

Prosodic Features of Lying: A View From Jordanian Colloquial Arabic

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Abstract—Lying is an intentional act of delivering false information to deceive others using language. Examining the linguistic features of this act has been an area of interest for Forensic linguists because of its potential value in investigating various legal contexts such as allegations, testimonies, criminal investigations, and police interrogations. This study aims to explore the relationship between the frequency and duration of Filled pauses (FPs) and lying in Jordanian colloquial Arabic (JAC) and examines their social constraints. To achieve this aim, a corpus of 288 narratives, 144 lying and 144 truthful, was collected through face-to-face interviews with 48 speakers stratified by gender, age, and educational attainment. The truthful accounts served as a baseline to detect any change in the pattern of FP frequency and duration in the lying condition. The results obtained from the analysis revealed that lying accounts contained more frequent and longer FPs than truthful accounts, indicating that the frequency of FPs and their duration are potential cues for deception in JAC. In addition, the data showed that the three social factors influence the frequency and duration of FPs when lying. In terms of gender, female deceptive accounts displayed a higher frequency of and longer pauses than males'. With regard to age, the lying narratives of old speakers had the highest frequency and longest FPs among all age groups. As for education, the deceptive narratives of high-educated speakers contained more frequent and longer pauses than their low-educated counterparts.

Index Terms—Forensic Linguistics, Filled Pauses (FPs), lying, deception detection

I. INTRODUCTION

Forensic Linguistics is considered an applied linguistic science in which linguistic knowledge is utilized in examining some legal issues (Olsson, 2008; Coulthard & Johnson, 2010); thus, it refers to the application of any scientific linguistic principle to any text that could be potential of being forensic like text messages, emails, recorded speech, testimonies, and confessions.

Considering that any legal matter is codified in language, linguists of all the various subfields of linguistics could always have a role in contributing to the field of law. For example, syntacticians, semanticists, and pragmaticians can have their input when legal documents are in question by offering linguistic analysis; phoneticians could help identify speakers and contribute to trademark cases where sounds of names are at issue; dialectologists could determine the country or city of origin of suspects (Tiersma & Solan, 2002). Therefore, forensic linguists play an influential role in the legal system by detecting linguistic cues in the examined court case to reveal certain pieces of evidence.

Owing to the fact that the act of lying violates veracity and goes under the umbrella of deception, its detection has been an area of interest for scientists in many fields. Throughout history, lying detection has been examined through different approaches. A number of scientists studied whether there are any physiological cues associated with lying via polygraphs; some conducted voice analyses, and others examined the non-verbal cues associated with lying (Nicklaus & Stein, 2022; Vrij, 2008). However, since lying is a linguistic activity (Horn, 2017) that cannot be performed without the use of language, some linguists have been interested in searching for the verbal cues of deception by developing verbal veracity assessment tools that could be implemented in investigations in court cases, e.g., false testimonies, confessions, or accusations (Masip et al., 2005; Vrij, 2008; Nicklaus & Stein, 2022). In attempt to contribute to the field of law from a linguistic perspective, this study aimed to investigate whether the occurrence and frequency of filled pauses (FPs) are potential cues for deception in Jordanian Colloquial Arabic.

Pauses are among the acoustic cues that signal breaks in the prosodic units of natural speech. There are two major types of pauses: silent and acoustic-filled ones. Silent pauses are defined as “periods of non-articulation by the speaker” (Rose, 2017, p. 49), whereas acoustic-filled pauses FPs e.g., ‘Um’ in “*behind um the banana that’s not peeled*” are defined as “gaps in speech production filled with non-lexical vocalizations (Gosy, 2023, p. 1)”. These pauses indicate various processes, such as recalling a word, controlling speech production, keeping the floor, and managing communication between interlocutors (Clark & Tree, 2002; Benus et al., 2006). However, pauses of both types cause interruptions to an ongoing speech, which could affect listeners’ judgment of the veracity of an account. They might either boost or lower their confidence in the speaker’s knowledge as they indicate uncertainty and hesitation (Vrij et al., 1996; Arciuli et al., 2010; Chen, 2020).

To explore the relationship between FPs and deception, a corpus of lying and truthful accounts was gathered through face-to-face interviews with 24 male and 24 female speakers of Jordanian Colloquial Arabic. Truthful narratives were

used as a baseline to explore any remarkable deviation in the frequency or duration of pauses that occurred in the lying accounts.

