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Subjective Time Experience: Identifying Psychological Correlates by Narrative Psychological Content Analysis¹

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Abstract

This paper is a report on the use of computerized content analysis in mapping the psychological correlates of subjective time experience recalled in experimentally created autobiographical narratives. First the history of the field and the justification of the use of the method, then the categories a computer algorithm, and finally the first correlational validity results are reported.

A brief historical survey of time research in psychology

The use of computerized content analysis in the study of psychological correlates of subjective time experience is a late development in the long history of theoretical and empirical research on the relationship between man and time in general. The psychology of time originates from the philosophy of time. Outlining the history of the philosophy of time from Plato, to Descartes, Kant, Condillac, Spencer to Guyau, Paul Fraisse created solid ground for the psychology of time by stating that “around the middle of the nineteenth century there evolved an entirely new approach to the problem of time: the empirical study of the accuracy with which men perceive time” (Fraisse, 1964, p. 8). The early interest in the psychology of time was focused on the accuracy of the estimation of small time periods and on the rhythmicity of living organisms (Fraisse, 1964, Doob, 1971). A new thread in this early

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texture was the otiose search for a particular time organ in the human body. Another new development was the emergence of the research of ‘lived time’ as opposed to the former ‘microtime’ studies (Gorman and Wessmann, 1977). The lived time paradigm can be conceived as an umbrella term for several directions of research, such as the broad field of time pathology; the personality psychology problematic whether time experience is a state or a trait; research on the nature and effects of time perspective; time sociology, and so on (see classic handbooks by Cohen, 1967; Ornstein, 1969; Doob, 1971; Yaker and Osmond, 1972; Cottle and Klineberg, 1974; and Gorman and Wessmann, 1977). Since the eighties of the nineteen up to the present, the psychological research on time seems to have been channelled into the stream of (mostly autobiographical) memory science (Rubin, 1986, 1996; Hoerl and McCormack, 2001). One may, perhaps, say that the ‘lived time’ paradigm has been replaced by the ‘recalled time’ paradigm.

The point of intersection of recalled time and computerized content analysis is the autobiographical, or at least self-related, text. In this field, temporal sequence of autobiographical narratives was analyzed in relation to identity stories and trauma elaboration (Pillemer, et al., 1998, 2001; Erős and Ehmann, 1997; Ehmann, 2005). Complex time structures in narratives, however, are difficult to grasp by language technological devices. They require grammatical analysis beyond the sentence level. On the other hand, subjective time experience of the narrating person can be mapped with local grammars. Therefore, we have developed morpho-syntactic algorithms, which detect subjective time experience in autobiographical narratives. Based on this technique, we try to infer the psychological states of the narrator.

Theoretical and empirical background of the content analysis of subjective time experience

The psychological research on recalled Subjective Time Experience (STE) is a three-phase process: (1) identifying phenomenological types of STE; (2) developing a standardized tool of their measure in the texts, and (3) connecting the identified STE types to existing psychological constructs.

Content analysis is present in all three segments of this process. In the first segment, the phenomenological types of STE are emerging categories derived from frequency lists of words and expressions from large text corpora; in this early form, these categories do reflect only temporal, and not yet psychological, qualities. In the second segment, the psychological counterparts of these categories are identified on an experimental basis. In the third segment, the psychologically validated STE categories are used as indicators of existing psychological constructs – in its fully standardized form, criterion based content analysis may be used as a psychometric tool. This means that the test subjects in any framework will not fill out preformed psychological tests: the diagnosis or any other psychological results or implications are gained directly from the quantitative content analysis of their text samples.

In broad terms, this scheme is true not only for time-related categories, but for the interwoven nature of content analysis and any psychometric constructs as a whole. One reason is that the overwhelming majority of test factors – and in many cases even particular test items themselves – are constructed either from the previous use of qualitative content analysis of the oral or written verbal behavior of the related test population, or are collected directly from large dictionaries of natural language. One may ponder that the era of itemized verbal tests will be replaced by computerized content analysis of natural language in the future. Though “no one has yet devised a compelling psychological theory of word usage”,

the word use approach is a hot topic in contemporary psychometry (see Pennebaker, Mehl, and Niederhoffer, 2003).

