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| RESEARCH ARTICLE

Practice-Dependent Differences in the Automatization of Literary Arabic (LA) Speech Production

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| ABSTRACT
Native speakers of Arabic acquire language in a diglossic context that requires them to use different varieties for different purposes: spoken Arabic (SA) is the dialect they use informally in daily oral communications; literary Arabic (LA) is the variety they use mainly for reading, writing, and formal communications. In general, Arabic native speakers perform differently across different tasks and modalities—performance tends to be better when the task requires SA or LA in the same way it is normally used. In this study, an LA speech production task was performed by two groups of Arabic native speakers who varied significantly in their amount of practice with LA. Although both groups acquired LA under the same conditions, the group with more practice was more fluent. Practice-dependent differences are interpreted within a memory-based automaticity framework. Such a framework, it is argued, is able to account for differences both in general performance patterns among the Arab population as well as specific, practice-dependent patterns such as those observed in the present study.

| KEYWORDS
Diglossia, literary Arabic, speech production, memory-based automaticity

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1. Introduction
Arabic native speakers develop their mother tongue in a unique diglossic context (Ferguson, 1959) that requires them to use two different varieties of Arabic: spoken Arabic (SA), the local dialect they are exposed to since birth and use for everyday oral communications, and literary Arabic (LA, also referred to as modern standard Arabic or fusha), the variety they acquire mainly through school and use for reading, writing, and formal communications (Ayari, 1996; Ferguson, 1959; Maamouri, 1998). SA and LA are used in a complementary fashion; each is strictly used in its specified context (Ferguson, 1959; Maamouri, 1998). Context, rather than the speaker, dictates which variety should be used (Hudson, 2002): SA is never used in formal education and LA is never used for everyday communication regardless of how literate the speaker is (Saiegh-Haddad, 2022). Acquiring the two varieties in such a diglossic context makes a native speaker of Arabic very similar to a coordinate bilingual, "a person who acquires the two languages in different context(s), for instance, one at home and the other at school" (D'Acierno, 1990, p. 12).

Do Arabic native speakers acquire SA as a first language (L1) and LA as a second (L2)? The answer seems to depend on factors such as the type of task (e.g., receptive vs. productive) and stimulus (e.g., visual vs. auditory) (Abou-Ghazaleh, Khateb, & Nevat, 2018; Nevat, Khateb, & Prior, 2014). In investigations using auditory stimuli (Ibrahim, 2006, 2009; Ibrahim & Aharon-Peretz, 2005), SA appeared as the dominant—L1-like—variety. In investigations using visual stimuli (Nevat et al., 2014), LA appeared dominant. The frequency of the stimuli also seemed to contribute to the dominance of the variety. For example, high-frequency LA written words appeared to have an advantage over LA low frequency and SA high-frequency words (Andria, 2016; Andria, Madi-Tarabya, & Khateb, 2022). During language production, however, SA and LA seem to behave competitively at the neural level. fMRI responses collected during picture naming showed that switching between varieties activated language control processes implying a shared lexical system (Abou-Ghazaleh, Khateb, & Nevat, 2020). Nevertheless, at the behavioral level, SA production in picture naming was faster and more accurate than LA production (Abou-Ghazaleh et al., 2018).

Studies of the cognitive mechanisms underlying SA and LA present a different view of their relationship. Boudelaa and Marslen-Wilson (2013, p. 47) found that complex words in both varieties are processed with the same “obligatory morphological decomposition” mechanism. In this process, a word is decomposed into its basic bound morphemes: the *root*, which carries broad semantic information, and the *pattern*, which serves as a vocalic template the root can be inserted into to create a meaningful and grammatically accurate word (Ryding, 2005). For example, when the word /ka:tib/ (writer) is processed, it is decomposed into the root /**k-t-b**/ and the pattern /f**a:**ʕ**i**l/. Thus it can facilitate the processing of other words sharing the same root, such as /ma**kt**a**b**/ (office), or pattern, such as /t**a:**j**i**r/ (merchant), regardless of the semantic distance between the words. Moreover, Boudelaa and Marslen-Wilson (2013) found no advantage for the processing of SA over LA in the auditory-auditory priming task they used. On the contrary, LA auditory stimuli were processed even faster and more accurately than SA stimuli, which is in sharp contrast with previous investigations.

