Exploring the spatial organization of interpersonal relations by means of computational linguistic analysis[1]

Pohárnok, M.*, Naszódi, M.**, Kis, B.**, Nagy, L. PhD*, Bóna, A.*, László J.*

*Institute of Psychology, University of Pecs

**Morphologic Ltd., Budapest

Abstract

A linguistic analyzer algorithm was developed to operationalize and identify the approach-avoidance movements in self-narratives. The algorithm deals with the co-occurence of given verbal categories – so called „relation-verbs" – and given nouns – common nouns referring to significant others. The outputs of the analyzer are approach- and avoidance codes linked to given text units. First the reliability of the algorithm was appraised by comparing the output of the algorithm with the former outputs of manual coding. Then the validity of the algorithm was examined in a clinical and also in a normative – without prior psychiatric treatments - sample. In the normative sample the validity test was made by comparing the output of the algorithm with the results of personality inquries – Experience in Close Relationships, Big Five Questionnaire (BFQ), Trait Meta-Mood Scale (TMMS) and the Purpose to Life Scale (PLS). We hypothesized that the higher incidence of approach and avoidance movements concurs with higher emotional lability and disturbances in emotional regulation. The results shows that in two kinds of life-events narratives lower score on Emotional Control, Impulse Control in the BFQ co-occur with higher prevalence of approach and avoidance expressions. Likewise the lower scores of the Clarity subscale in the TMMS and the lower score of

Manageability in the PLS co-occur with a higher prevalence of approach and avoidance expressions. On the basis of these results we can conclude that our presumptions about the relationship between interpersonal movements and relational- and emotional regulation seem to be corroborated.

INTRODUCTION

Our research intends to explore intra- and interpersonal psychological phenomena by means of computational linguistic analysis. It is hypothesized that the patterns and changes of spatial relations of characters could be considered as compositional characteristics of self-narratives, which has psychological meaning. The existence of an interpersonal or interactive space organised by the relation of the self to other/s is assumed. The extreme ends of this space would be the self and the other, and their movements in relation to each other could be regarded as the fundamental characteristics of their interpersonal relationship. The changes in the spatial organization of interpersonal relations can be best observed through computerized text analysis in biographical (or fictional) narratives which are about significant relationships (see Diguer et al., 2001).

Various concepts of space and distance are identified in psychological research on linguistic forms. Recent studies (e.g., Jungbluth, 2001; Cohn, Mehl and Pennebaker, 2004) focus on the subjective distance between the speaker and the topic discussed. Based on the work of Biber (1988, cit. Cohn, Mehl and Pennebaker, 2004) these authors pointed out that the relationship between the narrator and the narrated topic can be seen as a distance parameter. Jungbluth (2001) analyzed the use of demonstratives in the Spanish language and concluded, that "The distance parameter is reinterpreted in terms of emotion. *Este* - nearness – is used to show affection and inclination, *ese* -distance – connotates often pejorative or contemptouos affects,(…)in this sub-space, which we might call *social space*." (Jungbluth, 2001, p. 10.)

Cohn, Mehl and Pennebaker (2004) in another study analyzed the expressions of psychological "distance" and "closeness" relative to the events of September 11. 2001. They applied the concepts of immediacy – involved production (Biber, 1988) – and nonimmediacy (Wiener and Mehrabian, 1968) to examine how individuals deal with the threatening events. A way an individual can defend herself from the emotional upheaval from an event is to detach or psychologically remove herself from the event. "When people are writing with high psychological distance (compared with low psychological distance), they use longer words

and more articles, and avoid present tense and first-person singular." (Cohn, Mehl and Pennebaker, 2004, p. 688.)

From this viewpoint nearness means involvement, a kind of emotional connection between the speaking or writing individual and other people, places, things, beliefs which are represented in the narration. Formal contexts and informal, emotional settings could be compared in this way.

In the present study spatial and emotional relations of the characters are examined in self-narratives. According to object-relational psychoanalytic theories (e.g., Mahler, 1975) and theories of self-development (e.g., Stern, 2002) both the physical closeness and distance between self and other, and the emotional closeness and distance presented by mental states relating to the self and other, have a significant role in both organizing relations and organizing self. Similarly, in intimate adult relationships the dimension of closeness and distance provides information about the ways of organizing and regulating a romantic relationship, and hereby it implies the self regulatory and emotional regulatory capacities of the participants (Bartholomew and Shaver, 1998).

