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USING HUNGARIAN LANGUAGE TO CLARIFY LANGUAGE-THOUGHT RELATIONS IN IMPAIRED POPULATIONS[1]

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The paper argues that even in studying genetically disordered populations, taking a cross-linguistic and cross-cultural approach seems to be fruitful. Using data from several languages, including Hungarian, might help to clarify the real nature of some cognitive and linguistic disorders. Data from the longitudinal Hungarian Williams Syndrome Project, which included mainly children between five and eighteen, are presented. Williams syndrome is an extremely rare (1: 25,000 live births) genetic disorder, that shows serious impairments in spatial cognition, with a relatively intact language. However, many claims were made regarding qualitative peculiarities within the language area as well. The Hungarian data helped to clarify some of the controversies around these issues. Most notably there were no signs in Hungarian for morphological overgeneralizations being more characteristic of Williams syndrome people. Regarding spatial language, using the rich Hungarian system of suffixes and postpositions, it was observed that while their spatial term use is limited, as expected on the basis of their constrained spatial cognition, the qualitative pattern is similar to typically developing children. On the whole, our data support the use of cross-linguistic comparisons to support a more refined theory of development in genetic impairments, with a role for the individual life path.

Keywords: spatial language, Williams syndrome, cross-linguistic comparisons, genetically disordered people

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Disordered populations and cross-linguistic comparisons

During the last two decades, with the development of modular theories towards the mind (see Fodor, 1983), stronger and stronger claims were made regarding the underlying brain structures, and the innate organization supporting the modular workings of the mind. The structural and logical claims look like the chart outlined on *Figure 1*.

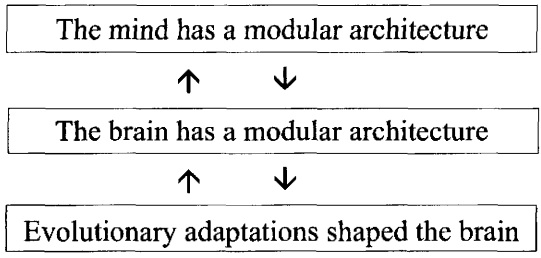

Figure 1. The stepwise logic of claims regarding modular organization

In its mature form this approach suggests that the human mind was shaped under the pressure arising from specific demands of the environment, and these specific adaptations developed specific brain structures that, on their part, correspond to specific mental organs, or modules (Pinker 1997). This domain specific approach to the mind has its own peculiar interpretations towards psychopathology as well. Since major behavioral and cognitive adaptations would mainly be innately organized, one can look for specific developmental disorders that would support the specificity of the cognitive and behavioral organization of an innate modular nature.

One research strategy during the last two decades of developmental psychopathology was to look for disorders that support decomposing the mind/brain into component systems using disorders that show a *double dissociation pattern*. Autism, for example would be a primary case where an impaired social cognition is combined with relatively intact other cognitive domains. The study of autism spectrum disorders combined with the preservation of other aspects of cognition has become essential in our knowledge of the structural, developmental and neural aspects of human social cognition. (For a critical review with some Hungarian data see Győri, Lukács, and Pléh 2004.)

Along this path an entire research trend took shape. This work tries to look for genetic disorders to help us to understand the organization of the mind. The volume edited by Hirschfeld and Gelman (1994) shows how this genetic and modular approach developed into a broad strategy in cognitive science.

As with all universalistic innatist claims in cognitive science, the question arises how to interpret cultural and linguistic differences within the frames of this research strategy. One does not have to be satisfied with studies done on a single given culture and language (mainly English), even regarding a genetic disorder, since cross-cultural studies still might be relevant, following the logic outlined below.

- If there is a genetic disorder, it should be manifested in the same way in all languages and cultures
- Cross-linguistic comparisons are still relevant:

A. They allow us to separate factors that are tied in one language. One good example is the issue of processing regular and irregular morphological forms in grammar. Irregularity and frequency in English morphology, an issue that has become so important in studies supporting a dual, rules *versus* items approach to language (Pinker 1991, 1999, Clahsen 1999) is complicated by the fact that these two variables are more or less tied in English. Beside being irregular, *went* is also frequent. One might look for languages – such as Hungarian happens to be – where the two factors can be untied, and therefore a clearer test of the general cognitive claim can be made easier.