Language development in a diglossic context has been recently explained (Hashem, 2022) in light of the *instance theory of automaticity* (Logan, 1988, 1990), which proposes that automatic, efficient performance is a memory-based phenomenon. Memory-based automaticity assumes that efficiency in task performance develops through practicing with specific items that can be encoded in and retrieved from memory directly, as opposed to its being the result of rules and processes that can be applied to unpracticed items. A beginner may well use various rules and processes to respond to a given stimulus in a given task. However, each time the task is performed and a response is reached, it is stored in memory, creating a “domain-specific knowledge base”. When the task is encountered again, the response is directly retrieved from this base without needing the rules and processes used earlier. As automaticity is item-based, not process-based, practice should only benefit the practiced stimuli (Logan, 1988, p. 492). Arabic native speakers’ performance seems to largely resemble such a mechanism of memory-based automaticity (Hashem, 2022). Because they are constantly practicing LA visual stimuli in reading and writing, speakers’ performance improves on tasks involving LA visual stimuli (Andria, 2016; Andria et al., 2022; Nevat et al., 2014). Because they are constantly practicing SA auditory stimuli in oral communication, their performance improves on tasks involving SA auditory stimuli (Ibrahim, 2006, 2009; Ibrahim & Aharon-Peretz, 2005) and SA language production (Abou-Ghazaleh et al., 2018). However, better SA production does not contradict the assumption that SA and LA could rely on a shared lexical system during language production (Abou-Ghazaleh et al., 2020). This is because performance differences in SA and LA production reflect a practice effect, rather than an effect of a separate lexical system. Such practice-dependent performance differences can emerge even within the same variety and on the same type of task and stimuli. For example, among LA visual stimuli, high frequency words were found to be better processed than low frequency words (Andria, 2016; Andria et al., 2022), and they surely rely on the same lexical system.

As mentioned, memory-based automaticity assumes that practice benefits only the practiced stimuli themselves; unpracticed stimuli, even when underlain by the same cognitive processing mechanism, cannot reap the practice benefit (Logan, 1988, 1990). Therefore, even though Arabic native speakers may employ the same mechanism for SA and LA processing (Boudelaa & Marslen-Wilson, 2013), the benefits of practice with a particular stimulus in a particular variety will be restricted to that stimulus, leading to the modality-dependent differences evident in research. The memory-based account does not contradict the morphological decomposition processing mechanism described earlier, in which the root and pattern that form words function and are accessed as lexical entries (Boudelaa, 2014; Boudelaa & Marslen-Wilson, 2013). The memory-based account, however, theorizes that it is the specific shared item (root or pattern), and not the shared processing mechanism, that is responsible for any facilitation between words. Interestingly, in Boudelaa and Marslen-Wilson’s (2013) auditory priming experiment, 86% of the SA and LA stimuli consisted of cognate roots (roots commonly used in SA and LA) or identical roots. Only 14% consisted of roots that belonged exclusively to SA or LA. From a memory-based perspective, the shared roots could explain why there was no auditory advantage of SA over LA. Indeed, Boudelaa and Marslen-Wilson (2013) emphasized the importance of cognate roots in the processing of SA and LA words; they indicated that the stimuli were selected in a way that “reflects the general lexical distributions for the two varieties, where most of their lexical stock is shared” (p. 1464).

Using the shared cognitive processing mechanism, independent of the shared items, to argue that SA and LA are represented as L1s is problematic. It implies that all Arabic dialects have the same relationship with LA even though they vary significantly in the number and type of linguistic items—phonological, morphological, or lexical—they share with LA. The concept of the varying linguistic distance between the different Arabic dialects and LA is especially highlighted in literacy research (Saiegh-Haddad, 2007, 2022), as children’s performance depends on whether the given literacy-related task involves LA items shared with their spoken dialect (Saiegh-Haddad, 2007; Schiff & Saiegh-Haddad, 2018). In short, it would be an overgeneralization to conclude that SA and LA are cognitively represented as L1s without discussing the role of the shared items between the two varieties. A memory-based automaticity account, however, can readily accommodate the L1 status of both varieties in addition to the fact that dialects vary in their distance from LA.

The memory-based view provides a unique perspective on the rise and fall of automatic performance in a cognitive task. The prediction is straightforward: If continuous practice leads to automatic, memory-based performance (i.e., direct retrieval of information from memory), then discontinuous practice can lead to a decline in automaticity (i.e., forgetting of information) (Grant & Logan, 1993). For example, in investigations of L1 attrition, the discontinuous practice has been shown to cause a decline in fluent speech production. When speaking L1 after a period of discontinuous practice, children (Yukawa, 1997) and adults (Schmid & Fägersten, 2010) were less fluent: they frequently paused before completing an utterance. Thus, individual differences in practice could affect performance even of the same task using the same variety of language.

For these reasons, the current study investigates the effect of practice on LA speech production. Two groups of Arabic native speakers are used. Each group mastered SA and LA under the same conditions (the same age and mode of acquisition). However, by the time of the study, the first group was still actively practicing LA, whereas the second had stopped using it for a considerable time. It is predicted that the differences in speech production will emerge as a function of practice: the continuous practice group should be able to produce more fluent (i.e., automatic) LA speech.

