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Hazim Alkhrisheh – Kees de Bot: The effect of maturity and gender on verbal fluency: in Jordanian University students

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The effect of maturity and gender on verbal fluency: in Jordanian University students

Im vorliegenden Artikel werden von jordanischen Studierenden generierte Daten zur verbalen Flüssigkeit dargestellt. Ziel war es, die Auswirkungen von Geschlecht und Reife (definiert als Anzahl von Jahren in einem akademischen Umfeld) zu untersuchen. Die Daten zu den traditionellen phonetischen und semantischen Kategorien wurden auf Standard-Arabisch, dem lokalen Dialekt der Schüler und auf Englisch als Fremdsprache gesammelt. Die Ergebnisse zeigen, dass das Geschlecht als ein Faktor, der die sprachliche Reife beeinflusst, hier keine Rolle spielt. Es wurden signifikante Unterschiede zwischen Anfängern und älteren Studierenden zu Gunsten von Senioren festgestellt. Die Ergebnisse zeigen auch, dass es einen signifikanten Unterschied zwischen den beiden VF-Kategorien zugunsten der semantischen Kategorie gibt, da die Schüler hinsichtlich der Anzahl und Korrektheit der Antworten in der semantischen Kategorie signifikant besser abschneiden, als in der phonetischen. Die Ergebnisse zeigen schließlich, dass die Schüler im Standard-Arabischen und im lokalen Dialekt deutlich besser abschneiden, als im Englischen.

Introduction

Verbal fluency (VF hereafter) tests have been used widely in psychological research on bilingual processing (see Friessen et al. 2016 for an overview.). The aim is to test components of cognitive functioning, such as short-term memory and inhibitory control. There are two versions: the phonetic version involves the selection of a letter and have participants name as many words as possible starting with a particular letter in a short period of time, typically one minute. The semantic category involves the listing of a members of a semantic category (e.g. animals) which is also done in one minute. The verbal fluency test is a short and valid test that evaluates the cognitive functioning of participants. It is often used by physicians and other practitioners to assess mild cognitive impairment. However, not all the related research focuses on aspects of dementia. Mathuranath et al. (2003) conducted a study to examine the effects of age, education and gender on verbal fluency. The results of the study show that (1) the level of education significantly influences letter fluency but not semantic category fluency. (2) the level of education and age affect category fluency. (3) Age has a differential effect on verbal fluency, influencing

category fluency more than letter fluency. There is a substantial body of research on the differences in processing for the two types of VF. Costafreda et al. (2006) used Functional magnetic resonance imaging (fMRI) to locate the most important parts of the brain involved in VF tasks and support the assumption of distinct dorsal–ventral locations for phonologic and semantic processes within the Left. Inferior frontal gyrus (IFG).

There is also research on the use of VF with bilinguals (see for an overview Friessen et al. (2017)). They argue that: ‘given the behavioral evidence demonstrating bilingual advantages in executive control coupled with evidence from neuroimaging studies demonstrating that the letter task differentially recruits these executive control networks, bilinguals should show an advantage on the letter task but not on the category task.’ Bialystok, Craik, and Luk (2008) postulated that ‘a bilingual advantage in letter fluency may be masked by weak language proficiency. That is, performance on verbal fluency depends on both the quality of the language representations in the language of testing and the executive control processes that are recruited.’

In the present study we also looked at gender as a factor as a number of studies have reported (see Berninger, & Fuller, (1992)) such gender differences in which boys performed significantly better than girls on oral verbal fluency and girls performed significantly better than boys on written orthographic fluency. Girls consistently outperformed boys on the number of words and the number of clauses produced in narrative and expository composition.

Literature review

The VF task along with other tasks such as Simon effect are usually used to investigate linguistic issues such as language attrition, (see de Bot and Hulsen (2002)) cognitive decline (see Alladi et al. (2013); Bialystok, Craik & Freedman (2007)) and the various subtypes of executive functioning among participants to detect a form of cognitive advantage (see Kirk, Scott-Brown, & Kempe (2013)). An important assumption with respect to VF tasks is that the tasks reflect steady states, i.e. VF cannot be trained. Recent work by Gates et al. (2013) suggests that this assumption may be wrong. Incidentally, the second author of the present article took part in a project on the impact of cognitive training on cognitive behavior. He (rightly) assumed that in the pre-post-test design some form of VF would play a role, he trained himself in doing VF tasks, literally going from A to Z and generating words with all letters in addition to semantic categories such as occupations, boys’ names, fruits and vegetables and animals. The individual and autonomous training of VF taken appeared to have a massive effect. While scores of 15-20 items per category are found typically for VF, this individual showed scores above 40 for both

semantic (animal names) and letter VF. This suggests that VF is trainable and therefore less valid as a test of cognitive functioning. It could be argued that doing the tasks is also training them. Research by Gates et al. (2013) provides additional evidence for effects of training for verbal fluency tasks. Awareness raising on phonotactic clustering for phonological VF (If the target letter is S, how many words can you come up with that start with ST?) may be a useful and trainable strategy to get higher scores. At the same time, the impact of training is relatively small: once short-term memory is affected, VF scores are bound to go down.

