Perfil evolutivo da fluência da fala de falantes do Português brasileiro***

Speech fluency developmental profile in brazilian Portuguese speakers

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Abstract
Background: speech fluency varies from one individual to the next, fluent or stutterer, depending on several factors. Studies that investigate the influence of age on fluency patterns have been identified; however these differences were investigated in isolated age groups. Studies about life span fluency variations were not found. Aim: to verify the speech fluency developmental profile. Method: speech samples of 594 fluent participants of both genders, with ages between 2:0 and 99:11 years, speakers of the Brazilian Portuguese language, were analyzed. Participants were grouped as follows: pre-scholars, scholars, early adolescence, late adolescence, adults and elderlies. Speech samples were analyzed according to the Speech Fluency Profile variables and were compared regarding: typology of speech disruptions (typical and less typical), speech rate (words and syllables per minute) and frequency of speech disruptions (percentage of speech discontinuity). Results: although isolated variations were identified, overall there was no significant difference between the age groups for the speech disruption indexes (typical and less typical speech disruptions and percentage of speech discontinuity). Significant differences were observed between the groups when considering speech rate. Conclusion: the development of the neurolinguistic system for speech fluency, in terms of speech disruptions, seems to stabilize itself during the first years of life, presenting no alterations during the life span. Indexes of speech rate present variations in the age groups, indicating patterns of acquisition, development, stabilization and degeneration.
Key Words: Speech; Speech Production Measurements; Growth and Development; Aging.

Resumo
Tema: a fluência de fala varia de indivíduo para indivíduo, fluente ou gago, dependendo de diversos fatores. Estudos que investigam a influência da idade nos padrões de fluência foram identificados, mas em grupos etários isolados. Estudos sobre a variação da fluência da fala ao longo da vida não foram localizados. Objetivo: verificar o perfil evolutivo da fluência da fala. Método: foram analisadas amostras de fala de 594 participantes fluentes, de ambos os gêneros com idades entre 2:0 e 99:11 anos, falantes do Português Brasileiro, agrupado em: pré-escolares, escolares, adolescência inicial, adolescência final, adultos e idosos. As amostras de fala foram analisadas a partir das variáveis do Perfil da Fluência da Fala e comparadas quanto a: tipologia das rupturas (disfluências comuns e gagas), velocidade de fala (em palavras e sílabas por minuto) e freqüência das rupturas (porcentagem de descontinuidade de fala). Resultados: ao longo das idades não houve diferença estatisticamente significante para os índices de ruptura (disfluências comuns e gagas e porcentagem de descontinuidade de fala), embora tenham sido identificadas algumas variações isoladas. Já para velocidade de fala observa-se diferença estatisticamente significante entre os grupos. Conclusão: a maturação do sistema neurolingüístico para a fluência, no que se refere às rupturas, parece se estabelecer já nos primeiros anos de vida e tendem a se manter inalteradas ao longo da vida. Os índices de velocidade de fala sofrem diferentes idades, indicando aquisição, desenvolvimento, estabilização e degeneração dos padrões.
Palavras-Chave: Fala; Medida de Produção de Fala; Crescimento e Desenvolvimento; Envelhecimento.

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Introduction

The conscience and understanding of several communication characteristics, among them speech fluency, as a manifestation of the normal development of the communication abilities through life, can clarify the broader understanding of not only the normal but also of the pathologic speech and language development (1).

For the English language, studies that verify the occurrence of speech disruptions in fluent speakers have been developed since the 30s (2-5). However, most of them take into consideration only the speech fluency of children and concentrate com comparing at least three different age groups (6).

For the Portuguese language, studies that point parameters of normally fluent speech (7-13) have already been published, but none of them present an analysis of the variations through life.

Given this, the purpose of the present study was to verify the speech fluency developmental profile based on the variables established by the Speech Fluency Profile Protocol. The tested hypotheses were:

. hypothesis 1. The index of speech disruptions varies, indicating a variation between acquisition, development, stabilization and degeneration of the speech fluency patterns.