2. Methods

2.1. Participants

A total of 14 Arabic native speakers (mean age 24.3 years) participated in the study. All had acquired Arabic as a first language in Saudi Arabia. Since birth, they were exposed to a Saudi western dialect that they still use daily for everyday communication. The participants had some slight exposure to LA before going to school, usually by watching cartoons and children's programs on TV. Like most school children, they had intensive LA exposure K-12. The academic records of all participants were excellent. After graduating from high school, half the participants joined the Department of Arabic Language and Literature at a Saudi university, where their exposure to LA became even more intensive. After a four-year bachelor's program, they entered a two-year master's program in Arabic literature. Here they conducted research, presented seminars, took exams, and participated in class oral discussions using LA exclusively. In addition, they used LA in other cultural activities such as debates and poetry readings. After graduating from high school, the other half of the participants enrolled in the Department of the English Language at a Saudi university. Here, their exposure to LA was minimal, as English was the main medium of instruction. Exposure to LA through the media was also very limited because they deliberately accessed English-based media in order to increase fluency. After a four-year bachelor's program in English literature and linguistics, they entered a two-year master's program in which English was the exclusive medium of instruction; LA was not used at all. As this group had stopped using LA, they will be referred to as the *discontinuous practice* group, whereas the first group will be referred to as the *continuous practice* group. At the time of the study, both groups were in the final week of their master's program.

2. 2. Materials

A film retelling task was used to elicit speaking samples. The short (2-min) silent film tells the story of a man who was indifferent to people in his community. However, when he had a car accident and needed a blood donation, everyone in the community helped him, causing him to change his attitude and start helping others. The task was used because it permits the participants to produce free speech yet with controlled content, and that could result in a considerable homogeneity in terms of vocabulary choices and styles (Schmid & Fägersten, 2010).

2. 3. Procedure

Participants were shown the film once on a computer screen in individual sessions. They were told that they would be asked to retell what they had watched. Retellings were not prompted or interrupted at any point, and they were recorded with the participants' informed consent.

2. 4. Data Analysis

The recordings were transcribed using computer software and then coded by the researcher. The transcription and coding were checked by the researcher and a colleague. Table 1 shows the measures used to assess fluency (Kormos & Dénes, 2004).

Table 1. Measures of Speech Fluency

Measure	Unit
Duration of silent pauses	Second
Frequency of silent pauses	Number of silent pauses per minute
Frequency of filled pauses (i.e., vocalized hesitations or lengthening such as eee, em, hm, etc.)	Number of filled pauses per minute
Frequency of disfluencies (i.e., repetitions, restarts, repairs, and reformulations)	Number of disfluencies per minute

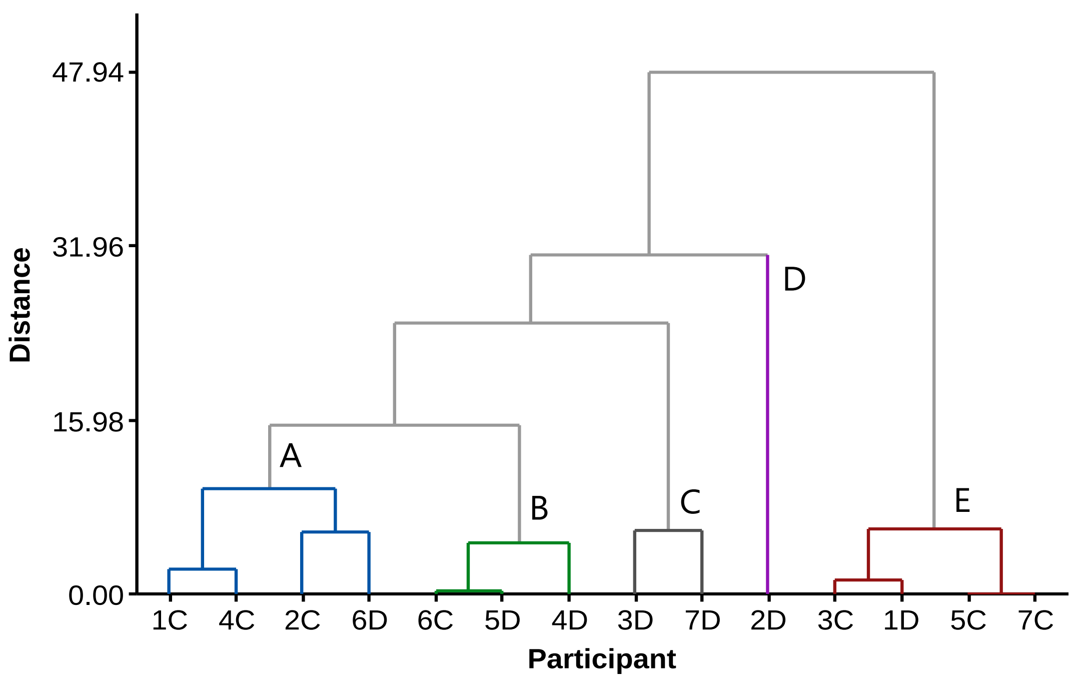
Only pauses lasting over 0.2 seconds were considered a disfluency marker. Pauses shorter than 0.2 seconds are regarded as normal “micro-pauses,” not a sign of disfluency (Riggenbach, 1991). However, as the produced speech samples varied in length, Kormos and Dénes’s (2004) method was used in order to extract the length of pauses per minute, as well as the number of pauses and disfluencies per minute. To estimate the length of pauses per minute, the total length of pauses over 0.2 seconds was divided by the total number of pauses over 0.2 seconds. To estimate the number of pauses or disfluencies per minute, the total number of pauses or disfluencies was divided by the total amount of time spoken represented in seconds, and then multiplied by 60.