The present paper aims to investigate the verbal fluency of learners in relation to maturity, language variety and gender. Maturity refers to the students' academic experience (i.e. beginning students in comparison to senior students). Maturity and age are closely related, but age does not necessarily predict the students' academic level and thus it is irrelevant in this research since the aim is to investigate the effect of the academic level on the students' performance in the verbal fluency task. Furthermore, the paper aims to investigate the differences between male and female students. The paper also aims to examine the differences between the categories (phonetic and semantic) and languages (native language in opposition to L2 and standard Arabic in opposition to the local dialect). The research question behind this is to what extent different types of languages (standard language, dialect and foreign language) are processed differently using the verbal fluency task to the enhancement of cognitive abilities.

One factor that has not been studied extensively is the role of typological distance on processing mechanisms in bilinguals and language learners. More specifically, the question is to what extent bidialectism, characterized by a small typological distance between the languages involved, can be seen as a form of bilingualism. There is some research focusing on this issue concerning the effect of the typological distance between dialects.

Antoniou, Grohmann, Kambanaros, & Katsos (2016) discuss two subtypes of the executive functioning (namely working memory and inhibitory control) among children who grew up with Cypriot Greek and Standard Modern Greek. These two languages are different on all levels. Working memory and inhibitory control were examined among bidialectals. Then the study compared the results of the bidialectals to that of the multilinguals of English-Greek speaking participants. The results show that the bidialectal children have an advantage similar to that of the multilinguals with a minimal typological distance established between the two varieties of Greek. The implications of this study rise the question of the extent influencing verbal fluency, this paper also aims to investigate the difference between the two varieties of the same language (standard Arabic and the local dialect) on one hand and compare both varieties of Arabic counting as the native language to the L2 (English).

Another study conducted by Kirk, Fiala, Scott-Brown, & Kempe (2014) investigated the executive control of bilingual immigrants with different cultural and ethnic backgrounds compared to non-immigrant bilinguals and bidialectal monolinguals. The results of the study show that there are no differences between the groups in reaction time and Simon effect. They conclude that there is no evidence for relating executive control to different cultural and ethnic backgrounds.

Woutersen, Cox, Weltens, and de Bot, (1994) conducted a study to test the effects of a small typological distance between languages on the organization of the bilingual lexicon. The varieties used in the study were standard Dutch and the dialect of Maastricht. The framework of the study was Weinreich's model (Weinreich, 1953 cited in Woutersen, Cox, Weltens, and de Bot, 1994) by having three bilingual groups presented in the model – the compound, the coordinate and the subordinative. Even though Weinreich's model is outdated but the main concern of the research was the investigation of intralingual and interlingual repetition priming among subjects using the two varieties as the stimuli for the responses to see what kind of bilinguals the subjects were. Repetition priming refers to the improvement of behavioral responses when stimuli are repeatedly presented. The improvements can be measured by means of accuracy or reaction time. The results show that, according to Weinreich's model, the dialect speakers were coordinate bilinguals and the standard speakers were subordinative bilinguals.

The effect of structural linguistics varies in terms of differences among languages on verbal fluency scores. There are linguistic factors that may play a role in VF (e.g. Dutch and German allow for substantial stringing of nouns “De stad/de stadsmuur/de stadsmuurverval/De stadsmuurverzakkingsreparaties (the city/citywall/citywallsdecayrepair”) In Dutch and German these strings can be one word, and in VF it is possible to endlessly add new nouns to the string and it is not clear how the additional words should be counted: only the most basic string or every possible string. In Arabic, its dialects and in English, the previously mentioned kind of linguistic structures does not exist in the investigated languages. Moreover, Standard Arabic differ from the local dialect in a number of ways: in terms of lexical choices, the two languages bare many lexical items of their own. For example, the word ‘ruhit’ in the local dialect is used instead of the equivalent word ‘dahaptu’ in standard Arabic to express the phrase ‘I went’. In terms of phonological differences, the two languages also bare many phonetic items of their own. For example, the sound (g) is used in the local dialect but not in standard Arabic. On the other hand, the sound (q) which is a uvular plosive sound is commonly used in standard Arabic but not in the local dialect. These differences in linguistic terms imply that there are also differences in cognitive processing terms. The VF task is used to examine the participants' cognitive processing differences in the two versions of Arabic.

