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Extraction of likelihood-ratio forensic evidence from the formant trajectories of diphthongs

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The likelihood-ratio approach to forensic speaker recognition seeks to determine the likelihood that one would observe the evidence, the acoustic difference between suspect and offender speech samples, under the hypothesis that they were produced by the same speaker versus under the hypothesis that they were produced by different speakers. Before the results of a scientific forensic technique can be presented in court, it is necessary to demonstrate its efficacy. This presentation tests the efficacy of extracting information from the formant trajectories of diphthongs. Differences in physiology and learned motor patterns could potentially lead to different speakers producing quite different formant trajectories which could in turn lead to strong forensic evidence. The data tested were /aI/, /aυ/, /eI/, /"open o"I/, /oυ/, /i"schwa"/, and /ϵ"schwa"/ tokens produced in several phonetic contexts by twenty-seven male speakers of Australian English. Cubic polynomials were fitted to each vowel token, and the coefficient values were used in a multivariate-kernel-density procedure which calculated likelihood ratios. Cross-validated same-speaker and different-speaker comparisons were made, resulting in a series of same-speaker and different-speaker likelihood ratios for each vowel phoneme. Results indicated that substantial strength of evidence with respect to speaker identity can be extracted from diphthong formant trajectories.