A hierarchical cluster analysis using Ward’s method based on squared Euclidean distances was conducted to visualize differences between the measures in the form of tree structures or dendrograms. The ranked series of dichotomous branches reflected the distances between each measure. The farther apart the branches, the more distantly related were the measures. It may be wondered why multivariate methods—in this case, cluster analysis—were used instead of the more typical univariate approach. We used cluster analysis to compare the patterns of performance of each participant (Battaglia, Di Paola, & Fazio, 2016; Govindasamy & Velmurugan, 2018; Lee & Kim, 2021; Mindrila, Green, & McBane, 2017; Omar, Alzahrani, & Zohdy, 2020). Doing so avoids the ecological fallacy associated with summary statistics (e.g., comparing mean test scores in *t*-tests). “Fallacy,” because summary statistics are assumed to apply collectively to every member of a group, whereas in reality, depending on the variance, the statistics may apply to only some of the group (Connolly, 2006; May, Boe, & Boruch, 2003). Specific details that differentiate group members could be lost when quantitative data are aggregated to compute summary statistics, resulting in potentially misleading causal inferences (Sedgwick, 2015). Sample size is also relevant. If sample size is too small (e.g., $n < 30$ per group), as in the current study, there is insufficient statistical power (< 80%) to determine whether there is a meaningful difference between the means of two or more groups (Hedges & Rhoads, 2010; VanVoorhis & Morgan, 2007). With cluster analysis, on the other hand, the interpretation of the results does not depend on sample size (Everitt, Landau, Leese, & Stahl, 2011).

3. Results

Figure 1 displays the results of hierarchical cluster analysis based on a combination of all measures listed in Table 1. The 14 participants (continuous practice group: 1C–7C; discontinuous practice group: 1D–7D) were classified along a ranked series of dichotomous branches according to the distances between their combined measures of fluency. The participants in the branches on the extreme left-hand side of the dendrogram (Cluster A) were most dissimilar to the participants in the branches on the extreme right-hand side (Cluster E). If all continuous participants had been on one side of the dendrogram and all discontinuous participants on the other, then the levels of fluency in the two groups would have been totally dissimilar.

Figure 1. Dendrogram to Classify All Measures of LA Speech Fluency Between the 14 Participants



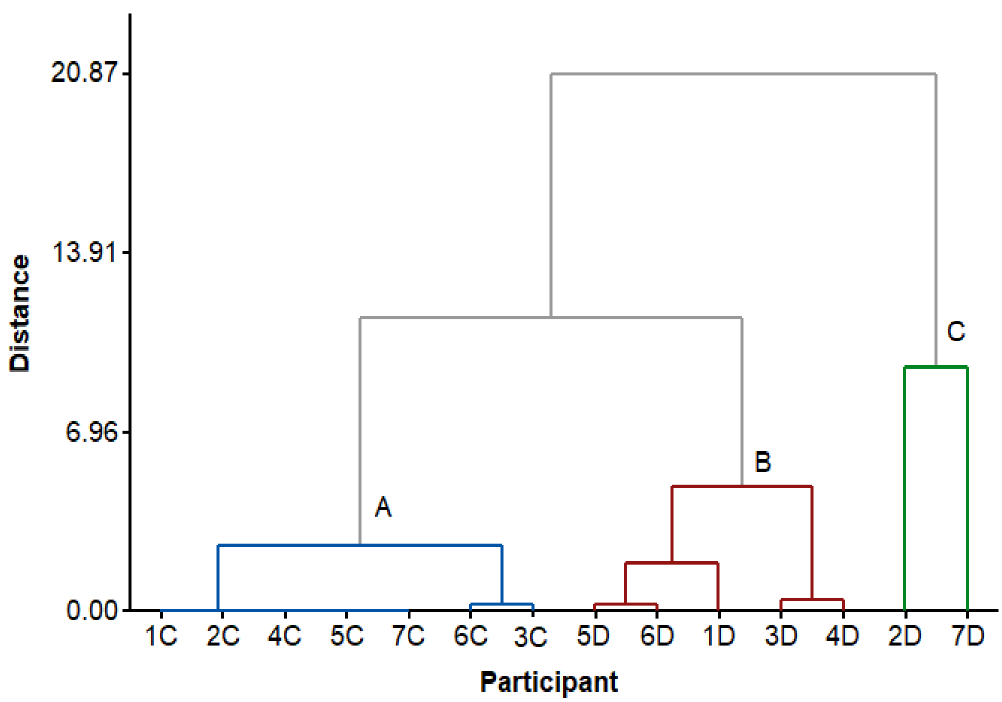
Note: Participants 1C to 7C = Continuous practice; 1D to 7D = Discontinuous practice

