Cross-linguistic similarity affects L2 cognate representation: *blu* vs. *blue* in Italian-English bilinguals

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In a psycholinguistic study we explored semantic shifts of focal colours for 'blue' terms in Italian-English bilinguals. Italian speakers require more than one basic colour term to name blue colours: *blu* 'dark blue' and *azzurro* 'light/medium blue'; *celeste* 'sky/light blue' is salient, too [1-2]. Participants were Italian-English bilinguals residing in Liverpool (N=13). Their naming data, collected in two languages (L1, L2), were compared to those of Italian (N=13) and English (N=16) monolinguals. An unconstrained colour naming method was used to name each Munsell chip (M=237) embracing the BLUE area of colour space. Participants also indicated the best example (focal colour) of *blu, azzurro* and *celeste* (Italian) or *blue* and *light blue* (English). Here we report two main findings: (i) Lightness shift: for the majority of the bilinguals, their L2 *blue* foci are semantically down-shifted towards L1 *blu* 'dark blue' foci. The semantic shift is thought to result from cross-linguistic similarity between the homophone Italian *blu* and English *blue*, facilitating asymmetric L1–L2 mediation in favour of the dominant language representation; (ii) Hue shift: proficient bilinguals revealed a hue shift of the L1 *azzurro* focus from azure, characteristic of Italian monolinguals, towards that of English monolinguals' *blue*, with a purplish hint. The findings indicate Whorfian effects, or modulation of semantic-lexical representations, in proficient bilinguals immersed in L2 and, in addition, point to their integrated mental lexicon.

Introduction

Language specific concepts direct attention to certain perceptual attributes of reality. The universalist stance holds that imprints of perception and cognition are universal and as such are common for languages. In contrast, according to the relativist view, the factors governing categorisation are particular to a person's culture. In addition, perception of the world is influenced by the semantic categories of a person's native language, and these categories vary across languages with few constraints – the conjecture known as the Sapir-Whorf hypothesis of linguistic relativity.

Colour naming across languages is ideal for testing the predictions of both theories. In this domain, the universalist viewpoint is represented by the Berlin and Kay [3] hypothesis: (i) languages can contain up to 11 basic colour terms (BCTs) consistently appearing in a given language's colour lexicon; (ii) colour categories are organised around universal focal colours. In a later model, based on data from the World Color Survey, Kay and Maffi [4] elaborated (iii) the evolutionary sequence of colour category acquisition.

In comparison, according to the now broadly accepted weak relativity hypothesis, advocated, e.g., by Roberson and associates [5-6], boundaries of colour categories vary cross-linguistically affecting colour perception and cognition.

Colour naming in bilinguals, i.e. persons who use two languages in everyday life [7], is a means of testing the two theoretical views. It also opens an avenue to investigate whether bilingual's cognitive representation of colour varies depending on which language is used. One possibility is that bilinguals do partition colour space differently in their two languages, native language (L1) and second language (L2), and code-switch between the two distinct conceptual systems when using L1 or L2. An alternative possibility is a shift in colour concepts – focal colours and category boundaries – in either L1, or L2, or both affected by another language [8]. The paradigm in such research is to compare bilinguals' colour naming and categorisation to that of monolingual speakers of the corresponding languages.

To our knowledge, studies on bilinguals' colour naming and colour categorisation are not abundant; these converge though in the conclusion that bilinguals' colour naming and categorisation deviate from those of monolinguals of each language. Below several findings are listed that provide evidence of Whorfian effects and cross-language modulation:

- Bilinguals' colour categories are less stable than those in L1 monolinguals; for BCTs their focal colours are shifted towards those of monolingual speakers of L2 (semantic convergence) [9-12];
- Bilinguals reveal a hybrid colour naming that comingles the naming tendencies exhibited by the L1 and L2 monolingual groups but not identical to these (e.g. use of modifiers vs. non-BTCs). Consensus in colour naming is increased among bilinguals, since they tend to use BCTs more frequently, probably due to a focus on what is shared across their two languages and/or a L1 vocabulary attrition that in the first instance affects less frequently used terms describing subtleties of colour appearance [13-15];
- The denotative ranges of category mappings are specific for L1 and L2 in predictable ways for each language. The choices of focal colours, in comparison, are very close – with the exception though of lower agreement on foci in the colour space area which is denoted by one category in one language but by two categories in another one (e.g. English *green* vs. Korean *Choloksayk* 'basic green' and *Yentwusayk* 'yellow-green/light green') [16];
- Perceptual distinction of colours – L1-like or L2-like – depends on several factors:
  o the level of L2 proficiency (major factor);
  o the language used most frequently in daily activities;
  o the length of immersion in an L2-speaking environment (modulating factor).

These factors indicate that ultimately it is (i) language exposure that drives the observed modulation in bilinguals' colour cognition [17] and, as bilingual studies in other domains have demonstrated, (ii) the communication pressure (for a review see e.g. De Bot, 2008 [18]).

In the present study we explored a possible semantic shift of focal colours for 'blue' in Italian-English bilinguals. Recent psycholinguistic studies provide accumulated evidence that Italian has more than one BCT for 'blue', in accord with the weak relativity hypothesis. However, specific characteristics of

conceptualisation of the BLUE area were demonstrated to depend on the region in Italy and, hence, exposure to the corresponding dialect, with the La Spezia-Rimini Line marking a series of isoglosses that distinguishes Northern Italian speech from that of Tuscany, home of the Standard Italian language [cf. 19].