. hypothesis 2. Speech rate varies, indicating a variation between acquisition, development, stabilization and degeneration of the speech fluency patterns.

Method

The procedures for the selection and assessment of the participants only began after the pertinent ethical procedures: approval by the Ethics Committee (CAPPesq HCFMUSP no. 791/99) and informed free consent of the participants or parents/ guardians (for the participants who were under 18 years). The research did not involve any invasive or experimental technique that has not yet been given evidence, classifying the research as a low risk study.

Participants of this study are part of the research project entitled Speech Fluency Profile of Children, Adolescents, Adults and Elderlies (9,11). Five hundred and ninety four individuals of both genders, with no distinction between races, residents in the city of São Paulo, with ages between 2:0 and 99:11 years (11) took part in this study. In order to organize the analyses of the data, the participants were grouped as shown in Table 1.

TABLE 1. Characterization of the studied groups

group	age range	n
PS – preschoolers	2:0-6:11	100
E – scholars	7:0-11:11	100
A_1 – early adolescence	12:0-14:11	65
A_2 – late adolescence	15:0-17:11	65
18-27	18:0-27:11	34
28-37	28:0-37:11	34
38-47	38:0-47:11	34
48-59	48:0-59:11	34
60-69	60:0-69:11	36
70-79	70:0-79:11	48
80-89	80:0-89:11	31
90-99	90:0-99:11	13

None of the participants presented personal and/or family complaints of stuttering and/or of familial stuttering and/or of associated communication or health deficits. All of the participants presented SSI (14) results compatible with normal speech fluency; and did not present any neurological, psychiatric and/or communication disorders.

All of the participants voluntarily agreed to take part in the research. Children and adolescents were selected from public day care centers and schools. Adults and elderlies were selected from public locations like for instance parks, churches, banks etc., located in the city of São Paulo.

The methodology used to gather and to analyze the speech samples was that proposed by Andrade (9,15), taking into account the following speech fluency parameters: speech disruption typology (typical disfluencies - hesitation, interjection, revision, word and/or segment and/or phrase repetition, unfinished word; less typical disfluencies - syllable and/or sound repetition, prolongation, block, pause sound and/or segment intrusion); speech rate in words and syllables per minute; and frequency of speech disruptions (percentage of speech discontinuity). Two hundred fluent syllables were gathered for analysis. These were obtained based on a visual stimulus (for individuals under 4:0 years) and during a communicative interaction with an adult (for children between 2:0 and 3:11 years). All of the speech samples were recorded on tape and video.

Disfluencies considered by the author as typical are: hesitation, interjection, revision, unfinished word, word repetition, segment repetition and phrase repetition. Disfluencies considered as less typical are: syllable repetition, sound repetition, prolongation, block, pause and intrusion of a sound or segment.

In order to obtain the rate of speech in syllables per minute, the total number of fluent syllables (200) of each participant was divided by the total amount of time, including pauses. A chronometer was used to determine the total time of each speech sample (16). The rate of speech in words per minute was calculated considering the total number of words produced by each participant divided by the total amount of time, including pauses.

For the statistical analysis of the results, ANOVA was used to compare each variable between the different age groups. The Tukey T-Test was used for multiple comparisons. The level of significance was of 5%. Significant results are marked with an asterisk.

Results

Tables 2 and 3 present the results of the statistical analysis for each one of the studied variables.

For the total number of typical disfluencies (Table 2) there was a statistically significant difference between the age groups, indicating that the age group of 60 and 70 years presented fewer typical disfluencies when compared to A1 and PS. The age groups also presented statistical differences regarding the total number of less typical disfluencies (Table 2), that is, the age group of 60 years presented fewer less typical disfluencies when compared to A1 and, the group of 70 years fewer less typical disfluencies than S.

As for the percentage of speech discontinuity (Table 2), there was also a statistically significant difference between the age groups: 60 years presented a lower percentage of speech discontinuity than SP and A1 and, 70 years presented a lower percentage of speech discontinuity than SP, S and A1.

