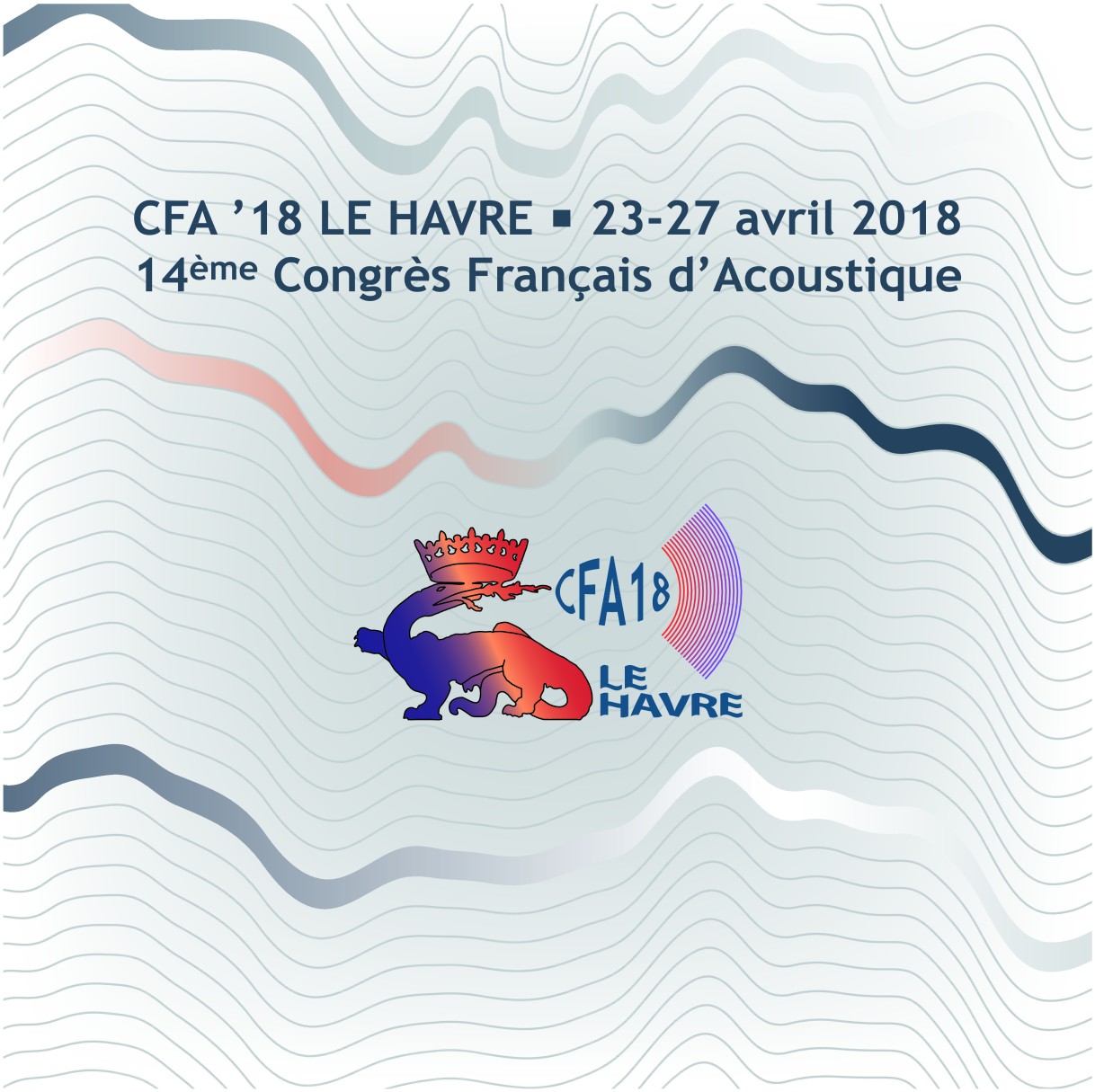

Coding strategies inspired by speech statistics may help mitigate the spread of excitation in cochlear implants

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The spread of excitation (SOE) along cochlear implants (CIs) is commonly believed to cause CI users' speech-in-noise intelligibility to plateau above 8 effective channels (Friesen et al., 2001). Consequently, a faithful CI simulation should exhibit a knee point shift to lower numbers of effective channels with increased SOE. Vocoders typically incorporate SOE by distributing envelope contributions from activated electrodes to the same number of carriers; however, these vocoders do not show the expected effect. SPIRAL, a tonal vocoder (Grange et al., 2017), decouples the reconstruction and analysis stages by using a fixed, large number of tone carriers intended to better represent the continuous spiral ganglion. A first study employing SPIRAL revealed the knee-point shift effect. Increasing SOE elevated speech-reception thresholds (SRTs), but a knee-point remained without simulated current spread, suggesting that SOE is not the only limiter of effective channel number. Factor analysis (FA) showed that the temporal-modulation information carried by speech is distributed in bands whose widths grow non-monotonically with frequency. Given spectral smearing by SOE, optimizing information transmission must be considered in the design of CI coding strategies. A scree plot shows that 5-7 channels should suffice to transmit the speech information. Consequently, speech statistics may be a fundamental limiter of effective channel number. A second study employed FA-inspired CI-coding strategies aimed at optimizing information transmission. Little SRT improvement beyond 5 FA-inspired channels was found, regardless of simulated SOE. Mitigating SOE may demand spectral warping, which may require more adaptation. A perceptual learning experiment may help reveal the full potential of FA-inspired CI-coding strategies. Friesen et al. (2001) JASA 110(2), 1150-1163. Grange et al. (2017a) JASA-EL 142(5), EL484-489.