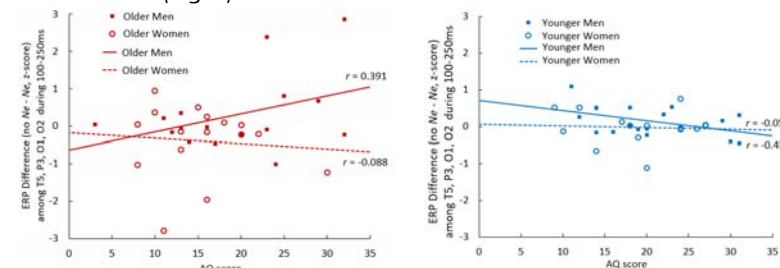


Figure 4. Individual differences in the early posterior negativity (EPN) for sentences with and without *-ne*.

DISCUSSION

These findings demonstrate that an emotional reaction to a linguistic operator of interpersonal relation such as Japanese *-ne* depends on age, sex, and individual's autistic tendencies even among the TD native speakers. Especially, older native Japanese speakers with higher autistic traits may have atypical understanding of this kind of linguistic marker.

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