The below section reviews related literature on the use of Filled Pauses with regard to lying.

II. REVIEW OF LITERATURE

This section reviews the pertinent literature on the relationship between filled pauses (FPs) and deception.

Filled pauses like *uh* and *um* tend to be used at specific points in discourse, serving multiple intentional and unintentional communicative messages such as signaling speakers' intention to take the floor in a conversation, facilitating the perception and comprehension of the next proposition (Tree, 2002), and managing interpersonal communication (Bortfeld, 2001). However, this prosodic feature has also been an area of interest for researchers due to its potential association with verbal deception.

Chen et al. (2020) examined four linguistic and acoustic-prosodic features of discourse, namely filled pauses, false starts, response latency, and repetition, in relation to human perception of deception. They collected data through a game where participants were requested to rate a corpus of deceptive and truthful interviews. Subsequently, researchers pointed out the acoustic-prosodic and linguistic characteristics of language that raters adopted to judge the veracity of interviewees. Afterward, they compared them to the features they actually detected in truthful and deceptive discourse to examine the accuracy of people's perception of the veracity of statements in alignment with reality. The findings revealed that successful lies were shorter, with fewer sentences and fewer filled pauses than unsuccessful ones. In addition, it was shown that successful liars responded more quickly than unsuccessful ones.

Levitan et al. (2018) also examined deception detection in a corpus containing dialogues conducted between 340 subjects in the English language. Besides, they explored the perception of deception by highlighting the features of the statements that were identified as truthful or deceiving by interviewers. The analysis revealed significant differences between honest and deceiving responses. First, results showed that participants' deceptive responses were longer and contained more words than truthful ones. Second, it was revealed that the increase in the average response duration and number of words per sentence were significant indicators of lying. Third, their analysis showed that the increase in the use of filled pauses in participants' response segments is a significant indicator of deceit.

Montacié et al. (2016) investigated three prosodic cues namely pauses, speech segmentation, and phone duration with regard to deception detection. They applied computational methods to a deceptive speech database consisting of truthful and lying answers to a number of unknown questions. Findings showed that deceptive answers contained more frequent and longer pauses than truthful ones as a result of the extra cognitive load liars assume when fabricating an event.

Arciuli and Villar (2010) examined the use of two utterances, namely 'um' and 'like' in laboratory-elicited lies. Participants were asked to share two accounts as part of the data collection process. In the first account, they were instructed to honestly express their opinions about specific social issues (e.g., smoking ban, legalizing marijuana, abortion) to the interviewer. In the second one, they were requested to provide an untruthful response and convince the interviewer with an opinion opposite to their genuine belief. Results revealed that filled pauses were less frequent and shorter in deception than in truth-telling. Researchers attributed this finding to two possible reasons. The first reason is that the utterances 'um' and 'like' should not be classified as filled pauses as they can hold a lexical status, similar to injections, that appears in effortless communication. The second possible reason might be that speakers attempt to control the use of any utterance that could signal uncertainty when lying to mask their lies.

Mann et al. (2004) examined the ability of ninety-nine police officers to distinguish between truthful and lying statements said by suspects in videotaped police interviews using a set of verbal cues and non-verbal cues. Findings showed that police officers had a higher success rate in detecting lies when pauses were more frequent in the statements. However, the efficiency of this feature as a cue for deception varied on the officer's level of experience and the severity of the offense.

Tree (2002) examined the perception of deceptive speech by comparing how overhearers perceived second speakers' contributions to a conversation depending on whether the responses were immediate, preceded by a pause, a preceded by an 'um,' or preceded by an 'um' and pause. The findings showed that listeners perceived the use of filled pauses after direct questions (e.g., "Are you here because of affirmative action?" (*pause, um, or both*) "It helped me out a little bit.") (p. 73) as a signal of dishonesty or discomfort with the subject being discussed.

