Individual pragmatic abilities modulate neural indices of pragmatic NPI licensing

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Introduction. Traits associated autism spectrum disorder (ASD) may be modulatory of language processing in neurotypical and neurodivergent individuals. The Autism Spectrum Quotient (ASQ) [1], comprised of five sub-scales, is one instrument through which to measure autistic traits. Several psycholinguistic studies have observed that traits measured via the Communication Subscale (CS) of the ASQ may modulate semantic-pragmatic processing [2][3]. These findings raise interesting questions about the extent to which individual pragmatic ability may modulate negative polarity item (NPI) processing in neurotypical populations. NPIs (e.g., “ever” in English) may be licensed across a range of negative (anti-veridical; [4][5]) and non-veridical (encompassing downward entailing) [4][5][6] environments. NPI licensing draws on syntactic and semantic-pragmatic processes, reflecting a continuum of negation. Consider (1a) and (1b) (suppl. mats.). (1a) presents a canonical, anti-veridical licensing environment given the licensor “no”. (1b) presents a pragmatic process, namely “rescuing” the NPI by negative implicature [6] (i.e., “beginner pilots and *no others*….”). It thus reasons that individual pragmatic ability may modulate NPI processing.

Methods. We investigated the neural indices of NPI licensing as a function of CS-ASQ scores in an exploratory ERP analysis (n=27 native English speakers). We utilized a negative (1a), “rescuing” (1b), and ungrammatical (1c) condition. In analyses, we defined two contrasts (Helmert coded): grammaticality (licensed: unlicensed) and licensor (no: only). CS-ASQ score was centered. We conducted linear mixed effects models in the 300-500ms (N400) and 500-900ms (P600) time-window on each word position of interest (table 1). In line with prior investigations [2], we predicted that as CS-ASQ score increased, the difference in ERP amplitude between un/grammatical conditions would decrease.

Results. In the P600 epoch on the CW+1 we observed a significant interaction between CS-ASQ score and *licensor* ($b=0.72$, $SE=0.28$, $t=2.54$, $p<0.05$). As CS-ASQ increased, mean P600 amplitude decreased in the rescuing (1b) condition compared to (1a) and (1c) (fig 1). We observed no other significant effects (fig 2; table 2, 3). No individual differences in grand averaged waveforms were observed between N400/P600 responses per condition.

Discussion. We observed that individual pragmatic abilities differentially modulate neural indices of NPI licensing. Furthermore, amidst a large body of psycholinguistic research in NPI licensing, our study suggests that extralinguistic factors may impact NPI licensing in non-trivial ways, posing avenues for further investigation.

References

[1] Baron-Cohen et al. (2001). The Autism-Spectrum Quotient (AQ): Evidence from Asperger Syndrome/High-functioning Autism, Males and Females, Scientists and Mathematicians. *Jour Autism Experimental Disorders*; [2] Xiang et al. (2013); Dependency-dependent interference: NPI interference, agreement attraction, and global pragmatic inferences. *Frontiers in Psych*; [3] Nieuwland et al. (2010). On the incrementality of pragmatic processing: An ERP investigation of informativeness and pragmatic abilities. *Jour. Memory & Language*; [4] Giannakidou (2002). Licensing and sensitivity in polarity items: From downward entailment to (non)veridicality. *Proceedings. Chicago Ling. Society*; [5] Giannkidou (2006). Only, emotive factive verbs, and the dual nature of polarity dependency. *Language*; [6] Hoeksema (2012). On the natural history of negative polarity items. *Linguistic Analysis.*

Table 1: Conditions and Stimuli; Statistical Methods

CW = Critical word; **CW+1** = Word following CW; **CW+2** = Second word following CW

Anti-veridical	(1a) No beginner pilots have ever$_{CW}$ | flown$_{CW1}$ | that$_{CW2}$ | route
Rescuing	(1b) Only beginner pilots have ever$_{CW}$ | flown$_{CW1}$ | that$_{CW2}$ | route
Ungrammatical	(1c) Most beginner pilots have ever$_{CW}$ | flown$_{CW1}$ | that$_{CW2}$ | route
Statistical model:	lmer(AvgVoltage ~ LicCond * ASQScore.c + (1 |Participant), data=P600CW1Avg)

Table 2. Simplified model outcomes for P600 epoch ([*] significant; [.] approaching significance

	Critical Word (CW)	**Word following CW (CW+1)**
Grammaticality	b=0.63; SE=0.41; t=1.54; p=0.12	b=0.09; SE=0.37; t=0.25; p=0.80
Licensor	b=-0.07; SE=0.47; t=-0.15; p=0.88	b=0.43; SE=0.43; t=0.99; p=0.32
Grammaticality x ASQ Score	b=0.13; SE=0.27; t=0.49; p=0.62	b=0.16; SE=0.24; t=0.67; p=0.50
Licensor by ASQ Score	b=-0.43; SE=0.31; t=-1.40; p=0.16	b=0.72; SE=0.28; t=2.54; p=0.01**[*]**

Table 3. Simplified model outcomes for N400 epoch. ([*] significant; [.] approaching significance

	Critical Word (CW)	**Word following CW (CW+1)**
Grammaticality	b=-0.10; SE=0.41; t=-0.25; p=0.80	b=0.25; SE=0.41; t=0.63; p=0.53
Licensor	b=0.19; SE=0.47; t=0.40; p=0.68	b=0.52; SE=0.47; t=1.10; p=0.27
Grammaticality by ASQ Score	b=0.05; SE=0.27; t=0.18; p=0.85	b=0.16; SE=0.27; t=0.61; p=0.54
Licensor by ASQ Score	b=-0.40; SE=0.31; t=-1.29; p=0.20	b=0.61; SE=0.31; t=1.95; p=0.05**[.]**

*****As CS-ASQ score increases, pragmatic abilities decrease

P600 posterior electrodes: Cz, Pz, Cp1, Cp2, Cp5, Cp6, P3, P4, P7, P8, Pz

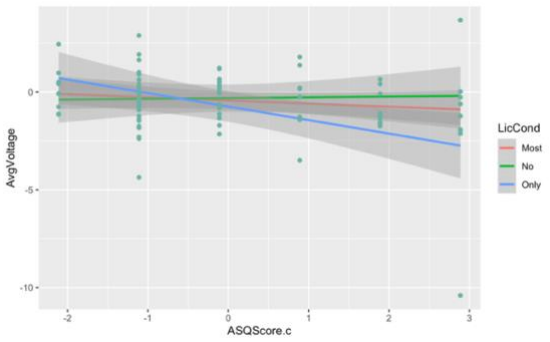

Figure 1. Averaged ERP amplitudes as a function of CS-ASQ Score.

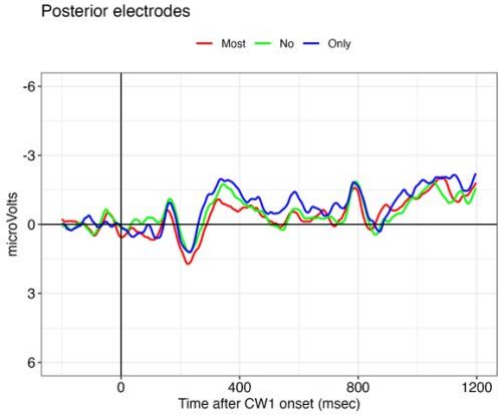

Figure 2. Grand averaged ERP waveforms on the CW1 over posterior electrodes. Negative plotted up.