

SPOONERISMS OF CHILDREN

DONALD G. MACKAY*

Psychology Department, University of California, Los Angeles, California 90024, U.S.A.

(Received 16 September 1969)

Abstract—The study compared Spoonerisms (phoneme reversals) in the natural speech of children (age 3–6) and adults (over age 22). All of the factors studied influenced the Spoonerisms of adults and children in the same way, relative to chance expectation. However, some factors played a bigger role in child than adult Spoonerisms and the reverse was true for other factors. Thus the differences between children and adults were quantitative rather than qualitative. Moreover these quantitative differences appeared to reflect the child's lack of skill in integrating successive acts in the speech sequence.

INTRODUCTION

ARE the mechanisms for the serial ordering of behavior largely built in or do some aspects of the problem of serial order vary with age? This was the basic question of the present study. Following LASHLEY [1] I viewed Spoonerisms (phoneme reversals in speech production) as a concrete manifestation of the problem of serial order in behavior. Consequently I was interested in whether factors influencing Spoonerisms varied as a function of age. The factors studied were those shown to be important in the Spoonerisms of adults; word stress; repeated phonemes in the context of reversed phonemes; syllabic position of reversed phonemes; and the proximity and similarity of the reversed phonemes (see MACKAY [2]). The results indicated that the differences between children and adults were quantitative rather than qualitative; word stress, contextual effects, syllabic position, and phonetic similarity played less of a role in Spoonerisms of children than in those of adults. On the other hand, the reversed phonemes of children occurred closer together than those of adults. However, all of these factors played a role beyond chance expectation in the Spoonerisms of both children and adults. Finally, these results suggested two developmental factors in the problem of serial order in behavior—one related to speech rate and another related to the child's lack of skill in modifying phonemes to fit the context in which they occur.

DATA

In 1908 RUDOLF MERINGER [3] published 23 Spoonerisms that occurred in the natural speech of children, mainly his own (aged 3–6). We were interested in comparing these Spoonerisms with the 124 Spoonerisms of adults that he published in 1895 [4] and 1908 [3] examined in detail in MACKAY [2]. Meringer's methods of data collection have much to recommend them and are described in detail in MACKAY [2], as are the formulae for calculating the null hypotheses described below.

* This work was supported by UCLA grant 2426 and USPHS grant 16668-01. The author thanks H. Schulze for help in translating Meringer.

NULL HYPOTHESES

For each of the factors considered, a null hypothesis was tested. The null hypothesis is, of course, the assumption that a factor plays only a chance role in the Spoonerism, which is reflected in the frequency of the factor in speech not containing Spoonerisms. Of course we wanted this "non-Spoonerized speech" to be representative of the speech of the children making the errors. However, this proved difficult since Meringer only published the errors of his children. Thus in order to obtain a corpus of natural (conversational) speech we corrected a set of sentences containing analogical errors (e.g. 1 and 2).

1. Er hat geschwimmt (for geschwommen).
(meaning He has swam for swum)
2. Er ist gegeben (for gegangen).
(meaning He has goed for gone)

The corrections represented the intended sequence rather than the erroneously produced sequence. We based our null hypotheses on this set of sentences (and not the erroneous ones the child produced).

Three main sets of factors were examined: contextual, syllabic, and stress factors.

1. Contextual factors

a. *Repeated phonemes*. Our first question was whether Spoonerisms of children, like those of adults, frequently involve repeated phonemes before or after the reversed phonemes as in 3 and 4 (repeated phonemes underlined).

3. Kinderzimmer → Kimmerzinder*
4. Kommode → Mokode

About 33 per cent of the Spoonerisms of children involved phoneme repetition either before or after the reversed phonemes. The chance expectancy (based on the natural speech of these children) was 21 per cent. This difference reached significance at the 0.05 level (two-tailed Chi Square test).†

Table 1. The frequency of Spoonerisms involving repeated phonemes in children and adults (# counted as a phoneme)

	Repeated phonemes proactive and retroactive	No repeated phonemes
Adults	78	22
Children	33	67
Chance	21	79

Chance is calculated from the natural speech of children.

However, the repeated phoneme effect was stronger in adults than children. The adult data are also shown in Table 1. About 78 per cent of the adult Spoonerisms involved repeated phonemes, in comparison to 33 per cent for children, a difference significant at the 0.01 level (Chi Square test). Clearly repeated phonemes occur more frequently around the reversed phonemes of adults than children.

b. *Proactive vs. retroactive repetition*. Our next question was whether the repeated phonemes more frequently precede than follow the reversed phonemes in child Spoonerisms. Proactive repetition was said to occur whenever the repeated phoneme immediately preceded the reversed phonemes, and retroactive repetition whenever the repeated phoneme followed the reversed phoneme. The results are shown in Table 2. As can be seen there proactive Spoonerisms were no more frequent than retroactive Spoonerisms. This finding, while consistent with the adult data (see MACKAY [2]), contradicts a prediction of the chain association model of Spoonerisms advanced by WICKELGREN [5].