Gender differences in VF

A number of studies have looked at the impact of gender differences on VF scores. Heister 1982 compared boys and girls on a number of cognitive functions and found that ‘Although both word fluency and ideational fluency are said to show female superiority, a significant difference in favor of females could be found only in the task which primarily requires lexical access and not in the task requiring mental access to color and form of objects. In contrast, Weiss et al (2003) found no gender differences in VF tasks. A full discussion of this complex issue is beyond the scope of the present article.

Foreign language learners in Jordan

One of the aims of the present research is to see to what extent verbal fluency reflect proficiency of students in Jordan. We are not implying that the verbal fluency task is a proper measurement of proficiency, but the students’ low proficiency might be reflected in the task. They typically show a low level of proficiency in English and the same holds for teachers (Hemabati Ngangbam, 2016; Al-Sawalha, Abdulla & Chow, Thomas, 2012; Oqlah M. Smadi & Abeer al-Ghazo, 2013). The low level of proficiency in Jordan may be caused by three factors: (1) either the teachers did not receive proper training to provide adequate instruction, (2) the learning resources, the learning materials and the learning environment in Jordan are not efficient or (3) the students are not motivated enough to progress in L2. The last assumption is more likely the case since studies on motivation have shown that the non-linguistic aspects of language learning (i.e. motivation and attitude) (Ababneh, 2013; Al-Khasawneh & Al-Omari, 2015; Al-Shourafa, 2012; Tahaineh, Y & Daana, 2013) play a crucial a role in language learning. Following Gardner’s model (2004), these studies demonstrated that there is a high level of “instrumental” motivation. The results of these studies also show that there are differences between males and females. These results also account for the teachers themselves lacking the motivation for learning or teaching the language. The main factor is the lack of opportunity to use the language meaningfully. This has a huge effect on learners’ and teachers’ motivation. In addition, the learning resources and learning material in Jordan may not be adequate and don’t result in the desired outcomes.

One thing needs to be established here, as discussed earlier, that the studies conducted in Jordan demonstrate that students have a low level of proficiency which might be reflected in the results of the VF task in this study.

Participants

The sample of the study consisted of twenty students from Mutah University, Jordan (aged between 18 and 26). Ten male students and ten female students have done the verbal fluency tests. Eight of them are senior students and twelve are beginners. By beginning students, we are referring to 1st and 2nd year students; and by senior students, we are referring to 3rd and 4th year students. The selection is based on the purpose of the study which is considering gender as a factor affecting verbal fluency performance on one hand and considering the students' maturity (the students' academic level. i.e. beginning and senior students) as a factor affecting verbal fluency on the other hand. There are other objectives for the study that will be discussed in the next section.

Research questions

- 1- Are there significant differences in verbal fluency related to maturity and gender?
- 2- Are there significant differences between the phonetic and the semantic categories in terms of the ease of access as measured by the verbal fluency scores?
- 3A. Are there any significant differences between standard Arabic and the local dialect in terms of the ease of access as measured by the verbal fluency scores?
- 3B. Are there any significant differences between the speakers' native language (Arabic) and the L2 (English) in terms of the ease of access as measured by the verbal fluency scores?

Hypothesis

The hypothesis of concern is that students' maturity (beginning students compared to senior students) will have an effect on the verbal fluency test hypothesizing that senior students will have better scores in the verbal fluency test than beginning students. The other objective of the paper includes investigating the difference in the answers between males and females to see if gender has an effect on the verbal fluency performance. We hypothesize that females would have better scores than males. Other objectives include investigating the difference in the answers of the students between the two categories (phonetic and semantic), the difference between the native language and the L2 and finally, the difference between the standard language (standard Arabic) and the local dialect. We expect that students would have better scores in the semantic category than they would in the phonetic category based on the previous literature. We would also hypothesize

that students would do better in their native language than they would in the L2 considering their low level of proficiency in L2 as demonstrated in the background.

