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Sound Symbolism in Color Modality: The Case of Arabic Speaking Children at Guiri Brothers Primary School- Algeria

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Abstract:

The present paper addresses the phenomenon of sound-color symbolism in Arabic language, specifically the concept of brightness on children. Thus, the study samples eighteen monolingual Arabic speaking children equally dichotomized into males and females. By performing a free-choice task that employs auditory stimuli made of vowels-only, consonants-only, then CV strings; and physical stimuli made of eleven colored balls. Children were asked to match the auditory stimuli they hear with the colored ball it represents. Through chi-square results, it is elicited that sound-color relations are valid in Arabic language where voiced consonants and back vowels match dark colors, while voiceless consonants and front vowels match bright colors. Also, salience in sound-color relations in Arabic is attributed to vowels and consonants alike, as it falls into the hierarchical sonority order by Parker (2002). Finally, the gender- related differences are indexed as limited. These results are discussed and contemplated throughout the study.

Keywords: Sound-Color Symbolism; Salience; Sonority Scaling; Brightness; Gender Differences; Arabic Language.

1. INTRODUCTION

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Language evolution adopts a dichotomous argument, where language is on one token arbitrary. This view is approved by such as De Saussure (1983) and Bloomfield (1933), in which physical references and their linguistic forms establish no relations. By another token, language is claimed to evolve through the sounds i.e. there is a compatibility between the physical entity and the language it represents (Nuckolss, 1999). These accounts were modulated afterward to accept both views stated where languages can be both: arbitrary and symbolic (Nanny & Fischer, 2005).

The linkage established between the sounds we produce and the meanings we convey is referred to as sound symbolism. As such, the long investigated phenomenon defies the arbitrariness of the language which is progressively and constantly evolving. Sound symbolism asserts itself as a fundamental asset for such evolution, its global understanding, and even basic vocabulary learning.

Despite the range of the considerable set of data on size and shape sound symbolism (Sapir, 1929; Kohler, 1947), color-sound symbolism is an integral part of learning basic vocabulary (Berlin, 1994; Kovic et al., 2010). Actually, there are shared properties that bridge both cognitive and linguistic literature on the phenomenon of sound symbolism. The semantic field of color sets an example on cross-modality and the perception of the subject matter, well as cognitive mechanisms governing the latter (Hubbard et al., 2011; Perniss et al., 2010).

Nonetheless, the Arabic language requires further investigation. In fact, Ibn Geny in what he called *Gers Al- Alfadh*, attributes sounds like /θ/ to vastness, /h/ to weakness, and /q/ to strength; he also affirms that /f/ with /d, t, T, r, n/ in Arabic symbolize weakness and lack of something, while with /s, l, m/ they refer to kindness (*cited in* Jehjooh, 2019).

Indeed, Jehjooh (2019) argues that sound-symbolism behaves in Arabic much like English, suggesting the notion of phonesthemes to represent both languages (Initial-Cluster Phonesthemes and Final-Cluster Phonesthemes) as the concept of which is interlinked with psychology, phonetics, and poetics. Following Ibn Geny, Jehjooh (2019) provides the outline of the Arabic phonesthemes of /s/ representing easiness, relaxation and whispering; /ʃ/representing outbreaks of spreading; /ʕ/ representing intensity; /ɣ/ representing potential, ambiguity and concealing; /q/ representing instability of movement; and /h/ representing the wind and airing features.

The universality of sound symbolism in that regard motivates onomatopoeia and synesthesia to generate the phenomenon in the first place in Arabic, be it standard or dialectal (Alameer, 2019; Holes, 2004); the case of quadrilateral verbs, for instance, is dependent on onomatopoeia to signify intensity, plurality, movement and repetitive events (Anani, 2012).

Being stated, the present study attempts to scope sound-symbolism, opting for color modality in the Arabic language context; with regard to children instead of adults, it seeks to answer main questions:

1- Are sound-color associations salient in the Arabic language?

2- Is salience attributed to vowels-only, consonants-only or both in sound-color relations?

3- Does Arabic language correspond to sonority scaling established by Parker (2002)?

4- Is sex a determinant factor in sound-color relations?

The experiment conducted foregrounds hypotheses that Arabic, as English, is sound symbolic in terms of color modality (precisely the concept of color brightness), where salience is attributed to consonants and vowels alike, since Arabic is consonant-based language. Additionally, corresponding to pre-mentioned scales, the color-sound associations might be governed by sex indeed, in which different sounds might invoke different perceptions of color.

