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Evolving Secondary Colours: Evidence from Sorbian

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EVOLVING SECONDARY COLOURS
EVIDENCE FROM SORBIAN

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1. *Introduction*

Lower Sorbian and Upper Sorbian belong to the West Slavonic branch of languages, which also includes Polish, Czech and Slovak.[1] Historically, the Sorbs were in the forefront of the Slavs' push westward, and their territory gradually became encircled by German speakers. The consequence has been that these languages are isolated from the rest of the Slavonic family. There are only 55,000 Upper Sorbian speakers, and Lower Sorbian fares even worse with only 14,000 (Gordon 2005). There are no monolingual speakers in either language. This situation means that there is an urgency attached to any informant-based study of the Sorbian language. In the summer of 2000 we carried out informant work on the lexicon of Lower and Upper Sorbian. We specifically focused on the semantic field of colour for both methodological and theoretical reasons. On the one hand, there are well developed and well documented field methods for eliciting basic colour terms, and on the other, Berlin and Kay's (1969) Basic Colour Terms sequence represents a theory of colour system evolution that has been insightful for psychologists, anthropologists and linguists. Our findings suggest that the colour systems of both languages are still evolving. There is also an indication that the colour space of one category, PURPLE, is larger than expected, and we speculate that this is a direct consequence of the absence of a PINK category. This is of theoretical interest, and we compare these findings with the converse situation in Tsakhur, a Nakh-Daghestanian language spoken in Daghestan and Azerbajdjan, in which PINK is a lexicalized category, but there is no PURPLE category.

2. *Lexicalization of colour categories*

We are using Berlin and Kay's framework here, which has been used to capture the fact that the similarities between colour systems vastly outweigh the differences. However, we acknowledge that there has been considerable

[1] The research reported here was supported by the ESRC (grant no. R000237845). Thanks are due to Nigel Woodger for his technical support in creating the figures.

disagreement in this area. Berlin and Kay's assumption of a basic perceptual colour space is not accepted by all (see, for example, Wierzbicka in this volume), but even those who disagree with Berlin and Kay regarding the origin of colour categories accept the notion of a perceptual colour space. This space may be modified ('stretched' or 'shrunk') by category learning (Özgen & Davies 2002), but these effects are relatively small (Roberson, Davies, Corbett & Bester 2005).

Of the various terms denoting colour in a language, there is an identifiable set which could be described as the 'core' colour vocabulary, or the 'basic' set of terms. Working with the notion of the basic colour term, Berlin and Kay (1969) developed a theory with certain claims of universality regarding the lexical encoding of colour categories. According to their 1969 theory, there is a maximum of eleven basic colour categories, and their emergence is universally highly constrained. This is shown in Figure 1.

$$\begin{bmatrix}\text{white}\\ \text{black}\end{bmatrix} \rightarrow [\text{red}] \rightarrow \begin{bmatrix}\text{green}\\ \text{yellow}\end{bmatrix} \rightarrow \begin{bmatrix}\text{yellow}\\ \text{green}\end{bmatrix} \rightarrow [\text{blue}] \rightarrow [\text{brown}] \rightarrow \begin{bmatrix}\text{purple}\\ \text{pink}\\ \text{orange}\\ \text{grey}\end{bmatrix}$$

Stage I Stage II Stage III Stage IV Stage V Stage VI Stage VII

Figure 1: *Basic Colour Categories sequence (Berlin & Kay 1969:4)*

The sequence can be seen as a constraint on the evolution of basic colour categories and their associated basic terms in a language. In the lexicalization of basic colour categories, languages evolve through Stages I to VII. Hence a Stage V language with a basic BLUE term must have emerged from a Stage IV language which lacked a basic term for BLUE but had such terms for WHITE, BLACK, RED, YELLOW and GREEN. Such a language might evolve to Stage VI where a basic term for BROWN will be added. Note that at Stage VII there is no predicted ordering with respect to the lexicalization of PURPLE, PINK, ORANGE and GREY.

2.1 *Primary and derived colour categories*

A general principle is that primary colour categories are lexicalized before derived ones: primary categories are WHITE, BLACK, RED, YELLOW, GREEN and BLUE, and derived categories are perceptual blends of the primaries, for example ORANGE is perceived as a blend of RED and YELLOW. As perceptual blends, derived categories are predicated on the primaries, and, in Figure 1, they appear at stages that follow on from those of the primaries. Although the Berlin

and Kay theory has undergone a number of revisions, the principle remains that derived colour categories and their terms appear only in the later stages. Figure 2 shows a revised model (Kay & McDaniel 1978; Kay, Berlin, Maffi & Merrifield 1997).

