

THE "OLDER" VOICE

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ABSTRACT

-A number of speech and voice changes are associated with advancing age -- even in individuals who are normal. Apparently, they are due to tissue loss and reduction in mobility (the physiological model). However, a second theory is needed to account for other alterations: it is the Male-Female Coalescence Model of Vocal Aging. Specifically, it has been established that, at puberty, the sexes become biologically less like each other; these processes appear to reverse during female menopause (and its counterpart in males) with the sexes becoming more alike. Thus, the cited model supplements the older theory and permits more accurate predictions of those speech changes which correlate with advancing age.

1. INTRODUCTION

-Certain voice and speech alterations appear to accompany the aging process. However, the nature and extent of these changes is not well understood. For one thing, it has been argued [11] that they are due to pathologies that are associated with old age. However, this position has been sharply countered by a large number of authors [6,8,17]. It is conceded, of course, that the elderly can exhibit pathologies of many types (and that some of them can lead to changes in speech and voice). Yet, it also can be expected that, while cohorts of normally aging people do not suffer from these deficit related changes, they nonetheless will exhibit shifts of some type -- and there is evidence to support this postulate. For one thing, it has been found that auditors are fairly good at accurately estimating the age of talk-

ers from their speech [9,13,16]. If some sort of change had not occurred, re: the older talkers, these judgements simply could not have been made. But, what are these changes? Do they result from growing old (chronological age), from physiological changes, or from some other set of factors? Of course, chronological age plays a major role in the process as the shifts must be related to the passage of time. However, are they well documented physiologically or do other factors also operate? Two theories appear useful in this regard; they are the physiological model of vocal aging and the male-female coalescence model.

2. THE PHYSIOLOGICAL MODEL

-In the past, most investigators have subscribed to a theory that can be referred to as the "physiological model" of vocal aging. Although not always articulated as such, this theory explained the normal aging process as one that results from a reduction in the efficiency of the human biosystems as a function of time. Specifically, the changes which are observed in the elderly are said to be due to tissue atrophy/reduction and an associated loss of mobility. (See Figure 1.) -In a sense, the physiological model was developed (at least informally) in response to the question "What is old?" [4,17]. In this regard, it was observed [1-4,8] that the chronological age of a person does not always appear to best represent their "actual" age. Indeed, if these (and other) authors are to be believed, the aging process is neither linear nor invariable. That is, it would appear necessary to directly assess the

mental, sensory, motor and communicative capabilities of older individuals in order to determine their true age. It is not argued, of course, that no degradation occurs; rather it would appear that the process is one that varies -- and sometimes dramatically -- from person-to-person. Hence, the physiological model of aging served to replace the traditional chronological metric. Unfortunately, even today, this model is far from complete. A brief review of the relevant factors may be found in Hollien [8], and, of course, these relationships are being continually updated. On the other hand, even though this physiological model accounts for many of the changes which occur as a person ages, there still are discrepancies.

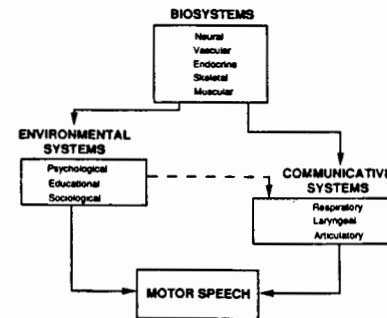


Figure 1

2.1 Relevant Data

-It is without question that most of the research carried out on the communication characteristics of older persons has been focused on the deficits resulting from one form of pathology or another. Moreover, even when normal subjects are the focus of interest, it is the human voice that tends to be studied -- and the discussion to follow will reflect these biases. Specifically, the vocal/speech correlates of aging include speaking fundamental frequency (especially), vocal intensity, speech spectra, timing and, in some instances, perceptually based information.