Diatopic variation manifests itself in the number of Italian *basic* colour terms for 'blue': in Verona (Veneto region) the two identified BCTs are *azzurro* 'azure, light blue' and *blu* 'dark blue' [2, 20]; in comparison, three BCTs denoting the BLUE area of colour space, *celeste* 'sky blue, light blue', *azzurro* 'medium blue' and *blu* 'dark blue', are demonstrated for speakers in Florence (Tuscany) [1, 21] and Alghero (Algherese Catalan dialect, Sardinia) [22]. The multiple 'Italian blues' are conjectured to have emerged in response to the cognitive need to differentiate between the colours of the sky and the water of the Mediterranean Sea [21, 23]. In addition, linguistic and denotative refinement of the BLUE area in Italian is probably influenced by culture-specific practices leading to distinct functional loads of the two 'Italian blues' [cf. 2, 24-25].

The case of blues in Italian bilinguals is particularly interesting in view of findings for Greek-English bilinguals [12]. In his study Athanasopoulos [12] estimated best exemplars (foci) of two Greek BCTs for 'blue', *ble* 'dark blue' and *ghalazio* 'light blue', using colours of the Munsell Mercator projection, i.e. fully saturated and varying in hue and lightness. Advanced bilinguals, with high proficiency in English and long acculturation, revealed a shift of the *ble* foci towards the *blue* focus of English monolinguals along the Munsell Value (lightness) dimension. Moreover, the focus of *ghalazio* appeared to be shifted away from the *blue*, to maintain the lightness perceptual distance between the two native-language 'blue' foci.

In view of these findings, for Italian-English bilinguals we anticipated a semantic shift of the *blu* 'dark blue' focus towards the English medium-lightness *blue* focal colour, accompanied by corresponding shifts of *azzurro* and *celeste* away from the *blue* focus (a Whorfian effect). We also explored the role of linguistic and the socio-cultural factors indicated above.

Method

Participants were Italian-English bilinguals (N=13; 6 females; 22-58 y.o.; Liverpool); Italian monolinguals from Alghero, Sardinia (N=13; 7 females; 19-48 y.o.) and British English monolinguals (N=16; 12 females; 19-48 y.o.; Liverpool). All had normal trichromatic colour vision as diagnosed with the Ishihara Pseudoisochromatic Plates [26]. None had reported any ocular disease, eye surgery, diabetes or use of a medication that could have affected colour vision.

Almost all bilinguals were either academic staff or university students. The level of their proficiency in English was assessed using the Nation Vocabulary Test [27]. This estimates vocabulary at five levels, ranging from the 2,000-word up to the 10,000-word level, with the score 80-90 (maximum) indicating advanced level [cf. 12]. In addition, information was obtained on the bilinguals' place of birth, age of L2 acquisition, duration of immersion in the L2 environment and the percentage of weekly English use. Table 1 shows that all, apart from three, were late bilinguals, i.e. have acquired L2 at the age of 6 years or later [28]. The majority of participants were originally from Central Italy, Lombardy and Emilia-Romagna, two from Sardinia; one early bilingual was born in North-West England, UK. Advanced bilinguals (N=8), with Nation Test scores 78-90, are highlighted by bold face.

Bilinguals	Gender	Age	Immersion duration	Nation Test score	Age of L2 acquisition	%Weekly English
DB	M	35	**10 years**	**88**	**6**	**95**
EB	F	35	**10 years**	**90**	**8**	**90**
ER	F	24	2 months	74	23	70
FA	M	47	**17 years**	**85**	**14**	**95**
FB	M	29	**3 years**	**78**	**8**	**80**
FS	F	32	11 months	67	11	80
MG	M	30	**25 years**	**85**	**0***	**90**
MZ	M	42	**16 years**	**89**	**6**	**80**
NM	F	22	4 months	72	8	70
PD	M	56	5 years	72	5*	60
PG	F	58	**38 years**	**89**	**3***	**80**
SC	M	22	4 months	66	14	70
VA	F	32	**6 months**	**84**	**15**	**80**

*Table 1: Summary of the bilinguals' details. In bold face are advanced bilinguals; * indicates early bilinguals.*

Stimuli. From *The Munsell Book of Color* (glossy edition), we employed eight charts embracing the BLUE area, with Hue 7.5BG, 10BG, 2.5B, 5B, 7.5B, 10B, 2.5PB, 5PB (illustrated in Figure 1). Value of the Munsell chips varied between 2-9 and Chroma varied (even number notation) from 2-10, or 12 in 10B, 2.5PB, 5PB.
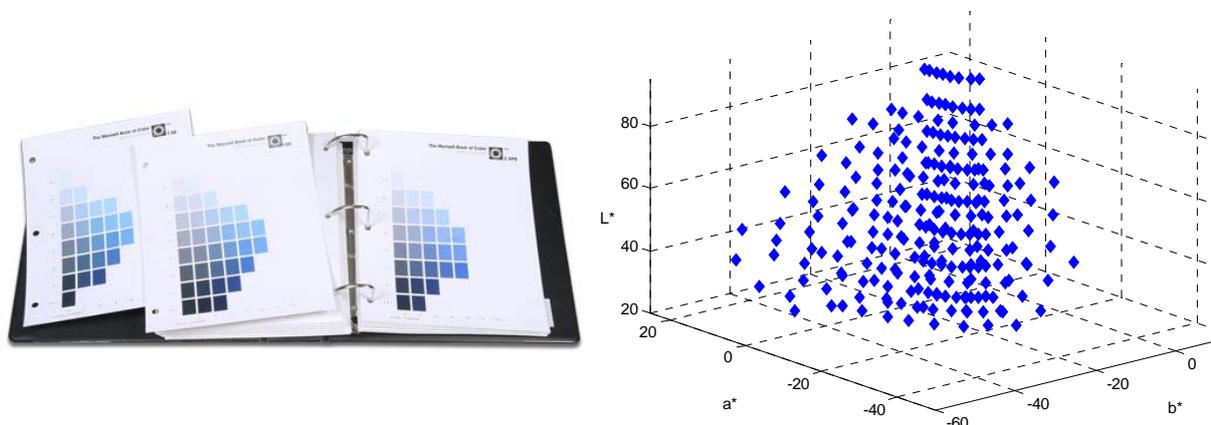