* The arrows in these formulae are synonymous with "was spoken as".

† Since only two-tailed tests were used in this analysis, this information will not be repeated.

Table 2. The frequency of Spoonerisms involving retroactive and proactive repetition of phonemes in children (# counted as a phoneme)

	Probability of phoneme repetition	
	Proactive	Retroactive
Children	53	47
Chance	50	50

Chance is calculated from the natural speech of children.

c. *Phonetic similarity.* Our next question concerned the similarity of reversed consonants in child Spoonerisms. A distinctive feature analysis of these consonants was carried out as in MACKAY [2], with the results shown in Table 3. As can be seen there about 40 per cent of the reversed phonemes of children differed in only one distinctive feature and 60 per cent differed in more than 1. The expected frequency of a difference in only one distinctive feature (assuming consonants are reversed at random), was 22 per cent. Thus, the reversed consonants of children were more similar than would be expected by chance.

Table 3. The similarity of phonemes reversed by children and adults

	One distinctive feature different	More than 1 distinctive feature different
	Adults	56
Children	40	60
Chance	22	78

Chance is calculated from the natural speech of children.

However, consonants reversed by adults were much more similar than those of children. About 56 per cent of the adult Spoonerisms differed in only 1 distinctive feature (see Table 3). This difference between children and adults was significant at the 0.02 level (Chi Square test). For some reason the reversed phonemes of adults are more similar than those of children.

Our next question was whether consonants were reversed more frequently than vowels in child Spoonerisms as was found for adults [2]. Consonants were reversed in about 92 per cent of the child Spoonerisms as compared to 83 per cent for adults (see Table 4). This difference between children and adults was statistically reliable, but for both children and adults consonants were reversed significantly more frequently than would be expected by chance (Chi Square, 0.01 level).

Table 4. The frequency of consonant and vowel Spoonerisms in children and adults

	Consonants	Vowels
	Adults	83
Children	92	8
Chance	68	32

Chance is based on the natural speech of children.

d. *Proximity of reversed phonemes.* We next compared the separation of the reversed phonemes of children and adults. The results are shown in Table 5, where it can be seen that reversed phonemes occurred more closely in child than adult Spoonerisms. This difference was statistically reliable. However, for both adults and children the separation of reversed phonemes was less than would be expected by chance, calculated as in MACKAY [2]. For some reason reversed phonemes occur more closely together in the Spoonerisms of children than adults.

Table 5. The proximity (in phonemes) of reversed phonemes of children and adults (for both within and between word Spoonerisms)

	Children	Adults
Proximity	1.6	3.0

Finally, between-word reversals tended to be more frequent in the Spoonerisms of adults than children. The data are shown in Table 6. About 86 per cent of the child Spoonerisms occurred within words as compared to 38 per cent for adults. This finding may, of course, reflect the fact that reversed phonemes of children

Table 6. The frequency of within and between word reversals in children and adults

	Within-word reversals	Between-word reversals
Adults	38	62
Children	86	14

occur more closely together than those of adults (Table 5). Another hypothesis is that both results reflect the possibility that children are preprogramming smaller chunks of speech than the adults. But it seems unlikely that children of this age (3-6) are programming only a word at a time, the assumption required for this hypothesis to explain the small number of between-word reversals in Spoonerisms of children. Available evidence suggests that even younger children (age 2-3) must be programming at least two words at a time since the stress value given a word must sometimes involve consideration of a later word in their utterances (as in 3 and 4, stress marked by ').

3. Dáddy cár (meaning daddy is in the car)
4. Dáddy cár (meaning this is daddy's car)

2. Syllabic position

The reversed phonemes of children were situated in the same syllabic position more frequently than would be expected by chance (see Table 7). However, syllabic position of reversed phonemes were less frequently identical for adults than children, a difference significant at the 0.01 level, Chi Square test. For some reason syllabic position makes less of a difference for Spoonerisms of children than adults.