2. Color-Sound Symbolism

Johanson et al. (2019: 59) provides a clear typology of color, where three main features are found: luminance (brightness), saturation, and hue. The first feature is attributed to color's reflection; the second is related to the color's degree of colorfulness, and the last is reflected in the wavelength. The sound-color relations are often related to the acoustic properties of the sound such as pitch, formant frequencies, or sonority; this is marked cross-linguistically, where the concept of brightness (luminance) is reflected in high frequencies.

A consequent explanation for both variables is urged i.e. sonority and brightness; for the factor of sonority of sounds on a general level. Using language universals and specific patterns in addition to psycho-dynamic and acoustic aspects, Parker (2002) provides a well-defined sonority scaling: Glides > Liquids > Nasals > Voiced Fricatives > Voiced Stops > Voiceless Fricatives > Voiceless Stops and [a] > [o e] > [u i]. As for color scaling, Berlin and Kay (1969) indicated the following typology: black and white > red > green and yellow > blue > brown > purple, pink, orange, and gray. This color typology is dependent on visual perception of colors in the brain.

Indeed, Hubbard, Bang and Ramachandan (2011) dictate that sound-symbolism is resulted by cross-modal combination of acoustic cues of a given speech and sensory modalities of the brain. Such cross-modal pieces of evidence stem from the basic vocabulary large-scale cross-linguistic comparisons conducted. Illustrating, almost 50% of the world languages use a parallel phonetic form of the word 'night' when 40 basic vocabulary words were compared (Wichmann et al., 2010); likewise, for the color 'black' in Eurasian language families (Pagel et al., 2013). Also, West African and Bini languages use linguistic patterns to generate sound-color associations: rounded versus unrounded vowels and high versus low tone to signal dark versus light color, respectively (Wescott, 1975).

As well, participants in Yorksen's and Menon's study (2004) associated back vowels with thickness and darkness, while the opposite semantic property is associated with front vowels when participants were asked to select an inventive food brand name. The front vowels were generally more favored by consumers in brand names because they were perceived as lighter and cleaner. As for consonants, voiced consonants represent darkness, opposed to voiceless consonants which were associated with lightness (Hirata et al., 2011). Consequently, engendering sound-color associations cannot not be limited to perceptive or/ and acoustic cues only; indeed, the cross-linguistic comparisons are featured to a certain level.

Accordingly, the acoustic, articulatory and/or other cues which make the mechanisms of sound symbolism are found to be uncorrelated with factors of age and sex i.e. sound symbolism is listed as static across different age groups and opposite sexes (Krause, 2015). In color-sound symbolism, Mondloch and Maurer (2004) found that young children associate high-pitch vowels correspond to brightness opposed to low-pitch vowels).

Table 1. Associations of consonants and vowels with sensory modalities

Consonants and Vowels	Sensory Modalities
Voiced Consonants and Low Back Vowels	Roundness, Darkness in Color, Darkness in Light Intensity, and Slowness
Voiceless Consonants and High Front Vowels	Spikiness, Brightness in Color, Brightness in Light Intensity, and Quickness.

Source: Lockwood & Dingemanse, 2015, 6

The related literature elicited contextualizes the present experiment. Firstly, it attempts to balance the extensive literature on vowel-color relations by addressing consonant-color relations as well, since the language scoped is consonant-based; thus, Parker's (2002) scale will hand a comprehensive map on sonority in Arabic Language. Secondly, the experiment explores language evolution and language variation of which sex and age are determinant factors (Krause, 2015) and maps it onto Arabic language in the opposite sex groups.

3. Method

3.1 Participants

18 children (nine males and nine females) were included in the experiment. All of them aged between five and eight years old (all participants age average= 7.4 years old; males= 6.7 and females=7.4). All of them study in the Guiri Brothers primary school (Batna, Algeria). Additionally, they all have correct visual and auditory wellbeing and linguistically characterized as monolinguals; in addition to lacking any background knowledge on the topic investigated. For the respect of scientific ethics, all the participants were included merely upon the consent of their legal guardians.

Per se, the sample is equally divided in terms of sex to establish parallelism in the experiment together with noticing any probable difference and/or effect of sex on children' sound-color mappings. Moreover, the auditory and visual health is pertinent to the experiment to ensure its validity and reliability; it is also fundamental to engage children who are neither bilingual nor multilingual in order to obtain salient results regarding the sensitivity of sound-color relations, annulling the potential effect of other languages on the representation and the process of which.