Figure 1 shows that the 14 participants were located at the ends of five major dichotomous branches labeled cluster A (participants 1C, 4C, 2C, and 6D); cluster B (participants 6C, 5D, and 4D); cluster C (participants 3D and 7D); cluster D (participant 2D); and cluster E (participants 3C, 1D, 5C, and 7C). Figure 1 shows that the continuous and discontinuous participants were not clearly separated in this analysis. Three members of the discontinuous practice group and four members of the continuous practice group were classified into clusters A and B on the left-hand side of the dendrogram. Four members of the discontinuous practice group and three members of the continuous practice group were classified into clusters C, D, and E on the right-hand side of the dendrogram.

Another hierarchical cluster analysis was conducted. Whereas the first used a combination of all measures, the second focused on disfluencies (i.e., repetitions, restarts, repairs, and reformulations) and silent pauses within utterances. Excluded were silent pauses at utterance boundaries, as they could denote planning rather than retrieval struggles (De Jong, 2016; Levelt, 1983). Filled pauses were also excluded, as they can play the role of words or linguistic signals (Clark & Tree, 2002). Research in several languages, such as French (Dewaele, 1996; Duez, 1982), Swedish (Horne, Frid, Lastow, Bruce, & Svensson, 2003), Dutch (de Leeuw, 2004), German (de Leeuw, 2004; Künzel, 1997), Russian (Riazantseva, 2001; Stepanova, 2007), Italian (Giannini, 2003), Spanish (Edmunds, 2006), Japanese (Watanabe & Ishi, 2000), and Korean (Trofimovich & Baker, 2006), suggests that filled pauses appear in each language with a specific pattern to carry semantic functions such as emphasizing and structuring information (Schmid & Fägersten, 2010). The exclusion of silent pauses between utterances and filled pauses may help to reduce the potential "noise" in the first analysis.

Figure 2 displays the results of hierarchical cluster analysis based on disfluencies and silent pauses within utterances. The branches on the left with participants 1C–7C (Cluster A) were clearly separated from the branches on the right (Clusters B and C), with participants 1D–7D. In other words, the seven participants with the continuous practice were systematically and completely distanced from the participants exposed to the discontinuous practice.

Figure 2. Dendrogram to Classify Disfluencies and Silent Pauses within Utterances between the 14 Participants



Note: 1C to 7C = Continuous practice; 1D to 7D = Discontinuous practice

4. Discussion

Hierarchical cluster analysis identified empirical differences in LA speech fluency at the level of individual participants. The first analysis—which used all the measures—suggested that practice has no clear effect on fluency. Each branch tended to contain participants from both continuous and discontinuous groups. However, the second analysis—which excluded silent pauses between utterances and filled pauses—revealed a clearer pattern. The branches containing the seven participants with the continuous practice were clearly and cleanly separated from the branches containing participants with discontinuous practice. This analysis therefore supports the conclusion of systematic differences between groups with respect to LA speech fluency. The absence of differences in the first analysis was probably due to interference from factors other than fluency.

The present findings are consistent with studies that show that discontinuous practice can lead to nonfluent L1 speech production (Schmid & Fägersten, 2010; Yukawa, 1997). However, data obtained in the SA-LA (diglossic) context could be interpreted the other way around. Because LA is not the variety used in everyday communication, it may be that LA speech production of the discontinuous group was not fully automatized in the first place. While we can safely attribute the fluent LA speech production of the continuous group to a great deal of practice, we actually have no baseline for the discontinuous practice group with which to compare their performance before and after practice is discontinued. Even if both groups have outstanding academic records, we cannot assume that LA mastery in school is equivalent to LA speech fluency, especially when it is measured with such a task that generates a free-style speech intended to express everyday events.

Nonfluent LA speech production may indicate a decline in previously existing automatic speech production, in which case it would be similar to reported cases of L1 attrition (Schmid & Fägersten, 2010; Yukawa, 1997). Alternatively, it may indicate underdeveloped automatic speech production, in which case it would be similar to L2 nonfluent speech (De Jong, 2016; Riazantseva, 2001; Skehan & Foster, 2007; Tavakoli, 2011). In terms of the second alternative, it is worth remembering that all participants developed LA at the same age and with the same mode. Further, they all speak the same SA dialect, which means that no participant is advantaged because they speak a dialect more similar to LA. For these reasons, it seems feasible to attribute nonfluent LA speech production to the absence of practice but not of an L2.