Vrij et al. (2000) conducted a study examining the production of verbal and non-verbal deception behavior. Amongst the examined non-verbal deception behaviors were speech hesitations "e.g., 'ah' or 'mm'" speech errors "word or sentence repetition, change, completion, or slip of the tongue"; latency period "period of time between the question and the answer"; and speech rates "the number of spoken words divided by the length of interview minus latency period" (Vrij et al., 2000, p. 299). To examine these features with regard to lying, researchers conducted video and audio-taped interviews with seventy-three nursing students. Students were requested to either tell the truth or lie about a movie they had just watched. The results showed that liars demonstrated more filled pauses (e.g., *ums* and *uhs*), longer speech latency, and slower speech rates than truth-tellers. The researchers attributed the reason for these findings to the increased cognitive load participants assumed when they were requested to perform a difficult task, which is making up a bold-face story.

III. METHODOLOGY

This section overviews the research questions, participants, instrument, and data collection procedure.

A. Research Questions

This paper attempted to answer the following questions:

- a) To what extent do acoustic-filled pauses indicate lying in Jordanian Colloquial Arabic?
- b) To what extent does the duration of acoustic-filled pauses indicate lying in Jordanian Colloquial Arabic?
- c) To what extent do the social factors (gender, age, and educational attainment) constrain the use of filled pauses and their duration while lying?

B. Participants

The target population comprises all Jordanian speakers of colloquial Arabic aged between 21-30, 31-40, and 41-50. The researcher recruited 24 male and 24 female native speakers of Jordanian Colloquial Arabic who all live in West Amman.

As shown in Table 1, speakers were distributed into three age groups (young, middle-aged, and old). The age range of young speakers was between 21-30 years old, middle-aged speakers were between 31-40, and old speakers were between 41-50. Twelve participants within each age range were chosen. In view of the three age ranges, this would enable the researcher to examine whether 'age,' as an independent variable, affects the choice of linguistic expressions of lying and whether it indicates any linguistic changes in progress. As for participants' level of education, participants were classified into 24 highly educated individuals and another 24 low-educated ones.

TABLE 1
SAMPLING OF THE POPULATION ACCORDING TO GENDER, AGE, AND EDUCATIONAL ATTAINMENT

Education	Male			Female			Total
	21y-30y	31y- 40y	41y-50y	21y-30y	31y-40y	41y-50y	
High	4	4	4	4	4	4	24
Low	4	4	4	4	4	4	24
Total	8	8	8	8	8	8	48

A non-probability sampling method, precisely the convenience sampling technique, was employed to recruit the required number of participants. This technique is a way through which data is collected from a population that is accessible and close at hand to the researcher (Rahi, 2017). This technique was adopted in this research and not any other due to three reasons. First, the nature of the topic under investigation, lying, is widely regarded as a dishonorable behavior that is not tolerated in Jordanian society. Moreover, being identified as a liar is deemed face-threatening, which might prevent people unfamiliar with the researcher from telling a lying account or conducting the mock crime comfortably. Second, as Jordan is considered a conservative society, some males, especially of the old age group, might feel shy or embarrassed to lie in front of a female interviewer. Third, collecting data from three different age groups of males and females who are half highly educated and half low-educated is time-consuming; thus, this technique is time efficient since the population is accessible to the researcher.

C. Instrument & Data Collection Procedure

To investigate whether FPs and their length could be cues for lying detection in JAC, it was crucial to examine specific speech content in a systematic manner (Mann et al., 2004). As the scope of this study is limited to the Jordanian colloquial of Arabic, participants were interviewed by the researcher. Each interview was approximately 25- 30 minutes long. During each interview, three phases were conducted as explained below:

Phase 1: Breaking the Ice:

In this phase, the researcher started by asking the participants a few ice-breaking questions (e.g., how are you, how was your day...etc.) to put the participants at ease while talking to the researcher.

Phase 2: Eliciting Lying Accounts

In this phase, participants were requested to convincingly recount three false narratives about the following three scenarios (car accident, theft, and wedding they attended)

Before participants shared their narratives, the interviewer instructed them only to recount completely made-up narratives and not real past experiences and to be as detailed as possible.

Phase 3: Establishing a baseline

In order to establish a speech baseline to detect any change in the use of FPs and their length in the data obtained from the lying narratives, participants were requested to recall real past experiences in the same scenarios (a car accident they had or witnessed before, a wedding they attended, a trip they took before). They were asked to provide detailed responses to stimulate more speech.

As participants tend to adopt a formal way of speech and may be conscious of their lexical choices while being recorded (Labov, 1972), they were informed that the present study was on episodic memory and not linguistic in nature.