[White/Red/Yellow, Black/Blue/Green] Stage I
> [White, Red/Yellow, Black/Blue/Green] Stage II
> [Green, Black/Blue, White, Red/Yellow] Stage III
> [Red, Yellow, White, Green, Blue/Black] Stage IV
> [Black, Blue, Green, White, Red, Yellow] Stage V
> [Brown, Black, Blue, Green, White, Red, Yellow] Stage VI
> [Purple, Orange, Pink, Black, Blue, Green, White, Red, Yellow] Stage VII

Figure 2*: The revised Berlin and Kay sequence*

In the early stages, a language has composite categories, that is categories consisting of more than one primary colour, but denoted by a single basic colour term. For example at Stage I there is a term which denotes simultaneously the three primary colour categories of WHITE, RED and YELLOW. The path of colour category evolution often consists of "the progressive differentiation of colour categories" (Kay & McDaniel 1978:617). The first steps in this process involve the division of a composite category into distinct primary categories. The result of this partitioning, where it is fully carried out, is a number of distinct primary categories that are contiguous in the colour space, for example RED and YELLOW. This means that, for a Stage V language, a term for RED includes focal red but also covers areas impinging on, but not including, focal yellow. There are exceptions to this process, but Kay and Regier (2003) still claim that the generalization fits most languages.

To capture the qualitative aspects of colour terms, colour categories are viewed as fuzzy sets with the 'best' members closest to the focal point, and the 'worst' members furthest away. The boundary of a colour category is fuzzy, and is ultimately set by the focal point of the contiguous category. A second step of category differentiation, where taken, is to distinguish as separate categories the regions where colour categories meet, and these then constitute the derived categories. The category between YELLOW and RED is ORANGE. This evolutionary sequence describes a very common route, but by no means the only one. Davies et al. (1992), for example, describe the colour system of Setswana, a Bantu language spoken in Botswana, which has simultaneously a green-blue ('grue') composite term and a basic term denoting BROWN. Again using fuzzy set theory, the 'best' ORANGE will be closest to the midpoint

between RED and YELLOW. This can be seen in Figure 3, a graphical representation of the distribution of English basic colour terms used to name stimuli representing a sample of the colour space.

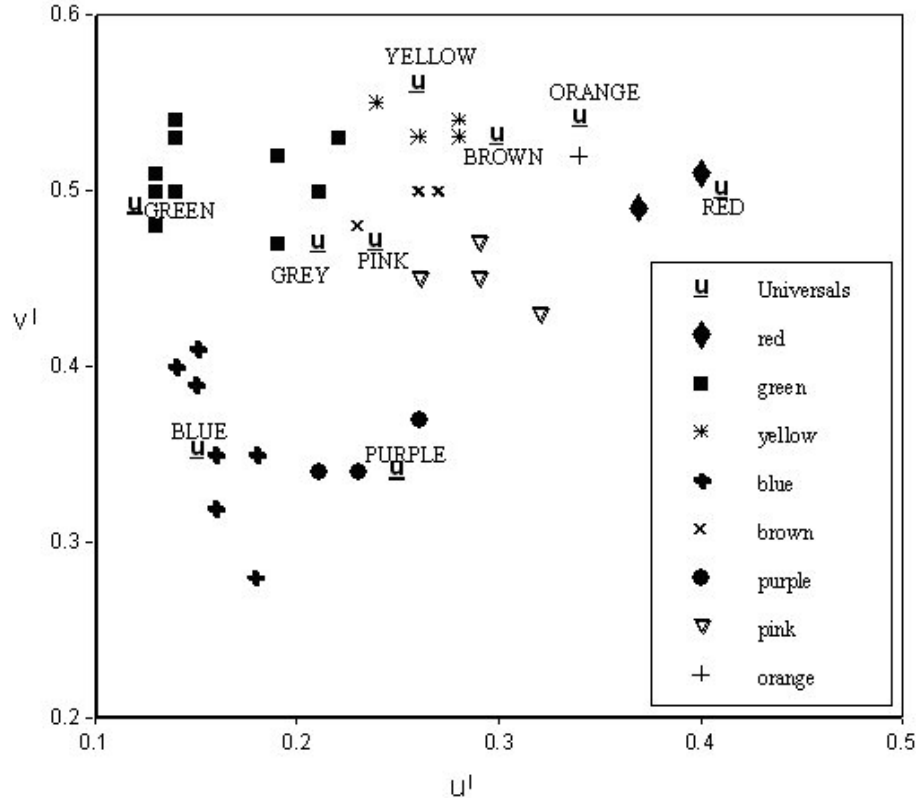

Figure 3*: English colour terms in CIE uniform chromaticity space*[2]

The **u** (universals) shows the locus of the category focus (as in Berlin and Kay 1969), the 'best' member of the category in fuzzy set terms. The symbols show the loci of the stimuli, with the symbol's interpretation in the legend at the right-hand side. The stimuli closer to the focus are 'better' members of the category. For ORANGE the universal is clearly at midpoint between focal YELLOW and RED. A prediction from the model is that Stage VI and VII languages, whose derived category terms have evolved, should have a retracted primary colour space. There appears to be exaggerated evidence of this from Tsakhur where, although the term for YELLOW (*zirgin*) denotes focal YELLOW,

[2] For details of CIE uniform chromaticity space, see Davies, Sosenskaja & Corbett (1999:202).

much of the YELLOW space is covered by the ORANGE term *Gi̯|bi̯n* We will see that the data from Sorbian suggest that it is not only primary colour space that is dependent on the presence of derived colour categories, but derived categories are affected by the absence or presence of other derived categories.