It is presumed that the movements in the interpersonal space between the self – as the narrator – and the significant other in self-narratives could bear meaning concerning the narrator's psychological state.

According to object-relational psychoanalytic theories (e.g. Mahler, 1975) and theories of self-development (e.g. Stern, 2002) both the physical closeness and distance between self and other, and the emotional closeness and distance presented by mental states relating to the self and other, have a significant role in relation organizing- and self organizing processes. In intimate adult relationships the dimension of closeness and distance, the dynamic pattern of approach and avoidance, provides information about the ways of organizing and regulating a romantic relationship, thereby it implies the self regulatory and emotional regulatory capacities of the participants. (Bartholomew and Shaver, 1998)

THE INTERPERSONAL SPACE IN NARRATIVE FICTION AND NON-FICTION

Applying spatial metaphors for describing modes of narrative fictions, could be regarded as a recurrent topic in literary criticism. (Frye, 1957, Bakhtin,1981). Frye (1957) among others, makes a distinction between fictions in which the hero/protagonist becomes isolated from his

society and fictions in which the hero integrates into his society. The former corresponds to the myth of tragedy, the latter to the myth of comedy. However, these archetypical spatial patterns constitute only a section of all spaces found in texts. The Hungarian literary critic Kornélia Faragó (2001), attempts to define real, and metaphorical spaces and their function appearing in Hungarian fiction. She emphasizes those topics represented by spatial motifs which refer to subordination versus supraordination (vertical); and those which refer to co-ordinated (horizontal) spatial relations. The mythical topics, such as earth-boundedness vs. ascension, fall vs. apotheosis, and heaven vs. hell could exemplify the recurrent patterns of vertical spatial relations. Considering interpersonal relationships, horizontal relations have great importance, as well. The oscillation between approach and avoidance in the physical and intersubjective space of the story represents the dynamic pattern of the emotional-motivational relation between the characters of the narrative. The "game of from you-toward you", the oscillation between approach and avoidance manifests itself in the spatial-emotional relation between the protagonists. According to Frye (1957) approaching another person e.g. feeling compassion for him/her, and avoiding somebody, e.g. being afraid of him/her, represent the two main directions of emotional attitudes.

Our main assumption is that the interpersonal dynamics of approach and avoidance always refer to the mode of emotional regulation, thus they co-occur with the changes in affective states. However, these dynamics are not only indicators of emotional regulation, they can also serve as its means. Bakhtin (1981) describes the chronolocal sequences of romance as recurrent patterns of spatial motifs. The lovers **meet each other**, obstacles **hinder their union**, they become **separated,** but eventually they find each other again and they **rejoin** in happiness. From our point of view, the characters operate their relationship and organize its narrative by the means of these motions.

The relation of the self to others can first be described with physical movements. These real actions include movements from the self to the other and vice versa. Examples in a first person narrative could be the following:

"Mom left me alone in our flat" – Other avoids self.

"I pushed her off" – Self avoids other.

"Mom came close to my crib" - Other approaches self.

"I went to daddy every day" – Self approaches other.

Second, the relation of the self to other can be described as an intersubjective aspect of the interactive space. Here a more abstract aspect of space is concerned, in which approach corresponds to intersubjective sharing (e.g. understanding, accepting) and avoidance

corresponds to the lack of intersubjective sharing (e.g. ignoring, dismissing). Here the mental states relating to the self-other relationship – wishes, affects, intentions – indicate (emotional) closeness and distance. Similarly, even the emotional evaluation of the person - the other in the first person, singular narrative – could imply meanings of closeness and distance. The emotionally positive evaluation of the other evokes approach, while negative evaluation indicates avoidance. Examples for emotional approach and avoidance in a first person, singular narrative could be the following:

"My mother rejected me." - Other avoids self.

"I really hated him at the time" - Self avoids other.

"I get love from my mother." - Other approaches self.

"I can count on them" - Self approaches other.