3.2 Stimuli and Materials

The stimuli employed in the experiment combines auditory and visual stimuli. The auditory stimuli are made of vowels-only, consonants-only, and non-words CV strings through a *booba*/*kiki* paradigm. Related literature has focused on the vowels dismissing consonants (eg. Mompean-Guillamon, 2013), given that they are of highest sonority is the focal reason behind engaging miscellaneous auditory stimuli. All the vowels and consonants are adapted from IPA system (Ladegfod, 1971), whereas non-word CV strings are recorded the researcher in a high quality mobile application.

The arrangement of non-words CV string is adopted in order to reduce words' real meanings on the children' mappings in chorus with the effect of neighboring consonant/vowel as in the probable case of CVC or CVCV strings. Yet, the CV strings encompass only two main vowels with all consonants which are /a/ and /i/; both are the extremes (high vowel versus low vowel) of the sonority scaling of vowels consistent with Parker's classification (2002), which the present study adopts. Accordingly, the auditory stimuli used are displayed below.

Table 2. Auditory stimuli employed in the study

Stimuli Types	Stimuli Formations
Vowels-only	/i, e, ɛ, a, ɑ, ɔ, o, u/
Consonants-only	/w, y, l, r, m, n, z, ʕ, ɣ, dˤ, ð, ðˤ, b, d, g, s, sˤ, ʃ, f, θ, t, ʈˤ, k, q, h, ħ, x /
CV Strings	/wi, yi, li, ri, mi, ni, zi, ʕi, ɣi, dˤi, ði, ðˤi, bi, di, dˤi, gi, si, sˤi, ʃi, fi, θi, ti, ʈˤi, ki, qi, hi, ħi, xi/
	/wa, ya, la, ra, ma, na, za, ʕa, ɣa, dˤa, ða, ðˤa, ba, da, dˤa, ga, sa, sˤa, ʃa, fa, θa, ta, ʈˤa, ka, qa, ha, ħa, xa/

As for the visual stimuli, the study makes use of real colored balls with the approximant size of a tennis ball and the weight of 50 g alongside small baskets. The colors used in the study are: white, black, grey, brown, red, orange, yellow, pink, green, blue, and purple, which make the total of eleven colored balls.

3.3 Procedure

To ensure the comfort of all participants in the study and to conduct the experiment in an enjoyable setting, the free-choice task was done in a form of a game (*let's color the sounds*!) that respects the safety measurements of all children. They were all given baskets and eleven colored balls, aligned in one row. Each participant fronted the basket at a distance of 0.5 meter, then asked to throw a ball in the basket, selecting the color which they believe to represent the sound they hear from the loud speaker, insisting that there's no right or wrong answers.

All steps were explained in Arabic (Darija) to efficiently perform the experiment, which lasted for about an hour. The children' choices during the three phases (vowels-only, consonants-only, and CV strings) were recorded on a sheet by the research to avoid the interruption of the game. Finishing successfully, the results obtained are analyzed through chi-square results to frame the experiment quantitatively in order to determine the accuracy and reliability of the data.

4. Results

4.1 Vowels Only

Chi-square derivation shows vowel-color associations above the expected level as shown in the Table next. Arabic speaking children are able to match bright colors with front vowels and darker colors with back vowels. The choices decided by the participants are displayed below, where the color choice is counted in terms of tendency of selection (the symbol * throughout the study represents the number to times a color was selected). Indeed, The brightest colors as 'yellow' and 'orange' are matched with the front vowel /a/; oppositely, less bright colors as 'brown' and 'blue' are matched with the back vowel /i/.

In terms of choices, it is noticed that all children refrained from selecting the color 'black', selecting 'blue' and 'brown' as alternatives. In that regard, the least chosen color was 'blue' for females and 'red' by males, which can evoke cultural associations rather than phonosemantic ones.

In the present niche of brightness, color-vowel wise, sex is indeed a distinctive feature, since male and female participants do not follow nearly the same pattern of selection as highlighted in the Table. While 'orange' was opted for once by females for the vowel /ɛ/, it was six times selected by males; and same applies to the color 'blue' for the vowel /ɑ/ as it was selected double times for males.