Figure 1 (left): Examples of three BLUE area Munsell charts[1].

Figure 2 (right): Munsell BLUE area stimuli (M=237) presented in CIELAB space.

For purposes of further analysis, Munsell coordinates of the stimuli (M=237) were also re-notated in CIELAB space[2], as presented in Figure 2.

Procedure. After adaptation to mesopic lighting, charts were presented in a viewing booth under D65-metameric illumination (Just Normlicht Mini 5000; Fa. Colour Confidence) suspended 40 cm above the chart and delivering 30×25 cm light area (Figure 3). At the chart surface, luminance was 220 cd/m² (measured by a PR-650 SpectaScan Colorimeter; Photo Research, Inc.), corresponding to illuminance of 1387 lux. Each chart was presented one-by-one in a fixed order (as indicated above).

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[1]Photo Credit: http://colorcard.net.cn/CMYK_Munsell_content.htm

[2]http://www.cis.rit.edu/research/mcsl2/online/munsell.php

Figure 3: Viewing booth with standardised lighting of Munsell charts.

For labelling Munsell chips, the unconstrained colour naming method was used: participants were requested to name each chip with the most appropriate term, including hue terms (e.g. Italian: *blu, azzurro, indaco*; English: *blue, turquoise, indigo*), compound terms or terms with modifiers (e.g. Italian: *blu notte, blu scuro, chiaro turchese*; English: *sky blue, pale blue, sea blue*). Participants worked row by row across the chart from top to bottom; colour names were recorded by hand immediately and exactly as the participant said them. Following this, across all eight charts, the participants indicated the 'best example', focal colour, of the terms *blu, azzurro* and *celeste* (Italian) or *blue* and *light blue* (English). The focal colours were noted on the response sheet and coded by their Munsell Hue, Value and Chroma.

In their two languages, bilinguals were tested on separate days, with the counter-balanced order of Italian and English sessions. During the session the experimenter provided instructions and communicated with the participant in the corresponding language.

Results

Italian monolinguals vs. English monolinguals: Focal colours

Figure 4 illustrates Munsell maps of Italian monolinguals' focal colours for *blu* and *azzurro*, superimposed on foci for English *blue* by English monolinguals. The size of the symbol indicates the relative number of participants who chose the corresponding chip as the focal colour. It is worth noting that the present range of English *blue* foci – 5B 5/10; 10B 5/12; 2.5PB 5/8–12; 5PB 4/10–12 and 5PB 5/12 – includes the foci for *blue*, with a purplish tint, reported earlier, i.e. 5PB 5/12 [29] and 2.5PB 5/12 [30-31], obtained using the Munsell Mercator projection array of fully saturated colours.

Blu* vs. *Blue (Table 2). The modal foci for both English *blue* and Italian *blu* are similar in Hue, varying between 10B, 2.5PB and 5PB. However, the foci of the two terms differ in lightness, with Value 4 or 5 for *blue*, compared to definitely darker *blu*, with Value 2-3:

Colour term	Hue	Value	Chroma
Blu	10B-5PB	2-5	4-12
Blue	5B-5PB	4-5	8-12

Table 2: Munsell coordinates of focal colours for blu *and* blue *in Italian and English monolinguals respectively.*

Azzurro* vs. *Blue (Table 3). As is shown in Figure 4, the modal *azzurro* focus, 10B 5/12, maps onto the 'vivid' *blue* focus. The ranges of the foci of the two terms overlap only partly though, with *azzurro* being more bluish (azure) than *blue* and including lighter colours (Value 6-7):

Colour term	Hue	Value	Chroma
Azzurro	7.5B-2.5PB	2-5	4-12
Blue	5B-5PB	4-5	8-12

Table 3: Munsell coordinates of focal colours for azzurro *and* blue *in Italian and English monolinguals respectively.*
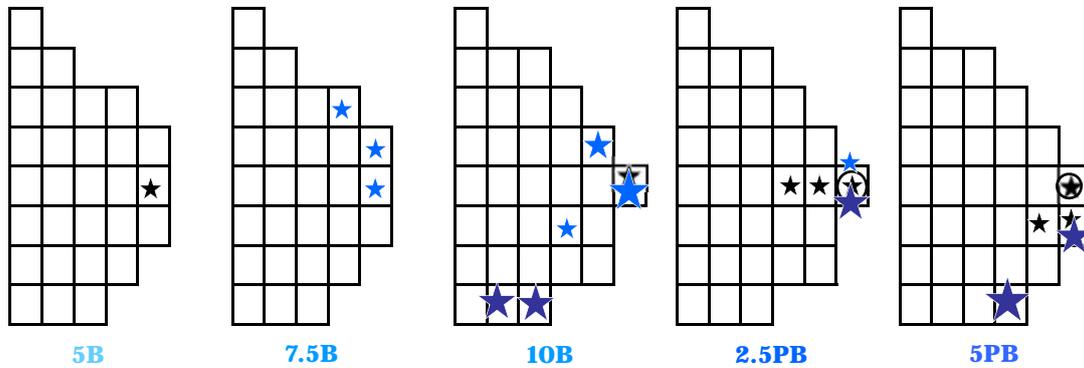