THE ADAPTATION OF THE NARRATIVE PSYCHOLOGICAL CONTENT-ANALYSIS TO THE APPROACH-AVOIDANCE DIMENSION

Our study is based upon the assumptions that narrative is a potential "indicator" or "carrier/ transporter" of psychologically meaningful contents (László, Ehmann, Péley, Pólya, 2002; László, 2005, 2007 in press). Self-narratives and group narratives provide particularly rich sources for this type of analysis. We presume that the content and the structure of the narratives we tell about ourselves, or about our significant relationships could refer to our own mental states regarding ourselves and others. Psychological content of narratives can be studied hermeneutically with qualitative methods. However, content analysis is also an accepted quantitative methodology in psychology (Holsti, 1969). Computerised forms of quantitative content analysis is sometimes termed "quantitative hermeneutics" (see Martindale and West, 2002). As opposed to word (phrase, passage, etc.) level psychological content analysis, *structura*l or *compositional* aspects of narratives have been widely neglected. László, Ehmann, Péley and Polya (2002), László (2007) showed that structural-compositional features of self-narratives such as temporal patterns, the narrator's perspective, evaluative patterns, narrative coherence, functions of characters etc. (see Onega and Landa , 1996 for a comprehensive review) can be related to the psychological states of the narrator. We consider spatial-emotional distance as an important compositional dimension of self-narratives, which is reflective to the narrator's emotional regulation.

5

LINGUISTIC OPERATIONALISATION OF THE APPROACH-AVOIDANCE DIMENSION

The present study is based upon the assumption that in narratives about significant relationships, changes of interpersonal space, the dimension of approach and avoidance, can be regarded as fundamental structural characteristics. A new morphologic-syntactic parsing and tagging software was developed for the purposes of the study by the Morphologic Ltd. The program is based on lexicalized local grammars (see e.g. Webber, 2004 for similar efforts), but built on the morphologic-syntactic characteristics of the Hungarian language. The ApproxChange algorithm of the parser was evolved to identify approaching and avoiding motions in the real and intersubjective space of the narrative.

The linguistic operationalisation of the approach-avoidance motions consists of three groups of linguistic markers. The first group of linguistic markers consists of verbs referring to physical motions. The algorithm identifies the first and third person plural and singular verbs by sorting them into twelve auxiliary semantic categories. Since Hungarian is an affixing language, a surface morphological analysis is sufficient to identify the number and person of the verb. The categories are the following:

APPR_FARVD1 = predicative, first person verb referring to motion (e.g. go)

APPR_FARVD3 = predicative, third person verb referring to motion (e.g. runs)

APPR_FARVI1 = predicative, first person verb referring to "moving something" (e.g. gave)

APPR_FARVI3 = predicative, third person verb referring to "moving something" – approach (e.g. sends)

APPR_FARVS1 = predicative, first person verb attracting noun in accusative (e.g. know)

APPR_FARVS3 = predicative, third person verb, attracting noun in accusative (e.g. kissed)

AVOID_NEARVI1 = negative, first person verb, attracting noun in accusative (e.g. I did not kiss)

AVOID_NEARV3 = negative, third person verb, attracting noun in accusative (e.g she does not know)

AVOID_FARVIX1 = predicative, third person verb referring to "moving something" – avoid (e.g. lose)

AVOID_FARVIX3 = predicative, third person verb referring to "moving something" – avoid (e.g. lost)

AVOID_NEXIST1 = negative, first person substantive verb (e.g. I was not)

AVOID_NEXIST3 = negative, third person substantive verb (e.g. he will not)

The second group of linguistic codes consists of nouns. Here the first person pronouns and their suffixed forms and another group of nouns which refer to significant others are taken into account. Persons are regarded as significant others are those who play crucial role in the narrator's life story. Based on former studies (e.g. Péley, 2002) family members, romantic partners and friends belong to this category. The tokens of this latter code are listed in dictionary files. However, in the course of the pilot analyses we recognized that in most of the cases these significant others are only labelled with pronouns, consequently, both the third and the first person pronouns and their suffixed forms are included in the analysis. The nouns are sorted into six categories depending on their semantic function. Examples of the categories are the following:

APPR_NEARNI1 = first person pronoun in dative (e.g. for me)

APPR_NEARNI3 = third person pronoun in dative or a significant other in dative (e.g. for mom)

APPR_NEARN1 = first person pronoun functioning as spatial adverb answering to WHERE TO? (e.g. to me)

