PAUSES, CLAUSES, SENTENCES *

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The tool of pause measurement was applied to the question of the psychological reality of syntactic structures in spontaneous speech. The material investigated covered a wide field of speech productions, of different speakers and different speech tasks. Their analysis showed that the hierarchy of syntactic structures is reflected differentially in the pause structure of spontaneous speech. When readings of the spontaneous texts were compared with the original spontaneous speech it emerged that the reading process modifies the pausing for different syntactic structures differently. Sentences as distinct from clauses are marked by their temporal cohesion in spontaneous speech as well as in reading. This fact is discussed with reference to Wundt's analytical theory of sentence-wholes.

Sentences, clauses and words are facts in the structure of language rarely disputed. While borderline cases are often discussed and subtle differences or overlaps are pointed out in linguistic writing, in general they are recognised as distinct patterns in the system of language.

However when we deal with the language as spoken and in particular with spontaneous speech, we meet again and again with workers in the field who express doubt as to whether the stream of spontaneous speech can meaningfully be divided in accordance with these grammatical structures. Moreover, even where divisions are stated with confidence and argued on solid grounds, they are qualitative and cannot be stated in measurable and therefore testable terms. For example, the category ' subordinate clauses ' is questioned as one covering comparable instances. " Not only are the places of subordinate clauses in longer constructions various, the clauses themselves are of different structure. One type is marked as subordinate merely by adding a marker—*because, while, if, since* and so on. The internal structure of the clauses is not altered in any way as a consequence of subordination. In this regard such clauses differ in no important respect from some co-ordinated clauses. The latter have different markers that is all. The second type has a special form, a relative, as one of its clause elements and often the order is different from what would be normal in independent clauses. The marks of connection, then, are integral in the clause rather than added to it. These two types clearly demand separate descriptions." (Gleason, 1965.)

The tool of pause measurement in spontaneous speech enables us to examine the validity of statements such as the above in terms of objective behaviour and psychological reality. If in the flow of spontaneous speech the transitions between its various constituent structures, between words, clauses—co-ordinate and subordinate, and of the latter, relative and others (adverbial)—as well as between sentences, if the transitions between these structures are of characteristic duration, then we can speak of their differential psychological reality and draw conclusions as to the degree of integration and independence of any of these units.

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Experiment

Pauses occurring in 9 samples of spontaneous speech (English) representing an unscripted radio talk, discussions, conversations, and in 5 samples of readings were examined in respect of their place of occurrence in the various texts and their duration measured. The transcripts from the synchronised tapes which are the basis of this analysis show the lengths (to one tenth of a second) of the pause preceding each continuous string of words, and the duration of the string. The pauses were classified as occurring between sentences,[1] between clauses (and further between co-ordinate and subordinate, and these between relative and other clauses) and within clauses (a clause is taken to be a predicative unit). They were also classified according to length starting with 0.25 sec. in intervals of 0.25 sec. We must also consider transitions between words, clauses or sentences without pause so that we have two classes of transition: fluent and hesitant. The latter can have sub-classes according to the length of pause dividing these units.

Material

The texts used were a long and unscripted radio talk by an eminent academic on Alexander Herzen, a Russian revolutionary publicist of the 19th century. As it contained 3099 words it was divided into three sections. In addition there were five discussions by young academics on controversial subjects of various kinds, one discourse

[1] *The problem of identifying the terminal point of sentences only rarely arose, as our speakers were highly literate people. With such literate speech where the sentence frame is intact, the only, rather rare, cases where a query arises are structures in which the complete sentence frames are linked by co-ordinate conjunction as in the following examples:*

(1) He lived in Moscow, still unknown to the public but in his own circle of friends he was already celebrated as a witty and dangerous observer of his own circle;/*and* of course what wasn't known what he couldn't altogether conceal either was that . . .

(2) He admired in everybody anything which he thought to be a noble or passionate impulse, however mistaken,/*and* he never, never laughed about that.