B. In the cases where they show variations in populations with the same genetic impairment, cross-linguistic studies may also help to support epigenetic theories that emphasize the complex pathways leading to disturbed cognition.

The Hungarian Williams Syndrome Project

In the following some data will be presented from a longitudinal project on a rather peculiar genetic disorder, Williams syndrome, where using Hungarian language data proved to be relevant. The interest towards Williams syndrome in the community of cognitive developmental researchers is motivated by several factors:

- Williams syndrome is an extremely rare (1: 25,000 live births) genetic disorder

- It is caused by well identified microdeletions on chromosome 7, where only 5–12 genes are affected (Bellugi et al. 2000)
- It is accompanied by peculiar changes in brain organization, especially in the parietal lobes. This cluster of factors promises to help better to understand the genes-brain-cognition chain of this impaired group (Reiss et al. 2004)
- It is characterized by clear dissociations proposed in cognition that can be summarized as a list of strengths and weaknesses (Bellugi et al. 2000). *Strengths of Williams syndrome subjects:* good social skills, relative good language, within language, grammar is specifically good, and they are rather musical
- *Weaknesses of Williams syndrome subjects:* mental retardation (low IQ 60-80), weak visuo-spatial cognition, within language, lexicon is relatively week and peculiar

In the frames of the Hungarian Williams Syndrome Project, working in cooperation with the Hungarian Williams Syndrome Association, our group (Ilona Kovács, Ágnes Lukács, Mihály Racsmány, and myself) has performed a number of studies on subjects between five and eighteen in different domains of Williams syndrome cognition.

- *Perception:* orientation detection, contour integration, perceptual learning
- *Spatial and numerical cognition:* spatial learning, map orientation, numerosity, use of orientation frames
- *Memory:* verbal and visual working memory
- *Language:* lexical learning, lexical organization, morphology and overgeneralizations, language of space, social pragmatics of language use

The details of the studies shall not be presented here, see for a survey Kovács (2004) and Lukács (2005). In most studies, 20–25 Hungarian Williams syndrome subjects of the same subject pool were contrasted with appropriate controls. *Table 1* summarizes some of our studies regarding whether they supported the simple dissociation claims or not.

As clearly indicated on the table, the strong dissociation claims are only supported regarding visuo-spatial cognition. In the following a few results of the language studies will be presented. They are particularly relevant for showing the relevance of studying genetically impaired cognition over different languages.

Table 2 presents a general survey of our language studies summarized in Lukács et al. (2004) and Lukács (2005). As the table indicates, very few reliable differences were found. Language measures rarely show qualitative differences, and most of the quantitative differences ('retarded development'), might be

Table 1. A summary of the results of the Hungarian Williams Syndrome Project

Dissociation: Spatial cognition	Slow down, individual differences	Identical to typical development
Visual working memory	Lexical acquisition	Social cues in learning
Spatial learning	Spatial language	Rule application
Contour integration task	Contour integration task	
Perceptual learning		

Table 2. A summary of our results regarding the specificity of Williams syndrome language (after Lukács 2005)

Language profile	WS level	WS pattern
1. Vocabulary	<	+
2. Semantic fluency	+	+
3. Pragmatic cues in lexical learning	+	+
4. Grammatical structures (TROG)	<	+
5. Regular and irregular morphology	<	+
6. Grammaticality judgement	<	-
7. Anaphora interpretation	+	+
8. Production and comprehension of spatial expressions	<	+
9. Sentence completion with spatial case markers	+	+

explained by general cognitive factors such as low level of intelligence, and problems with working memory (see Pléh et al. 2002, Farran and Jarrold 2003).

A missing dissociation: The case of rules

One of the clearest dissociations originally proposed by Pinker (1991, 1999), and later supported by Clahsen (1999, Clahsen et al. 2004) within the relatively good language skills of Williams syndrome subjects is the better grammar – weaker lexicon. This would show up both within the Williams syndrome group, and especially when you contrast Williams syndrome subjects with people characterized with a difficulty in developing grammar, the so called Specific Language Impairment (SLI) condition. English Williams syndrome subjects have a stronger tendency for morphological overgeneralization replacing *went* with the overgeneralized *"goed"*, while SLI subjects would acquire rule based, regular items such as *learned* also only as items. Thus, they would have as easy a time with irregulars *(went),* as with regulars *(learned).* These data are usually explained with reference to a brain based anterior rules system opposed to a posterior item system. In the case of Williams syndrome the posterior system, while in SLI the anterior system would be challenged. This interpretation has been

challenged already based on data from Indo-European languages. Karmiloff-Smith et al. (1997), Thomas et al. (2001, 2002) have produced challenging data that question the validity of the *Rules versus Items* model, and they also offer a rivaling theoretical explanation where a universal learning mechanism would have different tuning curves in the impaired population (Thomas et al. 2002, see about this Pléh, Lukács, and Racsmány 2002).