APPR_NEARN3 = third person pronoun functioning as spatial adverb or a denominative answering to WHERE TO? (e.g. to her, to my friend)

APPR_NHOME1 = first person pronoun answering to WHERE? (e.g. at my house)

APPR_NHOME 3 = third person pronoun or an inflected noun refer to significant other answering to WHERE? (e.g. by dad)

AVOID_FARND1 = first person pronoun functioning as spatial adverb answering to WHERE FROM? (e.g. from me)

AVOID_FARND3 = third person pronoun functioning as spatial adverb or a denominative answering to WHERE FROM? (e.g. from her)

AVOID_FARVS1 = first person pronoun in accusative (e.g. me)

AVOID_FARVS3 = third person pronoun or a significant other in accusative (e.g. him)

The verbal and nominal codes build up the macros of APPROX and AVOID. The coding process was assisted by sorting by priority. The relation of verbs and nouns are defined by

verbal prepositions which have to be provided by nominal structures. The predicative or negative form of the elements is substantial, because the negation of approach could denote avoidance, but it does not equal the negation of avoidance. The negation of avoidance does not definitely denote approach. Thus, the linguistic markers of approach and avoidance are text units consisting of co-present verbs and nouns.

Examples of the AVOID units:

"we did not even kiss each other"

"when I ran from him"

"I moved away from my husband"

Examples of the APPROX units:

"and dad snapped me up and put me into the car"

"and they came in to visit me"

"I called him before"

The third group of linguistic markers consists of interpersonal verbs (Brown and Fish, 1983), adverbs, personal pronouns and adjectives, which refer to the emotional, intentional proximity or distance of the protagonists. These words are listed in dictionary files. They are directly identified from the dictionary without considering their syntactic context. Examples could be following:

"I **loved** dad so much" – APPROX

 "he **accepted** me easily"-APPROX

 "my brother was **jealous** of me" – AVOID

" I was a bit **disappointed** in her" – AVOID

THE PSYCHOLOGICAL FUNCTION OF APPROACH AND AVOIDANCE

Frequency and pattern of approach and avoidance expressions could be linked to different psychodynamics. Different psychodynamics correspond to different modes of emotional regulation. The frequency and pattern of approach and avoidance expressions could indicate the distinctive mode of emotional regulation, and therefore it informs us about the potential disturbances in emotional regulation and related psychodynamics. Insofar as the frequency and pattern of approach and avoidance expressions in self-narratives correspond to the mode of relational and emotional regulation, correlation between these frequency and trait-like characteristics of emotional and relational regulation could be assumed.

Reliability test of the ApproxChange algorithm

Three self-narratives (approximately 2000 words) were coded both manually and by the ApproxChange algorithm. As can be seen in Table1., the algorithm has a total of 54% recall. It means that 54 % of the manually coded text units are identified by the ApproxChange algorithm. The identification of APPROX expressions shows a higher level of recall, but lower accuracy, and it works less reliably in the case of AVOID expressions. The relatively low level of reliability can be explained by two reasons. First, the word order in the Hungarian sentence is usually unbound, therefore the verbal and nominal codes of the APPROX and AVOID units often have distant place in the sentences. Accordingly, the algorithm cannot identify them as belonging together. Secondly, the regularities in the relation of verbs and nouns are rare in the living language, where idiom-like collocations are more frequent. So as to remedy the first problem, expansion of the search window of the parser could have been a solution, but it presumably would have resulted in less accuracy of identification. Thus a more complex syntax is required. The second problem can be fixed only by integrating idiomatic phrases into the ApproxChange algorithm.

Table 1.
Reliability of the AproxChange algorithm

APPROX	Right score	Omission	False score	TOTAL
Manual coding	46	-	-	**46**
ApproxChange-algorithm	**28**	18	31	**28 (60%)**
AVOID	Right score	Omission	False score	TOTAL
Manual coding	27	-	-	27
ApproxChange-modul	**12**	15	5	**12 (44%)**

VALIDITY TESTS OF THE APPROX-CHANGE ALGORITHM IN CLINICAL SAMPLE

It was presumed that a higher frequency of approach and avoidance expressions would appear in the self-narratives of patients with borderline personality disorder (BPD), as compared to the self-narratives of the normal sample. Both object relation theory (e.g. Mahler, 1975; Kernberg, 1975) and attachment theory (e.g. Fonagy et al., 2003; Holmes, 2004) claim that BPD is principally characterized by ambitendencies of interpersonal behaviour and by unstable emotional regulation. In the case of these patients the urge of avoidance due to the fear of engulfment and the wish for intimacy are activated simultaneously. This leads to unsuccessful regulatory attempts in relational regulation and emotional regulation.