In this context, the relation between self and identity on the one hand, and life stories on the other, provides a double opportunity. First, following non-essentialist self-theories (e.g. Erikson, 1968, Bruner, 1990), which derive self from life narratives, we may use temporal features of these narratives to characterize the qualities of the narrating self. Consequently, we may use narrative self theories for a theoretical explanation of psychometric correlations that have been unexplored as yet. Second, when using narratives as more or less organized texts, we may go beyond word level analysis and use language patterns that depict time experience in the course of advancing life.

STE categories emerging from psychotherapeutical theory and practice

To discover the aspects of subjective time experience and its pathologies mentioned and theoretized in psychotherapeutical literature, I first surveyed the PEP psychoanalytical database that contains full-text articles from nine leading journals (www.p-e-p.org). A total of 53 papers were found with the terms 'time' and 'temporal' in their titles from the period between 1935 and 1998. The main fields of interest were as follows:

1. *Relationship between time and the Unconscious.* Though the cornerstone of psychoanalytic theory is that the Unconscious is timeless, most papers dealing with time pathology refer to an article and a subsequent discussion between Sigmund Freud and Marie Bonaparte (Bonaparte, 1940), where the old Freud argued that the lineal, abstract temporality characteristic of the functioning of the Conscious system is not prevalent in the Unconscious system, but finally, he did "not rule out the possibility of other forms of temporality in the Unconscious" (Boschan, 1990, p. 338). This event is interesting for us not because it has served for psychoanalytical authors as a justification for any considerations about the unconscious aspects of any time pathologies. What is more important is that the non-linear nature of narrative chronology that can be empirically analyzed in written texts: when subjects recall life stories with multiple time loops back to previous events or with embedded sub-stories, this may be informative about the underlying psychological processes.

2. *Matte-Blanco's theory* about the 'symmetrical-asymmetrical bi-logic structures' in the conscious and the unconscious. These bi-logic structures are constituted by (1) Symmetry, with its disregard for time, space (...), and (2) Asymmetry, with all its object distinctions given by the existence of time, space and a clear difference between the whole and its parts, permits the conceptualization of past, present and future (...) (Matte-Blanco, 1988, 1989, Fink, 1993).

3. *Fraser's 'Umwelt' theory on the external and internal reality of time.* This theory uses a visual metaphor of the time arrow to conceptualize various forms and pathologies of subjective time experience along the stages of nootemporal, biotemporal, eotemporal, prototemporal and atemporal 'Umwelts', i.e. 'perceived realities' (Fraser, 1981).

4. *Anniversary reactions.* The pathology related to recurring dates, such as personal, religious, and national holidays, and the anniversaries of severe psychological traumas are a favorite topic in psychotherapeutical literature (Mintz, 1991; Pollock, 1971).

5. *Fragmented time.* Hartocollis claims that many borderline and narcissistic patients suffer from a pathologic condition when the subjective perception of the past and the future splits from that of the present, and even the present is fragmented into smaller parts (Hartocollis, 1972, 1978). (This phenomenon is similar to Fraser's eotemporal Umwelt.)

6. *Types of traumatized time.* Terr summarized the types and disorders of subjective time experience in survivors of extremely severe traumatic events. The main groups of disorders and distortions are treated under the titles of short time sense, duration, simultaneity and succession, and temporal perspective (Terr, 1984).

Permanent differences in STE – pathology or personality trait/state?

A classic test for assessing subjective experience of time is the Time Perception Scale in Experimental World Inventory, a psychodiagnostical test developed by El-Meligi (El-Meligi, 1972). The Author explicitly claims that “this scale is intended to measure the severity of psychopathology as reflected in the patient’s experience of time” (El-Meligi, 1972, p. 233).

The three factors and some illustrative items of the el-Meligi Time Perception Scale are as follows:

I. Changes in the Experience of Time Flow

(Characteristic items: ‘I am constantly in a hurry for no particular reason’; ‘I hardly pay attention to the sequences of day and night’)

II. Time Orientation

(Characteristic items: ‘I do not belong to this century’; ‘It is too late to try to be somebody’)

III. Experiential Age

(Characteristic items: ‘My age does not seem to change’; ‘I feel I have always been old’).