Figure 4: Munsell charts with foci for blu (★) *and* azzurro (★) *for Italian monolinguals superimposed on foci for* blue *for English monolinguals (★). The size of the symbols indicates relative number of participants' choices. Encircled* ★ *is the focal* blue: *2.5PB estimated in [29]; 5PB estimated in [30-31].*

Celeste vs. Light blue (Table 4). *Celeste* was used rather frequently by the Algherese participants but not as frequent as *blu* or *azzurro*; its focal colour range is more variable and comparable to that of the English non-BCT *light blue*. The focal colour ranges of the two 'sky blue' counterparts differ partly though, with the *celeste* choices extending to aqua (2.5B) and being more saturated:

Colour term	Hue	Value	Chroma
Celeste	2.5B-2.5PB	5-7	8-12
Light Blue	5B-2.5PB	6-8	6-10

Table 4: Munsell coordinates of focal colours for celeste *and* light blue *in Italian and English monolinguals respectively.*

Figure 5 illustrates focal colours for *celeste,* in relation to *light blue* foci. The modal *celeste* focus, 7.5B 7/8, maps onto one of the (frequently chosen) *light blue* foci.
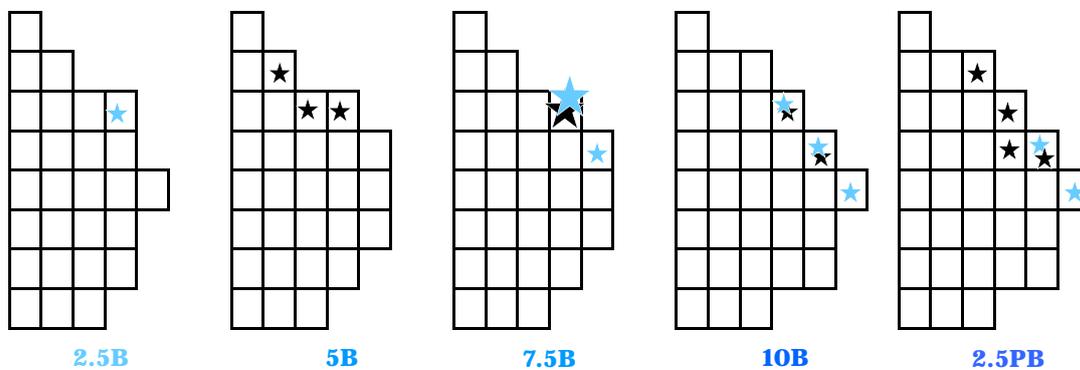

Figure 5: Munsell charts with foci for celeste (★) *for Italian monolinguals superimposed on foci for* light blue (★) *for English monolinguals. The size of the symbols indicates relative number of participants' choices.*

Centroids of focal colours. Figure 6 and Table 5 present CIELAB coordinates of centroids of focal colours for 'blue' terms for Italian and English monolinguals. The centroids confirm that *blu* is comprehended by Italians as 'dark blue'; *azzurro*, in comparison, is more likely to be the semantic equivalent of English *blue*, and *celeste* has its close counterpart in English *light blue*.
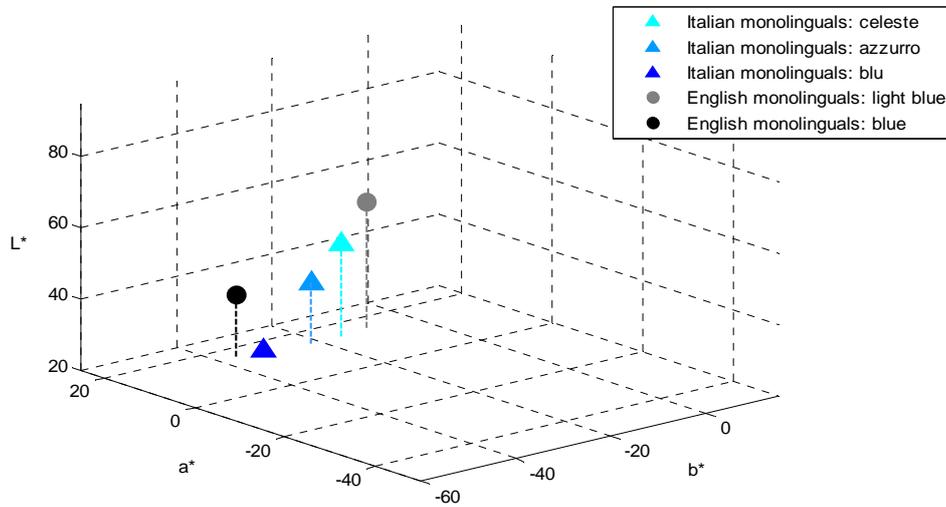

Figure 6: Centroids of focal colours for 'blue' terms for Italian and English monolinguals presented in CIELAB colour space.