The entire debate has several empirical constraints difficult to resolve within English. Namely, the regularity and frequency factors are difficult to separate. For an alternative explanation, and a defense of the *Rules versus Items* approach see Clahsen et al. (2004). Over the years we tried to test the hypothesis with Hungarian data. Using a modified version of the morphology test developed by Pléh, Palotás, and Lőrik (2002) frequent and rare regular (*cipő, hattyú* 'shoe, swan') as well as frequent and rare irregular (*kenyér, bogár,* 'bread, bug') items were used in a picture based morphology elicitation task. Subjects had to produce accusatives and plurals of pictured items, using all six nominal stem classes, like –v insertion stem *(kő),* epenthesis *(majom),* lowering *(hal),* shortening *(kenyér)* etc. The dependent measure was correct performance and the use of different types of errors.

As *Figure 2* indicates on the basis of analyses in Pléh, Lukács, and Racsmány (2003), an overall effect both of frequency and regularity was observed in both groups, and there was no clear effect of the proposed overgeneralization in the Williams syndrome group.

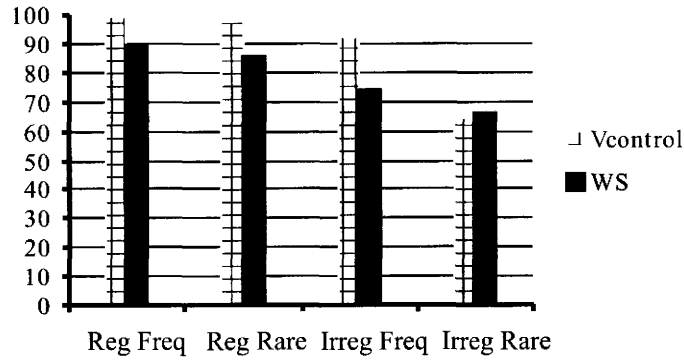

Figure 2. Effects of frequency and regularity in Williams syndrome and controls (Lukács 2005)

In a post hoc qualitative comparison of errors, as a matter of fact, more overgeneralizations were found in typically developing controls as in Williams syndrome subjects, as shown in *Figure 3*. Overgeneralization errors are of the types *kő-t* rather than *kö-vet*.

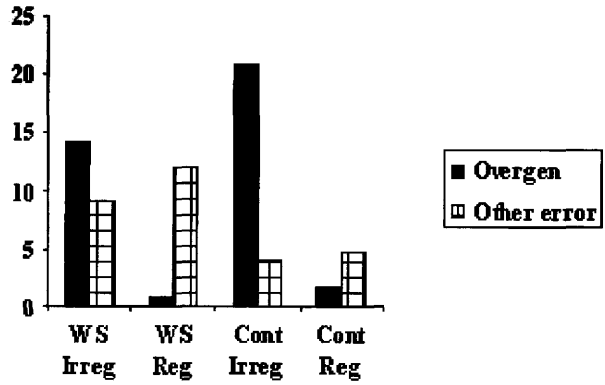

Figure 3. Frequency of overgeneralization and other types of morphological errors

In a comparison with SLI subjects, Lukács et al. (2005) also showed that while irregulars did not show a selective deficit in WS, regular forms did not show a selective deficit in SLI either. Thus, the Hungarian data do not provide a clear support for the intact rules – impaired lexicon model in Williams syndrome. The results in Hungarian do not argue for the modularity of the lexicon and grammar within language. They might be compatible with a dual route model of language, if in WS, both the lexicon and the grammar are supposed to be impaired, while in SLI only the lexicon is impaired. This reinterpretation clearly shows the usefulness of using cross-linguistic comparisons in understanding the underlying nature of some genetically based cognitive impairments.