Procedure

The verbal fluency test comes in two forms: phonetic and semantic. The languages being examined the following: (1) standard Arabic, (2) a local dialect of Arabic and (3) English. The two categories with the three languages formed six combinations as follows: (1) the phonetic category in standard Arabic, (2) the semantic category in standard Arabic, (3) the phonetic category in the local dialect, (4) the semantic category in the local dialect, (5) the phonetic category in English, and finally (6) the semantic category in English. The phonetic test consisted of listing as many words as possible that start with the letter 'A' in English and its counterpart 'أ, إ' in Standard Arabic and local dialect in one minute. The same procedure was done again but with the letter 'N' in English and its counterpart 'ن' in standard Arabic and local dialect. The two letters 'A' and 'N' were chosen because of their similar correspondences in terms of the manner of articulation as they prove to be very similar to both speakers of Arabic and English. As for the letter 'N', it is also familiar to both speakers of the two languages even in words where there are consonant clusters. Even though Arabic barely allows consonant clusters, but there are very few exceptions to this rule such as the clusters of the sound 'n' with the sound 'k'. Later, the answers for the two letters were added together in one phonetic category for each language. The phonetic category in the three languages is not distant in the sense that speakers of these languages can easily recognize the letters and their corresponding sounds. The semantic category consisted of listing as many 'animals' as possible in each of the three languages in one minute. The same procedure was done again but with listing as many 'fruits and vegetables' as possible in each of the three languages in one minute. Later, the answers for the two subsets (animals and fruits/vegetables) were added together in one semantic category for each language. The 'Independent Sample T-test' was used to investigate the differences between male and female students first, then the same test was used to investigate the differences between beginning and senior students.

The above procedure was done to compare the two independent variables labeled as 'Gender' and 'Maturity'. For comparing languages and categories, the situation is more complicated as the number of answers (each student had to provide six answers) is taken into account rather than the number of students. To do that, we had to put all 120 answers as one dependent variable where the new independent variables are identified as 'Language' and 'Category' for a suitable analysis. From the 120 answers, forty answers of which apply to each language and sixty answers of which apply to each category. A 'Two Way Anova' was conducted to investigate

the differences between the three languages and the two categories. The two-way Anova was conducted to make the comparisons between the categories and the languages all in one statistical test instead of using a one-way Anova for comparing the three languages and an independent sample t-test for comparing the two categories. However, Levene’s test for equality of error variances was violated (the result of Levene’s test showed a significant value as $p < 0.05$ which represents a violation of one of the assumptions for running an Anova test), and as a consequence, we would consider only a result of less than .01 instead of .05 to be accepted as significant. The tables 1.1 and 1.2 below represent the arrangement of the variables on SPSS (SA=Standard Arabic, LD=Local Dialect, E=English, SC=Semantic category, PHC=Phonetic Category). The variables presented in the table in italics are the independent variables, whereas the normal font represents the dependent variables.

Table 1.1 the suitable arrangement for comparing genders and maturity levels

Gender	Maturity	PHC/SA	SC/SA	PHC/LD	SC/LD	PHC/E	SC/E
		20	20	20	20	20	20
		answers	answers	answers	answers	answers	answers
<i>1=males</i>	<i>1=beginning</i>	M=10	M=10	M=10	M=10	M=10	M=10
<i>10</i>	<i>12 students</i>	B=12	B=12	B=12	B=12	B=12	B=12
<i>students</i>							
<i>2=females</i>	<i>2=senior</i>	F=10	F=10	F=10	F=10	F=10	F=10
<i>10</i>	<i>8 students</i>	S=8	S=8	S=8	S=8	S=8	S=8
<i>students</i>							

Table 1.2 the suitable arrangement for comparing languages and categories

Language	Category	All 120 answers
<i>1= SA / 40 answers</i>	<i>1= PHC / 60 answers</i>	40 answers to each language 60 answers to each category
<i>2=LD / 40 answers</i>	<i>2= SC / 60 answers</i>	
<i>3= E / 40 answers</i>		

These tables (1.1 and 1.2) are just a representation of the variables' arrangement and do not present any values.

Results

Only correct answers were counted in the analysis since the verbal fluency task took a written form using an online test (Free test generator, Flexiquiz. 2018) in which there was a timer that locks each page and moves to the next page automatically when the one-minute time limit is over. An 'Independent sample t-test' was used to investigate the differences between the variables classified under the labels of 'Gender' and 'Maturity'. First, the following results are presented in relation to gender. Table 2.1 below shows the means and the standard deviation of the correct answers of participants in both categories in all three languages. Followed by chart 1.1 that shows the difference between the correct answers of males and females in the VF task in concerning categories and languages. Table 2.2 (in the appendix) show the mean and standard deviation for both genders separately and table 2.3 (in the appendix) show the mean and standard deviation for beginners and seniors separately:

