**Naturalness in voices**

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**Abstract** (120 words)

Perceived naturalness of a voice is a prominent feature which affects our interaction with both human and artificial agents. In humans, naturalness can be affected by voice distortion or transformation. In artificial agents, its tremendous importance has been acknowledged through multiple efforts to create and constantly improve synthetic voices to resemble human vocal expression. Despite its importance, (a) conceptual underspecification, (b) inconsistent operationalization, (c) lack of exchange between research on humans and artificial agents and (d) insufficient anchoring in voice perception theory has precluded a systematic understanding of voice naturalness in both production and perception. In this work, we review the current insights into voice naturalness by pooling evidence from a wider interdisciplinary literature. Against that backdrop, we develop a concise definition of naturalness and propose a conceptual framework rooted both in empirical findings and theoretical models. Subsequently, I will identify core gaps in our current understanding of voice naturalness and discuss different approaches for further research.

Outline 1:

1. Introduction – voice naturalness (why, what, how, by whom)
   1. Clear identification of the importance and motivation for studying naturalness
   2. Identification of the key fields that are interested in voice naturalness
   3. Motivation for the current paper
2. Conceptual underspecification
   1. Proposition of the naturalness definitions
      1. Explain definitions
      2. Differentiation from other concepts (distinctiveness, typicality, pathology, authenticity)
3. Inconsistent operationalization
4. Lack of exchange between different research domains
5. Insufficient anchoring in voice perception theory
6. What can be done (propositions for the future)
   1. Operationalization: give some recommendations for report/design standards
   2. Recommend some keywords (and a consistent use of proper definitions)
   3. Relate naturalness to voice perception /person perception models
7. Open questions for the future/outlook

Outline 2:

1. Introduction – voice naturalness (why, what, how, by whom)
   1. Clear identification of the importance and motivation for studying naturalness
   2. Identification of the key fields that are interested in voice naturalness
   3. Motivation for the current paper
2. Current Problems
   1. Conceptual underspecification
   2. Inconsistent operationalization
   3. Lack of exchange between different research domains
   4. Insufficient anchoring in voice perception theory
3. Proposition of a concise framework for naturalness
   1. Definitions of naturalness
   2. Differentiation from other concepts (distinctiveness, typicality, pathology, authenticity)
4. Pooling evidence from different sources (“progressing in conjunction”)
   1. give some recommendations for report/design standards
   2. Recommend some keywords (and a consistent use of proper definitions)
   3. Foster exchange between domains
5. Naturalness research rooted in voice perception theory
   1. Relate naturalness to voice perception /person perception models
   2. Discuss where the topic is underexplored from the perspective of basic research
6. Open questions and future/outlook