(3) This two-fold so-to-speak contradictory play of his nature—suspicion and denial on the one hand and blind faith on the other—often led to puzzles and misunderstandings between him and his friends,/*and* used to lead to quarrels and to scenes.

Such sequences may be intended by the speaker as one sentence, representing one thought unit or the conjunction and *may be used to add a new thought unit, an after-thought. This, one would assume, would be reflected in the intonation. The typist (a graduate in several languages) transcribing the text and unaware of the problem mentioned may be expected in her use of punctuation to be influenced by the intonation. Her use of full stop, semi-colon or colon was therefore accepted as indicating the end of a sentence, whilst comma or no punctuation were taken as signs that the subsequent sequence was a co-ordinated clause. Example* 1 *illustrates the former case, examples* 2 *and* 3 *the latter. It may be noted that in examples* 2 *and* 3 *the cohesive ties are closer, whilst the cohesion between the two parts in example* 1 *seems looser. Statistically these instances are, however, of little impact as they are very rare indeed.*

(on language laboratories) delivered spontaneously by another academic, all involving 7 speakers in English. The length of these speech samples was between 800-1100 words.

Results

Fluency of transition was in the first place classified under two headings (a) fluent[2] plus pauses of less than 0.50 sec. and (b) pauses longer than 0.50 sec.; clauses were compared with sentences in respect of these two types of transition. This showed a large majority of sentences in spontaneous speech (77.9%) to be divided from each other by pauses of longer than 0.50 sec., while the transitions between the majority of clauses (66.3%) was either fluent or with a delay of less than 0.50 sec. Fluency scores were obtained, being the ratios of fluent over hesitant transitions, for sentences and clauses. The mean fluency score for sentences was 0.28 and for clauses 1.96. The difference as measured by the *t*-test was highly significant, *p* far beyond 0.001. Fig. 1 shows the distribution of the transitions of different lengths for clauses, sentences and words within clauses (as each of these categories differ in frequency the distributions are based on the percentage of the respective transitions in each group).

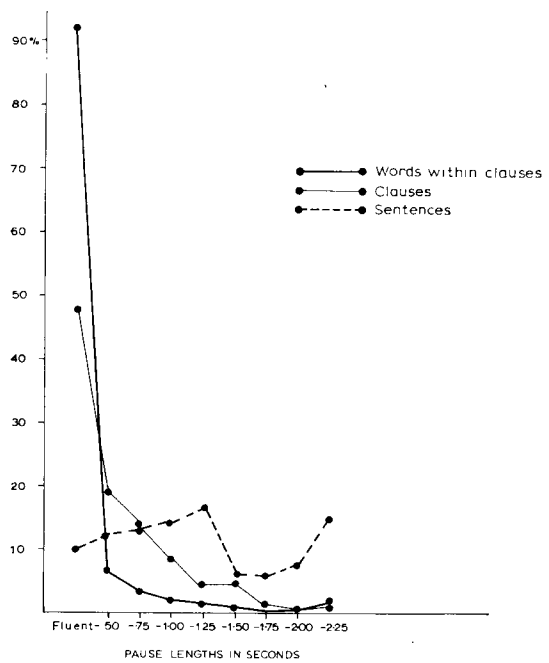

Fig. 1. Percentages of transitions in total number of words, clauses, sentences—between words within clauses, clauses, sentences (9 samples).

[2] *We classify as fluent all transitions of* 0-0.25 *seconds duration. (This is consistent with hesitations qualifying as such if pauses are at least* 0.25 *seconds.)*

From this we can see that as the pauses between sentences get longer, the proportion of sentences gets larger, whilst the proportion of pauses between clauses decreases as the pauses get longer. Indeed, it seems that durations beyond 0.75 sec. are difficult to sustain in transitions between clauses, while only about a third (35.4%) of sentences are separated from each other by less than 0.75 sec., 50.3% by more than one second, and 15% by more than two seconds. The distribution of transitions between words within clauses shows (a) that, as one would expect, the large bulk of these, i.e., 93.1%, are fluent and most of the remainder less than 0.75 sec. However, in absolute terms the number of transitions involving pauses of one second or more was about the same (119) in transitions between words within clauses as between sentences (116). Between clauses there were only 83 transitions lasting one second or more.