The case of spatial language

During the last two decades, spatial language has received special attention with regard to possible universal strategies based on neurocognitive mechanism. One of the general frames in this regard has been the Landau and Jackendoff (1994) proposal about a parallel division of labor in cortical systems and in language. The form sensitive rich vocabulary (~10,000) of nouns would correspond to the ventral WHAT system in the brain and visual processing, while

the system that is only sensitive to some topological aspects and to path distinctions with a corresponding small vocabulary (~100) would correspond to the action specific dorsal WHERE system. (For an outline of the two brain systems involved see Kovács 2004).

In our studies on Williams syndrome done together with Ágnes Lukács, some clarifications regarding the language-cognition interface were made using this spatially challenged population. The most remarkable feature of this developmental condition is the severe limitation of spatial cognition, related to the underdevelopment of posterior parietal areas (see on the profile in this respect Bellugi et al. 2000, Farran and Jarrold 2003, and on the parietal damage Reiss et al. 2004). In line with the neuro-cognitive limitations, spatial language in these subjects seems to be very limited compared to their general level of grammatical morphology (Lukács, Pléh, and Racsmány 2004). However, in detailed comparisons no differences were found in the qualitative pattern of performance and errors in using spatial language. It seems to be that the limitations of spatial cognition limit spatial language use in this group, but at the same time the types of computations performed by the limited system, as observed in spatial language use, are identical. As *Figure 4* shows, along with the data from the literature (Farran and Jarrold 2003) our Williams syndrome subjects also showed severe limitations of spatial working memory, while their verbal memory was relatively intact (Pléh, Lukács and Racsmány 2002).

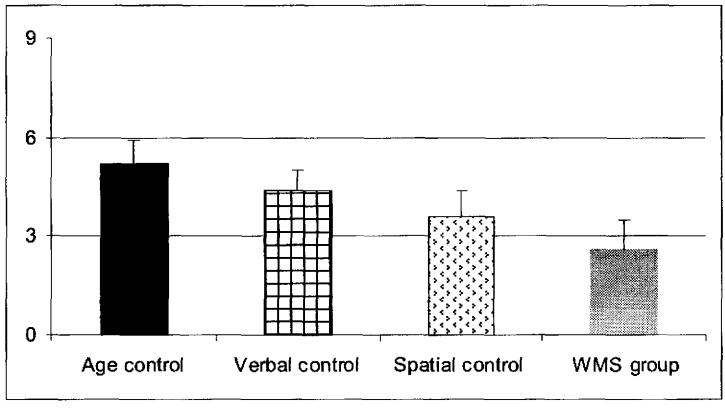

Figure 4. Limitations of spatial working memory span in Williams syndrome subjects

Along with other researchers we also wanted to see the patterning of spatial language in relation to the cognitive limitations in Williams syndrome. As summarized in *Figure 5,* their overall performance in spatial morphology (case

markers and postpositions) was much weaker than in non-spatial morphology such as plurals and accusatives in an elicited production task.

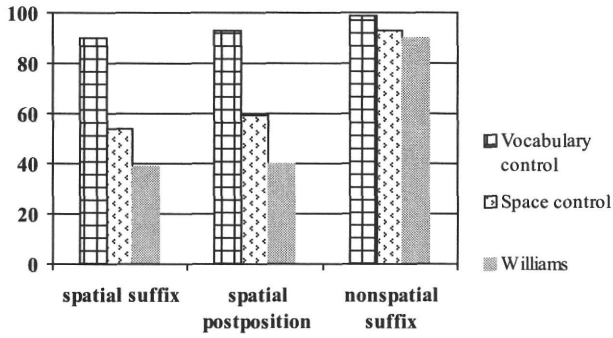

Figure 5. Limitations of Williams syndrome subjects in their spatial morphology compared to other morphology

Regarding the path differences, people with Williams syndrome had an especially hard time with sources, as *Figure 6* shows (Pléh, Lukács, and Racsmány 2002, Lukács 2005).

These data support Landau and Zukowski's (2003) hypothesis: the difficulty with retaining information in memory can account for special difficulty with SOURCE in Williams syndrome. This pattern is similar to what we observe in typical development at earlier stages.