D. Data Analysis Procedure

To investigate whether the frequency and duration of FPs can be cues for veracity or deception in Jordanian Colloquial Arabic (JCA), this section outlines the steps that were adopted to obtain comparable numerical data:

First, to examine whether the frequency of FPs varies when lying than when telling the truth, the following steps were applied to draw comparable numerical data:

- a) All FPs in all the lying and truthful accounts were counted.
- b) The overall averages of all FPs used in two modes (lying and truthful) with respect to the social factors were calculated by dividing the total number of FPs of each speaker by the total duration of records.
- c) The percentage change of the average of FPs between lying and truthful accounts was calculated by applying this equation: $(A-B)/B*100$. This equation calculates the percentage of variation in comparison to a reference value (B). In this thesis, A represents the average number of FPs in the lying accounts, while B represents the average number of FPs in the truthful accounts.
- d) In order to obtain accurate results, the average number of FPs per minute was calculated. This was deemed necessary since the length of the accounts varied between speakers.
- e) The data obtained from the truthful accounts served as a baseline to detect any change in the pattern of FP distribution that occurred in lying accounts

Second, to examine whether the duration of FPs varies when lying than when telling the truth, the following steps were applied to draw comparable numerical data:

- a) Duration of all FPs in all accounts was counted using a stopwatch
- b) The average single pause duration was calculated by dividing the duration of the pauses by the number of pauses;
- c) Afterward, the percentage of the duration of all pauses was calculated by dividing it by the total duration of the accounts;
- d) The percentage change in FP duration between lying and truthful accounts was calculated using the equation $((A-B)/B)*100$. This equation calculates the percentage of variation in comparison to a reference value (B). In this case, A is the percentage of FP duration in the lying accounts, while B is the percentage of FPs in the truthful accounts.
- e) The data obtained from the truthful accounts served as a baseline to detect any change in the pattern of FP distribution that occurred in lying accounts.

Due to the fact that this study examines the phonological features of lying by JCA speakers, only the data sets obtained from the analysis of deceptive accounts were explained in detail. On the other hand, those obtained from truthful accounts were only used as a benchmark to examine the patterns of deceptive language against them.

The section below presents the results of the study along with their discussion.

IV. RESULTS AND DISCUSSION

This section is mainly dedicated to presenting the findings of the study regarding the use of FPs and their duration with regard to lying in JAC. As I show below, the two types of accounts maintain differences between them in terms of prosodic features.

This section comprises two sub-sections that provide an analysis of two phonological features with regard to lying detection in JCA: (7.1) Filled Pauses (FPs) and (7.2) Duration of Filled Pauses (FPs).

A. Filled Pauses (FPs)

Drawing upon the reviewed literature, it is obvious that the production of deceptive utterances requires a higher cognitive load than producing truthful ones, which might consequently cause speech-planning difficulties; therefore, fillers come to compensate for the time the speaker needs to plan and control speech (Gosy, 2023, p. 10).

The following sub-sections present the average frequency of FPs as well as the percentage of their duration in the two lying and truthful modes with respect to social factors (i.e., gender, education, and age).

(a). Speaker's Gender

The influence of gender (males vs. females) on the distribution of FPs across data was examined by calculating the average of FP frequency in the two modes by applying the mathematical equations that were explained above. The results are shown in Table 2 below.

TABLE 2
AVERAGE OF FPs PER MINUTE IN THE TRUTHFUL AND LYING ACCOUNTS ACCORDING TO SPEAKER'S GENDER

Gender	Mode	
	Lying	Truthful
Males	4.23	3.251
Females	3.87	2.79

Table 2 demonstrates that males produced an average of 4.23 filled pauses per minute when lying, while females produced an average of 3.87 filled pauses per minute. This indicates that males used 10% more FPs than females when lying. By comparing the data sets obtained from the lying accounts to the truthful ones, it was observed that males tend to use more filled pauses when lying, averaging (4.23) as compared to when telling the truth (3.251). Similarly, females

tend to use more filled pauses in deceptive communication (3.87) than when being truthful (2.79). Thus, there exists a 30% percent increase with respect to the average number of pauses used by males when lying than when telling the truth. Additionally, there is a 37% percent increase in the average number of pauses used by females when being deceptive compared to when telling the truth. Hence, both males and females used a higher average number of filled pauses in lying accounts than in truthful accounts. Example (1) below illustrates this difference:

1.

