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Production of Intoxication States by Actors: Perception by Lay Listeners*

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ABSTRACT: The effects of ingesting ethanol have been shown to be somewhat variable in humans; there appear to be but few universals. Yet, questions about intoxication often are asked by law enforcement personnel (especially relative to DUI), clinicians and various individuals in social settings. A key question: Is it possible to determine if a person is intoxicated by observing them in some manner? A closely associated one: Can speech be used for that purpose? Two of the many issues related to the second of these questions involve the possibility that (1) speakers, especially actors, can effectively mimic the speech of intoxicated individuals, and (2) they may be able to volitionally reduce any speech degradation which results from intoxication. The approach used to test these two questions tasked auditors to determine if these simulations were possible. To this end, young, healthy actors chosen on the basis of a large number of selection criteria were asked to produce several types of controlled utterances (1) during a learning phase, (2) when sober, (3) at three simulated levels of intoxication (mildly, legally and severely drunk), (4) during actual, and parallel, levels of intoxication, and (5) at the highest intoxication level attained but when attempting to sound completely sober. Two aural-perceptual studies were conducted; both involved counterbalanced ABX procedures where each subject was paired with him/herself. Listeners were normally hearing university students drawn from undergraduate phonetics and linguistics courses. In the first study, they rated the actors as being more intoxicated—when they actually were sober but simulating drunkenness—88% more often than when they actually were intoxicated. In the second study, they were judged as sounding less inebriated when attempting to sound sober (than they actually were) 61% of the time. These relationships would appear to impact a number of situations; one of special importance would be the detection of intoxication in motorists.

KEYWORDS: forensic science, alcohol, simulation, effort, speech, actors, substance abuse, intoxication, driving under the influence

Determination of the presence and (especially) the level of intoxication being experienced by a human being is challenging; indeed, it is a task which can be difficult by any procedure or technique. Yet, decisions about this condition routinely must be made by law enforcement personnel, clinicians, bartenders, supervisors, the courts, family members, and many others. Sometimes the observer must make the judgment rather quickly.

The process often is complicated by the fact that sometimes the cited decisions can be based only on the auditor's perception of the talker's speech and voice. For example, consider the case where a police officer must decide if a particular motorist is inebriated and then (if the decision is in the affirmative) attempt to determine the physiological level of this condition. While a variety of techniques (breathalyzer, motor control tests) may be available, the officer's assessment—especially initially—often is based on the perception of the motorist's speech and voice. The questions, then, must be asked: (1) Is such determination justified in the first place and (2) if so, what factors can be used in this assessment? A review of research would suggest that, while the officer (or any person for that matter) can sometimes accurately identify the presence of intoxication simply by listening to a talker's speech, so many poorly understood relationships are associated with the task that it may be somewhat hazardous to attempt it. For example, a number of basic questions about this behavior are yet to be fully answered: including: (1) Is speech degradation always associated with intoxication? (2) Do all people produce the same severity of speech impairment at comparable levels of inebriation? (3) Does the type of impairment vary from person to person? (4) Does the severity of impairment correlate well with increasing intoxication? (5) Are the speech patterns different for increasing and decreasing levels of involvement? (6) Can effort on the part of the speaker change/decrease impairment? (7) Are the stereotypes produced by actors consistent with those that occur naturally. And (8), can actors accurately portray individuals who are intoxicated? Thus, while decisions about the presence/level of intoxication continue to be made, many appear to be based on incomplete, misunderstood, or, even false information. In turn, errors can (and do) occur and the resulting problems can be substantial. A case in point would be the criminal and civil trials that resulted from the *Exxon Valdez* accident (1–5). Quite obviously, there is a need for additional research on speech-intoxication relationships—that is, if the decisions commonly made are to be based on reasonable evidence. But, what currently is known about these relationships?

Background

Research on the effects of ethanol intoxication is rather extensive. A brief review of some of the more relevant behaviors associated with ingesting alcohol (6–18) should provide reasonable information about baseline relationships. For example, it has been demonstrated that the consumption of even moderate amounts of alcohol can result in impairment of cognitive function (18–24) and sensory-motor performance (10,18,23,25–29). Since the speech act represents the output of a number of high-level, integrated systems (sensory, cognitive, motor), it appears appropriate to assume that

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this process also may be susceptible to the effects of alcohol consumption. To be specific, it is well known that the oral production of any language involves the use of multiple sensory modalities, high-level cognitive functioning, complex cortical processing and a whole series of motor acts. Interruptions or insults to any part of this chain could result in disruptions of, or impairment in, the flow of the speech/language process (30,31). Yet, operation of the relevant systems appears lawful. For example, the speech signal contains features which can be utilized to provide information about a speaker's identity (32–36), the emotional states the human is experiencing (33,37–41), and so on. Thus, it would appear legitimate to suggest that intoxication also might be reflected in the voice/speech of the talker.

Speech-Alcohol Relationships

Only limited research on potential intoxication-speech relationships has been reported (3,5,42–60). Moreover, not all of the authors cited actually conducted experiments and several of the presentations are anecdotal, reviews, or somewhat tangential to the issue. This variation in product is understandable as the investigators who actually studied correlations between motor speech precision and alcohol consumption have faced severe difficulties in designing and conducting their research. On the other hand, some information is available, even though the cited investigations are not extensive; a particularly good review can be found in Chin and Pisoni (45).