2.2 *Eliciting basic colour terms*

A set of tests has been developed which has been widely used to assess the salience of colour terms in a language, and these can be used to elicit the language's basic colour terms. Full details are reported in Corbett and Davies (1997). The data we present are the result of two informant based tests: the 'list task' and the 'colour naming task'. In the list task colour terms are elicited by asking informants to list as many colour terms as they can think of within a specific stretch of time. The frequency of occurrence of a colour term across informants, as well as the rank position in which it occurs on the questionnaires, are used as measures of the term's salience. Higher frequency and greater prominence in the ordering correspond to greater likelihood that the term is basic. In the naming task, colour tiles representative of the colour space are assigned a colour term by the informant. The salient terms are marked out by high frequency of occurrence and high degree of consensus in the tiles they denote.

3. *Lower Sorbian and Upper Sorbian colour survey*

The Sorbian languages are Slavonic languages spoken within Germany in a small area of Brandenburg and Saxony, west of the River Neisse and east of a line drawn north to south from Calau, Senftenberg, Kamenz and Bischofswerda (Stone 1993:593-594). The Sorbs of Upper and Lower Lusatia are descendants of one of the many tribes of the Northwest Slavs who by the seventh century had spread as far west as the Baltic (Schenker 1995:46-47). A candidate set of basic colour terms for Lower Sorbian and Upper Sorbian is given in Stone (1993:677), deduced from dictionary searches. This is given in Table 1 and serves as a starting point for our informant based study.

The list in Table 1 partially corroborates the Berlin and Kay theory in that the primary category terms have roots in the (reconstructed) proto-language, Proto-Slavonic (for details see Herne 1954; Schenker 1993:111-112). The exception is *modry* and *módry* "blue", cognates of which are found chiefly in West Slavonic, suggesting it is a later, West Slavonic innovation (Zaręba 1954:47-49; Hippisley 2001:169-171). Regarding the derived terms, the term for BROWN (*bruny*) is the earliest attested of these terms, and was most likely a fifteenth-century borrowing from Middle High German (Schuster-Šewc 1978:74). Again, BROWN being the first derived category fits with the

Lower Sorbian		Upper Sorbian	
primary category terms		primary category terms	
běły	white	*běły*	white
carny	black	*čorny*	black
cerwjeny	red	*čerwjeny*	red
zeleny	green	*zeleny*	green
žołty	yellow	*žołty*	yellow
modry	blue	*módry*	blue
derived category terms		derived category terms	
bruny	brown	*bruny*	brown
purpurowy	purple? (crimson)	*fijałkowy*	purple
rožowy	pink	*różowy*	pink
oranžowy	orange	*1. oranžowy*	orange
		2. pomorančojty	
1. *šery*	grey	*1. šěry*	grey
2. *šeźiwy*		*2. šědźiwy*	

Table 1: *Candidate basic colour terms of Lower Sorbian and Upper Sorbian*

evolutionary model (see Section 2.1). As for the other derived categories and their terms, there is some doubt over PURPLE, since Lower Sorbian *purpurowy* denotes a crimson colour according to Stone (1993). The most recent Lower Sorbian-German dictionary, Starosta (1999), gives the German equivalent as *purpurn*, a term which denotes "crimson". There are two terms for GREY in both languages, and Stone (1993) notes that there is little distinction between them. There are also two ORANGE terms in Upper Sorbian. The psychological salience tests we carried out allow us to explore some of the questions raised by Stone's list.

3.1 *Results of the list task*

The list task was carried out on sixteen speakers of Lower Sorbian and sixteen speakers of Upper Sorbian. All informants were bilingual in German. For Lower Sorbian, six informants were female and ten male, with their ages ranging from forty-one to eighty-five years. The task was carried out in Cottbus

and the surrounding villages.[3] For Upper Sorbian, nine informants were female and seven male, with ages ranging from thirty-three to fifty, as well as one seventeen year-old. All informant work was carried out in Bautzen.[4] Tables 2 and 3 give the Sorbian terms elicited (at least three times).