Table 7. Similarity of the syllabic position of reversed phonemes of children and adults

	Same syllabic position	Different syllabic position
Adults	99	1
Children	70	30
Chance	29	71

Chance is calculated from the natural speech of children

Next we determined in what syllabic position the child Spoonerisms occurred. The results are shown in Table 8, where it can be seen that the initial position of words had an effect on child Spoonerisms. For both children and adults reversed phonemes occurred in the first position of words more frequently than would be expected by chance. Thus a lexical factor seems to play a role in child Spoonerisms. However, unlike adult Spoonerisms, the child Spoonerisms did not involve the first position of non-initial syllables as frequently as would be expected by chance (see Table 8). This finding was not statistically reliable, however.

Table 8. Consonant reversals as a function of syllabic position in within-word reversals of children and adults

	Consonant		Position		
	Syllabic	Initial	Next to initial	Next to final	Final
	Word initial	Not word initial			
Adults	33	63	0	0	4
Children	24	29	3	6	38
Chance	15	35	8	8	34

Chance is calculated from the natural speech of children

3. Stress factors

The effect of word stress on Spoonerisms in children was less than in adults, although in the same direction relative to chance. That is, the first of the reversed phonemes in child Spoonerisms occurred in an unstressed syllable more frequently than would be expected by chance. This difference was significant at the 0.01 level, Chi Square test. As in MACKAY [2] this effect will be referred to as the Stress Pre-Entry phenomenon. It is of interest that the Stress Pre-Entry phenomenon was more pronounced in adults than children (see Table 9). That is, the first of two reversed phonemes to be reversed occurred in an unstressed syllable and the second in a stressed one more frequently for adults than children. Apparently stress has a greater effect on the Spoonerisms of adults than of children.

Table 9. The stress of reversed phonemes in within-word reversals of children and adults

	Different stress		
	Unstressed stressed	Stressed unstressed	Same stress
Adults	80	0	20
Children	37.5	37.5	25
Chance	23	51	26

Chance is calculated from the natural speech of children

DISCUSSION

In all cases in the preceding analyses the factors conditioning adult Spoonerisms conditioned child Spoonerisms in the same way. In no case did a factor significantly influence the Spoonerisms of adults in one way and child Spoonerisms in another, relative

to chance expectation. It is therefore safe to assume that a model for explaining Spoonerisms of both adults and children will incorporate similar components. We therefore examined the model of Spoonerisms proposed by MACKAY [2] for adults, viewing the differences between child and adult Spoonerisms as evidence for developmental changes in these components.

Two levels were assumed in the adult model (see MACKAY [2]), a level representing individual phonemes and a contextual integration level. At this second level, a phoneme is assumed to become modified to fit the preceding or following phonemes. That is, for two adjacent phonemes AB, A is modified proactively to fit B and B is modified retroactively to fit A. Syllabic modifications are also assumed at this level, dependent on the rules for integrating a cluster of consonants around a single vowel.

Many of the quantitative differences between child and adult Spoonerisms may lie at this contextual integration level, reflecting the child's lack of skill in integrating successive acts in the speech sequence. For example, we know the child is originally able to babble all the phonemes in his language [6]. But when the child comes to speak spontaneously, he must "relearn" these sounds as parts of connected speech [7]. For example, consider the following dialogue between a mother and her child [8]:

Chris: Give me my pork (meaning fork).

Mother: OK, here's your pork (handing him his fork).

Chris: No, no! Pork! Pork!

Now, since Chris was able to perceive the difference between the phonemes p and f, as well as spontaneously produce them months earlier, his problem must lie in integrating the f into the novel context *ork*.

Note that this example is by no means atypical (see BROWN [9]). One could put forth, as a working hypothesis, that initial perception and production of individual phonemes depends on some innate capacities for structuring the acoustic material and selecting motor acts. Then the child's task becomes that of combining or integrating the component phonemes into connected speech. The child must learn motor operations for modifying high level phonemes to fit different phonetic contexts.

The absence of such integrative programs in the child would explain the differences between adults and children in the roles of the reversed phonemes, similarity of the phonetic context of the reversed phonemes, and similarity of the syllabic position of reversed phonemes. That is, if Spoonerisms reflect the interaction of similar programs in speech production, and the programs that are similar for the adult are not yet similar for the child, the reduced effect of these factors is to be expected.

Nevertheless the child's lack of skill in integrating phonemes in connected speech cannot explain the difference in proximity of reversed phonemes of adults and children. However, this fact fits the temporal model of Spoonerisms outlined in MACKAY [9]. This model predicts that the temporal separation of two phonemes in the speech output must be short for reversals to occur. Thus, the interacting phonemes must be very close together in Spoonerisms, and if they are not, the rate of speech must be very fast for Spoonerisms to occur. Now recent evidence indicates that children are not able to speak as rapidly as adults [10]. To compensate for the slower rate of children, the interacting phonemes must be very close together in a sentence for reversals to occur. Consequently, the fact that reversed phonemes occur more closely together in child than adult speech may reflect

their difference in speech rate, and thereby supports the scanning model of Spoonerisms proposed in MACKAY [2].