The transitions between clauses were then classified under the headings of co-ordinate (linked by: *and, but, or, therefore,* etc.), subordinate relative (*who, which, whose*) and other subordinate clauses (*because, while, since, if,* and so on). The distributions of the transitions on the scale from fluent to one second or more (rising by intervals of 0.25 sec.) shows transitions to relative subordinate clauses to be largely fluent (62.8%) and only 24.5% were longer than half a second. Other subordinate clauses (*because, if,* etc.) are preceded by 50.7% fluent transitions and 31.5% are transitions of more than 0.50 sec.

When we come to co-ordinate clauses, the percentage of fluent transitions drops to 33.2%, while 43.1% of transitions are more than 0.50 sec. There is indeed a gradual decline in the degree of temporal integration in the sentence body from words within clauses, to relative subordinate, to other subordinate clauses, to co-ordinate clauses. This is reflected in Fig. 3, in which the ratios of fluent to hesitant transitions, the fluency score, are shown for these categories. This relationship holds for each of the

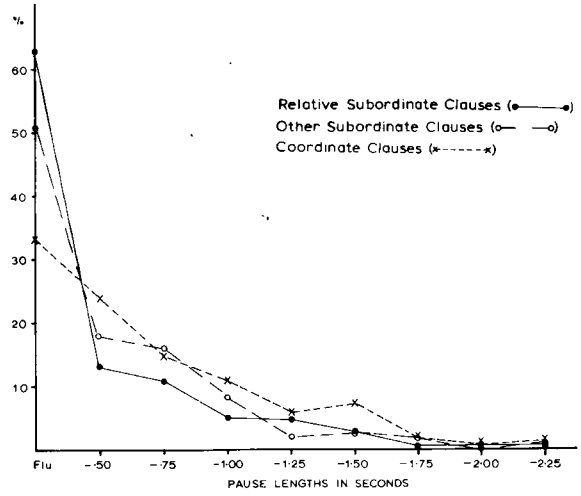

Fig. 2. Percentage transitions between relative subordinate clauses, other subordinate clauses and co-ordinate clauses.

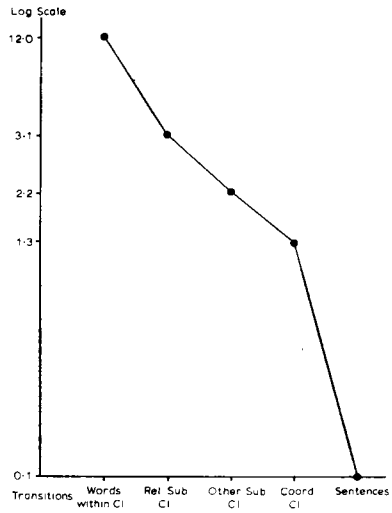

Fig. 3. Fluency scores (FL+−.50/.50+) for nine subjects in spontaneous speech.

individual samples (see Table 1) and considering the wide variety of speech situations covered by them appears to represent a general pattern. (Three samples of French spontaneous talk by three different speakers which were also analysed presented the same picture.) The fluency score was calculated by adding transitions of less than 0.50 sec. duration to those completely fluent and dividing them by transitions of more than 0.50 sec. As a check we also based fluency scores on a ratio of only fluent to all hesitant transitions with a similar result.

In view of the fact that the number of words went into many hundreds (between 700-1100) per text, we used single logarithmic graph paper for the illustration. The difference in the fluency of transitions between all but two of these groups tested by analysis of variance was highly significant at $p < 0.01$. The difference between relative and other subordinate clauses was significant at $p < 0.05$. In other words, *the grammatical description of each of the clause types has its quantitative reflection in the length or absence of pauses which precede it, in natural, unprepared and spontaneous speech.* It is in this sense that we can accord the various types of syntactic structures the property of psychological reality manifesting itself in objective and measurable behaviour.