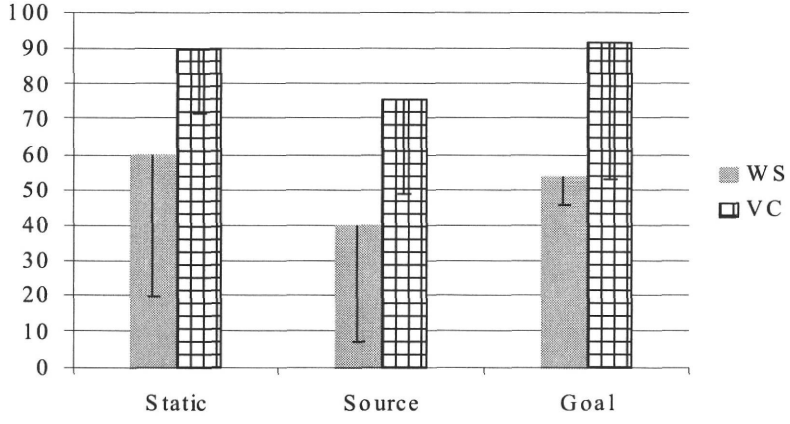

Figure 6. Sources are extremely difficult for Williams syndrome subjects in postposition production

To further test the nature of impairment in spatial language in Williams syndrome, Lukács (2005) also used a sentence completion task to compare the use of spatial suffices in their spatial and in an abstract or mental sense.

Look at sentences a) and b) below.

a) *Pisti tanult a baleset**ből***
Pisti learnt the accident-FROM.
Pisti learnt from the accident.

b) *Az oroszlán megszökött a ketrec**ből**.*
The lion escaped the cage-FROM.
The lion escaped from the cage.

While in (a), the spatial suffix is used in a mental, psychological sense, in (b) it is used in its literal spatial sense. Hypothetically, individuals with Williams syndrome might have difficulties choosing the right suffix with both spatial and non-spatial meanings. Errors with spatial use might arise stemming from the spatial deficit, while errors with the mental verbs might arrive from general cognitive limitations. Or, one may propose that a concrete – abstract acquisition sequence might be true for all speakers, independent of their spatial handicap.

As *Figure 7* shows, the pattern was strikingly similar for both groups. Spatial meanings were easier than non-spatial meaning. We should not forget, however, that in this task the subjects had to perform an entirely linguistic task (sentence completion) that does not necessarily entail activation of spatial representations.

The results imply that when spatial language is not prompted by the need to describe spatial relations in a scene (subjects only had to complete the sentence), WS individuals' special difficulty with spatial language disappears, and, there is better performance in spatial than in non-spatial use. Hence, the severe spatial impairment in Williams syndrome does not interfere with language in itself, and does not lead to a selective impairment of spatial terms *within* language.

In general, spatial language production is seriously impaired in Williams syndrome, but its pattern is the same as in typical development. No qualitative differences were found between typical and atypical development. 'Only' the computational space available for the reference of spatial computations is limited and that strictly limits spatial language use, but spatial language *per se* is not impaired. Difficulties in spatial language thus mirror impairments of spatial cognition, where the crucial mediating variable is limited spatial working memory.

In general, both in typical development and in impaired populations, our data support the effect of universal cognitive factors on the unfolding and organization of spatial language.

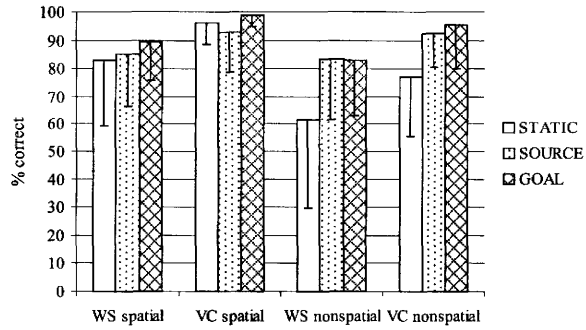

Figure 7. Performance of the WS and VC groups on the task by path type

As a summary, our data indeed indicate that it is worthwhile to use data form different languages in studying the impact of genetic impairments on language development. Data on Hungarian subjects with Williams syndrome help to understand the underlying complexities of the representation of language in the brain (that was the case with regulars and irregulars), and help to show the universal features of the unfolding of the language-cognition interface, even in cases where cognition is seriously challenged (that was the fact with our data on spatial language). The use of several languages in studying these complicated relationships allows us to use language diversity as an experiment in nature to understand another experiment in nature, genetic diversity and genetic disorders.

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