SUMMARY

A comparison of Spoonerisms of adults and children (age 3-6) revealed the following quantitative differences:

1. For both adult and child Spoonerisms, repeated phonemes followed or preceded reversed phonemes more frequently than would be expected by chance, but more so for adults than children.

2. For both adult and child Spoonerisms, the first of the reversed phonemes occurred in an unstressed syllable and the second in a stressed one with greater than chance expectation, but more so for adults than for children.

3. Reversed phonemes were more similar in adult than child Spoonerisms.

4. Reversed phonemes were situated in identical syllabic positions more frequently for adult than child Spoonerisms.

5. Reversed phonemes tended to occur more closely together for child than adult Spoonerisms.

6. A higher percentage of child Spoonerisms involved consonant reversals than adult Spoonerisms.

7. Initial syllabic position played less of a role in child than in adult Spoonerisms.

These differences between children and adults appeared to lie at a "contextual-integration" level in speech production. That is, Spoonerisms of children appeared to reflect their lack of skill in integrating successive acts in the speech sequence. Further research is needed to determine whether qualitative differences can be found for Spoonerisms of still younger children.

REFERENCES

1. LASHLEY, K. S. The problem of serial order in behavior. In *Cerebral Mechanisms in Behavior: The Hixon Symposium*, L. A. JEFFRESS (Editor). John Wiley, New York, 1951.
2. MACKAY, D. G. Spoonerisms: The structure of errors in the serial order of speech. *Neuropsychologia* **8**, 323-350, 1970.
3. MERINGER, R. *Aus dem Leben der Sprache*. Behrs Verlag, Berlin, 1908.
4. MERINGER, R. and MAYER, K. *Versprechen und Verlesen*. Göschensche Verlagsbuchhandlung, Stuttgart, 1895.
5. WICKELGREN, W. A. Context-sensitive coding, associative memory and serial order in (speech) behavior. *Psychol. Rev.* **16**, 1-15, 1969.
6. IRWIN, P. C. and CHEN, H. P. Infant speech: vowel and consonant frequency. *J. Speech Disorders* **11**, 123-125, 1946.
7. JAKOBSON, R. *Kindersprache, Aphasie und allgemeine Lautgesetze*. Almqvist & Wiksell, Uppsala, 1941.
8. TEUBER, H. L. Personal communication, M.I.T., 1965.
9. BROWN, R. *Words and Things*. Crowell-Collier, New York, 1958.
10. MACKAY, D. G. Metamorphosis of a critical interval. *J. Acoust. Soc. Am.* **43**, 811-821 1968.

Résumé—Dans cette étude, on a comparé les contrepèteries (inversions de phonèmes) dans la langue courante des enfants de 3 à 6 ans d'âge, et des adultes (au-dessus de 22 ans). Tous les facteurs étudiés influençaient les contrepèteries de l'adulte et de l'enfant de la même façon, conformément à ce que l'on pouvait attendre d'une distribution au hasard. Cependant, quelques facteurs jouaient un rôle plus accusé dans les contrepèteries de l'enfant que dans celles de l'adulte, et l'inverse était vrai pour d'autres facteurs. Ainsi les différences entre enfants et adultes étaient d'ordre quantitatif plutôt que qualitatif. En outre, ces différences quantitatives semblaient traduire le manque d'habileté de l'enfant à intégrer les actes successifs des séquences de parole.

Zusammenfassung—Die Studie vergleicht den Spoonerismus (Phonemumstellung) in der natürlichen Kindersprache (3.-6. Lebensjahr) und bei Erwachsenen (älter als 22 Jahre). Alle untersuchten Faktoren beeinflussen die Neigung zum Schüttelreim bei Erwachsenen und Kindern in gleicher Weise der Erwartungschance entsprechend. Trotz allem spielen manche Faktoren bei Kindern eine größere Rolle als bei Erwachsenen und auch das Gegenteil traf zu. Die Differenzen zwischen Kindern und Erwachsenen waren mehr quantitativer als qualitativer Natur. Darüber hinaus scheinen diese quantitativen Unterschiede die kindliche Unfähigkeit, sukzessive Vorgänge in einer Sprechfolge zu integrieren, widerzuspiegeln.