Readings

Readings of 5 spontaneous texts were performed by subjects other than the original speakers of these texts and Fig. 4 shows the modification of the pause structure when spoken texts are subjected to utterance by reading.

The readers were asked to familiarize themselves with the texts before the experiment by silent reading. Their subsequent reading aloud was recorded. The following

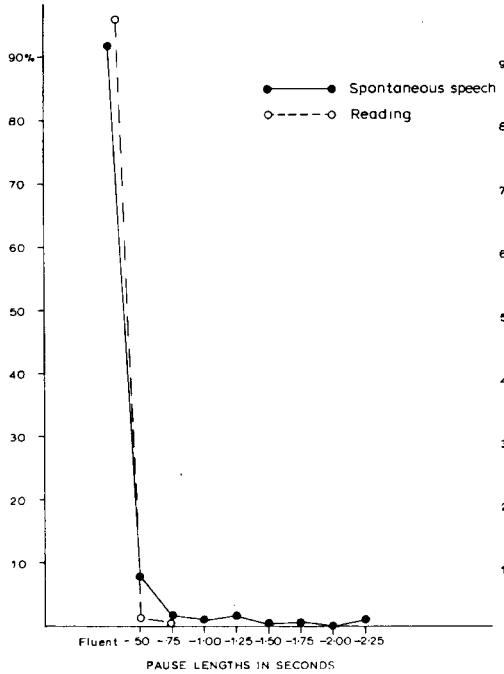

Fig. 4(a). Within clauses (lexical) transitions (5 samples).

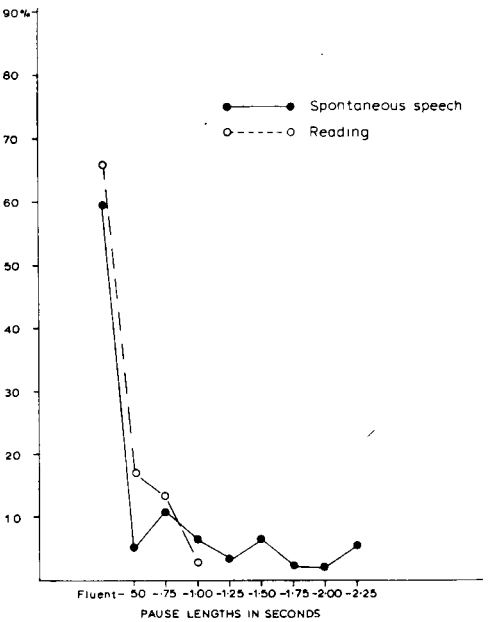

Fig. 4(b). Subordinate clauses (relative) transition length (5 samples).

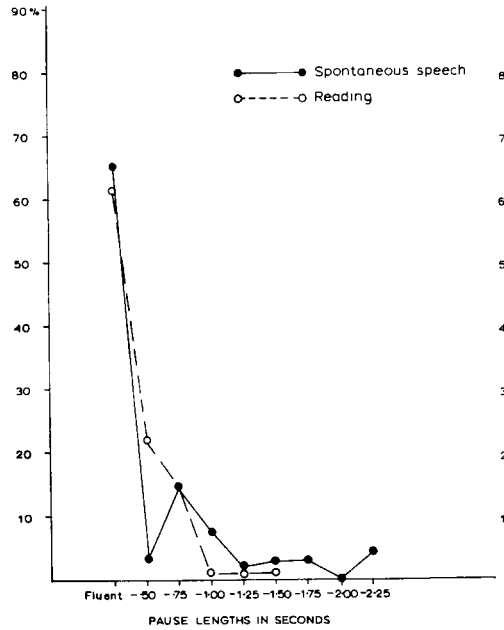

Fig. 4(c). Subordinate clauses (other) transition lengths (5 samples).