Regarding the parameter of words per minute (Table 3), a greater number of statistically significant differences were found: 18-27 years > SP and S; A2, 28-37, 38-47, 60-69 and 70-79 > SP, S and A1; 48-59 < 38-47 and 60-69; 80-89 > S. The same was observed for the number of syllables per minute (Table 3): 18-27 > SP and S; A2, 28-37, 38-47, 60-69 e 70-79 > SP, S and A1; 38-47 > 48-59 and 80-89; 48-59 > SP; 80-89 > SP and S.

TABLE 2. Statistical analysis of speech disruptions per group.

Groups	Typical disfluencies		Less typical disfluencies		% speech discontinuity	
	Mean	SD	Mean	SD	Mean	SD
PS	16.86	8.52	3.17	3.2	10.41	5.04
S	14	7.34	3.5	3.59	8.76	4.4
A_1	16.91	7.3	4.22	2.87	10.55	4.16
A_2	14.34	6.81	2.69	2.03	8.59	3.88
18-27	14.71	8.81	3.29	2.78	9.0	4.83
28-37	15.26	7.53	2.47	2.79	8.87	4.16
38-47	14.32	6.55	2.65	2.12	8.49	4.02
48-59	14.32	7.56	2.44	2.38	8.32	4.19
60-69	11.75	6.49	2.17	2.1	6.96	3.72
70-79	10.98	6.45	1.79	2.58	6.27	3.7
80-89	13.58	5.9	2.55	2.29	8.0	3.58
90-99	15.38	10.54	2.15	2.51	8.73	6.14
ANOVA	F=3.17; p<0.001* (60-69 e 70-79 ? A_1 e SP)		F=3.06; p=0.001* (60-69 e 70-79 ? A_1; 70-79 ? S)		F=4.54; p<0,001* (60-69 ? PS and A_1 ; 70-79 ? SP, S and A_1)	

TABLE 3. Statistical analysis of speech rate per group.

Groups	Words per minute		Syllables per minute	
	Mean	SD	Mean	SD
SP	84.62	25.14	145.74	42.79
S	82.72	28.22	150.78	51.03
A_1	93.5	28.4	166.6	50.2
A_2	109.3	26.2	200.4	48
18-27	103.25	29.48	192.67	53.3
28-37	113.21	26.76	215.09	48.5
38-47	119.05	25.53	224.24	43.8
48-59	95.03	18.81	179.78	32.99
60-69	118.4	29.26	216.95	53.24
70-79	111.38	30.44	201.64	52.4
80-89	102.92	30.1	183.61	54.56
90-99	99.67	28.14	177.34	50.52
ANOVA	F=12.06; p<0.001* (18–27 ? SP and S; A_2, 28–37, 38–47, 60-69 and 70-79 ? SP, S A_1; 48–59 ? 38–47 and 60-69; 80-89 ? S)		F=17.09; p<0.001* (18–27 ? SP and S; A_2, 28–37, 38–47, 60-69 and 70-79 ? SP, S A_1; 48–59 and 80-89 ? 38–47 and 60-69; 48–59 ? SP; 80-89 ? SP and S)	

Discussion

This study had as a purpose to determine the speech fluency developmental profile based on the analysis of speech disruptions and speech rate. The analysis of typical disfluencies and of the percentage of speech discontinuity did not distinguish children, adolescents, adults and elderlies, suggesting that the maturation of fluency, in terms of speech disruptions, occurs very early, during the first years of speech and language acquisition and also that the speech disruptions are not vulnerable to the aging process (16). The results indicate instability between childhood and late adolescence, followed by a period of stabilization during adulthood, a decrease at the ages of 60-70 years and a posterior increase at the age of 80. This variation, however, was overall not statistically significant.

These findings are different from those found by Yairi & Clifton (6), who point that adolescents present fewer speech disruptions than children and elderlies. The results are also different from those presented by Manning & Monte (17) and Leeper & Culatta (1), who point an increase in typical disfluencies from adulthood to old age, followed by a decrease in more elderly individuals (17).