A general conclusion may be that the more pathological a personality, the more distorted his or her subjective time experience.

Another field of STE-related psychometry is to differentiate among normal people as to their temporal characteristics and orientations. Wessmann extracted four main temporal experience factors in a study. These were the Immediate Time Pressure Factor, the Long-Term Personal direction Factor, the Time Utilization Factor and the Personal Inconsistency Factor (Gorman and Wessmann, 1973, p. 240). However, when the Authors intended to find the psychological correlates of these factors, they came to an embarrassing conclusion that “it may well be the case that temporal orientations are actually states”. Therefore “to assign trait labels such as ‘future-oriented’, ‘past oriented’, or ‘rapid’ versus ‘slow temporal flow’ to a person would be unjustified” (ibid., p. 242).

From the above considerations one may have a better understanding of why the assessment of subjective time experience by paper-and pencil tests is not too popular or widespread in psychological practice: as to pathology, severe conditions have better markers than STE (e.g. in schizophrenia or depression), and as to normal subjects, it has not yet been decided whether temporal orientation is a trait or a state.

Content Analysis in the assessment of Subjective Time Experience

Time categories in word frequency based content analytic programs

The LIWC2001 software developed by James W. Pennebaker (2001) is composed of 2300 words and word stems, and analyzes English language texts along more than 70 word categories. These include Standard linguistic dimensions, Psychological processes (affective or emotional processes, cognitive processes, sensory and perceptual processes and social processes), Relativity, and Personal concerns. The Relativity main category involves the Time category that is further broken down to Past Tense, Present Tense and Future Tense words (For further details, see www.liwc.net.)

Colin Martindale's Regressive Imagery Dictionary (RID) was designed to assess primordial versus conceptual thinking. It is composed of about 3200 words and roots assigned to 29 categories of primary process cognition, 7 categories of secondary process cognition, and 7 categories of emotions (Martindale, 1975, 1990). The two time categories of this program are Timelessness (eternal, forever, immortal, etc.) in the Regressive cognition category, and the Temporal Reference Scale (when, now, then, etc.) in the Secondary Processes Category (For further details, see www.provalisresearch.com/wordstat/RID.html.)

Content-dependent versus functional temporal references

The logic of the content analysis based investigation of subjective time experience in self narratives seems to converge toward distinguishing between content-dependent and functional time categories. After a long search to find psychological meaning in the use of a comprehensive variety of Subjective Time Experience Categories emerging from natural language, it became gradually clear that it is essential to distinguish between the two. Though content-dependence and functionality are dimensions rather than two distinct groups, there are two clusters of words and expressions that may deserve particular emphasis.

References to Temporal orders of magnitude. The large majority of time-related words in texts are composed of references to periods ranging from the momentous to the eternal (moment/minute/hour/day/week/month/year/decade/century, etc.). A subset of this frame is references to personal, religious and national *holidays* and to *important periods of life* (years in school, in army or in hospital, etc.). The frequency of these references is highly dependent on the particular topic recalled.

References to past, present and future. Though this set of temporal markers is mostly content-dependent, present and, moreover, future references seem to be more functional than contentual.

An example of the functional nature of future references was given by Rokeach and Bonier (1960). Based on manual content analysis of TAT picture stories collected within the seminal theory of open and closed mindedness, they found that while there was no difference in the use of past references, closed minded subjects tended to finish their stories with spontaneous references to the future. The authors came to the following conclusion: "The open-minded subjects are not lacking in future orientation as such, and thus hold their own with respect to the measures of extension into the future and time span. But they are not preoccupied with it, as are the closed subjects." (Rokeach, 1960, p. 374.)

The solution of the issue of eventual psychological correlates or the above-mentioned state-or-trait dilemma may lie in finding functional rather than content-dependent temporal categories.

Functional qualities of subjective time experience

When studying personal recalls more closely, a whole bunch of non-contentual temporal markers will emerge. These qualities can be organized into two main groups: *timeline-anchorable* and *timeline non-anchorable categories* (the examples below show temporal adverbs only):

I. TIMELINE ANCHORABLE CATEGORIES (= references to)

- Point-Fixed Anchoring (examples: when, that morning, just at the moment, etc.)
- Sequential Advance (then, and then, on the next day, etc.)
- Start (at the beginning, initially, etc.)
- Duration (for years, all the night, in that period, etc.)
- End (until that day, finally, etc.)
- Repetition (frequently, again, every August, etc.)
- Future (tomorrow, in the next year, in the future, etc.)