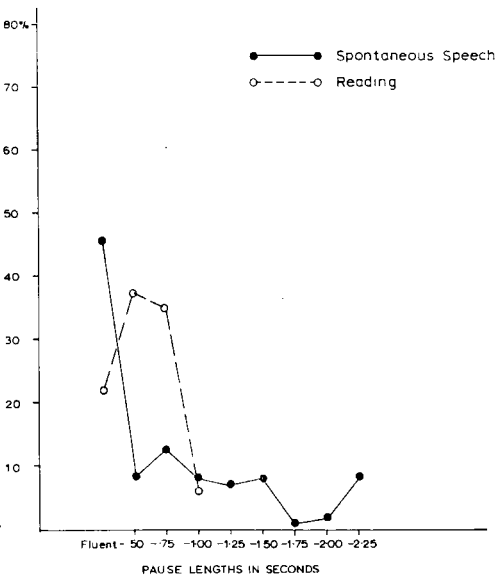

Fig. 4(d). Co-ordinate clauses (transition lengths, 5 samples).

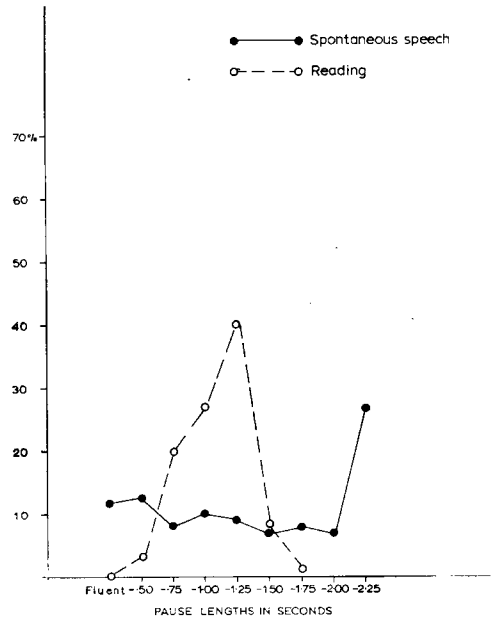

Fig. 4(e). Sentences (transition lengths, 5 samples).

TABLE 1

Texts	a	b	c	d	e
Gi	21.77	4.00	**1.40**	1.15	0.44
OB1	38.00	5.33	**3.17**	1.75	0.31
OB2	60.93	3.67	**3.33**	1.75	0.09
IB1	55.22	2.89	**1.40**	1.07	0.18
IB2	41.96	5.00	**2.80**	2.00	0.14
IB3	24.72	2.86	**3.50**	0.92	0.28
S10	18.37	2.25	**2.50**	1.33	0.24
S11	12.56	1.73	**1.54**	1.50	0.29
S12	30.23	**2.10**	**4.00**	1.00	0.53
Means	26.12	2.95	2.17	1.32	0.28

These scores are ratios of fluent transitions plus pauses of less than 0.50 sec. over pauses of more than 0.50 sec. in transitions between:

(a) words within clauses
(b) subordinate relative clauses
(c) subordinate other clauses
(d) co-ordinate clauses
(e) sentences

F between positions (a, b, c, d, e) $= 26.22$ $p < 0.001$
F between texts $= 1.43$
F between b and c $= 4.98$ $p < 0.01$
F between c and d $= 8.99$ $p < 0.001$
F between d and e $= 8.03$ $p < 0.01$

picture emerged when the place and the duration of the pauses made under this condition were found and measured:

(1) Pauses within clauses, i.e., lexical pauses longer than 0.75 sec. that were present in spontaneous speech disappeared in the reading of the texts and the proportion of words uttered fluently rose from 91.5% to 98.3%.

(2) A similar trend is evident in the pauses preceding relative subordinate clauses. The proportion of fluencies rose from 58.9% to 65.5%, only 16.8% being pauses less than 0.50 sec. and 13.4% less than 0.75 sec. Again all the pauses of greater length present in spontaneous speech disappeared in the reading.

(3) The distribution of pause lengths for spontaneous speech and readings in transitions preceding subordinate clauses other than relative (marked by *because, since, if,* etc.), shows a reversal of the above trend in respect of fluencies, i.e., a decrease in fluent transitions in the readings (from 64.8% to 60.9%) and a less abrupt disappearance of the longer pauses present in spontaneous speech.

