The Perceptual Effects of Phonotactic Rareness and Partial Allophony in Canadian French

Patrick Murphy, Philip Monahan, & Margaret Grant
University of Toronto
p.murphy@mail.utoronto.ca, philip.monahan@utoronto.ca, meg.grant@utoronto.ca

Overview: In this paper we investigate how the perceptual tendencies of French speakers are affected by two properties of affrication in Canadian French: a pattern of phonotactic rareness, and a state of partial allophony. We ask two questions: (1) Do listeners have a bias against perceiving sequences of sounds that are phonotactically possible but rare in their language? (2) When phonetic detail can be contrastive or non-contrastive depending on the environment, are listeners less aware of it in environments where it is non-contrastive? Results from a group of Canadian French speakers on two perception experiments show an effect of phonotactic rareness, but no effect of contrastive status in a state of partial allophony. In addition, preliminary results for a group of European French speakers living in Quebec suggest similar perceptual effects to the Canadian French speakers, even though they are only exposed to affrication in the speech of others and do not have it in their own speech.

Previous Research: This study builds on previous research showing three main facts. First, listeners are biased against perceiving sequences of sounds that are phonotactically impossible in their language, as shown for English (Massaro & Cohen 1983) and Japanese (Dupoux, Kakehi, Hirose, Pallier, & Mehler 1999). Second, listeners perceive non-contrastive sound pairs as being more similar than contrastive sound pairs (Goto 1971; Boomershine, Hall, Hume, & Johnson 2008), suggesting that they are more aware of phonetic detail when it is contrastive. And third, speech perception can be affected by linguistic experience, whether with another language (MacKain, Best, & Strange 1981) or with another dialect (Sumner & Samuel 2009).

Phenomenon: In most dialects of Canadian French, coronal stops undergo affrication (/t, d/ → [ts, dz]) before high front vowels and glides (/i, y/ and /j, ￿/). Non-derived/non-allophonic affricates exist in French, and they are possible before other vowels (e.g. /e, a/), but they are rare. Examples include reduced forms (tsé “y’know”, from tu sais) and loan words (tsar “tsar”). This results in: (1) a pattern where non-high-front vowels following affricates are phonotactically possible but rare, and (2) a state of partial allophony, where coronal stops and affricates are contrastive only outside the context of high front vowels.

Experiment 1: This experiment involved a 10-step vowel continuum from [e] to [i], made by editing the first three formants in Praat (Boersma & Weenick 2015). The vowel continuum was presented after either a stop or an affricate in a French pseudo-word (e.g. [fot_] and [fots_]). Participants were asked to listen to the pseudo-words and identify whether they heard “é” or “i” at the end. If they have a bias against perceiving phonotactically rare sequences, they should identify hearing “é” less often following an affricate than when following a stop, because “é” after an affricate is phonotactically rare in their language.

There were two groups of participants: Canadian French speakers living in Montreal or Toronto (n=13) and a smaller, exploratory sample of European French speakers living in Montreal (n=6, time living in Quebec=1-4 years). A repeated measures ANOVA was run on the results from the Canadian French speakers, finding a significant effect of preceding consonant (F(1,12)=51.28, p<0.001)—they were much less likely to identify hearing an “é” after an affricate, as seen in Figure 1. Preliminary results from the European French speakers in Quebec suggest a similar effect.
**Experiment 2:** This experiment involved a 10-step consonant continuum from [ts] to [t] (and [dz] to [d]), made by incrementally removing frication from (and adding closure duration to) an affricate in Praat. The consonant continuum was presented before either a high front vowel [i] or a mid front vowel [e] in a French pseudo-word (e.g. [fo_i] and [fo_e]). Participants listened to the pseudo-words and identified whether they heard a “ts”/“dz” sound or a “t”/“d” sound. If they are less aware of phonetic detail (frication on a stop) when that phonetic detail is non-contrastive, they should identify hearing “ts”/“dz” less often before a high front vowel.

The same two groups of French speakers participated in this experiment. A repeated measures ANOVA was run on the results from the Canadian French speakers, finding that the following vowel did not have a significant effect on identification of the consonant (F(1,12)=0.002, p=0.97), as seen in Figure 2. Preliminary results from the European French speakers in Quebec suggest a similar lack of effect.

**Conclusion:** This study takes two established perceptual phenomena (involving phonotactics and contrast) and tests whether similar effects can be found under altered conditions. The first experiment shows that the perceptual bias against phonotactically illicit sequences of sounds also exists for sequences that are phonotactically possible but rare. The second experiment looks at partial allophony. Although previous research has shown that listeners are less aware of phonetic detail when it is non-contrastive, we do not find evidence for a similar effect when the contrastive status depends on the environment.

In addition, preliminary results from European French speakers living in Quebec suggest an effect of dialect experience, which highlights the division between perception and production—they do not have this affrication pattern in their own speech, but their perception seems to be affected by hearing it in the speech of others.

**References:**