II. TIMELINE NON-ANCHORABLE CATEGORIES (= references to)

- Evertime (always, permanently, forever, etc.)
- Nevertime (never, ever, etc.)
- Uncertain time (any time, whenever, etc.)

Considering the number of relevant linguistic markers, the first category group robustly outnumbers the second one. Furthermore, *references to temporal order of magnitude, to holidays or to significant life events have their subjective temporal quality not in themselves, but only when they are overwritten by temporal qualifiers:*

‘ALL /THE/’ + TEMPORAL ORDER OF MAGNITUDE ADVERBS
(moment/minute/hour/day/week/month/year, etc.)
= DURATION;

‘EVERY’ + TEMPORAL ORDER OF MAGNITUDE ADVERBS
(moment/minute/hour/day/week/month/year, etc.)
= REPETITION, etc.

Having these rules at hand, the next step was to find content analysis software flexible enough to work with user-defined algorithms with high reliability. This was Lin-tag² for our validity studies in Hungarian language texts³.

² The Lin-Tag Software for Narrative Psychological Content Analysis was developed from the linguistic and computer side by a leading Hungarian software company, Morphologic Ltd (who made, among others, the Hungarian spell-checking software for Microsoft Word), and from the psychological side by the Hungarian Academy of Sciences and by the Pecs University (László, 2005).

The Lin-Tag Software has several other Modules (Perspective Module, Approach-Avoidance Module, Character-Function Module, and the Negation and Self-Reference Modules, see other papers in this Issue). The Time Module is one of them (Ehmann, et al., 2005).

Correlational validity studies of STE categories

The initial idea of categorizing timeline anchorable and non-anchorable adverbs and adverbial expressions from natural language came from the hundred-year-long controversy of psychotherapeutical literature as to the relationship of man and time. The main problematic of STE categories emerging from natural language is rather rudimentary: what do they measure? Do they measure anything at all?

In an attempt to answer the above dilemma, correlational validity studies were performed as the first step.

Sample and Method

Frame and Participants. As part of a more comprehensive project (László, 2004), correlational validity studies on the STE categories were based on a common textual corpus of various self-narratives. The total number of subjects involved in the study was 83 (29 men and 54 women; 50 young /18 to 35 years of age/ and 33 “old” /45 to 60 years of age/).

Textual corpus. The full corpus, collected from a total of 83 normal subjects on various autobiographical topics, was composed of 281,306 words, 1,467,858 characters. The average length of individual texts was nearly equal, around 3500 (+/- 200) words per story.

Psychological tests. The autobiographic recalls were supplemented with a test battery for each subject. These involved, among others, shortened versions of the *El-Meligi's Time Perception Scale* (El-Meligi, 1972), *Aaron Antonovsky's Sense of Coherence Test* (Antonovsky, 1987), the *Hungarian version of the Beck Depression Questionnaire* (Kopp and Skrabski, 1990), and the Emotion Control and Impulse Control Factors of the *Hungarian version of the Big Five Questionnaire* (Rózsa, et al., 1997).

Text processing. The above-mentioned Lin-Tag software was used for computerized content analysis.

Statistical method. The subjects were distributed into low and high scorers (roughly along the lowest and highest quartiles) in all the four psychological tests, respectively, and then Two Sample t-tests were performed to explore the differences between the groups as to the frequencies of various STE categories.

Results

Textual frequency patterns of STE categories

The frequency of occurrence of Subjective Time Experience categories is shown in Table 1 and Figure 1.

Timeline Anchored STE categories. As is ‘normal’ for a non-clinical population, people recall their life episodes – be it positive or negative – in a manner that they string the events onto the line of calendar time /Point Fixed Anchoring/. The next important aspect of life

³ As to the reliability of these rules, they were, of course, 100% reliable. As to the reliability of the categories as a whole, hand-made check of the findings in 10 randomly selected pages of the sample textual corpus by three coders confirmed around 80 to 95% reliability for the particular STE categories (the program is not yet fine enough to find expressions such as ‘when I was in high school’ = duration, for example).

events seems to be their Duration and Sequential Advance. In general, people give emphasis to the Start, the End and the Repetition of events, and quite often refer to the Future, as well.