(4) This reversal of trend becomes quite clear when the pauses preceding co-ordinate clauses are examined. We note a regression towards the mean with the large majority (72.5%) of transitions being pauses of less than 0.75 sec., the mode being less than 0.50 sec.

(5) The regression towards the mean length of pauses becomes quite pronounced between sentences but the mode of these has now shifted from the 0.50 sec. of co-ordinate clauses to 1.25 sec. in the case of sentences. The few fluent transitions between sentences in spontaneous speech disappear in the reading as do all pauses longer than 1.50 sec. of which there were 41.3% in spontaneous speech.

Discussion

In contemplating the above results, what seems to be noteworthy is the fact that the sentence proves to be a distinct and separate pattern of strong cohesion in spontaneous and unprepared speech, not very much less distinct than in readings where the cognitive processes of planning and selecting are on the whole absent and speech utterance must be mainly concerned with the requirements of rhetoric and communication, and subject to conventional structuring. This would indicate that the speaker who thinks on his feet organizes his message in highly cohesive sentence units with a clear hierarchical structure whereby constituent clauses are temporally integrated into the sentence frame, if by this we mean uttered with fluency, to a far greater extent than sentences are into the whole discourse. The degree of this temporal integration follows the order supposed and suggested by grammarians, diminishing as we move from relative subordinate, other subordinate to co-ordinate clauses (see Fig. 3). The conventional groups of subordinate and co-ordinate clauses show a corresponding cohesion and the temporal picture reflects a difference which is in the conventionally expected direction. It does not, at least in general terms, reflect the differences more in line

with internal structures cutting across conventional syntactic classifications in the way suggested by Gleason. Fluent transitions between sentences are extremely scarce even in spontaneous speech, where the dynamics of improvisation may more frequently be expected to drive beyond the conventional point of arrest in continuous phonation. This scarcity of fluency between sentences as compared with clauses, not to speak of words within clauses (Table I), indicates that a basic property is involved, marking sentences as distinct units of speech, occupying in the general stream of the discourse a figure to ground position. Some indication on this matter may be gained from examining transitions within and between clauses and between sentences based on readings as well as on speech. Here we see that the small proportion of pauses within clauses (lexical pauses) is further reduced, that the transitions preceding relative subordinate clauses show the same tendency towards increased integration into the stream of speech. With subordinate clauses other than relative we observe a slight reversal of this trend, tending towards using pauses rhetorically and shedding the rhetorically disturbing longer and probably cognitive pauses. Co-ordinate clauses are subject to even more pronounced demarcation through shortish pauses (0.50 to 0.75 sec.) in reading, with the fluencies or long pauses, present in spontaneous speech, disappearing. The transitions between sentences in readings show a total absence of fluencies or of short pauses, and of pauses longer than 1.50 sec., a temporal distribution which clusters around a central value distinctly higher (1.00-1.25 sec.) than the one which characterizes co-ordinate clauses. This would indicate that pauses between syntactic units have two functions, one of demarcation which remains when cognitive activity has ceased to operate and one of hesitation. In spontaneous speech the time of the latter seems to be added to the time required by the former. With readings pauses within clauses disappear but between sentences they are highly concentrated about a mean value. This suggests that in reading the pause has one circumscribed function. The wide distribution of pause lengths between sentences indicates that factors additional to the basic demarcation of sentences in the stream of speech enter into the process, mainly adding to the length of transitions, though on a very few occasions moving on without pause. If cognitive determination of pauses between sentences is supreme in spontaneous speech with rhetoric taking the back seat, as was shown to be the case with the incidence of breath-intakes during spontaneous speech (Goldman-Eisler, Henderson, Skarbek, 1966), then fluent transitions between sentences might be taken to occur where no new thought has entered into the utterance. The rarity of such fluent transitions in spontaneous speech would indicate that in most cases a sentence presents the externalisation of a thought unit. We are reminded here of the great emphasis accorded to the sentence form by Wundt as a fundamental unit which becomes articulated and analysed into the constituent elements of words and clauses as external linguistic expression is undertaken. If this is so then sentences would be distinct stepping-stones in a discourse and therefore would maintain their distinctness in the act of reading as much as when formed and articulated out of the thought unit in the act of creation.