Table 3. Percentages vowel-color associations in the experiment

Vowels	Female Participants	Male Participants
/i/	Brown *3 = 33.3% Blue *6 = 66.7 %	Brown *3 = 33.3% Gray *6 = 66.7%
/e/	Gray *6 = 66.7% Orange *3 = 33.3%	Blue *4 = 44.4% Gray *5 = 55.6%
/ɛ/	Orange *1 = 11.1% Green *3 = 33.3% Gray *5 = 55.6%	Pink *3 = 33.3% Orange *6 = 66.7%
/a/	Yellow *7 = 77.8% White *2 = 22.2%	Orange *4 = 44.4% Brown *5 = 55.6%
/ɑ/	Blue *3 = 33.3% Brown *6 = 66.7%	Blue *7 = 77.8% Green *2 =22.2%
/ɔ/	Green *6 = 66.7% Yellow *3 = 33.3%	Gray *4 = 44.4% Brown *5 = 55.6%
/o/	Purple *5 = 55.6% Red *2 = 22.2% Pink *2 = 22.2%	Orange *9 = 100%
/u/	Pink *6 = 66.7% Red *3 = 33.3%	Pink *8 = 88.9% Red *1 = 11.1%

4.2 Consonants Only

Voiced consonants are associated with dark colors 'black, brown, and blue' and voiceless consonants with bright colors 'yellow, pink, and orange' for children of both sexes. Participants deviated in their pattern of selection in consonants similar to vowels, especially in voiced consonants. Yet, interestingly, the participants managed to maintain the concept of brightness by attributing it to the voicing (and non-voicing) of consonants.

Subsequently, the scaling proposed by Parker (2002) seem to serve the typology of colors elicited by Berlin and Kay (1969) only to a limited level; nonetheless, what can be noticed is that the less sonorous the consonants are the less brightness inclinations found among participants, for instance the colors 'yellow' and 'pink' are selected most when voiceless fricatives and voiceless stops are displayed. Voiced fricatives and stops along with glides, nasals and liquids are associated with 'brown, blue and red'.

Table 4. Percentages consonant-color associations in the experiment

	Consonants	**Female Participants**	**Male Participants**
Voiced Consonants	**/w/**	Black*6 = 66.7% Brown*3 = 33.3%	Blue*7 = 77.8% Purple*2=22.2%
	/y/	Blue*4 = 44.4% Green*5 = 55.6%	Purple*3= 33.3% Green*6 = 66.7%
	/l/	Purple*2 = 22.3% Blue *7 = 77.8%	Green*5 = 55.6% Red*4 = 44.4%
	/r/	Green*2 = 22.2% Red* 2 = 22.2% Gray*5 = 55.6%	Gray*4 = 44.4% Green*5 = 55.6%
	/m/	Brown*5 = 55.6% Green*4 = 44.4%	Brown*3=33.3% Red* 6 = 66.7%
	/n/	Brown*4 = 44.4% Red *5 = 55.6%	Purple*4= 44.4% Red*3 = 33.3% Brown*2=22.1%
	/z/	Purple*4 = 44.4% Red *5 = 55.6%	Black*8 = 88.9% Blue*1 = 11.1%
	/ʕ/	Black*7 = 77.8% Blue*2 = 22.2%	Blue*6 = 66.7% Purple*3= 33.3%
	/ɣ/	Blue* 4 = 44.4% Purple*5 = 55.6%	Red *2 = 22.2% Green*5 = 55.6% Blue*2 = 22.2%