This hypothesis was tested in two samples of self-narratives (BPD N=33; control N=33 in the case of Good story with a significant other, and BPD N=32; control N=32 in the case of Bad story with a significant other). It was presumed that a greater proportion of approach and avoidance expressions would appear in the BPD group. The control and the BPD samples were matched according to the age of the participants and the number of words per story, and we applied an independent sample t-test to compare the means of approach and avoidance expressions in the two episodes.

Table 2.
Frequency of APPROX and AVOID units and their co-occurrence (APPRAVOID) in the matched samples

GOOD STORY						
	APPROX p = 0.078 (p<0.10)		AVOID p= 0.029 (p<0.05)		APPRAVOID p=0.081 (p<0.10)	
	M	SD	M	SD	M	SD
Control (N=33)	3.121	2.583	0.515	0.972	3.636	2.804
BPD (N=33)	4.090	3.521	0.969	1.310	5.060	4.022
BAD STORY						
	APPROX p=0.0699 (p<0.10)		AVOID p=0.033 (p<0.05)		APPRAVOID p=0.237 ns.	
	M	SD	M	SD	M	SD
Control (N=32)	4.281	3.205	0.687	0.965	4.968	3.477
BPD (N=32)	4.093	3.401	1.343	2.057	5.437	4.641

As can be seen in Table 2., there is a tendency in the differences between the two groups in the case of the good story. Although the difference in the AVOID units is statistically significant, there are no statistically significant differences in the total of approach and avoidance expressions. For the Bad story again, AVOID units differ significantly, whereas the difference in APPROX units only approach the significance level. Thus, the results with the AVOID units support our hypothesis, whereas the APPROX results only partly do so.

VALIDITY TESTS OF THE APPROXCHANGE ALGORITHM IN THE STRATIFIED NORMAL SAMPLE

Correlations with questionnaire and projective measures

Subjects

83 persons have participated in this study. Participants were recruited from two age cohorts: young adults (18-35 years old: 46 persons, M=23.04, SD=3.94) and adults (45-60 years old: 37 persons, M=52.17, SD=3.92). Persons were payed 1000 HUF.

Procedure

Participants have recounted five stories about the following life events: an event during which a person experienced achievement, loss, fear, and two events with 'significant others', one is valenced as negative ("bad story"), and the other as positive ("good story"). In the second part of the session, personality measures were administered. Recounted narratives were tape-recorded and later transcribed.

Personality measures

To assess the quality of relational regulation the scale of "*Trust in partners*" of the **Experiences of Close Relationships** (Brennan, 1998) questionnaire was used. To assess the trait-like differences in self-regulation we used the subscales of "*Emotion control*" and "*Impulse control for Emotional Stability*" of the **Big Five Questionnaire** (BFQ, Caprara at al., 1993), the "*Clarity*" subscale of the **Trait-Meta Mood Scale** (Salovey et al., 1995) and the "*Manageability*" subscale of the **Purpose to Life Scale** (Antonovsky, 1987).

Hypotheses

First, we presumed that differences would appear in the total of approach and avoidance expressions between narratives involving negative emotional states (e.g. Loss story) and narratives involving positive emotional states (e.g. Good story).

Second, we presumed that the larger amount of APPROX and AVOID units – the more frequent co-occurrence of approach and avoidance motions – demonstrates that the person who tells the story has difficulties with the adaptive emotional regulation. These difficulties are presented in the more intense "toward-away" motions in relation to the other and correlate with certain trait-like features of regulative mechanisms.

To test the first hypothesis the statistical method of independent sample t-test was applied and we found that the results met our expectations in the case of the Bad story and the Achievement story. We found the largest number of approach expressions in the Achievement

stories and the largest number of avoidance expressions in the Bad stories. The results of the next paired t-tests showed only non-significant differences between story-types (see Table 3.) To account for these results, we assumed that the pattern of approach and avoidance is a deep-rooted feature of the organization of experiences – a trait-like characteristic feature - , which appears independently from the emotional charge of a narrative. Besides this, we have to consider that the efficiency of the ApproxChange algorithm is responsible for the overall proportion of approach and avoidance expressions in the episodes. There is a smaller amount of recall in the case of avoidance expressions in all stories.