In the context of diglossia, some stimuli or tasks will be more prone to the individual practice effect than others. For example, SA auditory stimuli and oral production tasks could elicit general performance patterns, as all typically developed Arab speakers practice SA in the same way and use it for daily communication. LA visual stimuli are similarly expected to elicit general performance patterns among the Arab literate population, as all practice it as the medium of literacy. However, in auditory processing and oral production tasks, LA could reflect more practice-dependent differences because there is no fixed norm of its practice in such a mode.

5. Conclusion

The current study aimed to investigate the effect of practice on LA speech production. The LA speech samples were produced by two groups of Arabic native speakers who developed LA under the same conditions (the same age and mode of acquisition) but varied in the continuity with which they practiced it. The results revealed that the group that had been continually practicing LA was able to produce more fluent (i.e., automatic) LA speech. Such results could be understood within the memory-based view of automaticity, which predicts that continuous practice would lead to automatic, memory-based performance, while discontinuous practice would lead to a decline in automaticity (i.e., forgetting of information) (Grant & Logan, 1993).

In addition to accommodating modality-dependent performance differences that could occur between varieties, memory-based automaticity can accommodate the changes in performance that occur gradually throughout the natural course of language development. For example, basing literacy on LA is challenging for children as they are required to construct their LA linguistic knowledge and the orthographic knowledge needed to represent it simultaneously (Saiegh-Haddad, 2003). Accordingly, they would find linguistic structures exclusive to LA to be difficult to deal with (Saiegh-Haddad, 2007; Schiff & Saiegh-Haddad, 2018). However, given continuous practice with LA in reading and writing, their performance on LA written stimuli improves so much so that when they are adults it may be even better than their performance on SA written stimuli (Andria, 2016; Andria et al., 2022; Nevat et al., 2014).

Memory-based automaticity also allows a better understanding of changes in performance that could follow socially endorsed changes of how SA and LA could be used. For example, although SA is generally used in oral modality and LA is generally used in the written, the evolution of social media has led to an increase in the use of SA in writing. If this trend continues, and this is what is expected, an advantage for processing SA written stimuli might appear particularly for people who use social media applications to communicate SA written content. The diglossic situation derives its stability from using each variety in its specified context (Keller, 1982) but not necessarily with a specific modality. Therefore, although modality-dependent differences in SA and LA task performance are at root the result of practice, *practice*-dependent differences could be a more accurate term when discussing language performance in a diglossic context.

However, it should be acknowledged that the results of the current study may not be representative of the Arab-speaking population due to the small sample size, which could limit the generalization of our conclusion. Therefore, future research is recommended to be conducted on a larger sample to address the limitations of the current conclusion and reinforce its external validity.

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References

[1] Abou-Ghazaleh, A., Khateb, A., & Nevat, M. (2018). Lexical competition between spoken and literary Arabic: A new look into the neural basis of diglossia using fMRI. *Neuroscience, 393*, 83–96. https://doi.org/10.1016/j.neuroscience.2018.09.045

[2] Abou-Ghazaleh, A., Khateb, A., & Nevat, M. (2020). Language control in diglossic and bilingual contexts: An event-related fMRI study using picture naming tasks. *Brain Topography, 33*(1), 60–74. https://doi.org/10.1007/s10548-019-00735-7

[3] Andria, S. (2016). Diglossia in Arabic: Event-Related Potentials during a Visual Lexical Decision Task. University of Haifa, Faculty of Education, Department of Learning Disabilities.

[4] Andria, S., Madi-Tarabya, B., & Khateb, A. (2022). Behavioural and electrophysiological analyses of written word processing in spoken and literary Arabic: New insights into the diglossia question. *The European Journal of Neuroscience, 56*, 4819–4836. https://doi.org/10.1111/ejn.15781

[5] Ayari, S. (1996). Diglossia and illiteracy in the Arab world. *Language, Culture and Curriculum, 9*(3), 243–253. https://doi.org/10.1080/07908319609525233

[6] Battaglia, O. R., Di Paola, B., & Fazio, C. (2016). A new approach to investigate students' behavior by using cluster analysis as an unsupervised methodology in the field of education. *Applied Mathematics, 7*(15), 1649–1673. https://doi.org/10.4236/am.2016.715142

[7] Boudelaa, S. (2014). Is the Arabic mental lexicon morpheme-based or stem-based? Implications for spoken and written word recognition. In Handbook of Arabic literacy (pp. 31–54). Springer. https://doi.org/10.1007/978-94-017-8545-7_2

[8] Boudelaa, S., & Marslen-Wilson, W. D. (2013). Morphological structure in the Arabic mental lexicon: Parallels between standard and dialectal Arabic. *Language and Cognitive Processes, 28*(10), 1453–1473. https://doi.org/10.1080/01690965.2012.719629

[9] Clark, H. H., & Fox Tree, J. E. (2002). Using uh and um in spontaneous speaking. *Cognition, 84*(1), 73–111. https://doi.org/10.1016/S0010-0277(02)00017-3

[10] Connolly, P. (2006). Summary statistics, educational achievement gaps and the ecological fallacy. *Oxford Review of Education, 32*(02), 235–252. https://doi.org/10.1080/03054980600645404

[11] D'Acierno, M. R. (1990). Three Types of Bilingualism.

