The concept of “contrast” is at the heart of phonological analysis (Avery et al., 2008). In phonological theory, segments that distinguish between lexemes are considered to be in a contrastive relationship, and have been viewed as belonging to a stored inventory of underlying phonological representations. Segments that are not contrastive are in allophonic relationship. However, the traditional dichotomy of contrastive vs. allophonic relationships is far more complex (Hall, 2013). Researchers are re-examining the way phonological relationships are defined (Boomershine et al., 2008; Dresher, 2008; Hall, 2009, 2013; Hualde, 2005; Scobie & Stuart-Smith, 2008) - describing intermediate relationships such as “quasi-contrastive”, “semi-allophonic”, and “mushy contrast”. However, there is little experimental research, and results have varied. This research explores phonological relationships based on the measures of minimal pair counts and frequency. These measures were applied to Canadian French vowels to quantify three degrees of contrast between pairs: High, Mid and Low contrast. For traditional definitions, both High and Mid contrast pairs would be classified as phonologically contrastive, and Low contrast pairs as allophonic. As such, a binary view of contrast predicted that High and Mid contrast pairs would pattern together on tasks of speech perception, and Low contrast pairs would show a different pattern (H=M>L). The gradient view predicted all vowel pairs would fall along a continuum (H>M>L).

**Experiment 1: AX Task**

The OMNILEX database was used to establish a word list of French one-syllable words. Minimal pair and frequency calculations were based on Brown (1988). The number of minimal pairs for each vowel was calculated, for every consonant and consonant combination in CV, VC, CVC and CCV syllables. Vowels were compared across consonantal contexts to determine how many vowels occurred in the same context. From this, it was calculated (a) how many minimal pairs a single vowel participated in with all other vowels, and (b) how many minimal pairs existed between two specific vowels. To represent a scale of contrast, vowels were chosen from the High-, Mid-, and Low-end range of minimal pair counts, both for individual and shared vowel counts. Frequency of vowels was calculated by the number of times a vowel occurred in each syllable type. Stimuli were based on four consonant C_C frames of [l, b, f, ŋ], combined with the six vowels [a, ɔ, o, ʊ, y, ʏ], making 24 non-word syllables. F1 and F2 were measured, and values were similar to Martin’s (2002: 84) vowel space for male speakers of the Quebec. There were two conditions: Trial Type (Different, Same) and Contrast (High [a-ɔ], Mid [o-ʊ], Low [y-ʏ]). Same condition stimuli were acoustically different, e.g., [bob₁-bob₂]. Participants were 32 speakers of Canadian French. A 2 x 3 ANOVA showed main effects of Trial Type (p < .01), Contrast (p <.001), and an interaction between Trial Type x Contrast (p < .001). Among Different pairs, RTs for High-Mid and High-Low were significantly different. In Same trials, RTs for Low-Mid and Low-High were significantly different. See Figure 1.
Experiment 2: Similarity-Rating Task
Stimuli were different pairs used in the AX task. Participants heard each CVC-CVC pair once (consonants: [b,f,l,ʃ]; vowels: [a,ɔ,o,ʊ,y,ʏ]), totalling 24 trials and 8 instances each of High, Mid, and Low Contrast stimuli. Participants were the same as in Experiment 1. They were told that they would hear two different syllables and their task was to decide how similar or how different the two syllables were on a scale of 1 to 6 with “1” being “Not very similar” and “6” being “Very similar”. A 1-way ANOVA with 3 levels was done on the similarity ratings for High, Mid and Low Contrast pairs. Results showed a main effect of Contrast ($p < 0.001$). Pairwise comparisons indicated that all conditions were significantly different from one another (High-Mid, High-Low, Mid-Low).

The results did not support a strict binary interpretation of contrast, since the High, Mid and Low contrast vowel pairs pattern differently across AX Task and Similarity Rating Experiments. Instead, the results support a gradient view of phonological relationships. These results provide experimental evidence for what is being more frequently acknowledged in the theoretical literature, namely that there are phonological relationships that fall between purely allophonic or purely contrastive. This nuanced view can better represent the range of relationships between categories of speech sounds and further our understanding of sound patterns in human language.

References