HOW DO MANDARIN NATIVES INTERPRET IMPLAUSIBLE SENTENCES?

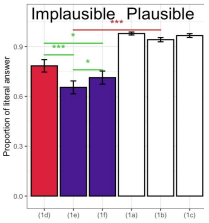
Ruihua Mao (Université Paris Cité), Sihan Chen (MIT) & Edward Gibson (MIT)
ruihua.mao@etu.u-paris.fr

A complete language comprehension mechanism should consider the existence of errors. Based on Shannon(1948) and Levy(2008), Gibson et al. (2013) propose the noisy channel model, arguing the probability $p(s_i \mid s_p)$ for a rational comprehender to infer the intended sentence(s_i) from a perceived sentence(s_p) is proportional to the probability of the intended sentence $p(s_i)$ and the likelihood of the intended sentence to be corrupted to the perceived sentence $p(s_i \rightarrow s_p)$.Previous studies showed the noisy channel model successfully predicted English sentence interpretation. Here we test it in a typologically different language.

Materials & Procedure: Zhan et al. (2023) manipulated sentence structure (active/passive) and plausibility(plausible/implausible). By adding Mandarin Ba sentences, we devised a 3 x 2 design. The table below shows example items and corresponding edits. Although implausible passive Bei and implausible Ba sentences can be formed by substitution between "Bei" and "Ba", Poliak et al.(2023) suggest that substitutions may be somewhat unlikely. Thus we still start with "exchange" here. 81 Mandarin natives read testing items and answered corresponding yes/no questions which allows us to infer whether participants interpret the item literally or not.

Plausible	**Edits**	**Implausible**
1a). 奶奶 打碎了 这个 碗 **(active)** Grandma break-ASP this-CL bowl	NP Exchange across verb	**1d).**这个 碗 打碎了 奶奶 **(active)** This-CL bowl break-ASP grandma
1b). 这个 碗 被 奶奶 打碎了**(passive)** This-CL bowl bei grandma break-ASP	NP Exchange across function word	**1e).**奶奶 被 这个 碗 打碎了**(passive)** Grandma bei this-CL bowl break-ASP
1c). 奶奶 把 这个 碗 打碎了**(Ba)** Grandma ba this-CL bowl break-ASP	NP Exchange across function word	**1f).**这个 碗 把 奶奶 打碎了**(Ba)** This-CL bowl Ba grandma break-ASP

Predictions: The noisy channel framework makes predictions according to the probability of the edits required. The higher edit probability, the higher inference rate, and thus the lower literal interpretation rate, so we expect that the literal interpretation sequence in this study is: Plausible conditions > Implausible active > (Implausible passive=Implausible Ba). **Results & Discussion:** Mixed-effect logistic regression analysis shows:(1) Plausible materials were interpreted literally much more often than the implausible materials ($p<0.001$); (2)Implausible active sentences were interpreted literally more than implausible passive sentences ($p<0.001$) and implausible Ba sentences ($p<0.05$) respectively; (3) In contrast to the prediction, implausible Ba sentences were interpreted literally more often than the implausible passive sentences ($p<0.05$). There may be two possible reasons: (i) Mandarin passive sentences are less frequent than Ba sentences. The prior probability $p(s_i)$ for infrequent structures is low, so other possible intended sentences with higher prior probability become more attractive for comprehenders(Liu et al., 2020); (ii) In addition to exchange, implausible Ba sentences can also be obtained by inserting "Ba" in Mandarin's topic-comment structure "这个碗，奶奶打碎了" (This bowl, grandma broke). Insertions are more likely to happen than exchanges(Gibson et al., 2013), which may influence comprehenders' judgment. The results show the robustness of noisy channel theory, and are also consistent with Cai et al.,(2022) incremental processing theory, which claims that the high literal rate for the implausible active/passive materials compared with implausible dative materials is because readers do not have access to the alternative more plausible interpretation when reading the initial NP and verb.



Ref: [1] Cai et al., Cognition 2022; [2] Gibson et al., PNAS 2013; [3] Liu et al., Amlap 2020; [4] Poliak et al., 2023; [5] Shannon, BellSystTech,1948; [6] Zhan et al., submitted 2023