			Black*2 = 22.2%
	/ð/	Green*5 = 55.6% Blue*2 = 22.2% Red* 2 = 22.2%	Brown*3=33.3% Purple*6= 66.7%
	/ðˤ/	Green*7 = 77.8% Blue*2 = 22.2%	Green*4 = 44.4% Purple*5= 55.6%
	/b/	Black*2 = 22.2% Brown*7 = 77.8%	Red*6 = 66.7% Green*3 = 33.3%
	/d/	Purple*6 = 66.7% Green*3 = 33.3%	Black*5 = 55.6% Gray*4 = 44.4%
	/dˤ/	Green*7 = 77.8% Brown*3 = 33.3%	Gray*5 = 55.6% Orange*4=44.4%
	/g/	Purple*3 = 33.3% Red*7 = 77.7%	Red*7 = 77.8% Gray*2 = 22.2%
Voiceless Consonants	**/s/**	Yellow*5 = 55.5% Pink*4 = 44.4%	Yellow*6=66.7% Pink*3 = 33.3%
	/sˤ/	Yellow*7 = 77.8% Orange*2 = 22.2%	Pink*8 = 88.9% Orange*1=11.1%
	/ʃ/	Orange*3 = 33.3% Red*7 = 77.8%	Orange*5=55.6% Brown*4=33.3%
	/f/	White*5 = 55.6% Pink*4 = 44.4%	Yellow*6=66.7% Orange*3=33.3%
	/θ/	Gray* 8= 88.9% Yellow*1 = 11.1%	Pink*5 = 55.6% Orange*4=44.1%
	/t/	Orange*7 = 77.8% Gray*2 = 22.2%	White*6 = 66.7% Gray*3 = 33.2%
	/ţˤ/	Gray*5 = 55.6% Pink*4 = 44.4%	Red*5 = 55.6% Orange*4=44.4%
	/k/	Gray*6 = 66.7% Orange*3 = 33.3%	Yellow*5=55.6% Brown*4=44.4%
	/q/	Pink*9 = 100%	Orange*7=77.8% Pink*2= 22.3%
	/h/	White*7 = 77.8%	White*5 = 55.6%

		Green*2 = 22.2%	Pink*4 = 44.4%
	/ħ/	Pink*6 = 66.7%	Pink*6= 66.7%
		Orange*3 = 33.3%	Gray*3 =33.3%
	/x/	Yellow*4 = 44.4%	Yellow*6=66.7%
		Purple*5 = 55.6%	White*3= 33.3%

4.3 CV String

For CV strings, the color rate is found to be salient in terms of sex, because darker colors are higher in rate for male participants than female one. However, for brighter colors as ‘white, yellow, and pink’, they are higher in tendency of choice by female participants. Additionally, the color opted for the most and the least by males are ‘gray and pink’, whereas females have selected ‘white and orange’, respectively. The disparity shapes a comprehensive overview regarding sound-color associations and gender.

On the same note, the chi-square results reveal that sound-color associations are attributed to both vowels and consonants (CV Strings), particularly when the consonants are voiced. Indeed, bright colors are more salient when the string is formed by a voiceless consonant and the front vowel /a/, and dark colors correspond most when conditioned with a voiced consonant and the back vowel /i/. Again, this falls in the line with Parker’s (2002) sonority scaling.

Table 5. Percentages CV string-color associations in the experiment

Colors	Female Participants	Male Participants
Black	*28= 5.79%	*32= 6.79%
Brown	*59= 12.21%	*67= 14.22%
Gray	*58= 12%	*74= 15.71%
White	*71= 14.69%	*65= 13.80%
Red	*57= 11.80%	*45= 9.55%
Orange	*22= 4.55%	*20= 4.24%
Pink	*30= 6.21%	*16= 3.39%
Yellow	*55= 11.38%	*53= 11.25%
Purple	*30= 6.21%	*28= 5.94%
Green	*42= 8.69%	*44= 9.34%
Blue	*31= 6.41%	*27= 5.73%

Generally, the chi-square results grouped in the Table below indicate significant values of sound-color associations. It shows a variety of tendencies in terms of selection; this may answer to what extent vowels, consonants, or CV strings can incorporate the concept of brightness through sounds. Indeed, salience is rated higher when the stimuli is composed of a CV string; what is noticed; however, is that bright colors are salient most when they are conditioned either with vowels-only segments or CV strings (eg. yellow and white); for dark colors, the results are salient most when conditioned consonants-only tokens alongside with CV strings (eg. black, brown, blue, and purple).

Additionally, the scaling of colors of this present study is as follow white> black> brown> gray> orange> purple> blue> red> pink> green> yellow which shows an interesting variance of typology forwarded by Berlin and Kay (1969), which can be inferred to as a language-specific attribute.