In Table 2, the primary category terms suggested by Stone are all placed within the eleven most frequently occurring terms, and, with the exception of the terms for BLUE and RED, are the highest ranking terms. For the derived terms, there appears to be confirmation that *bruny* is the basic BROWN term, and, of the two GREY terms in Stone's list, *šery* is within the eleven most frequently occurring terms, while *šeźiwy* does not appear. The list task also suggests that the basic PURPLE category term in Lower Sorbian is not *purpurowy* (as in Stone's list) but *lylowy*, which appears on every list bar one. The low frequency of *rožowy* "pink" casts doubt on the basicness of this term, as does that of the term given for ORANGE (*oranžowy*). Finally, we should note that there are two terms for BLUE in the list, *modry* and *płowy*. The latter is restricted to certain villages north-west of Cottbus, and is reported in Fasske, Jentsch and Michałk (1972:119) as being a dialectal equivalent of *modry*.[5] At this stage, the conclusion would be that Lower Sorbian has nine basic colour terms (using Berlin and Kay's definition), with emergent terms for the PINK and ORANGE categories.

From Table 3 we can see that there are nine terms with a frequency of over 80%, and these are all terms appearing in Stone's list. As with Lower Sorbian, the first of Stone's terms for GREY, *šěry*, has a high frequency. And, also as with Lower Sorbian, the PINK category term, *różowy*, is marginal, with a frequency of 62.5%. The ORANGE term, *oranžowy*, has a very low frequency of 37.5%, and there is no appearance of the alternate ORANGE term, *pomorančojty*.

On the evidence so far, we reach the following tentative conclusion. Both Lower Sorbian and Upper Sorbian have basic terms for all the Berlin and Kay colour categories, except for ORANGE and possibly PINK. A difference between the languages occurs in the PURPLE category where Lower Sorbian has the term *lylowy* and Upper Sorbian uses the term *fijałkowy*.

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[3] We are very grateful to Madlena Norberg for helping to coordinate the Lower Sorbian informants.

[4] Thanks to Gerald Stone, who provided the Lower and Upper Sorbian translations for the questionnaire.

[5] For a fuller discussion of *płowy* as a Lower Sorbian colour term see Steenwijk (2000).

term	gloss	frequency		rank
		occurr.	as %	
běły	white	16	100.00	2.5
carny	black	16	100.00	2.5
zeleny	green	16	100.00	2.5
žołty	yellow	16	100.00	2.5
bruny	brown	15	93.75	6.0
lylowy	purple	15	93.75	6.0
šery	grey	15	93.75	6.0
cerwjeny	red	14	87.50	8.0
modry	blue	13	81.25	9.0
rožowy	pink	9	56.25	10.5
płowy	blue OR pale yellow	9	56.25	10.5
swětłomodry	light blue	7	43.75	12.0
oranžowy	orange	6	37.50	13.0
šamnozeleny	dark green	4	25.00	15.5
šamnomodry	dark blue	4	25.00	15.5
swětłozeleny	light green	4	25.00	15.5
pisany	coloured	4	25.00	15.5
fijałkowy	purple	3	18.75	21.0
pinkowy	pink	3	18.75	21.0
šamnobruny	dark brown	3	18.75	21.0
šamnocerwjeny	dark red	3	18.75	21.0
nazeleny	greenish	3	18.75	21.0
swětłožołty	light yellow	3	18.75	21.0
nabruny	brownish	3	18.75	21.0
wioletny	purple	3	18.75	21.0
slobrany	silver	3	18.75	21.0

Table 2: *List task; Lower Sorbian informants (N=16)*

On the evidence so far, we reach the following tentative conclusion. Both Lower Sorbian and Upper Sorbian have basic terms for all the Berlin and Kay colour categories, except for ORANGE and possibly PINK. A difference between the languages occurs in the PURPLE category where Lower Sorbian has the term *lylowy* and Upper Sorbian uses the term *fijałkowy*.

term	gloss	frequency		rank
		occur.	as %	
běły	white	16	100.00	2.5
čorny	black	16	100.00	2.5
žołty	yellow	16	100.00	2.5
fijałkowy	purple	16	100.00	2.5
čerwjeny	red	15	93.75	6.0
zeleny	green	15	93.75	6.0
bruny	brown	15	93.75	6.0
módry	blue	13	81.25	8.5
šěry	grey	13	81.25	8.5
różowy	pink	10	62.50	10.0
swětłomodry	light blue	8	50.0	11.0
swětłozeleny	light green	7	43.75	12.5
ćmowozeleny	dark green	7	43.75	12.5
ćmowomodry	dark blue	6	37.50	15.0
oranžowy	orange	6	37.50	15.0
swětłobruny	light brown	6	37.50	15.0
ćmowobruny	dark brown	5	31.25	17.0
złoty	gold	3	18.75	18.5
slžborny	silver	3	18.75	18.5

Table 3: *List task; Upper Sorbian informants (N=16)*

3.2 *Results of the naming task*

In the naming task informants are asked on an individual basis to name sixty-five colour tiles chosen to represent the colour space and shown in random order.[6] The same set of informants who took part in the list task also performed the colour naming task, with the single exception of one Upper Sorbian informant who only performed the list task. Tables 4 and 5 summarize the results. In the tables, the sixteen most frequently elicited terms are ranked in frequency order. Modified terms have been counted in with simplex terms, for example *swětłocerwjeny* "light red" is counted as an instance of *cerwjeny* "red". Columns 4 to 9 are used to give a measure of consensus and are discussed below.