Monolinguals	Colour term	L*	a*	b*
Italian	*Celeste*	63.93	-11.07	-39.58
	Azzurro	54.65	-10.65	-45.66
	Blu	28.45	4.07	-41.53
English	*Light blue*	72.08	-8.02	-31.47
	Blue	47.21	2.07	-49.30

Table 5: CIELAB coordinates of the centroids of 'blue' foci for Italian and English monolinguals.

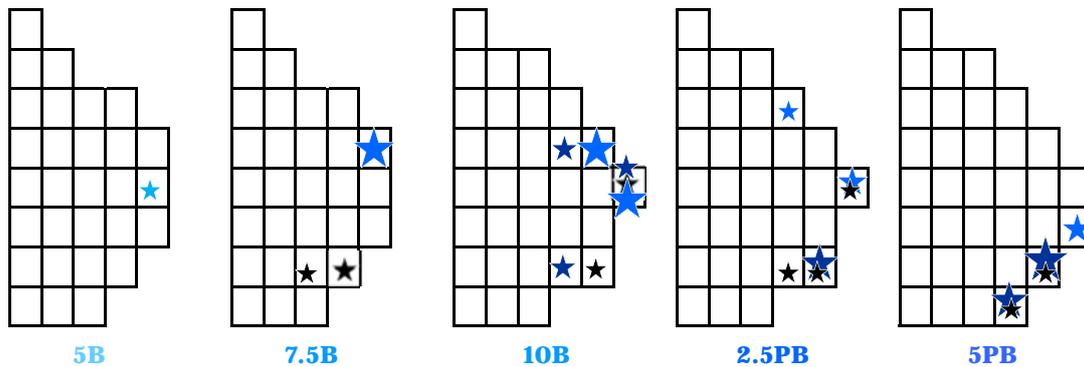### Bilinguals: Focal colours in Italian (L1) and English (L2)

Figure 7: Bilinguals: Munsell charts with foci for blu (★) *and* azzurro (★) *in Italian (L1) superimposed on foci for* blue (★) *in English (L2). The size of the symbols indicates relative number of participants' choices.*

Blu & Azzurro (L1) vs. Blue (L2). Figure 7 shows mapping, on the Munsell charts, of bilinguals' foci for *blu* and *azzurro* (L1) and *blue* (L2). Frequently chosen foci for all three terms vary in Hue

between 7.5B, 10B, 2.5PB and 5PB, being similar in this to the corresponding foci for Italian and English monolinguals (cf. Figure 4).

Celeste (L1) vs. *Light blue (L2)*. Figure 8, again mapping foci, suggests that for Italian-English bilinguals *celeste* is the counterpart of English non-basic *light blue*. Choices of *celeste* foci are spread in Value from medium to very light colours, as are foci for English *light blue*.
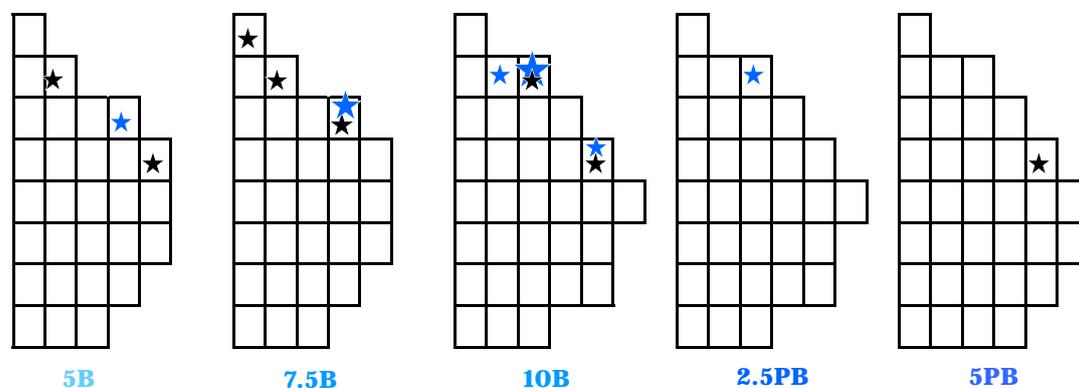

Figure 8: Bilinguals: Munsell charts with foci for celeste (★) in Italian superimposed on light blue foci (★) in English. The size of the symbols indicates relative number of participants' choices.

It is worth noting that *celeste* was named less frequently by bilinguals than either *blu* or *azzurro*. In addition, some bilinguals remarked that *celeste* denotes the same colour as *azzurro* and they hardly use it, apart from when alluding to the 'heaven' meaning in a religious context. Compared to the Italian monolinguals' choices, *celeste* foci of bilinguals spread across fewer BLUE charts, i.e. less vary in Hue; they also have higher Value (lightness) and extend to low Chroma (Table 6).

Language	Participants	Colour term	*Hue*	*Value*	*Chroma*
Italian	*Italian Monolinguals*	*Celeste*	2.5B–2.5PB	5-7	8-12
	Italian-English Bilinguals	*Celeste*	5B–10B	6-9	2-10
English	*English Monolinguals*	*Light blue*	5B–2.5PB	6-8	6-10
	Italian-English Bilinguals	*Light blue*	2.5B–5PB	6-9	4-10

Table 6: Range of the Hue, Value and Chroma (Munsell coordinates) of the 'light blue' focal colours for Italian monolinguals, Italian-English bilinguals and English monolinguals.

Lightness of bilinguals' 'blue' focal colours

Figure 9 shows L^*-coordinates (lightness; in CIELAB colour space) of focal colours for individual Italian-English bilinguals: their foci for Italian *blu, azzurro* and *celeste* (L1) are superimposed on the foci for English *blue* and *light blue* (L2). For comparison, L^*-coordinates of centroids of focal colours for Italian monolinguals and English monolinguals are shown on the right.