Table 2.1: means and standard deviations

	Mean	Std. Deviation
<i>The phonetic category correct answers in Standard Arabic</i>	13.8	5.4
<i>The semantic category correct answers in Standard Arabic</i>	19.2	6.9
<i>The phonetic category correct answers in the local dialect</i>	12.6	5.0
<i>The semantic category correct answers in the local dialect</i>	15.2	6.2
<i>The phonetic category correct answers in English</i>	7.8	3.5
<i>The semantic category correct answers in English</i>	9.8	4.0

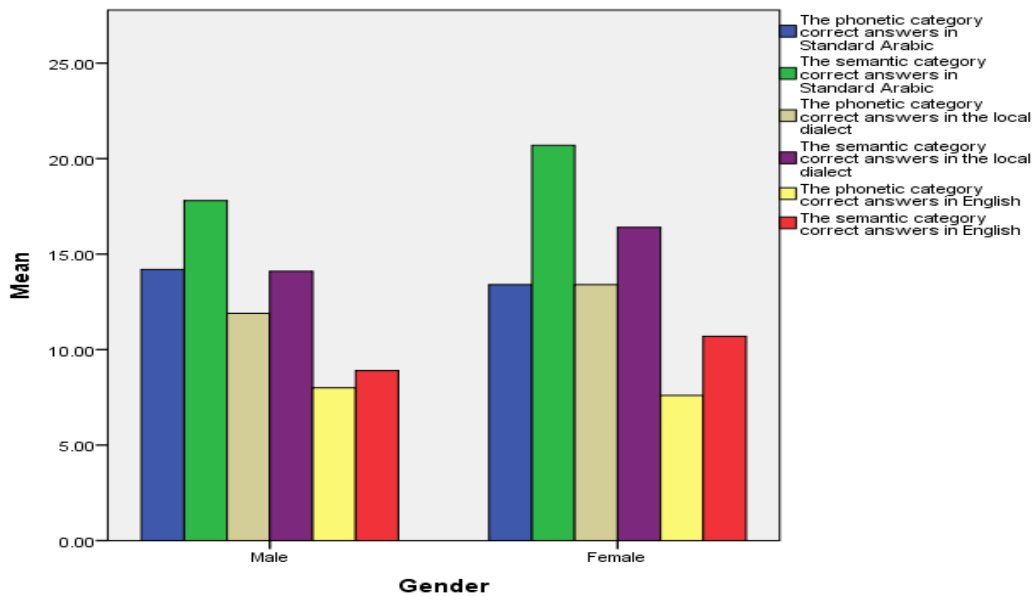


Chart 1: A visual display figure of means for gender differences

Second, the following results are presented in relation to maturity. Chart (2) below shows the difference between the correct answers of beginning and senior students in the VF task concerning categories and languages:

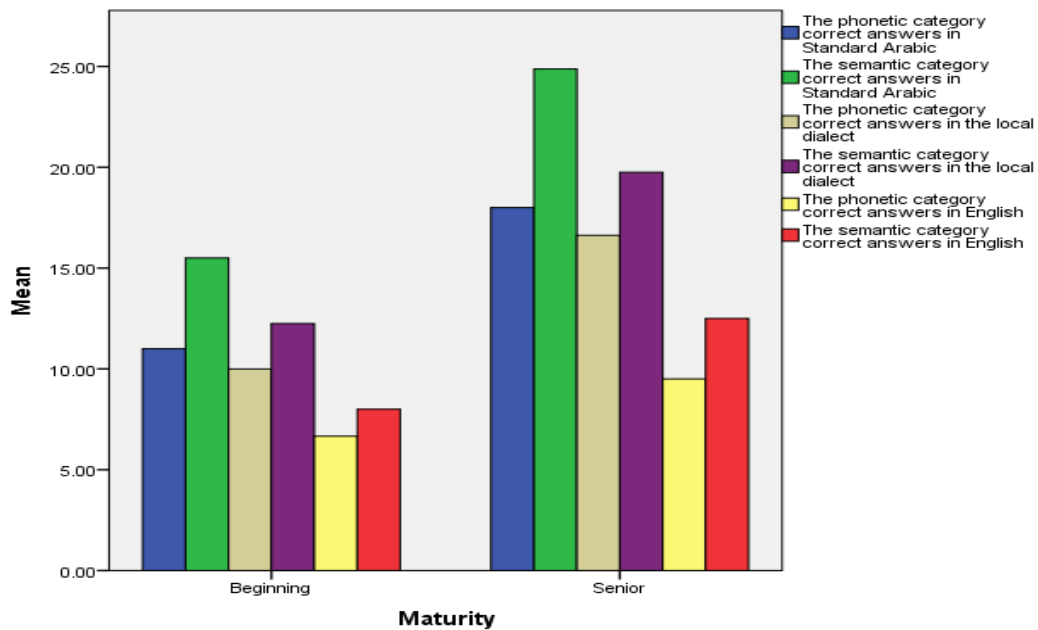


Chart 2: A visual display figure of means for maturity differences

Third, the next results represent the difference between the phonetic and the semantic category in table 3 represented in the mean score and standard deviation.