Non-Anchored STE categories. It is striking that the normal population frequently refers to ‘Evertime’. However, both the table and the figure illustrate that the ‘Nevertime’ (which is the denied counterpart of ‘Evertime’) and the ‘Uncertainty’ categories gave an extremely low number of hits.

Table 1. Descriptive statistics of the occurrence STE category hits (n=83)

	Minimum	Maximum	Total	Mean	Variance
PFA*	4	107	2778	33.47	428.22
SeqAdv*	0	39	854	10.29	76.69
Start	0	29	572	6.89	20.29
Duration	0	49	1100	13.25	64.77
End	0	19	516	6.22	20.24
Repetition	0	16	550	6.63	17.31
Future	0	23	390	4.71	14.76
Evertime	0	30	471	5.67	25.539
Nevertime	0	13	166	2.00	5.04
Uncertainty	0	3	45	.54	.66

*PFA = Point Fixed Anchoring; SeqAdv = Sequential Advance

Psychological correlates of recalled Subjective Time Experience

Results for the Eli-Meligi Test

1. *Time Flow Scale.* Normal subjects who self-reported themselves as having certain difficulties in experiencing and following the “normal” flow of time used significantly more words and expressions ranged into the Timeline Anchorable, Duration, and into the Non-Anchorable, Evertime Categories (at $P < 0.05$ level in both cases).
2. *Time Orientation Scale.* No significant results were obtained with the Timeline Anchorable Categories, but those who considered themselves as having difficulties in deciding whether or not they “globally fit” the time they lived gave abundant thematizations in the Non-Anchorable, Evertime and Nevertime Categories.
3. *Experiential Age Scale.* Neither significant correlations, nor tendencies were obtained.

Table 2. Significant differences in low and high El-Meligi’s Time perception Scale scorers as to Subjective Time experience Categories

El-Meligi’s Time perception Scale						
STE	Mean	SD	Mean	SD	t-test	
Time Flow Factor						
	Low (n=22)		High (n=16)		$t_{(df)}$	Sig
Duration	10.72	4.97	16.06	7.43	$t_{(24.5)} = -2.49$.02 (P<.05)
Evertime	4.50	3.77	7.31	4.50	$t_{(36)} = -2.07$.04 (P<.05)
Time Orientation Factor						

	Low (n=16)		High (n=14)		t _(df)	Sig
Evertime	4.35	3,21	7.50	5.15	t _(21.2) = -2.03	.05 +
Nevertime	1.18	1.04	2.42	2.02	t _(18.1) = -2.06	.05 +
Experiential Age Factor						
No significant results were obtained						

Results for Antonovsky's Sense of Coherence Test

1. *Manageability Factor.* Subjects who self-reported that they can manage their world appropriately showed a tendency to thematize more words and expressions ranged into the Timeline Anchorable, Point-Fixed Anchoring and Sequential Advance (at P<0.05 level in both cases).
2. *Meaningfulness Factor.* Subjects who scored high in this factor tended to use more words and expressions in the Timeline Anchorable, Duration and Repetition Categories (at P<0.05 level in both cases).
3. *Comprehensibility Factor.* No significant correlations were found in our sample.

Table 3. Significant differences in low and high Antonovsky's Sense of Coherence Test scorers as to Subjective Time experience Categories

Antonovsky's Sense of Coherence Test						
STE	Mean	SD	Mean	SD	t-test	
Manageability Factor						
	Low (n=28)		High (n=36)		t _(df)	Sig
Point Fixed Anch.	28.82	15.76	39.91	24.96	t _(59.7) = -2.16	.03 (P<.05)
Seq. Advance	8.64	8.08	13.63	9.6	t ₍₆₂₎ = -2.20	.02 (P<.05)
Meaningfulness Factor						
	Low (n=26)		High (n=36)		t _(df)	Sig
Duration	10.26	6,83	15.16	8.76	t ₍₆₀₎ = -2.37	.02 (P<.05)
End	5.42	4.92	6.83	3.73	t ₍₆₀₎ = -1.92	.05 +
Comprehensibility Factor						
No significant results were obtained						

Results for the Beck Depression Scale

High scorers in the normal sample showed a tendency to use more future-related adverbs and adverbial expressions spontaneously.

