COMPREHENSIVE EXAM

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Question 1

The control of the fundamental frequency of a speech signal can be important in both singing and in speech production. Our ability to control the production of laryngeal vibration is, to a great extent, dependent on our ability to extract that information perceptually from a complex speech signal.

Discuss how fundamental frequency of such complex signals is encoded at various levels of the auditory system. Relate that discussion to our ability to perceive changes in fundamental frequency in psychophysical experiments with relatively simple stimuli as well as with speech.

Question 2

Explain what fundamental theories of physics and engineering underlie the myoelastic-aerodynamic theory of phonation. Can glottal airflow, tissue vibration, and acoustic wave propagation be derived from the same basic equation? Carefully describe all the typical assumptions that are made in classical speech and voice science to simplify glottal aerodynamics, soft tissue mechanics (including muscle mechanics), and one-dimensional acoustics of the vocal tract.

Question 3

Currently, there is a call for research on speech articulation modelling by the NIH. Prepare a small grant (e.g., NIH R03 format) in which you propose to use finite element modelling to characterize upper and lower lip movement during production of a simple speech task (e.g. /u/). In your proposal, discuss the application of your model to study the influence of deformities such as those associated with a repaired unilateral cleft of the lip on speech performance. You will need to include the following sections of the grant:

1. Introduction
2. Specific Aims
3. Significance
4. Literature Review
5. Hypotheses
6. Methodology