As for the less typical disfluencies, the overall variation was also not statistically significant. Only a few isolated significant variations were observed: elderlies of 60 to 79 years presented fewer less typical disfluencies than adolescents of the early phase, and scholars presented more less typical disfluencies than elderlies of 70 to 79 years. It is important to observe, however, that the total number of less typical disfluencies is low for all age groups. This was an expected result since this variable characterizes the presence of fluency disorders.

As presented in the literature, less typical disfluencies also appear in the speech of fluent individuals, although having a lower occurrence (1,6,16-22). Also, no variation is observed among the age groups.

Overall, the occurrence of less typical disfluencies was of up to 2%, an index considered as a limit for a fluent speech pattern (19,23-28). As for the percentage of speech discontinuity, the results were in general up to 10% as pointed in other studies with fluent individuals (1,6,16,17,20). A few of the participants presented an index of speech disruptions above 10%, the same was observed in studies of Leeper & Culatta (1) and Searl et al. (20).

As observed in other studies (1,6,19,20,27), there was a great variability between the individuals for all age groups (i.e. standard deviation values). This finding is in agreement with the definition of speech fluency itself, highlighting this variability according to the day, emotions, knowledge about the theme of conversation and different speaking situations (15).

As for the speech rate, an increase in the number of words and syllables per minute was observed from child to adulthood, followed by a decrease with the aging process. Overall, preschoolers and scholars presented a speech rate (words and syllables per minute) that was lower than the one presented by adults with ages between 18 to 59 years and elederlies with ages between 60 to 79 years. It was also observed that children presented a speech rate similar to the one presented by individuals in early adolescence and different from the one presented by individuals in late adolescence.

Both phases of adolescence differed from each other (13). When comparing early with late adolescence, an increase in speech rate was observed. Individuals in early adolescence tend to have a speech rate similar to the one presented by children, and those in late adolescence a speech rate similar to the one of adults and elderlies up to 79 years, indicating a transition between child and adulthood. This constant increase in speech rate from childhood to the beginning of adulthood can be explained by the development of the motor processes involved in speech production. According to Walsh & Smith (29), the development of the motor processes involved in speech prolongs itself until 16 years of age and stabilizes around 21 years. As the years go by, the variability in the articulartory movements decrease and the rate of speech movements increase.

As for the group of adults, a decrease in speech rate was observed between the ages of 48 and 59 years, which differed from both borderline age groups (38 to 47 years and 60 to 69 years), being significantly higher only in terms of syllables per minute when compared to preschoolers. It is interesting to observe that the findings of Duchin & Mysak (16) also present these differences. When comparing the configuration of the figure drawn from the data presented by Duchin & Mysak (16) with those of the present study, a great number of similarities are observed. However, the variation found by Duchin & Mysak (16) was not statistically significant. This can be explained by the size of the research sample, since the group investigated by the authors was 50% smaller than the one used in

the present study.

At the age of 60, speech rate tends to decrease along the decades. At the age of 60-79 years, the elderly presents a speech rate that is higher than preschoolers and scholars and higher than individuals in early adolescence. At the age of 80, speech rate starts to present a similar pattern to the one presented by children and adolescents, making evident the process of speech rate degeneration. These findings confirm data presented in the literature that indicate an increase in speech rate when comparing children and adults (30) and a decrease with the aging process (1,16,20). Most probably, during the aging process, instability in the speech motor control occurs, leading to a decrease in speech rate.

Conclusion

Given the design in which the research was developed, the tested hypotheses indicate that:

Hypothesis 1: not confirmed. According to the results, the typology of speech disruptions and the percentage of speech discontinuity do not vary along life. The pattern of speech disruptions does not suffer great variability, indicating that the maturation of the neurolinguistic system involved in speech fluency is functionally established since the first years of life and maintains itself along life.

Hypothesis 2: confirmed. Speech rate varies along the stages of life, indicating acquisition, development, stabilization and degeneration. Children talk more slowly when compared to adolescents and adults. Their profile is similar to that of elderlies, suggesting the maturation and degeneration of the neuromotor system.

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