-Speaking fundamental frequency (SFF or F_0) has been studied extensively in populations of all ages (see Figure 2). As can be observed, SFF levels shift markedly during adolescence with this lowering much greater for males than females. The data for mature males suggest that F_0 is further lowered during adult life but then begins to rise as middle age is concluded -- and perhaps rises sharply as male cohorts reach an age where they can be classed as elderly. This pattern is one that could be predicted on the basis of the physiological model. The configurations for females follow a slightly different course. The downward shift in SFF is seen at puberty -- even though it is less extensive than that for males -- and then SFF levels appear not to change much during life, excepting perhaps for a very slight rise in the elderly. On the other hand, there now are data which support the notion of a downward shift in female SFF as a function of old age [5,12,18]. This change is one which is contrary to that predicted by the physiological model. In that instance, the atrophy associated with aging would be expected to force a rise in female SFF -- just as it does in males. Apparently, this does not happen.

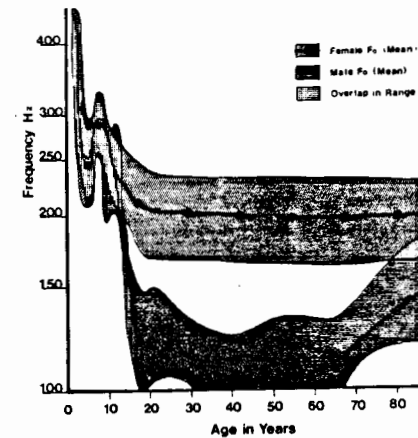


Figure 2.

-Other 'old age' related speaking characteristics also have been reported. For example, the vocal loudness levels of older individuals are thought to be greater than those for younger people [13,15] and others [10] argue this position even for older populations who show no evidence of significant hearing loss. Physiological findings, however, are difficult to reconcile with the above statements. For example, certain investigators [14,15] have reported a decline in intraoral breath pressure and vital capacity with increasing age. On this basis, it does not seem logical that increases in vocal loudness would be observed in the elderly. However, if they were, they might be gender related.

-Vocal fry is the lowest voice register to be found on the frequency continuum produced by the human voice [7]; it may contribute to voice tremor [15] -- and voice tremor would be predicted by the physiological model. Finally, other voice and vocal tract changes have been observed; breathiness is an example [15]. This factor, coupled with a slowing of articulation and a reduction in phonational frequency range, could serve to explain why individuals of advanced age can be recognized as older simply from listening to their speech. Additionally, many of the relationships noted are consistent with the physiological theory. On the other hand, there are enough data in variance with this theory that it would appear necessary to modify or supplement it.

3. THE MALE-FEMALE COALESCENCE THEORY

-The male-female coalescence model of aging is not at all unique to human communication. Indeed, it is employed to explain many of the (other) events/changes associated with aging. Briefly, this model suggests that menopause (and its physiological counterpart in males) is a functional reversal of the sex oriented changes that occur at puberty. As stated, it would appear that hormonal effects at pubescence operate differentially on males and females with the

greatest changes occurring in the male. Thus, the sexes become biologically less like each other at puberty whereas, at menopause (and during subsequent

life-changes associated with advancing years) these processes appear to shift in the opposite direction -- i.e., males and females become more like each other. Of course, it is conceded that this model will explain only a portion of the observed processes and that aging affects behavior, physiology and communication in other ways. For example, tissue atrophy, reduction in strength due to muscle deterioration, changes in neural function and reaction to environmental changes, also will degrade communicative skills. This model simply accounts for a limited set of relationships in the process -- a set that previously has been a little difficult to explain.

-Application of the coalescence model would result in predictions reflecting reversals in some of the shifts which took place at puberty. For example, it could be employed to predict that SFF for the male would rise as a function of advancing age but that it would not do so for females. That is, the interaction between elements related to both theories would permit the suggestion that SFF in females either would not shift dramatically or be lowered -- and this effect is now documented [12,18]. Finally, other gender related changes could be expected, in part based on the differential increase in strength at puberty. Unfortunately, even though there are suggestions that these differences occur, definitive information currently is lacking -- primarily (1) due to the fact that little research (re: communication) has been carried out on these issues and (2) due to the confounding effects of those pathologies which exist in many of the elderly.

4. CONCLUSIONS

-The male-female coalescence model of vocal aging has proved to be an excellent supplement to the basic physiological model. While, this coalescence theory is in-and-of-itself physiologically based, it nevertheless serves to modify the larger theory in ways which permit more robust predictions to be made on the nature of vocal aging.

5. REFERENCES

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