[12] De Jong, N. H. (2016). Predicting pauses in L1 and L2 speech: The effects of utterance boundaries and word frequency. *International Review of Applied Linguistics in Language Teaching, 54*(2), 113–132. https://doi.org/10.1515/iral-2016-9993

[13] de Leeuw, E. (2004). An instrumental and auditory phonetic comparison of hesitation markers in English, German and Dutch. *Unpublished MA dissertation, University of Trier*.

[14] Dewaele, J.-M. (1996). Les phénomènes d'hésitation dans l'interlangue française: analyse de la variation interstylistique et interindividuelle. *Rassegna italiana di linguistica applicata, 28*(1), 87-104.

[15] Duez, D. (1982). Silent and non-silent pauses in three speech styles. *Language and Speech, 25*(1), 11–28. https://doi.org/10.1177/002383098202500102

[16] Edmunds, P. (2006). *Buen---buena gente: Repair in the Spanish of the Southwest.* Paper presented at the Selected proceedings of the 8th Hispanic linguistics symposium.

[17] Everitt, B. S., Landau, S., Leese, M., & Stahl, D. (2011). Cluster analysis (5th ed.). John Wiley. https://doi.org/10.1002/9780470977811

[18] Ferguson, C. A. (1959). Diglossia. *word, 15*(2), 325-340.

[19] Giannini, A. (2003). *Hesitation phenomena in spontaneous Italian.* Paper presented at the Proceedings of the 15th International Congress of Phonetic Sciences.

[20] Govindasamy, K., & Velmurugan, T. (2018). Analysis of student academic performance using clustering techniques. *International Journal of Pure and Applied Mathematics, 119*(15), 309–323.

[21] Grant, S. C., & Logan, G. D. (1993). The loss of repetition priming and automaticity over time as a function of degree of initial learning. *Memory & Cognition, 21*(5), 611–618. https://doi.org/10.3758/BF03197193