Table 3: Data on the difference between the phonetic and the semantic category

Category	Mean	Std. Deviation
Phonetic	11.42	5.366
Semantic	14.77	6.975

Fourth, the following results represent the differences between the languages (standard Arabic, the local dialect and English) represented in the mean score and standard deviation in table 4:

Table 4: Data on the differences between the three languages

Language	Mean	Std. Deviation
Standard Arabic	16.53	6.752
Local Dialect	13.95	5.760
English	8.80	3.911

Finally, the next figure (chart 3) represents the results of the ‘Two Way Anova’ (displayed in the profile plot figure) test for comparing languages and categories (green = the semantic category; blue = the phonetic category):

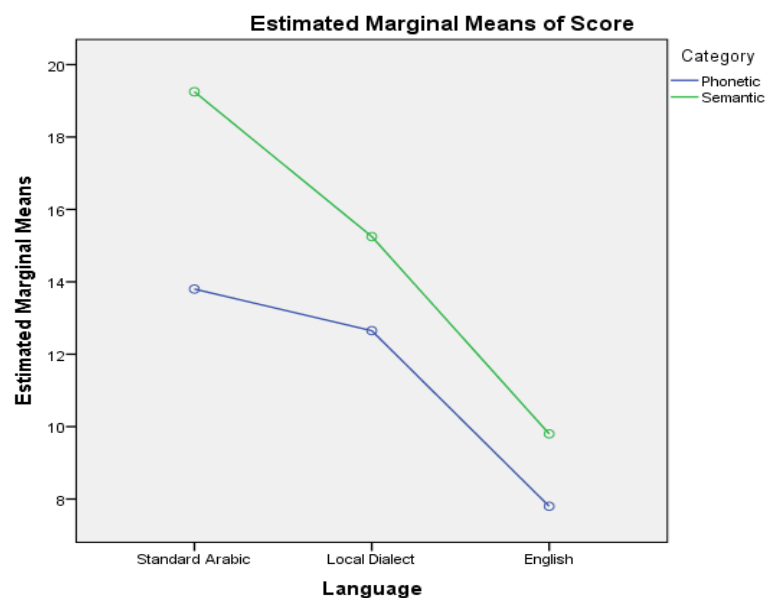


Chart 3: A profile plot display for the differences between languages and categories

The results concerning the effect of gender on fluency are presented in chart 1 (and in table 2.2 in the appendix presented in the mean score and standard deviations for males and females) as follows: there was no significant difference in the scores for males (M=14.2, SD=7.14) and females (M=13.4, SD=3.47) in the phonetic category in standard Arabic; $t(18) = .318, p = 0.754$. There was also no significant difference in the scores for males (M=17.8, SD=6.57) and females (M=20.7,

SD=7.28) in the semantic category in standard Arabic; $t(18) = -.934, p = 0.363$. There was also no significant difference in the scores for males ($M=11.9, SD=5.21$) and females ($M=13.4, SD=4.94$) in the phonetic category in the local dialect; $t(18) = -.660, p = 0.518$. Furthermore, no significant difference in the scores for male students ($M=14.1, SD=3.78$) and female students ($M=16.4, SD=8.12$) in the semantic category in the local dialect; $t(18) = -.811, p = 0.428$. Moreover, no significant difference in the scores for males ($M=8.0, SD=4.71$) and females ($M=7.6, SD=2.22$) in the phonetic category in English; $t(18) = .243, p = 0.811$. There was also no significant difference in the scores for males ($M=8.9, SD=4.55$) and females ($M=10.7, SD=3.46$) in the semantic category in English; $t(18) = -.994, p = 0.333$.