(1) Excerpt from a lying account:

knt ʕa: ala:ja:ra {pause: eeeeh} wfdʒʔa: hsjt {pause: eeeh} ʔlsja:r ʔlj wra:j θrkt {pause: eeeeh} wnzlna: (pause: Eeeeh} nʃwf ʃw sʕa:r [M:Middle-aged: H]
 ‘I was stopping at the light {pause: eeeh} suddenly I felt {pause: eeeeh} that a car hit mine from behind {pause: eeeeh} so we got out of the car {eeeeeh} to see what had happened.’

(2) Excerpt from a truthful account:

wa:hd skra:n ʔdʒa: xbtʃj ba:lsja:r mn wra: {eeeh} wma: sʕa:r ʃʃj ʔʃj bs ʔdʕra:r ba:lsja:r
 ‘A drunk person hit my car from behind {pause: eeeh} nothing happened to me but the car was damaged.’ [M: Middle-aged- H]

(b). *Speaker’s Age*

Table 3 below presents the average number of FPs used by each age group across the three scenarios. Second, the effect of age on the distribution of filled pauses in the corpus has been examined by calculating the average of FPs in the three scenarios of each age group (22-32/ 33-43/ 54-54), as demonstrated in Table 3 below.

TABLE 3
 AVERAGE OF FPs IN THE TRUTHFUL AND LYING ACCOUNTS ACCORDING TO SPEAKER’S AGE

Age	Mode	
	Lying	Truthful
21-30	3.77	3.31
31-40	4.25	3.27
41-50	4.14	2.88

It is apparent that individuals in the 33-43 age group exhibit a higher tendency for filled pauses during lying, as indicated by their higher average of 4.25 compared to the other age groups. However, the age group (22-32) showed comparatively less use of filled pauses when lying, averaging at (3.77), the lowest within this age range. For the 44-54 age group, the average number of filled pauses per minute is 4.14, which falls between the other two groups. The average difference between age groups in using FPs in the lying accounts indicates that speakers aged 33-43 use 12.73% more FPs than speakers aged 21-32 and 2.65% more than those aged 44-54. Example (2) represents the high number of FPs a female took while recounting a false event. As for the percentage change in the use of FPs between the lying and truthful accounts, data shows that there is a 13.89% increase in the lying narratives of young speakers, a 29.96% increase in the narratives of middle-aged speakers, and 43.75 in the narratives of old speakers. Therefore, the frequency of FPs increases with age when lying.

After testing the findings against the numerical data obtained from the analysis of truthful accounts, the use of FPs in the deceptive accounts was higher than in the truthful accounts, with a noticeable difference. In addition, it was revealed that the percentage difference in the number of FPs between lying and truthful accounts changes with age. The age group of 44-54 has the highest percentage difference, indicating a more significant change in filled pause usage between lying and truthful scenarios. Speakers aged 44-54 used 43.75%; 32-43 used 30.01%; and 21-32 used 13.90% more pauses in the deceptive accounts than in the truthful accounts. These results indicate potential age-related differences in the filled pause patterns used in deceptive communication, with older people showing a substantial difference in FP patterns between lying and telling the truth. Example (2) demonstrates this difference.

(1)

(A) An excerpt from a lying account

ħa:tʕ mwba:jlj θt ʔlmnʃfeh {pause: u:.....} wrħt ʕla ʔlʔiʕ jʕnj qʕdna: {pause: eeeeeeh} ʃj ʕʃr dqa:jq {pause: eeeeh} ʃlma: rdʒʕt {pause: eeeeh} qʕdt wnsjt mwdʕwʕ ʔlmwba:jl.
 [F, Middle-aged, H]

‘I put my phone under a towel {pause: u:.....} and went to the beach and stayed there {pause: eeeeeeh} for about 10 minutes {pause: eeeeh} When I got back {pause: eeeeh} I sat down and forgot about my phone.’

(B) An excerpt from a TRU account

knt tʃl sʕjʃr {pause: eeeh} kna: dʒa:jjn ʔdʒa:z mn ʔlkwjt ʕa:la:rdn wna:zljn ʕla ʔlywr {pause: u:..} ʔxtj btqtʕʕ ʔʃa:rʕ wdʕstha: sja:r

‘I was a little girl {pause: eeeh} We were coming on vacation from Kuwait to Jordan and were going down the Jordan Valley {pause: u:..} My sister was crossing the street, and a car ran over her.’