The overlapping or close location of the dark open circles (*blu*) and crosses (*blue*) prompts the suggestion that for the majority of bilinguals (10 out of 13), the best example of English *blue* is (implicitly) understood as Italian *blu* or even darker than that (NM).

With regards to lightness, Italian-English bilinguals' *azzurro* foci are similar to English monolinguals' *blue*. Further, *celeste* foci of Italian-English bilinguals, though highly variable, are comparable to Italian monolinguals' *celeste* and English monolinguals' *light blue*.
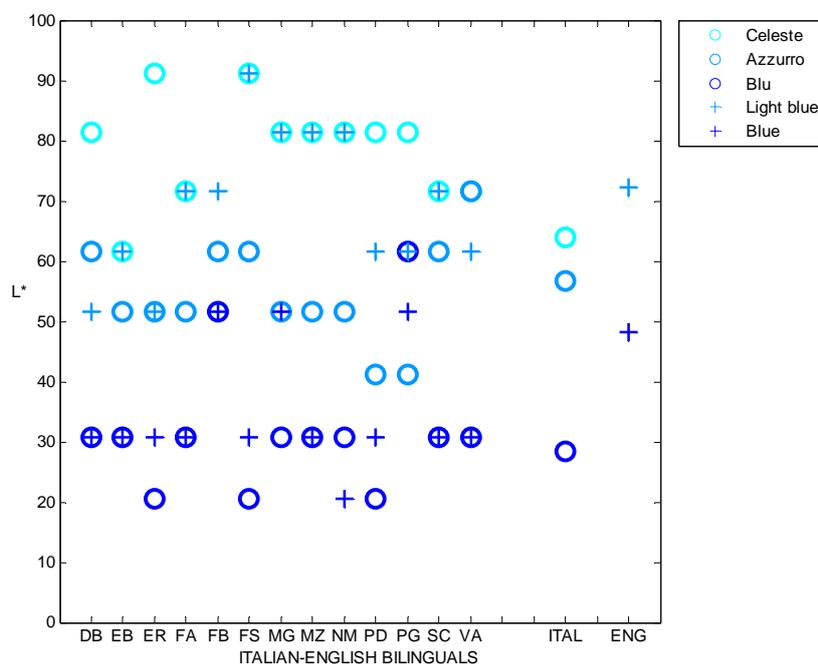

Figure 9: L*-coordinates (lightness), in CIELAB colour space, of focal colours for 'blue' terms for individual Italian-English bilinguals. For comparison on the right, L*-coordinates of centroids of focal colours for Italian monolinguals (Alghero) and English monolinguals are shown.

Table 7 presents CIELAB coordinates of centroids of focal colours for the Italian-English bilinguals. The L^*-coordinates confirm that bilinguals' concept of *blue* is definitely darker than that of English monolinguals (cf. Table 2: L^*=47.21) and very close to the concept of their Italian *blu*. Note though that the centroids do not reflect great dispersion of bilinguals' focal colour choices, a variability that is probably related to significant variation in bilinguals' English proficiency, age of L2 acquisition and duration of immersion in an L2-speaking environment (cf. Table 1)

Language	Colour term	L^*	a^*	b^*
Italian (L1)	*Celeste*	78.33	-8.21	-25.27
	Azzurro	54.42	-4.82	-47.26
	Blu	31.54	4.14	-42.55
English (L2)	*Light blue*	66.47	-10.51	-33.10
	Blue	33.77	-1.00	-42.26

Table 7: CIELAB coordinates of the centroids of focal colours for 'blue' terms in Italian (L1) and English (L2) for the Italian-English bilinguals.

Discussion

In accord with previous linguistic and psycholinguistic studies [1-2, 20-23], our results confirm that Italian speakers require at least two colour terms to name the BLUE area, *blu* and *azzurro* (Figures 4 and 6), both being basic. Also, as we demonstrated earlier for Algherese [22], *azzurro* has the 'medium

blue' meaning. For denoting light blue shades, it is complemented by *celeste*, with the range of foci similar to that for English *light blue* (Figures 5 and 6). *Celeste* is argued [22] to be a contender for a third 'blue' BCT for this monolingual sample exposed to Algherese Catalan dialect [19, 23], presumably influenced by the two Catalan terms for 'blue', *blau marí* 'navy blue' and *blau cel* 'sky blue' [32]. The status of *celeste* ('relative basicness' [cf. 33]) seems though to be lower than that of *blu* and *azzurro*.

In their choices of 'blue' focal colours, the Italian-English bilinguals reveal several features which diverge from the performance of the Italian monolinguals (see Figures 7-9).

