

On hearing colours: An investigation into cross-modal associations in L1 and L2 vowel perception in a non-synaesthetic population

Magdalena Wrembel & Karolina Rataj (School of English, Adam Mickiewicz University, Poznań)

The application of colour terminology with relation to vowels can be traced back to Jakobson (1962), who pointed to the regularity of colour associations in coloured hearing synaesthesia and called for research into mappings between phonemic features and colour attributes in order to provide insights into the perceptual aspect of speech sounds. Synaesthetic research reports a strong correlation between auditory pitch and visual luminance as well as a general tendency to associate high pitch sounds with light colours and low tones with darker hues (cf. e.g. Hubbard 1996, Ward et al. 2006). Some of the existing theories addressing the causes of synaesthesia point to the fact that strong tendencies in intersensory, cross-modal matching especially between auditory and visual stimuli have also been found in people without synaesthesia (Marks 1975; Harrison 2001). However, very few studies have explored the phenomenon of making associations between colour spectrum and speech sounds in non-synaesthetic perception (cf. Flagg and Stewart 1985, Dailey et al. 1997, Wrembel & Rataj - forthcoming).

The present contribution promotes a non-traditional approach to the study of speech perception mediated through colour. In the study, the results of two experiments on sound-colour mappings conducted on Polish speakers of English who did not report any synaesthetic experience and whose task was to match Polish and English vowel sounds with colors were compared. The study intended to investigate whether the associations with specific colours evoked by the perception of L2 speech sounds differed from those triggered by native sounds. It was run on a specially designed computer program, implemented in Visual Basic, that offered the following functionality: (1) played a randomised number of sounds in every testing cycle; (2) displayed the palette of 11 basic colours as specified by Berlin & Kay (1969); (3) registered the selected colours and response times. The analysis of results revealed a statistically significant correlation between certain sounds and colours for all the Polish vowel sounds and for 8 out of 12 English vowels ($p < .01$). For the remaining English vowels, strong tendencies have been observed. Strong correlations were also found when the analysis accounted for not individual sounds, but rather vowel categories (front/central/back and high/mid/low).

The findings indicate that vowel-sound mappings in non-synaesthetic perception appear non-arbitrary and follow the general tendencies in which bright colours (yellow, green) are associated with prominent high front vowel sounds, whereas dark colours (brown, blue, black) are attributed to back vowels, open sounds tend to be perceived as red and central vowels are mapped onto achromatic grey. Thus the results seem to corroborate the hypothesis that also in non-synaesthetic perception there may exist associations between speech sounds and colours, as previously indicated by Ward et al. 2006. Further research into this phenomenon is definitely needed to verify this hypothesis more thoroughly. Moreover, it may provide specific implications for L2 pronunciation pedagogy and thus may enhance the effectiveness of second language phonological acquisition.

Bibliography

- Berlin, B., Kay, P. 1969. *Basic colour terms: Their universality and evolution*. Berkeley, CA: University of California Press.
- Dailey, A., Martindale, C., Borkum, J. 1997. "Creativity, Synaesthesia, and Physiognomic Perception", *Creativity Research Journal*, 10: 1-8.
- Flagg, L., Stewart, J. 1985. "Studying speech perception in adolescent school-age children by utilizing primary color perception", *J. of Psycholinguistic Research*, 14: 67-80.
- Harrison, J. 2001. *Synaesthesia. The strangest thing*. Oxford: Oxford University Press.
- Hubbard, T.L. 1996. "Synesthesia-like mappings of lightness, pitch and melodic interval", *American Journal of Psychology*, 109: 219-238.
- Jakobson, R. 1962. *Selected Writings: I Phonological Studies*. The Hague: Mouton.

- Marks, L. 1975. "On coloured-hearing synaesthesia: cross-modal translations of sensory dimensions", *Psychological Bulletin* 82(3): 303-331.
- Ward, J., Huckstep, B., Tsakanikos, E. 2006. "Sound-colour synaesthesia: to what extent does it use cross-modal mechanisms common to us all?" *Cortex*, 42, 264-280.
- Wrembel, M., Rataj, K. forthcoming. "Sounds like a rainbow - sound-colour mappings in vowel perception", *Proceedings of the ISCA Tutorial and Research Workshop on Experimental Linguistics, 2008, Athens, Greece*.