(2)

(A) An excerpt from a lying account

kna: bʃrs b {pause: eeeeeh} lslʃ {pause neeeeeh} ka:n ʔlʃrs hʃlw {u:::} ka:n ʃrs ʃb sʃa:hʃb ʔlj {pause: mmmm} ka:n ba:lsʃjʃ

[M, Old, H]

‘We were at a wedding in {pause: eeeeeh} Salt {pause: neeeeeh} the wedding was nice {u:::} it was a wedding for a friend {pause: mmmm} it was in the summer’

(B) An excerpt from a truthful account

rht ʃla ʃrs ʔbn xa:lj ba:lsʃʃ {pause: eeh} mʒrʃ hʃlw ktjr ʃrs ktjr mrtb {pause: eeh} wa:lʃrws wa:lʃrjs ktjr ka:nw mbswtʃjn

[M, Old, H]

‘I went to my cousin's wedding in Salt {pause: eeh}, a very nice farm, a very well-arranged wedding {pause: eeh}, and the bride and groom were very happy.’

(c). Speaker's Education

Table 4 below shows the average FPs used by high-educated and low-educated speakers in both account modes (lying and truthful).

TABLE 4
AVERAGE OF FPs IN THE TRUTHFUL AND LYING ACCOUNTS IN RELATION TO AGE

Education	Mode	
	Lying	Truthful
High	4.48	3.50
Low	3.59	2.73

The results indicate that highly educated speakers tend to use more filled pauses per minute at an average of (4.48) than low-educated speakers, averaging (3.59) during lying scenarios. Hence, high-educated speakers tend to use 24% more FPs than low-educated speakers. As for the difference between lying and truthful accounts, the analysis uncovered that the average number of FPs is higher in the former (4.48, 3.59) than the latter (3.50, 2.73) regardless of education level, with a noticeable difference, especially for the low-educated speakers. Accordingly, a 28.00% increase was observed for highly educated speakers and a 31.42% increase for low-educated speakers in lying accounts compared to truthful ones.

3

(A) An excerpt from a lying account by a highly educated speaker

qbl ʃjr snjn {pause: eeeeh} bbnzl ʔna: wa:sʃdqa:ʔjj {pause: eeeeh} bjdʒwnj mn ʃma:n {pause: fa:::} fmnzl ʃla hma:ma:t ma:ʃjn {pause: u:::} hwa:lj ʔhna: {pause: eeeeh} ʔʃxa:sʃ

[M, Middle-aged, H]

‘Ten years ago {pause: eeeeh} friends of mine they came from Amman {pause: a:::} we went to Ma'In Hot Springs {pause: u:::} we were around {pause: eeh} 4 people.’

(B) An excerpt from a truthful account by a highly educated speaker

sa:ʃrna: qbl ʔrbʃ snjn {pause: eeeh} ʃla mdjn ʔstʃnbwl qʃdna: ʔja:m {u::} rʃna: ba:lsʃjʃ wka:nt sfr hʃlw

[M, Middle-aged, H]

‘We traveled four years ago {pause: eeh} to the city of Istanbul. We stayed for 8 days {u::} we went in the summer, and it was a nice trip.’

The following section provides an analysis of the duration of FPs with regard to lying in JCA.

B. Duration of Filled Pauses

This section presents an analysis of the percentage of FPs duration in the three scenarios (car accident, wedding, and trip) in the two modes (lying and truthful) in light of the three social factors of gender, age, and education.

The following section presents the frequency of occurrence of FPs with respect to speakers' gender.

(a). Speaker's Gender

Table 5 shows the average duration of pauses in the two modes in relation to speakers' gender.

TABLE 5
PERCENTAGE OF FP DURATION IN THE LYING AND TRUTHFUL ACCOUNTS ACCORDING TO SPEAKER'S GENDER

Gender	Mode	
	Lying	Truthful
Males	13.42	10.92
Females	11.08	9.46

Table 5 showed that males and females had longer pause lengths when recounting deceptive stories than truthful ones. The average pause duration percentage for males was notably higher when lying (13.42) than when telling the truth (10.92), indicating a 22.89% increase in the lying scenarios. Similarly, the pause duration percentage for females was higher when lying (11.08) than when telling the truth (9.46), indicating a 17.12% increase in the lying scenarios. The comparison between the percentage change in the duration of FPs between the lying and truthful accounts demonstrates that the rise in duration in the lying narratives of males was higher than that of females.

