A comparison of associative networks between genders: A Singapore English Case Study

Keywords: word association networks, cognitive networks, Singapore English, gender, mental lexicon

Extended Abstract

Motivation. Word associations provide unique insights into the internal organization of mental representations of humans. In a word association task, human participants are presented with a *cue* word (e.g., *dog*) and respond with the first word that comes to their mind (examples of responses include *woof, cat, pet*). Large-scale databases of word associations such as the Small World of Words project (https://smallworldofwords.org/en) enable cognitive scientists to study the organization of lexical concepts [1] and how this organization changes with aging [2]. Singapore English is the dialect of English spoken in Singapore, which contains lexical items (e.g., *shiok*, which denotes a feeling of pleasure) that do not exist in other major dialects of English such as North American English or British English, but are commonly used in Singapore Colloquial English, also known as *Singlish*. The Small World of Singlish Words project (https://singlishwords.nus.edu.sg) was created to collect word associations for concepts unique to Singapore English (i.e., "*Singlish*" concepts). In this work, we wished to investigate if the organization of Singlish concepts in the lexicon differed among females and males. Given that gender plays an important role in shaping an individual's lived experiences, we expected to find cognitive footprints of these differences.

Approach and Methodology. The original dataset was collected from participants who were native speakers of Singapore English (n_{female} = 1128, n_{male} = 1116). Ethics approval for this study was obtained from the NUS Institutional Review Board (NUS-IRB-2022-886). Each participant provided up 3 responses to 240 cues, which were familiar Singlish words and concepts. After pre-processing the responses to correct for spelling errors and lemmatizing the responses, the original dataset was sub-sampled such that 100 associations were randomly selected for each cue from each gender. Separate cue-response matrices were constructed for males and females and transformed into a cue-by-cue matrix where each cell denoted the similarity of responses provided to each pair of nodes. Pairs of cue words that shared many responses in common that were also unique relative to the entire corpus received a stronger similarity score [3]. The cue-by-cue matrix was further filtered using the Triangulated Maximally Filtered Graph method [4] to retain edges of nodes by maximizing the strength of their association to other nodes while keeping the extant network planar. Male and female networks were then statistically compared using a node-wise bootstrapping approach as recommended by [5] for comparing networks with the same set of nodes. Briefly, the node-wise bootstrapping method involves selecting subsets of nodes in the full network and reestimating the networks, which provides sampling distributions for statistical comparisons. The underlying logic is if the full networks differ from each other, then any partial network consisting of the same nodes should also be different.

Results. Figure 1 shows a visualization of the full female and male networks. The female network has an average shortest path length (ASPL) of 6.02, global clustering coefficient (CC) of 0.707, and modularity (Q) of 0.797. The male network has an ASPL of 5.31, CC of

0.706, and Q of 0.770. Figure 2 shows the results of the node-wise bootstrapping. All comparisons were statistically significant. Across all node-drop proportions, partial female networks had a higher ASPL and higher CC than partial male networks. The patterns were less consistent for Q, where partial male networks had a higher Q than partial female networks but only for conditions where a higher proportion of nodes were retained.

Conclusions and Outlook. The overall structure of associative networks of Singlish concepts differed across male and female participants. The male network had a lower ASPL than the female network, which may indicate more efficient navigability of Singlish concepts in their lexicon. The male network also had a lower CC than the female network, which may suggest finer-grained meaning distinctions among Singlish concepts. Future psycholinguistic studies could establish if these network differences are associated with measurable influences on linguistic behavior and performance of males and females.

References

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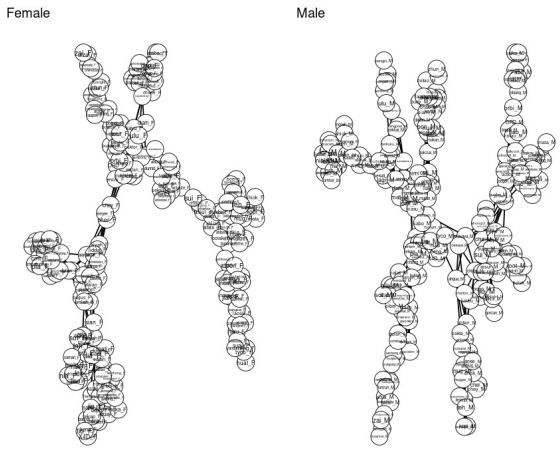

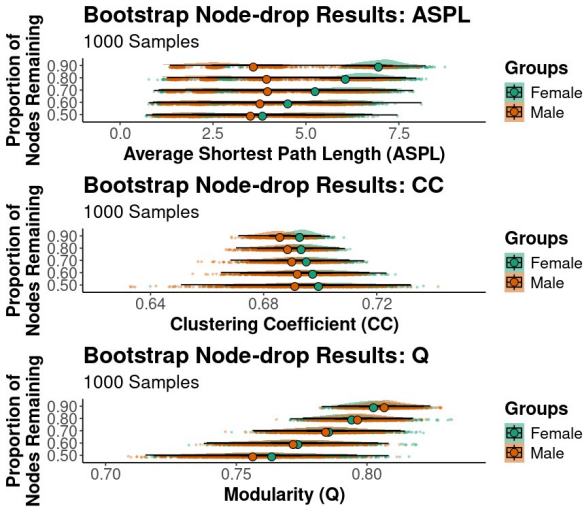

Figure 1 (Left). Full Female and Male Networks.

Figure 2 (Right). Bootstrapping Results Comparing Female and Male Networks.