Azzurro

- For seven bilinguals, *azzurro* foci, in Hue, are located at 10B, 'vivid' blue ∕ azure of medium lightness, as is the case for the Italian monolinguals (see Figures 4 and 7). However, six other, advanced bilinguals chose, as best *azzurro* exemplar, 2PB, blue with a purplish tint, with medium lightness, i.e. the hue of English monolinguals' focal *blue*, in the present as well as earlier studies [29-31]. This shift hints at the adjustment in hue of the L1 'medium-blue' to the L2 *blue* concept.
  Hue shift: L1 *azzurro* → L2 *blue*

Blue

- Remarkably, when naming in English, ten late bilinguals (see Table 1) chose L2 *blue* foci with Value 2-3 (Figure 8), i.e. comparable in lightness to the modal focus of *blu* of Italian monolinguals but significantly darker than the modal focus of English monolinguals' *blue* [29-31], a fact which indicates that, with regards to lightness, L2 *blue* is comprehended by bilinguals as their L1 *blu.*
  Lightness shift: L1 *blu* ← L2 *blue* (Late bilinguals)

- In comparison, three proficient bilinguals (FB, MG, PG) made much lighter L2 *blue* focus choices, with Value 5-6, as do English monolinguals, thus, indicating an opposite direction of the conceptual adjustment of their L1 *blu* to L2 *blue*. Noteworthy, two of these are early bilinguals: PG arrived in the UK as a 3-year old and since then resided in the country for 38 years; her 25-year old son (MG) was born in the UK. As suggested by one of the reviewers, this opposite shift might be present solely in a restricted linguistic community, one family. We cannot exclude though an alternative explanation – that emergence of the opposite effect may be explained by PG's and MG's native-like level of L2 proficiency [cf. 34].
  Lightness shift: L1 *blu* → L2 *blue* (Early bilinguals)

- For all bilinguals, the Hue range of their L2 *blue* foci is extended to 10B and 7.5B, i.e. azure, the Hue typical of *azzurro* foci for Italian monolinguals, compared to the purplish blue of foci of *blue* for English monolinguals, 2.5PB or 5PB.
  Hue shift: L2 *blue* foci extended to azure

Our finding, for the majority of Italian-English bilinguals, of the semantic shift of their L2 *blue* foci towards native-language *blu* 'dark blue' foci along the lightness dimension is at odds with the findings for advanced Greek-English late bilinguals who demonstrated the opposite tendency, i.e. a lightness shift of *ble* 'dark blue' foci towards *blue* focus of English monolinguals [12].

We conjecture that the L2 *blue*–towards–L1 *blu* semantic shift observed in Italian-English bilinguals is affected by phonological and orthographic neighbourhood of the Italian *blu* and English *blue* [cf. 35-

37], both having the identical vowel ['u'], unlike non-homophones English *blue* and Greek *ble*. The phonological and orthographic similarity of *blu* and *blue* in the present case appears to facilitate asymmetric connections between L1 and L2 in bilinguals' mental lexicon, i.e. concept mediation: whilst the L1 has privileged access to the meaning, the L2 is more likely to require mediation via the L1 translation equivalent [38].

Notably, the opposite lightness shift, L1 *blu*–towards–L2 *blue*, was observed in two proficient early bilinguals, both with long UK acculturation. This observation is in accord with the finding that the L1–L2 asymmetry is not manifested after bilinguals have acquired sufficient skill in the L2 to access the word meaning in L2 directly [37-38].

It is also worth noting that, unlike Greek *ghalazio* 'light blue', *azzurro* and/or *celeste* do not show the shift in lightness away from of the *blue* focus in Italian-English bilinguals. However, in proficient bilinguals the concept of L1 *azzurro* manifests the shift in hue towards that of English monolinguals' *blue*, from azure to blue with a purplish hint.

The present findings point to Whorfian effects in the mental representation of cognates and semantic equivalents of 'blue' in Italian-English bilinguals – a 'darker' L2 *blue*, compared to English (L2) monolingual speakers, and a 'more purplish' L1 *azzurro*, compared to Italian (L1) monolingual speakers. These shifts manifest bidirectional convergence of L1 and L2 colour term meanings. The direction of convergence appears though to be contingent on the *linguistic similarity* – phonological, orthographic and semantic neighbourhood, – as well as on the *bilingualism characteristics* – the age of acquisition, level of L2 proficiency and the duration of immersion in the L2-speaking environment. The present findings, thus, provide additional evidence in support of an integrated, rather than language-specific, mental lexicon in the bilingual mind [39].

Acknowledgements

References

1. Bimler D and Uusküla M (2014), "Clothed in triple blues": Sorting out the Italian blues. *Journal of the Optical Society of America A*, **31**, A332-A340.

2. Paggetti G, Menegaz G and Paramei GV (2016), Color naming in Italian language. *Color Research and Application,* **41**, 402-415.

3. Berlin B and Kay P (1969/1991), *Basic Color Terms: Their Universality and Evolution*, University of California Press, Berkeley and Los Angeles, CA.

4. Kay P and Maffi L (1999), Color appearance and the emergence and evolution of basic color lexicons. *American Anthropologist,* **101**, 743-760.

5. Roberson D, Davies I and Davidoff J (2000), Color categories are not universal: Replications and new evidence from a stone-age culture. *Journal of Experimental Psychology: General*, **129**, 369-398.

6. Roberson D (2005), Color categories are culturally diverse in cognition as well as in language. *Cross-Cultural Research: The Journal of Comparative Social Studies*, **39**, 56-71.

7. Grosjean F (2013), Bilingualism: A short introduction, *The Psycholinguistics of Bilingualism*, Grosjean F, Li P (eds.), Wiley-Blackwell, Oxford-Chichester, 5-26.

8. Athanasopoulos P and Aveledo F (2012), Linguistic relativity and bilingualism, *Memory, Language, and Bilingualism: Theoretical and Applied Approaches*, Altarriba J and Isurin L (eds.), Cambridge University Press, Cambridge, UK, 236-255.

9. Erwin SM (1961), Semantic shift in bilingualism. *The American Journal of Psychology*, **74**, 233-241.

10. Caskey-Sirmons LA and Hickerson NP (1977), Semantic shift and bilingualism: Variation in the color terms of five languages. *Anthropological Linguistics,* **19**, 358-367.