The subsequent section exhibits the frequency of occurrence of FPs with respect to speakers' gender.

(b). *Speaker's Age*

Table 6 presents the average duration in the two modes with regard to speakers' age of pauses.

TABLE 6
PERCENTAGE OF FP DURATION IN THE LYING AND TRUTHFUL ACCOUNTS ACCORDING TO SPEAKER'S AGE

Age	Mode	
	Lying	Truthful
22-32	12.2568	10.1963
33-43	12.00615	10.3223
44-54	11.2871	9.1439

Similar to the findings of gender, all age groups tend to have longer pause durations while lying than when recounting truthful narratives. Among speakers aged 22-32, there was a noticeable 20.17% uptick in pause duration when they were being untruthful (12.5) rather than truthful (10.19). Similarly, for those aged 33-43, there was a substantial difference of 16.36%, indicating a heightened pause duration while telling false narratives (12.00) than when telling truthful ones (10.32). Those aged between 43-54 exhibited a more significant increase in pause duration at 23.41% in the lying mode (11.28) compared to the truthful mode (9.14). The comparison of the percentage of change in the duration of FPs between the two account modes revealed that old speakers had the highest percentage of increase in the FP duration, followed by young and middle-aged speakers.

The next section presents the frequency of occurrence of FPs with respect to speakers' gender.

(c). *Speaker's Education*

Thirdly, the analysis considered the education level of speakers to identify patterns in the length of FPs between truthful and deceptive narratives amongst speakers. Table 7 shows the percentages of pause duration in the modes according to the speakers' education level.

TABLE 7
PERCENTAGE OF FP DURATION IN THE LYING AND TRUTHFUL ACCOUNTS ACCORDING TO SPEAKER'S EDUCATION

Education	Mode	
	Lying	Truthful
High	13.9105	11.5032
Low	10.603	8.889

The data indicates noticeable differences in pause durations between the lying and truthful scenarios for speakers of both education attainments. In fact, both had longer pause durations while lying than when telling the truth. The percentage of pause duration by highly educated speakers in the lying mode was 13.91. In the truthful mode, it was 11.50%, indicating a 20.93% increase in pause duration while lying. Low-educated speakers also demonstrated similar results with a 10.60% pause duration in the lying accounts and 8.88% in the truthful accounts, which implies a 10% increase in pause duration while lying than when telling the truth. Furthermore, the data indicates that highly educated speakers take longer pauses while telling the truth than their low-educated counterparts.

C. *An Excerpt From a Lying Account*

kna: qa:ʃdʒn {pause: 2.76 seconds} wknt ɦa:tʰtʰ mɦfðʳtj ʒa:liʳa:wl {pause: 2.76 seconds} 2.91 seconds} nzlɪ ʔdʒɪb ʔfj rdʒʃt {pause: 2.53 seconds} lqjt ʔlmɦfðʳ mf mwdʒwd
[H, Middle-Aged, M]

'We were sitting {pause: 2.76 seconds} and I had put my wallet on the table {pause: 2.76 seconds}. I went down to get something and came back {pause: 2.53 seconds} to find that the wallet was not there.'

(B) An excerpt from a truthful account

wsʳlɪna: ʔlbtra: ʔlðʳhr {pause 1.50 seconds} wsʳlɪna: ʔlðʳhrwtydɪna: wsbɦna: wa:rɦna: {pause 1.56 seconds} dʳlɪna: hna:k

[H, Middle-Aged] After analyzing the collected corpus, several findings were revealed. swam, rested, {pause 1.56 seconds} and stayed there.

As observed from the examples, the speaker used longer pauses when lying than when telling the truth.

After stating the analysis results, below is a discussion of the main findings.

Several findings were revealed upon examining the use of filled pauses and their duration in the collected corpus. First, it was observed that deceptive accounts had a higher frequency of filled pauses (FPs) than truthful accounts, with females using more FPs than males. Second, the analysis indicated that middle-aged speakers used the highest frequency of FPs, followed by old and young speakers, respectively. Third, high-educated speakers used more FPs in their lying narratives than their low-educated counterparts. As for the analysis of the duration of FPs in the collected corpus, it was revealed that the duration of FPs was longer in deceptive accounts than in the truthful ones, with females using longer pauses when lying than males. Second, results showed that old speakers used longer pauses across all age groups while lying. Third,

the data indicated that highly educated speakers took longer pauses while telling the truth than their low-educated counterparts.