The results concerning the effect of maturity on fluency are presented in chart 2 (and in table 2.3 presented in the mean score and standard deviation for beginners and seniors) as follows: there was a significant difference in the scores for beginning students ($M=11.0, SD=2.59$) and seniors ($M=18.0, SD=6.11$) in the phonetic category in standard Arabic; $t(18) = -3.550, p = 0.002$. There was also a significant difference in the scores for beginning students ($M=15.5, SD=4.62$) and seniors ($M=24.8, SD=6.01$) in the semantic category in standard Arabic; $t(18) = -3.945, p = 0.001$. Moreover, significant differences were found in the scores for beginning students ($M=10.0, SD=2.41$) and seniors ($M=16.6, SD=5.37$) in the phonetic category in the local dialect; $t(18) = -3.777, p = 0.001$. Furthermore, there was a significant difference in the scores for beginning students ($M=12.2, SD=3.46$) and seniors ($M=19.7, SD=7.04$) in the semantic category in the local dialect; $t(18) = -3.183, p = 0.005$. There was no significant difference in the scores for beginning students ($M=6.6, SD=2.34$) and seniors ($M=9.5, SD=4.56$) in the phonetic category in English; $t(18) = -1.832, p = 0.084$. And finally, there was a significant difference in the scores for beginning students ($M=8.0, SD=2.73$) and seniors ($M=12.5, SD=4.34$) in the semantic category in English; $t(18) = -2.859, p = 0.010$.

The results concerning the difference between the categories in terms of the ease of access as measured by the verbal fluency task are presented as follows: table 3 and chart 3 show that there was a significant difference between the phonetic ($M=11.4, SD=5.36$) and the semantic ($M=14.7, SD=6.97$) categories; $p = 0.001$ ($p < .01$). As mentioned earlier, only a result of less than .01 is considered significant. The significant result exhibited between the two categories account for the differences between them.

The results concerning the differences between the languages in terms of the ease of access as measured by the verbal fluency task are presented in chart 3 and in the mean score and standard deviation in table 4 as follows: the difference between standard Arabic ($M=16.5, SD=6.75$) and the local dialect ($M=13.9, SD=5.76$) is not significant; $p = 0.033$ ($p > .01$). The second question (B) is related to the difference

between the native language and the L2. The difference between standard Arabic (M=16.5, SD=6.75) and English (M=8.8, SD=3.91) is significant; $p = 0.000$ ($p < .01$). The difference between the local dialect (M=13.9, SD=5.76) and English (M=8.8, SD=3.91) is also significant; $p = 0.000$ ($p < .01$).

Discussion

Considering the first question which is related to the effect of gender and maturity on verbal fluency. As mentioned earlier, an independent-samples t-test was conducted to compare male students to female students. These results suggest that gender doesn't have an effect on the verbal fluency task. The reason behind that could be related to the cognitive processing employed by both genders to access verbal fluency which seems to show that there aren't many differences between males and females. This phenomenon has been addressed with previous research that focused on neuroimaging technique by Weiss et al (2003) and showed that their argument against between-sex differences in cerebral activation patterns during lexical verbal fluency is confirmed using functional magnetic resonance imaging.

The data on to the effect of maturity on verbal fluency have very different scores between beginners and seniors represented in significant results for the effect of maturity on verbal fluency excluding the phonetic category in English as ($P > 0.05$). An independent-samples t-test was also conducted here to compare beginning students to senior students. The overall results indicate that maturity is accounted for as a factor affecting verbal fluency having significant differences found in five out of the six combinations discussed earlier in which senior students had better results in the verbal fluency test compared to beginning students. The main objective of this paper is to examine the influence of the years of education on the students' cognitive processing. The results suggest that the years of education have a significant influence on language processing as measured by the verbal fluency task. Age, however, was irrelevant in the sense that age does not necessarily predict the years of education (one could be 30 years old but still a beginning student in his/her first academic year). What is interesting in this paper is that the academic level had an impact on the VF task in all three languages and the two VF categories even though the students are English language and literature students which means that in case there was an impact or an influence of the academic year on performance, it should have influenced the English language in isolation of the other two languages. The academic progress seems to have a greater impact than we thought it had. It seems that a buildup experience affects cognitive processing in a much wider range. Part of that might be related to the linguistic and cognitive resources that the senior students could have developed in their academic progress.

The second question is related to the differences between categories. Chart 3 shows the 'Two Way Anova' profile plot results and table 3 shows the mean score