[6]The sixty-five tiles give an even distribution in CIE uniform chromaticity. See Davies, Sosenskaja and Corbett (1999) for details about these stimuli.

term	gloss	freq.	nmf	D 0.5	D 0.75	D 0.9	dtf	spec.
zeleny	green	165	13	10	8	7	144	0.87
modry	blue	137	11	10	4	0	121	0.88
lylowy	purple	106	10	7	0	0	76	0.72
cerwjeny	red	89	5	4	2	1	50	0.56
šery	grey	77	5	4	4	2	57	0.74
różowy	pink	65	6	1	0	0	9	0.14
bruny	brown	64	5	4	3	2	55	0.86
žołty	yellow	62	4	3	3	3	46	0.74
carny	black	46	2	2	2	2	32	0.70
płowy	blue	37	0	0	0	0	0	0.00
oranžowy	orange	32	3	0	0	0	0	0.00
wioletny	purple	27	0	0	0	0	0	0.00
běły	white	16	1	1	1	1	15	0.94
šerozeleny	grey-green	9	0	0	0	0	0	0.00
oker	ochre	8	0	0	0	0	0	0.00
fijałkowy	purple	7	0	0	0	0	0	0.00

Table 4: *Colour naming summary; Lower Sorbian (N=16)*

From Table 4 we see that very nearly the same nine terms that performed well in the list task (Table 2) also have the highest frequencies in the naming task. The exception is *běły* "white", ranked thirteenth. This should be seen, however, as an artefact of the task, since only one tile in the sample could be described as pure white.[7] This tile was given the same label (*běły*) by over 90% of all informants, and this confirms that a simple frequency score is inadequate as a measure of salience; we also need to score consensus of use amongst informants. To do this we calculate a term's 'dominance', that is the degree to which it is used for a particular tile. The number of tiles for which a term is the most frequently used is recorded in the *nmf* column (column 4), for example *zeleny* "green" is used most frequently for thirteen tiles. Of those tiles, we distinguish those for which the term is dominant, meaning those for which *zeleny* is used in over 50% of the naming exercises. A finer analysis is also possible by distinguishing between degrees of dominance: we record separately the number of tiles for which the proportion is greater than 50% (D 0.5), the number where it is greater than 75% (D 0.75), and where it is greater than 90% (D 0.9). Thus for *zeleny* "green", we see that it is the most frequent term for

[7] The same did not happen for BLACK because *two* tiles were labelled as *carny* "black" by many of the informants, since the sample included a very dark grey tile (GRAY 8).

thirteen tiles and of these it is dominant for ten tiles. Amongst the tiles for which it is the dominant term, it has over 75% of the share of all terms offered for eight tiles and over 90% for seven. Dominance is summarized in the last column using the specificity score, which is the proportion of its total use for which it is a dominant term, that is the frequency of its uses for its dominant tiles (the *dtf* given in column 8) over the frequency of all its uses (given in column 3). For *zeleny* this is 0.87, meaning that 87% of all its occurrences represent high consensus of use amongst informants. Returning to *běły* we see that, although its frequency is lower than those of the other putative basic terms, it has the highest specificity score (0.94).

We can view the results of the naming task as further evidence that Lower Sorbian has at least nine basic colour terms, the same as those suggested by the list task. These terms have high frequency rankings and / or high specificity scores. As in the list task, the term for PURPLE is *lylowy*, the third most frequent term, and it has a high consensus index (dominant for seven out of ten of the tiles for which it is the most frequent term, and having a specificity score of 0.72). Other PURPLE category terms elicited were *wioletny* and *fijałkowy*, neither with any claim to basicness (they have low rank frequency and specificity scores of 0.00). The list task suggested that Lower Sorbian lacks basic terms for ORANGE and PINK and we find further evidence for this suggestion from the naming task. The term *oranžowy* "orange" has a low rank frequency, as well as a low consensus index. Although it is the most frequently elicited term for three tiles, it is not dominant for any of them, and this is reflected in its specificity score of 0.00. The term *różowy* "pink", on the other hand, has a high rank frequency, but again it performs badly on the consensus index with a specificity of 0.14, that is there has been consensus in the term's use on only 14% of all the occasions it was used to name a tile. It is only dominant for one tile and in fact on closer inspection we see that it covers only 56% of the terms used to name the tile, in other words, it is barely dominant. The results of the naming task for Upper Sorbian are given in Table 5.