[22] Hashem, R. (2022). Language Processing in Arabic Diglossia: Evidence for Memory-Based Automaticity. *International Journal of Cognition and Behaviour, 5*(1). https://doi.org/10.23937/2690-3172/1710014
[23] Hedges, L. V., & Rhoads, C. (2010). Statistical Power Analysis in Education Research. NCSER 2010-3006. National Center for Special Education Research.
[24] Horne, M., Frid, J., Lastow, B., Bruce, G., & Svensson, A. (2003). *Hesitation disfluencies in Swedish: Prosodic and segmental correlates.* Paper presented at the Proc. 15th ICPhS, Barcelona.
[25] Hudson, A. (2002). Outline of a theory of diglossia. https://doi.org/10.1515/ijsl.2002.039
[26] Ibrahim, R. (2006). Morpho-phonemic similarity within and between languages: A factor to be considered in processing Arabic and Hebrew. *Reading and Writing, 19*(6), 563–586. https://doi.org/10.1007/s11145-006-9009-y
[27] Ibrahim, R. (2009). The cognitive basis of diglossia in Arabic: Evidence from a repetition priming study within and between languages. *Psychology Research and Behavior Management, 2*, 93–105. https://doi.org/10.2147/PRBM.S5138
[28] Ibrahim, R., & Aharon-Peretz, J. (2005). Is literary Arabic a second language for native Arab speakers?: Evidence from semantic priming study. *Journal of Psycholinguistic Research, 34*(1), 51–70. https://doi.org/10.1007/s10936-005-3631-8
[29] Keller, R. E. (1982). Diglossia in German-speaking Switzerland. *Standard languages: Spoken and written*, 70-93.
[30] Kormos, J., & Dénes, M. (2004). Exploring measures and perceptions of fluency in the speech of second language learners. *System, 32*(2), 145–164. https://doi.org/10.1016/j.system.2004.01.001
[31] Künzel, H. J. (1997). Some general phonetic and forensic aspects of speaking tempo. *International Journal of Speech Language and the Law, 4*(1), 48–83. https://doi.org/10.1558/ijsll.v4i1.48
[32] Lee, W., & Kim, H. (2021). Cluster Analysis of the Challenges of Teaching Korean to Immigrant Learners. *어학연구, 57*(2), 167-193.
[33] Levelt, W. J. (1983). Monitoring and self-repair in speech. *Cognition, 14*(1), 41–104. https://doi.org/10.1016/0010-0277(83)90026-4
[34] Logan, G. D. (1988). Toward an instance theory of automatization. *Psychological Review, 95*(4), 492–527. https://doi.org/10.1037/0033-295X.95.4.492
[35] Logan, G. D. (1990). Repetition priming and automaticity: Common underlying mechanisms? *Cognitive Psychology, 22*(1), 1–35. https://doi.org/10.1016/0010-0285(90)90002-L
[36] Maamouri, M. (1998). Language Education and Human Development: Arabic Diglossia and Its Impact on the Quality of Education in the Arab Region.
[37] May, H., Boe, E. E., & Boruch, R. (2003). The ecological fallacy in comparative and international education research: Discovering more from TIMSS through multilevel modeling.
[38] Mindrila, D., Green, W. L., & McBane, C. (2017). Cluster analysis in educational research: Applications in the development of teacher and student typologies. *Focus on Educational Research: Practices, Challenges and Perspectives*, 51-88.
[39] Nevat, M., Khateb, A., & Prior, A. (2014). When first language is not first: An functional magnetic resonance imaging investigation of the neural basis of diglossia in Arabic. *The European Journal of Neuroscience, 40*(9), 3387–3395. https://doi.org/10.1111/ejn.12673
[40] Omar, T., Alzahrani, A., & Zohdy, M. (2020). Clustering approach for analyzing the student's efficiency and performance based on data. *Journal of Data Analysis and Information Processing, 8*(03), 171–182. https://doi.org/10.4236/jdaip.2020.83010
[41] Riazantseva, A. (2001). Second language proficiency and pausing a study of Russian speakers of English. *Studies in Second Language Acquisition, 23*(4), 497–526. https://doi.org/10.1017/S027226310100403X
[42] Riggenbach, H. (1991). Toward an understanding of fluency: A microanalysis of nonnative speaker conversations. *Discourse Processes, 14*(4), 423–441. https://doi.org/10.1080/01638539109544795
[43] Ryding, K. C. (2005). Arabic word structure: An overview. *A Reference Grammar of Modern Standard Arabic*, 44-56.
[44] Saiegh-Haddad, E. (2003). Linguistic distance and initial reading acquisition: The case of Arabic diglossia. *Applied Psycholinguistics, 24*(3), 431–451. https://doi.org/10.1017/S0142716403000225
[45] Saiegh-Haddad, E. (2007). Linguistic constraints on children's ability to isolate phonemes in Arabic. *Applied Psycholinguistics, 28*(4), 607–625. https://doi.org/10.1017/S0142716407070336
[46] Saiegh-Haddad, E. (2022). A Psycholinguistic-Developmental Approach to the Study of Reading in Arabic Diglossia: Assumptions, Methods, Findings and Educational Implications. In Handbook of Literacy in Diglossia and in Dialectal Contexts (pp. 135–163). Springer. https://doi.org/10.1007/978-3-030-80072-7_8

[47] Schiff, R., & Saiegh-Haddad, E. (2018). Development and relationships between phonological awareness, morphological awareness and word reading in spoken and standard Arabic. *Frontiers in Psychology, 9*, 356. https://doi.org/10.3389/fpsyg.2018.00356

[48] Schmid, M. S., & Fägersten, K. B. (2010). Disfluency markers in L1 attrition. *Language Learning, 60*(4), 753–791. https://doi.org/10.1111/j.1467-9922.2010.00575.x

[49] Sedgwick, P. (2015). Understanding the ecological fallacy. *BMJ (Clinical Research Ed.), 351*, h4773. https://doi.org/10.1136/bmj.h4773

[50] Skehan, P., & Foster, P. (2007). Complexity, accuracy, fluency and lexis in task-based performance: A meta-analysis of the Ealing research. *Complexity, accuracy, and fluency in second language use, learning, and teaching, 207*, 226.

[51] Stepanova, S. (2007). *Some features of filled hesitation pauses in spontaneous Russian.* Paper presented at the Proceedings of ICPhS.

[52] Tavakoli, P. (2011). Pausing patterns: Differences between L2 learners and native speakers. *ELT Journal, 65*(1), 71–79. https://doi.org/10.1093/elt/ccq020

[53] Trofimovich, P., & Baker, W. (2006). Learning second language suprasegmentals: Effect of L2 experience on prosody and fluency characteristics of L2 speech. *Studies in Second Language Acquisition, 28*(1), 1–30. https://doi.org/10.1017/S0272263106060013

[54] VanVoorhis, C. W., & Morgan, B. L. (2007). Understanding power and rules of thumb for determining sample sizes. *Tutorials in Quantitative Methods for Psychology, 3*(2), 43–50. https://doi.org/10.20982/tqmp.03.2.p043

[55] Watanabe, M., & Ishi, C. T. (2000). *The distribution of fillers in lectures in the Japanese language.* Paper presented at the Sixth International Conference on Spoken Language Processing. https://doi.org/10.21437/ICSLP.2000-504

[56] Yukawa, E. (1997). L1 Japanese attrition and regaining: Three case studies of two early bilingual children. Centre for Research on Bilingualism, Stockholm University.