The findings mentioned above align with those of Vrij et al. (2000), Tree (2010), Levitan (2018), Montacie (2016), Mann et al. (2004), Zukerman et al. (1981) revealing that the increased use of pauses correlates more with deceptive than truthful speech. Therefore, this can be ascribed to the assumption proposed by Zuckerman et al. (1981), DePaulo et al. (2003), and Vrij et al. (2008) that lying increases cognitive load and, therefore, leads to more pausing in deceptive speech due to difficulty in speech planning and production. When speakers recount truthful stories, they tend to retrieve self-experienced memories, making it easy for them to provide information deliberately and quickly. On the other hand, when speakers recount false narratives, they may need to construct externally derived memories based on perception to make their stories sound more believable. They may also attempt to monitor their responses to avoid giving away inconsistencies that might get their lies detected, leading to extra cognitive load and an increased number and duration of FPs while recounting a story (Zuckerman et al., 1981). As for telling the truth, speakers tend to retrieve self-experienced (internally derived) events that are already stored in their memories, which is a process that would not take as much time as making up an externally derived event.

Moreover, the analysis revealed a correlation between the speaker's education level and the number and duration of filled pauses (FPs). High-educated speakers had a higher frequency but shorter FPs than low-educated speakers when lying. Speakers with higher education attainment might have advanced cognitive processing skills, which enables them to organize their thoughts more efficiently. Consequently, they might need more pauses to produce more complex and creative ideas, but they tend to keep them short to maintain overall fluency. Additionally, they used frequent pauses to make their stories sound real, mimicking a spontaneous flow of speech.

Furthermore, data showed that middle-aged speakers used more frequent and prolonged pauses while lying across all age groups. Speakers of this age group in Jordanian society may be burdened with numerous career and family responsibilities, which can take a significant amount of cognitive capacity. Thus, when they choose to lie, they must keep track of the truth, falsify details, and maintain a convincing story, all of which require additional mental effort on top of their already heavy cognitive load. Therefore, they take more frequent FPs while lying to make up events that are not self-experienced.

V. CONCLUSION

A mixed method analysis of the frequency and duration of acoustic-filled pauses (FPs) was conducted with regard to lying based on a corpus of 144 lying and 144 truthful narratives gathered from 48 speakers of Jordanian Colloquial Arabic. The study calculated the average frequency and length of filled pauses in both lying and truthful accounts. Data obtained from truthful accounts served as a baseline to detect any change in the FP frequency and length pattern in the lying accounts. The analysis showed that the frequency and duration of filled pauses could be cues for deception detection in Jordanian Colloquial Arabic; deceptive accounts had a higher frequency and longer duration of filled pauses (FPs) than truthful accounts. Furthermore, the study revealed that FPs and their duration are socially constrained by speakers' age, gender, and educational attainment. Regarding gender, it was found that females used more FPs than males. In terms of age, middle-aged speakers used the highest frequency of FPs, followed by old and young speakers, respectively. As for education, it was revealed that highly educated speakers used more FPs in their lying narratives than their low-educated counterparts. Therefore, the findings of this study imply that the examination of Filled Pauses and their duration in a speech could be a potential cue for lying detection in JCA.

The current study has demonstrated a number of compelling findings with regard to filled pauses and lying in Jordanian colloquial Arabic. Based on the results of the present study, the researcher proposes the following recommendations:

1. The corpus of the present study consisted of lying and truthful accounts on general topics. It is recommended to explore genuine courtroom confessions, testimonies and criminal investigations to obtain more practical and relevant outcomes in the field of forensic linguistics.
2. One prosodic feature of speech was investigated in regard to deception. Future researchers are recommended to explore the relationship between lying and other prosodic features such as stress, pitch, and intonation.
3. The current study was limited to a small corpus of lying and truthful accounts from 48 speakers of Jordanian Colloquial Arabic. Thus, it would be premature to generalize these findings due to the topic's sensitivity. Further investigation is recommended to explore the use of FP with regard to deception in a larger corpus.

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