The candidate basic terms suggested by the list task for Upper Sorbian also perform well in the naming task when we take both frequency and consensus into account. There is strong evidence that the PURPLE category principal term in Upper Sorbian is *fijałkowy*, based on both frequency, where it is the third most frequent term, and consensus, where it is dominant for eight tiles, and has a specificity score of 0.76. From the list task, as with Lower Sorbian, doubt surrounds the basic status of terms for the Upper Sorbian PINK and ORANGE categories. In the naming task, the PINK category term (*różowy*) has a low frequency and a low specificity score (0.25). It is dominant for one tile, but only

term	gloss	freq.	nmf	D 0.5	D 0.75	D 0.9	dtf	spec.
zeleny	green	142	13	9	8	6	123	0.87
módry	blue	138	13	9	7	6	119	0.86
fijałkowy	purple	116	11	8	3	1	88	0.76
šěry	grey	74	5	5	4	2	66	0.89
čerwjeny	red	72	5	4	3	1	51	0.71
oranžowy	orange	55	4	3	2	0	35	0.64
bruny	brown	49	4	3	3	1	40	0.82
žołty	yellow	44	3	3	3	1	39	0.89
čorny	black	35	2	2	1	1	25	0.71
różowy	pink	32	6	1	0	0	8	0.25
lila/lylowy	purple	19	0	0	0	0	0	0.00
běły	white	17	1	1	1	1	14	0.82
modrozeleny	blue-green	11	1	0	0	0	0	0.00
pink	pink	9	1	0	0	0	0	0.00
modrošěry	blue-grey	7	1	0	0	0	0	0.00
purpurowy	purple	7	0	0	0	0	0	0.00

Table 5: *Colour naming summary; Upper Sorbian (N=15)*

marginally so, representing only 53% of the terms used to name tile RO-T3. This is further evidence against the existence of a basic term for PINK in Upper Sorbian. While, in the case of PINK, the evidence from both tests appears to be compatible, this is not the case with ORANGE. We may recall that, in the list task (Table 3), *oranžowy* performed particularly badly: it had a frequency of 37.5% and a ranking of 15, pushing it well beyond the bounds of the group of terms considered basic. From Table 5, however, we see that it has a strong frequency ranking of 6 and is dominant for three tiles, two of which it dominates at over 75%. This is reflected in a strong specificity score of 0.64.

4. *Discussion: colour category lexicalization and its effect on the colour space*

The results of the tests outlined above suggest that the two languages under investigation lack a basic term denoting PINK, and that Upper Sorbian probably has a basic ORANGE term, whereas in Lower Sorbian this term is emergent at best. The most interesting finding, however, is the effect of a weak concept of PINK on the colour space. When we translate the results of the naming task into a graph representing the CIE uniform chromaticity space, the purple region appears to be larger than expected. In section 2 we outlined the progressive differentiation approach to basic colour term evolution, and made the point that,

since primary categories are contiguous, the colour space of a primary term is larger in the absence of a related derived term. In the case of both Lower and Upper Sorbian, the absence of a basic derived term for PINK seems to be affecting the colour space of another derived term, that for PURPLE, by letting it expand beyond its expected margins. This is shown in Figure 4 for Lower Sorbian.