Table 6. Chi-square results of the experiment

Color	**Chi-square value P= 0.05<**			
			CV String	
	Vowels- Only	**Consonants- Only**	**Strings ending with /i/**	**Strings ending with /a/**
Black	/	X_2= 10.2	X_2= 1.5	X_2= 9.08
Brown	X_2= 4.01	X_2= 0.8	X_2= 2.18	X_2= 17.8
Gray	X_2= 9.3	X_2= 0.2	X_2= 10.76	X_2= 11
White	X_2= 10.6	X_2= 7.36	X_2= 12.84	X_2= 13.08
Red	X_2= 4.9	X_2= 6.56	X_2= 1.38	X_2= 0.8
Orange	X_2= 5.1	X_2= 0.09	X_2= 13.22	X_2= 11
Pink	X_2= 1.46	X_2= 2.75	X_2= 1.5	X_2= 11.62
Yellow	X_2= 1.34	X_2= 0.36	X_2= 2.18	X_2= 2.26
Purple	X_2= 6.3	X_2= 0.36	X_2= 5.96	X_2= 4.44
Green	X_2= 0.8	X_2= 8.2	X_2= 0.08	X_2= 0.08
Blue	X_2= 2.17	X_2= 1.11	X_2= 5.92	X_2= 11.62

5. Discussion

The present study addresses the association of sound-color relations in Arabic, seeking precisely the linkage motivated by vowels, consonants, and by the joint of both. Next, the study verifies the applicability of Parker's (2002) sonority hierarchy on Arabic language. Thus, the data obtained from the participants show firstly significance in relations between vowels, consonants, and CV strings with colors, this falls in the realms of related studies on the matter (Wrembel, 2009; Wrembel & Rataj, 2008). However, there is a disparity attributed to the factor of sex: while girls seem to choose brighter colors in some stimuli contexts, boys seem to select darker ones; it is also detected that Arabic speaking children are more sensitive to sound-color relations in comparison with adults reported in the study of Mompean-Guillamon (2013).

The first observation can be culturally bound, where society conventionalizes certain linguistic and paralinguistic choices, such as colors. In the Algerian culture, females are supposed to represent femininity, serenity, and calmness, while males represent strength, braveness, and resilience; parents on the same pattern, for example tend to incline their daughters with bright colors opposed to their sons; therefore the choices of colors in the present experiment sit well with the explanation provided.

Indeed, male participants when asked about their option of 'pink' and 'red' to represent the vowels /ɛ/ and /e/, they commented that these two vowels are mostly used by girls at the end of most sentences (hence words), the reason males opted for feminine-oriented colors. By the same token of stimulus (vowel-only condition), males refrained from selecting the color 'purple' because they have equated it with 'pink', as they have reported.

In fact, this is utterly true as males and females exhibit differences in terms of visions as part of their biological sensory parameters: males seem to consider the color 'orange' more inclined to 'red'; in this experiment, the color in question was opted for by males more than females in vowel-only and consonant-only stimuli (Fider & Koramova, 2019). Additionally, females selected the color 'green' more times than men for the fact that women see the color 'green' to be darker than men do (Murray et al., 2012).

Again, the cultural boundaries manifest themselves when all participants excluded the selection of the color 'black' in the vowel-only stimulus due to its stigma, as the black universally represents sadness and roughness, to which participants reported that it does not represent any of the vowels for that they can be identified as 'light'; hence, since vowels are the most sonorous, it confirms the statement of Parker (2002). For the consonant-only stimulus, the color in question was selected equally (total of fifteen times) by males and females to indicate voiced-fricatives, voiced-plosives, and glides; which can forward the argument that culture holds a stronger position in sound-meaning relations than gender does.

By another token, participants of both sexes, seem to select at least one color in common for the universality of certain properties of sound-symbolism cross- and in- languages, hence it can be claimed that such results manifest the significance of the phenomenon itself, by which sound symbolism is counted for as universal (Hunter-Smith, 2007), and the effect of gender differences, aligned with deviance among participants can correspond to the color phenomenon in isolation which can be situated by different constraints as the biological ones pre-stated.

In return, it explains the relatively similar tendency of colors' selections among male and female participants, which is generalized into: dark colors versus bright colors as the typology suggested by Berlin and Kay (1969). Even though, the results do not match the classification proposed, the results significantly show that dark colors representing voiced consonants and back vowels versus light colors representing voiceless consonants and front vowels.

Additionally, the pattern of selection for both sexes in the CV string context was found to be almost identical; this is explained by real language bias, by which children tend to map the sounds they hear on real language words, exemplified by the choice of the color 'yellow' to represent the CV strings of /dˤi/ and / dˤa/, which in Arabic language can stand for the words *dˤia'e* and *dˤaw'e*, respectively meaning lightening and light; for the CV strings of /bi/ and /ba/, all participants opted for either purple (*benefseji*) or orange (*burtuqali*); this can assist the close association of voiced consonants and back vowels with dark colors to a limited level, because certain conventionality of language hinders the effective results of the phenomenon in question (Mompean-Guillimon, 2013).