and standard deviation of the answers in both categories in standard Arabic. The mean for the correct answers of the phonetic category in standard Arabic is 13.8 with a standard deviation of 5.4. The mean for the correct answers of the semantic category in standard Arabic is 19.2 with a standard deviation of 6.9. It is clear that there is a difference between categories, but it is not clear whether this difference is significant or not on the basis of this arrangement of the variables. The results from table 2 do not account for the analysis because of the changes that had to be done to the variables to do the analysis to answer the second and the third research questions. As mentioned earlier, the change included setting the variables in a way that suits the analysis (presented in table 1.2) by having two levels for the category variable as an independent variable, and having three levels for the language variable also as an independent variable. The change also included accounting the number of answers, but not the number of students. Since we have 20 students and 6 combinations of categories with languages, the overall number of answers was 120. The difference taken into account in this discussion is that students did significantly better in the semantic category than they did in the phonetic category as shown in the mean score and standard deviation in table 3 and chart 3. The question is: why did the students answer significantly better in the semantic category than they did in the phonetic category? According to the data, it seems that the two categories are very different in terms of processing. The phonetic category needs to be further investigated using neuroimaging tools because of its high cognitive demands in word retrieval because lexical entries in the category fluency are not listed alphabetically (Strauss, Sherman, & Spreen, (2006) cited in Friesen, Luo, Luk, & Bialystok (2015)) and thus it proves to be easier in terms of retrieval. Even in terms of proficiency, the students did significantly better in the semantic category than they did in the phonetic category in their native and non-native language. Friesen, Luo, Luk, & Bialystok (2015) in a study they conducted to investigate the effect of age on verbal fluency among bilinguals and monolinguals demonstrated that there is a cognitive advantage in the VF task for beginning bilingual children and a robust advantage for adult bilinguals. They also reported a significant influence of the effect of age and vocabulary knowledge on the semantic category fluency, and a significant influence of the bilingual effect on the phonetic category fluency. The phonetic fluency reflected an improvement in adulthood and a stable state in older age, whereas the semantic fluency reflected an improvement in adulthood but a decline in older age.

The other research question regards the various languages. Students did significantly better in standard Arabic and the local dialect than they did in English. Students are expected to have better scores in their native language than they would in L2. These outcomes can be explained as an effect of proficiency in L2. It is clear that the students' lexical knowledge seems to be lacking, which is understandable

since English is not their native language. Another question can be addressed here: if the learner achieves a higher proficiency in L2, would it be possible for him/her to process the semantic and the phonetic categories in a similar fashion to that of his/her native language to the extent where no significant differences can be found between the native language and the L2?

One issue that was discussed briefly and which was not part of the research reported on, but an issue that is related to the VF task: Are VF tasks trainable? And if so, do these skills generalize over languages. In other words: if subjects are trained to do VF tasks in language A, will these skills be effective when processing language B, and language C. Even more generally, will these skills be effective to other domains of cognitive control? For a better understanding of this issue a project should be set up on the effectiveness of training such skills in two or more languages and see how the effects transfer between languages.

Conclusion and recommendations

As we have demonstrated in the background, many participants have a low level of proficiency in English, it follows in the results that the students' performance in the verbal fluency test is unsatisfactory in L2 compared to their performance in their L1 considering that the participants are students in the English language and literature department where even senior students achieved significantly higher scores in the L1 than they did in L2. But, at the same time, achieved significantly higher scores than beginners. In terms of cognitive processing, any lack of knowledge leads to a lack in performance. The low level of proficiency in L2 had a clear and a significant impact on their performance in the VF task.

Regarding the languages, it was expected that students would do better in their native language considering the fact that their proficiency in L2 is low as discussed in the background section. Regarding the categories, it is more complicated to explain why students did better in the semantic category. The assumption that the phonetic category fluency requires higher cognitive demands is presented in a study by Friesen, Luo, Luk, & Bialystok (2015). They argue that the phonetic category fluency task is well suited to examine the potential bilingual advantage in word retrieval. This argument is definitely one to be considered since the bilingual advantage has been discussed thoroughly by many researchers in the field (Alladi et al. (2013); Bialystok, Craik, & Freedman (2007); and Bialystok, Craik, & Luk (2008)). If the phonetic fluency requires higher cognitive demands, it will definitely be a proper measure for examining any differences between bilinguals and monolinguals in terms of cognitive processing.

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Appendix

Table 2.2 the mean score and standard deviation for both genders

	Mean / Males	SD / Males	Mean / Females	SD / Females
The phonetic category in Standard Arabic	14.2	7.1	13.4	3.4
The semantic category in Standard Arabic	17.8	6.5	20.7	7.2
The phonetic category in the local dialect	11.9	5.2	13.4	4.9
The semantic category in the local dialect	14.1	3.7	16.4	8.1
The phonetic category in English	8.0	4.7	7.6	2.2
The semantic category in English	8.9	4.5	10.7	3.4

Table 2.3 the mean score and standard deviation for beginners and seniors

	Mean/Beginning	SD/Beginning	Mean/Senior	SD/Senior
The phonetic category in Standard Arabic	11.0	2.5	18.0	6.1
The semantic category in Standard Arabic	15.5	4.6	24.8	6.0
The phonetic category in the local dialect	10.0	2.4	16.6	5.3
The semantic category in the local dialect	12.2	3.4	19.7	7.0
The phonetic category in English	6.6	2.3	9.5	4.5
The semantic category in English	8.0	2.7	12.5	4.3