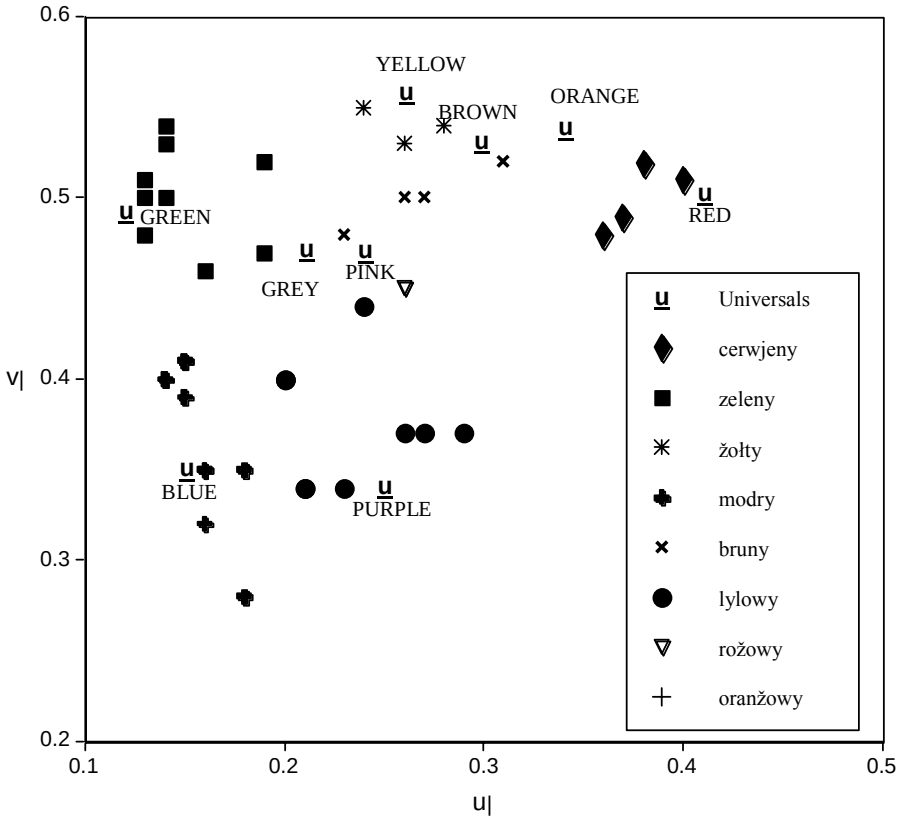

Figure 4: *Loci of Lower Sorbian terms in CIE uniform chromaticity space*

The legend for Figure 4 gives the names of the eleven candidate colour terms and a corresponding symbol. The symbols plot the coordinates of the tiles which the term dominates. Focal points are denoted by **u**. The graph for Lower Sorbian is very similar to that of English, as discussed in Section 2 (see Figure 3). The main differences are found in the purple region, which for Lower Sorbian extends nearly as far as focal pink. The purple space is much more restricted for English. Interestingly, the small extent of the pink area does not have a similar effect on the brown colour space, which is almost identical to that of English.

Figure 5 gives the CIE graph for Upper Sorbian. As has been mentioned, the case for a basic PINK term is even weaker in Upper Sorbian than in Lower Sorbian.

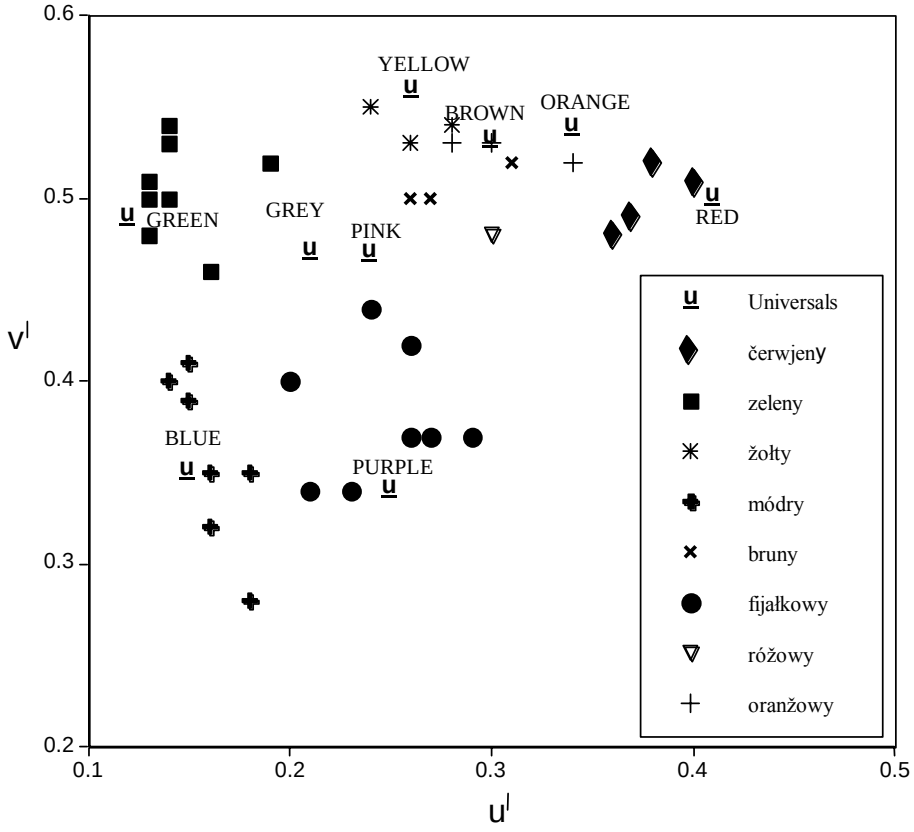

Figure 5: *Loci of Upper Sorbian terms in CIE uniform chromaticity space*

There is only one tile for which the PINK term is dominant, and it corresponds to a point that is some distance from the focus of pink. The graph clearly shows that the expanded purple region is even more exaggerated here than it is for Lower Sorbian, strongly suggesting that the expanded space is the result of a small PINK area. As for ORANGE in Upper Sorbian, the term *oranžowy* was identified with three tiles in the naming and mapping tasks, and we can see from the graph that one occupies a point in the colour space where a basic ORANGE term might be expected, although the others are closer to the yellow region.