In question of salience, for seven colors (bright and dark), it is noticed that their highest chi-square results are detected either in consonant-only or vowel-only contexts. This might be motivated by the phenomenon of vowel/consonant reductions when joined in CV string. The phenomenon is referred to as the shortening of sounds' durations whenever joined in a syllable of CV/VC construction (Ladefoged and Johnson, 2011). Literature highlights the validity of sound reduction in Arabic language, where voicing and sonority are the prime responsible for the sound reductions (Kasim, 2014). However, the role of reduction in color-sound association requires further unfolding of the acoustic cues of the stimuli and perception.

Besides, it is agreed that consonants and vowels mark relatively a similar level of salience (Lokwood & Dingermanse, 2015); however, the chi-square results of the vowels, consonants, and CV strings suggest interesting turnovers of variant results when put in different conditions (stimuli). For that matter, we find the salience of vowels is when associated with bright colors as 'yellow'; this can be attributed, by one reason, to a cross-modal proposal by Ohala (1997) that the articulatory characteristics of a sound determine its semantic features, in which all voiced consonants and low back vowels stand for the concept of largeness, opposed to voiceless consonants and high front vowels which stand for the concept of smallness; this applies to a color-sound relations in the present experiment.

By another reason, the salience of dark colors with consonants (especially the voiced ones) and CV strings is due to the nature of Arabic language, which is consonant-based. Arabic contains only three vowels /a, u, i/ and the long versions of which, in addition to the cultural representation of each color as 'blue' or 'yellow' (Mompean-Guillimon, 2013). Interestingly, though the limited number of vowels, children were sensitive to the set of vowels provided in the experiment, though all of them are English-based (IPA cardinal vowels chart).

In view of that, the sensitivity of children to sound-symbolism more than adults can be triggered by the fact that infants have more cortical connections in the brain more than adults (Imai & Kita, 2014; Walker et al., 2010); an evidence is forwarded by Kantarzis et al. (2013) who proposed Japanese novel verbs to English children to conclude that sound-symbolism is not only cross-linguistic or cross-modal, rather developmental as well. Moreover, children can elaborate sound-symbolism when being exposed to language because the exposure to the latter is context- dependent and can generate culturally- bias associations when hearing different sounds as an adult.

6. CONCLUSION

The present paper tackles the phenomenon of sound symbolism; particularly, sound-color symbolism in Arabic language. The study is initiated to determine sound-color relations salience with regard to consonants, vowels and the combination of both in correspondence with Parker's (2002) sonority scale, through sampling children rather than adults. The study proves that dark colors are attributed to voiced consonants and back vowels, whereas bright colors are attributed to voiceless consonants and front vowels. It can also be summarized that Arabic language is symbolic in nature similar to other languages, which again run with the argument of sound-meaning associations' universality (Hunter-Smith, 2007).

Thus, the salience is more inclusive in Arabic compared to other languages where color-sound symbolism is attributed to vowels and consonants, which is compatible with related literature cited (Hirata et al., 2011; Lockwood & Dingermanse, 2015; Mompean, 2013; Pagel et al., 2013; Wescott et al, 1975; Whichmann et al, 2010; Yorkson and Manon, 2004). In terms of sex, the study shows counter results found in sound-meaning relations data (Kelly, Leben, & Cohen, 2003; Krause, 2015), though it necessitates essential unfolding, the effect of sex factor in color-sound relations is overlapped by the reliability of related findings that challenge the present experiment, and by the effect of the factor on the color perception as a biological difference detected, this is marked in the limited success of meeting the color scale proposed by Berlin and Kay (1969).

Yet, the limitations of the study do not fail to hold both insights and implications for further researches. The present paper holds significant contribution on language evolution, language learning (Kantarzis et al., 2013), and language learning methods; it might serve as a methodological insertion in teaching foreign languages since sound symbolism aids in semantic mappings. It also casts the shadow on Arabic language and motivates its comparison with a large-scale cross- and in- language families. Mainly, sound symbolism is a complex and an expanding phenomenon which involve acoustic, articulatory, psycholinguistic and even biological patterns that need further understanding; as a result, larger sample and more accurate methods and materials can be implemented.

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