Table 4. Significant differences in low and high Beck Depression Test scorers as to Subjective Time experience Categories

Beck Depression Scale						
STE	Mean	SD	Mean	SD	t-test	
	Low (n=22)		High (n=27)		t _(df)	Sig
Future	3.40	3.34	5.62	4.59	t ₍₄₇₎ = -1.89	.06+

Results for the BFQ Emotion and Impulse Control Scales

Low scorers in the BFQ Impulse Control Factor used significantly more adverbs and adverbial expressions for the thematizations of Start and Future ($P < 0.05$ in both cases). No significant results were obtained with the BFQ Emotion Control Factor.

Table 5. Significant differences in low and high Big Five Questionnaire scorers as to Subjective Time experience Categories

Big Five Questionnaire						
STE	Mean	SD	Mean	SD	t-test	
Emotion Control Factor						
No significant results were obtained						
Impulse Control Factor						
	Low (n=20)		High (n=21)		t_(df)	Sig
Start	8.40	3.979	5.67	3.483	$t_{(39)} = 2.344$	0.024
Future	6.40	4.272	3.62	4.767	$t_{(39)} = 2.213$	0.033

Discussion

There has been controversy in psychological literature about the meaning of subjective time experience. There are no commonly used psychological tests to assess the phenomenon. On the other hand, the emergence of subjective time experience categories from natural language for content analysis is embarrassingly robust. Subjective time experience is, however, not yet in the main focus of top world programs for psychological content analysis.

In LIWC2001, little emphasis is given to the exact role of the Time Category (with its past, present and future verb subcategories) in the program. The concept of Time belongs to the domain of ‘Relativity’, together with ‘Space’ (Up, Down, Inclusive, Exclusive), and ‘Motion’.

In the Regressive Imagery Dictionary, the Timelessness Category is part of assessing regressive cognition, while the Temporal Reference Scale is part of assessing the presence of secondary process thinking. In the first case, ‘Timelessness’ (eternal, forever, immortal, etc.) is part of the Regressive Cognition Main Category, together with subcategories like ‘Unknown’ (secret, strange, unknown, etc.), ‘Consciousness Alteration’ (dream, sleep, wake, etc.), ‘Brink-passage’ (road, wall, door, etc.), ‘Narcissism’ (eye, heart, hand, etc.), and ‘Concreteness’ (at, where, over, etc.). ‘Temporal References’ (when, now, then, etc.) is part of the Secondary Process Main Category, together with subcategories like ‘Abstraction’ (know, may, thought, etc.), ‘Social behavior’ (say, tell, call, etc.), ‘Instrumental Behavior’ (make, find, work, etc.), ‘Restraint’ (must, stop, behind, etc.), ‘Order’ (simple, measure, array, etc.), and ‘Moral Imperative’ (should, right, virtue, etc.).

The present study claims that content analysis is able to identify functional, rather than merely content-dependent, markers of Subjective Time Experience. In our correlational validity study, we found some psychological correlates of the latter.

A psychometric approach similar to ours was seen in recent literature; in a Time Integration Questionnaire developed by Drakulic, et al. (2003), the tentative aspects of time organization of psychological functioning were suggested: Speed, Repetition, Continuity, Stability, Retroversion, Progression, Contiguity and Anteverision. Using various measures,

Bschor, et al. (2004), in a controlled study of 93 subjects, found that controls reported balanced, manic patients an enhanced, and depressive patients a slowed experience of subjective time flow. As to the controversial results concerning spontaneous references to the future, an interesting development was made by Conaghan and Davidson (2002): they differentiated between positive and negative references to the future, and found that older parasuicidal adults showed decreased positive future thinking, but no increase in negative future thinking.

Subjective time experience is manifested mostly in the self narrative. Simple morphosyntactical algorithms seem to be able to grasp its linguistic markers. Our results may contribute to the emerging convergence of the linguistic and the psychometrical approach: these correlations will probably be best interpreted in a complex narrative identity model.

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