In view of the controversy that has raged (Blumenthal, 1970) around Wundt's

analytic theory opposed by the synthetic theory of sentence production, facts such as the ones reported here might prove to be illuminating.

" It is important for Wundt's approach to language that it entails the priority of the *sentence* which he defines psychologically as the transformation of a simultaneous mental representation (Gesamtvorstellung) into sequentially ordered speech segments that are logically related to each other according to the rules of language. Because the *sentence* is primary and the *word* is secondary, word-forms are seen as the somewhat arbitrary results of the sequential organising activity." (Blumenthal, 1970.)

Edmund Burke Huey (1908) studying the reading process and the speech of children came out in strong support of Wundt's theory. " . . . meaning leads, and the idea of the whole dominates the parts. The sentence is not naturally composed of words which originally existed independently. . . . it might be said that the sentence is one long word. Our English and the kindred languages have made the analysis into parts of speech, words, etc., and our fashion of printing has made us very conscious of the results of this analysis. But in the living speech of conversation and thought these parts still adhere organically in the original sentence-wholes . . . and some consciousness of the whole usually precedes even the initial utterance. . . . The total of what is to be said exists in the consciousness precedent to the utterance, and dominates the utterance throughout. This total idea is not a mere sum of associations, but is an apperceptive unity. This unity becomes differentiated in the manner and in the direction indicated in its sentence expression, and the sentence is, according to Wundt, ' the analysis into its parts of a whole that is present in consciousness.'

The temporal cohesion or to use a Gestalt term, the temporal Prägnanz of sentences which characterizes our data seems very much in line with the idea of sentence-wholes. Wundt's view that the sentence is not a sum of associations, but is an apperceptive unity that becomes differentiated in the manner and in the direction indicated in its sentence expression, that the sentence is " the analysis into its parts of a whole that is present in consciousness," is supported by the fluency differentials of transitions not only between sentences and clauses but between the various types of clause. The fact that the more highly embedded a sentence is and the greater the degree of subordination of clauses, the more fluent are the transitions between clauses, supports the view that sentence formation is analytical; though the equally frequent occurrence (in absolute terms) of long pauses within clauses, i.e., of long lexical pauses, indicates an aspect of synthesis involving the choice of individual words. Wundt has implied such a phenomenon saying that while sentence formation is analytical, " as the separation of the parts of a whole . . . it is also synthetic in that it is an appearance of part after part in the focus of consciousness . . . Above all, however," he adds, " it is an analytical process."

Against this stands the view of a sentence as being the result of a chaining of words (Hermann Paul, 1886) which found modern expression in the Markov theory of word sequence. According to Paul the sentence is " . . . the linguistic expression, the symbol, for the fact that the connection of several ideas or groups of ideas has occurred in the mind of the speaker, and it is the means of creating the same connections in the mind

of the hearer."

If this were the case, there would be no explanation for the factor of temporal Prägnanz, of cohesion marking sentences from clauses as we find in spontaneous speech as well as in reading. Our results are much more in conformity with Wundt's analytical theory of sentence wholes. This does not mean that all parts of sentences are preconceived and contained in the initial thought unit and that supplementary sequences may not be added synthetically as might be the case in co-ordinate or even some adverbial clauses. But it is precisely in such cases that measuring the fluencies or length of pauses in transitions between the constituent clauses can be useful. Complex sentences which contain many times over embedded clauses, once on their way, are broken up by shorter and fewer pauses than are sentences containing co-ordinate clauses. Subordination, particularly of relative clauses, seems to be an aspect of " the analysis into its parts of a whole that is present in consciousness." In view of the fact that the hierarchy of dependence in clauses is so faithfully reflected in quantitative and temporal terms the occurrence and duration of pauses might give an indication whether the clause sequence concerned constitutes a new thought synthetically added, or an element implied in the original apperceptive unit, separated from it by analysis.

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