Table 3. Relative frequencies of APPROX and AVOID units in the autobiographical episodes

Topic	APPROX		AVOID	
	M	SD	M	SD
Achievement (N=78)	**0.900**	0.212	**0.099**	0.212
Fear (N=77)	0.815	0.313	0.185	0.313
Loss (N=78)	0.856	0.232	0.143	0.232
Bad (N=66)	**0.806**	0.301	**0.193**	0.301
Good (N=75)	0.853	0.247	0.146	0.247

To test the second hypothesis we analyzed the Achievement and the Loss stories, because they involve opposite and well defined emotions. We created two equal groups of Achievement and Loss stories. One group contained the lowest (L) and the other contained the highest (H) amount of APPROX and AVOID units. Then we compared the scores of the narrators' personality questionnaires in these two groups of subjects.

Table 4. The relation between the total of approach and avoidance expressions in the Achievement and the Loss stories (APPRAVOID) and personality questionnaire scores

		Personality traits									
		Emotion control M	SD	Impulse control M	SD	TMMS: Clarity M	SD	PLS: Manageability M	SD	ECR: Trust M	SD
Achievement APPRAVOID	**L**	39.433*	8.740	36.266*	6.073	47.100*	4.978	14.566*	2.699	44.900*	7.063
	H	29.714*	7.010	30.875*	7.579	40.666*	6.365	12.187*	2.948	39.500*	8.082
Loss APPRAVOID	**L**	38.034	8.033	36.862*	6.864	46.448	3.859	14.241	2.668	45.758*	6.588
	H	33.277	10.554	32.631*	7.197	43.000	7.615	12.947	3.865	40.157*	8.883

The asterisk means that there is a significant difference (p<0.05) between the two groups.

As can be seen in Table 4., participants who have lower scores on the scales of "*Emotion control*" and "*Impulse control for Emotional Stability*" of the BFQ have larger amount of APPROX and AVOID units, and have more frequent approach and avoidance expressions in their Achievement story. However, a smaller amount of APPROX and AVOID units were found in the Achievement story of those participants who were able to understand and anticipate the stimuli influencing them, and manage these stimuli appropriately.

These results confirm our hypothesis, as the prevalence of approach and avoidance expressions implies more unstable and inadequate regulatory capacities, while their lower frequency suggests more optimal emotional regulation. Those participants who have higher scores on the "*Trust in partners*" subscale, both in the Loss stories and in the Achievement stories show a lower frequency of approach and avoidance expressions. It could be assumed that these persons are more successful in "using" the reliable other for the support of their own emotional regulation, thus they do not have to rely on their own unsuccessful regulatory capacities.

CONCLUSION

In this study we conceived movements in physical and interpersonal space as compositional variable of self-narratives. We have developed a morpho-syntactical analyzer, which maps the linguistic markers of approach-avoidance movements on sentence level. We assumed that patterns of approach-avoidance contents reflect the narrator's emotional regulation. Specifically, high frequency of changes would indicate emotional instability, because disturbed relational regulation refers to unstable emotional regulation. (Mahler, 1975) Based on MacAdams' model of interrelations between personality traits needs and identity constructed in life stories (MacAdams, 2001; MacAdams, Anydoho, Huang, Kaplan, and Machado, 2004), we tested our hypotheses with life story episodes and with personality inventories sensitive to emotional regulation.

Up to this point the validity tests of the ApproxChange algorithm with the borderline patients and the normative sample have fulfilled our expectations. The linguistic markers developed to grasp the psychological phenomenon of emotional regulation seem to be applicable.

In future projects we intend to proceed in two main directions. First, we plan to improve the efficiency of the ApproxChange algorithm, in order to reach a minimum of 80 percent reliability. Second, the results of our former manually coded quantitative analyses (Poharnok, 2004) suggest that it would be worthwhile to examine the patterns and sequences of approach and avoidance expressions in self-narratives about significant relationship experiences. These analyses might provide a more detailed and deeper insight into the psychodynamics of relationships.

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