The Sorbian data indicate a dependence of the purple colour space on the evolutionary status of the PINK category. This raises the question of whether

another colour system with a basic PINK category but without one for PURPLE might alternatively demonstrate a dependence of the pink colour space on a still-evolving PURPLE category. Tsakhur has such a colour system, according to results using the same elicitation methods and the same tile set as were used for Upper and Lower Sorbian (Davies, Sosenskaja & Corbett 1999). Figure 6 is the CIE graph of the results of the Tsakhur naming task, in which only tiles for which the terms were dominant have been plotted.

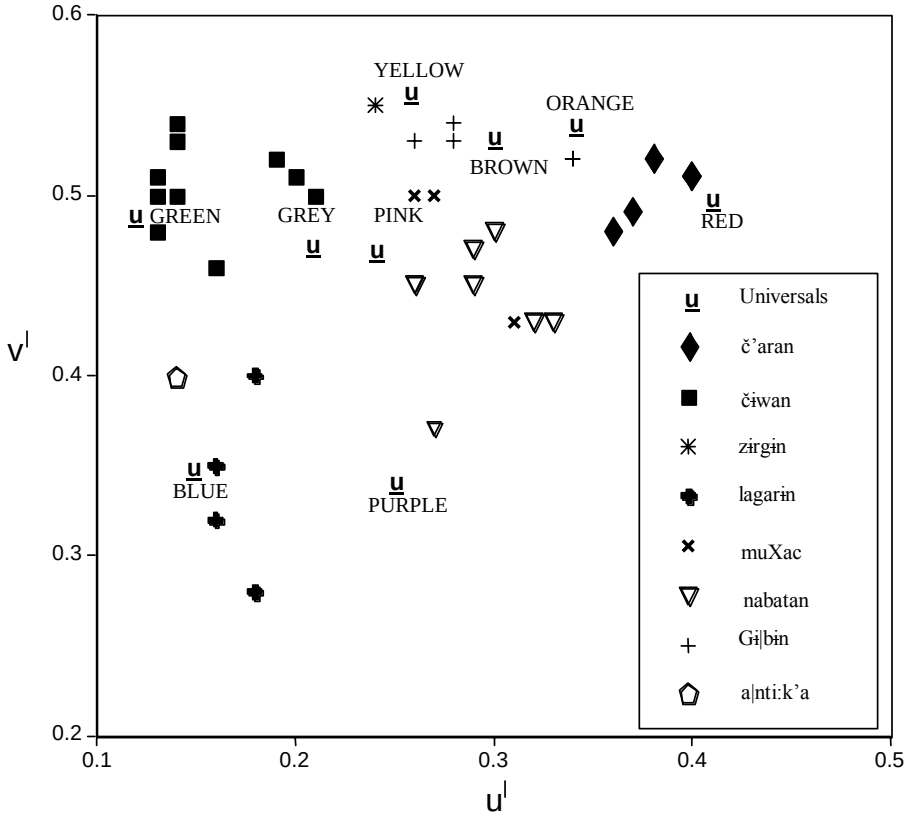

Figure 6: *Loci of Tsakhur terms in CIE uniform chromaticity space*

Key: *č'aran* "red", *čɨwan* "green", *zɨrgɨn* "yellow", *lagarɨn* "blue", *muXac* "brown" nabatan "pink", *Gɨ|ɨn* "orange", a|*nti:k'a* "turquoise

The colour space occupied by the Tsakhur terms is broadly similar to that of English (Figure 3). Where it differs is in regard to the purple and pink areas. In Tsakhur, the candidate term for PURPLE (*žangarɨn*) has no tiles for which it is dominant, hence no term covers the purple space on the graph. What is clearly seen is that the term for PINK (*nabatan*) extends well into what would be the purple space, as well as covering the pink space in the expected way.

5. *Conclusions*

To summarize, our informant work presents evidence that Upper and Lower Sorbian have colour systems that are still evolving. Both lack a basic term for PINK, and, whereas Lower Sorbian lacks a basic term for ORANGE, Upper Sorbian seems to have recently acquired one. An interesting theoretical finding is that the colour systems of two related languages (Upper Sorbian and Lower Sorbian) and one unrelated language (Tsakhur) appear to show the same phenomenon: the presumed colour space of a derived category is a function of another derived category. In each case, the derived categories in question are PINK and PURPLE. It is already known that primary colour space can retract upon the emergence of a basic derived category; Figure 6 shows this dramatically for Tsakhur YELLOW in the face of a strong ORANGE. Our findings suggest that, like the primary categories, the later derived categories may also require further evolutionary processes before they themselves are fully settled.

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