11. Andrews D (1994), The Russian color categories *sinij* and *goluboj*: An experimental analysis of their interpretation in the standard and emigré languages. *Journal of Slavic Linguistics*, **2**, 9-28.

12. Athanasopoulos P (2009), Cognitive representation of colour in bilinguals: The case of the Greek blues. *Bilingualism: Language and Cognition,* **12***,* 83-95.

13. Alvarado N and Jameson KA (2001), The use of modifying terms in the naming and categorization of color appearances. *Journal of Cognition and Culture*, **2**, 53-80.

14. Jameson KA and Alvarado N (2003), Differences in color naming and color salience in Vietnamese and English. *Color Research and Application*, **28**, 113-138.

15. Alvarado N (2016), Multilingual/bilingual color naming/categories, *Encyclopedia of Color Science and Technology*, Luo R (ed.), Springer-Verlag, Berlin-Heidelberg. doi: 10.1007/978-3-642-27851-8.

16. Deshpande PS (2015), *Color Categorization in Bilingual Population: Korean-English*. Undergraduate thesis, University of California Irvine.

17. Athanasopoulos P, Damjanovic L, Krajciova A and Sasaki M (2011), Representation of colour concepts in bilingual cognition: The case of Japanese blues. *Bilingualism: Language and Cognition,* **14**, 9-17.

18. De Bot K (2008), The imaging of what in the multilingual mind? *Second Language Research,* **24**, 111-133.

19. Società Linguistica Italiana (1995), *Dialetti e Lingue Nazionali*. Bulzoni, Roma (in Italian).

20. Valdegamberi V, Paggetti G and Menegaz G (2011), On the perceptual/linguistic origin of the twelfth basic color term in the Italian color lexicon, *Colour and Colorimetry: Multidisciplinary Contributions*, Rossi M (ed.), **VII B**, Maggioli S.p.a., 291-298.

21. Uusküla M (2014), Linguistic categorization of blue in Standard Italian, *Colour Studies: A Broad Spectrum*, Kay CJ, Hough CA and Biggam CP (eds.), John Benjamins, Amsterdam/Philadelphia, 67-78.

22. Paramei GV, D'Orsi M and Menegaz G (2014), 'Italian blues': A challenge to the universal inventory of basic colour terms. *Journal of the International Colour Association,* **13**, 27-35.

23. Giacalone Ramat A (1978), Strutturazione della terminologia dei colori nei dialetti sardi. Italia linguistica nuova ed antica, *Studi linguistici in memoria di Oronzo Parangeli II,* Pisani V and Santoro C (eds.), Congedo editore, Galatina, 163-181 (in Italian).

24. Levinson SC (2000), Yélî Dnye and the theory of basic color terms. *Journal of Linguistic Anthropology*, **10**, 3-55.

25. Malt BC and Majid A (2013). How thought is mapped into words. *WIREs Cognitive Science*. doi: 10.1002/wcs.1251

26. Ishihara S (1973), *Test for Colour-Blindness,* 24 Plates Edition, Kanehara Shuppan Co. Ltd., Tokyo.

27. Nation ISP (1990), *Teaching and Learning Vocabulary*. Newbury House, New York.

28. Wattendorf E and Festman J (2008), Images of the multilingual brain: The effect of age of second language acquisition. *Annual Review of Applied Linguistics,* **28**, 3-24.

29. Rosch Heider E (1972), Universals in color naming and memory. *Journal of Experimental Psychology*, **93**, 10-20.

30. Sturges J and Whitfield TWA (1995), Locating basic colours in the Munsell space. *Color Research and Application,* **20**, 364-376.

31. MacLaury RE (1997), *Color and Cognition in Mesoamerica: Constructing Categories as Vantages.* University of Texas Press, Austin.

32. Davies I, Corbett G and Margalef JB (1995), Colour terms in Catalan: An investigation of 80 informants, concentrating on the purple and blue regions. *Transactions of the Philosophical Society,* **93**, 17-49.

33. Kerttula S (2002), *English Colour Terms: Etymology, Chronology, and Relative Basicness*. Mémoires de la Société Néophilologique de Helsinki (Vol. LX). Société Néophilologique, Helsinki.

34. Dimitropoulou M, Duñabeitia JA and Carreiras M (2011), Two words, one meaning: Evidence of automatic co-activation of translation equivalents. *Frontiers in Psychology*, **2**:188. doi: 10.3389/fpsyg.2011.00188

35. Sumiya H and Healy AF (2004), Phonology in the bilingual Stroop effect. *Memory & Cognition*, **32**, 752-758.

36. Shook A and Marian V (2013), The bilingual language interaction network for comprehension of speech. *Bilingualism: Language and Cognition,* **16***,* 304-324.

37. van Heuven WJB and Dijkstra T (2010), Language comprehension in the bilingual brain: fMRI and ERP support for psycholinguistic models. *Brain Research Reviews,* **64**, 104-122.

38. Kroll JF, van Hell JG, Tokowicz N and Green DW (2010), The Revised Hierarchical Model: A critical review and assessment. *Bilingualism: Language and Cognition,* **13***,* 373-381.

39. Amengual M (2016), Cross-linguistic influence in the bilingual mental lexicon: Evidence of cognate effects in the phonetic production and processing of a vowel contrast. *Frontiers in Psychology*, **7**:617. doi: 10.3389/fpsyg.2016.00617