# Native Ohioans' speaking patterns help scientists decipher famous moon landing

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When Neil Armstrong took his first step on the Moon, he claimed he said, "One small step for a man, one giant leap for mankind" – but many listeners think he left out the "a." A team of speech scientists and psychologists from Michigan State University (MSU) in East Lansing and The Ohio State University (OSU) in Columbus is taking a novel approach to deciphering Armstrong's quote by studying how speakers from his native central Ohio pronounce "for" and "for a." Their results suggest that it is entirely possible that Armstrong said what he claimed, though evidence indicates that people are statistically more likely to hear "for man" instead of "for a man" on the recording. The team will present its work at the 21st International Congress on Acoustics (ICA 2013), held June 2-7 in Montreal.

Armstrong was raised in central Ohio, where there is typically a lot of blending between words such as "for" and "a." "Prior acoustic analyses of Neil Armstrong's recording have established well that if the word 'a' was spoken, it was very short and was fully blended acoustically with the preceding word," says co-presenter Laura Dilley of Michigan State University. If Armstrong actually did say "a," she continues, it sounded something like "frrr(uh)." His blending of the two words, compounded with the poor sound quality of the transmission, has made it difficult for people to corroborate his claim that the "a" is there.

Dilley and her colleagues, who include MSU linguist Melissa Baese-Berk and OSU psychologist Mark Pitt, thought they might be able to figure out what Armstrong said with a statistical analysis of the duration of the

"r" sound as spoken by native central Ohioans saying "for" and "for a" in natural conversation. They used a collection of recordings of conversational speech from 40 people raised in Columbus, Ohio, near Armstrong's native town of Wapakoneta. Within this body of recordings, they found 191 cases of "for a." They matched each of these to an instance of "for" as said by the same speaker and compared the relative duration. They also examined the duration of Armstrong's "for (a") from the lunar transmission.

The researchers found a large overlap between the relative duration of the "r" sound in "for" and "for a" using the Ohio speech data. The duration of the "frrr(uh)" in Armstrong's recording was 0.127 seconds, which falls into the middle of this overlap, though it is a slightly better match for an "a"-less "for." In other words, the researchers conclude, the lunar landing quote is highly compatible with either possible interpretation, though it is probably slightly more likely to be perceived as "for" regardless of what Armstrong actually said. Dilley says there may have been a "perfect storm of conditions" for the word "a" to have been spoken but not heard.

"We've bolstered Neil Armstrong's side of the story," she continues. "We feel we've partially vindicated him. But we'll most likely never know for sure exactly what he said based on the acoustic information."

Beyond shedding light on the famous quote, the work has implications for understanding how people perceive meaning in spoken language. "Every time we listen to speech and think we understand a sentence, we are performing a miraculous task, which is to take what is actually a continuous acoustic signal, break up that signal into somewhat arbitrary parts, and map those parts to our memories of all the words that we know in the language," Dilley says. "We need only look at computer speech recognition and how it succeeds and how it largely often fails to see how very difficult that problem is."

**More information:** Presentation 5aSCb53, "One small step for (a) man: Function word reduction and acoustic ambiguity," is in the morning session on Friday, June 7. Abstract: asa.aip.org/web2/asa/abstracts … h.jun13/asa1585.html

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