Investigators have asked listeners to make estimates about the quality of the speech of inebriated speakers—sometimes on the basis of an ''intoxication-sober'' continuum, other times by application of ''semantic differentials.'' Their reports, while helpful, have not been particularly definitive. To be specific, Sobell and Sobell (57) had their volunteers speak when sober and when exhibiting BAL (blood alcohol level) of 0.05 to 0.10. Of the five ''dimensions'' these authors employed, shifts (from sober) were found for articulation (degraded), speech rate (slower) and perception of drunkenness (increased). In a later study, Andrews et al. (42) reported that sober speakers were rated as sounding more ''scholarly, efficient, reasonable, artistic and self-confident'' than when they were inebriated. On the other hand, Pisoni and Martin (55) simply asked their auditors to make binary decisions as to whether or not their talkers were intoxicated or sober. Their subjects (all exhibiting BAL's in excess of 0.10) were correctly judged to be intoxicated from 62% to 74% of the time (depending upon the subjects, procedures and/or listeners they utilized).

A somewhat different approach has involved measurement of some related physical or phonetic property. The methods utilized here ordinarily have involved either scaled aural-perceptual judgments or some sort of quantitative analyses of the speech signal itself. Specifically, alcohol-related degradations of the morphology and/or syntax of language have been reported or implied (42,52,54) as have misarticulations involving phoneme substitutions, omissions, distortions and devoicing (53,57,60). However, the preeminent focus here (see the above references plus 46,48,49,51) appears to have been on those paralinguistic factors of: (a) speaking fundamental frequency (SFF) level (while variable, often is reported to have been lowered; SFF variability can be increased), (b) speaking rate (often slowed), (c) the number and length of pauses (most often increased), and (d) amplitude or intensity shifts (sometimes reduced).

One problem with virtually all of the relationships cited is that they appear to be quite variable. Just as Maylor and Rabbit (12) have demonstrated this problem in handwriting, so too have most of the authors (who have studied alcohol-speech relationships) reported effects that were far from uniform. However, Klingholz et al. (51) argue that they can account for many of the noted inconsistencies on the basis of inappropriate and/or differing research designs. They suggest that the observed variation is due to problems such as inadequate specification of BAL, too few subjects and/or imprecise measurements. Most of their observations appear quite accurate. Yet, even after completing their own research, these authors are careful to point out that ''intoxicated individuals can be falsely classified as sober'' and ''sober subjects also can be falsely evaluated as intoxicated.'' Moreover, the Klingholz et al. article does not address all of the problems found in the research they reviewed. That is, few of the investigators they cite controlled for (1) intoxication levels, (2) drinking habits, (3) increasing versus decreasing BrAC (i.e., Breath Alcohol Concentration) or (4) effort expended; nor did they (5) employ blind controls who had ingested placebo drinks, (6) take into account the sometimes observed motor enhancement (48,52) that may occur at low levels of intoxication, (7) contrast the effects of alcohol with those of other physiological and physical states, or (8) attempt to control subject ability/training. It would appear that any of these variables could interact with intoxication and, possibly, bias the resulting data.

The focus for this particular project was on just two of the many issues cited. First, it was postulated that humans could volitionally alter their speech so that they appeared inebriated when they were not and, second, that they could intentionally counter the effects of this state, so they appeared sober when they actually were intoxicated. Actors were chosen as speakers as it was hypothesized that, due to their experience in manipulating speech plus the training they received (as drama students) in simulating inebriation, their performance would be more robust than that of untrained individuals. Indeed, if no effects were found for this class of subjects, additional research on the issue would not be needed. It also should be noted that suggestions have been made that actors can bias commonly held percepts about speech-intoxication relationships—and that they do so when (for dramatic purposes) they exaggerate its effects on motor speech. The experiments reported here were drawn from a sponsored research program designed to study the impact of intoxication on speech and voice.

Materials and Methods

Consideration of the several available research approaches led to the selection of a paired comparisons design for the set of studies reported below. In the first of the two, samples of each actor's speech, produced when they were actually intoxicated, were contrasted with parallel samples made when they were sober but simulating the intoxicated condition. Listeners were asked to determine in which instance the talkers sounded more inebriated. The basic task was the same for the second study but, in that case, the contrast was between samples produced by the talker when severely intoxicated and, then, when he or she was just as intoxicated but tried to sound sober.

Speakers

Subjects were 12 young adults—seven males and five females—all of whom were experienced actors between the ages of 21 and 37 years. They were healthy and exhibited no speech or hearing problems; no female subject was included who was pregnant (urine test). As would be expected, all procedures employed had received prior clearance from the University of Florida IRB (Institutional Review Board) and subjects were required to read and sign a full description of the project (including its benefits and hazards). Finally, volunteers had to qualify as subjects; that is, they were evaluated on the basis of three sets of selection criteria, i.e., separately for (1) acting, (2) drinking patterns, and (3) general/medical status.

The procedure for determining acting competency was based on multiple evaluations. First, a general request for trained actors was sent to the University of Florida Theater Department and to the four local (professional and amateur) theater groups; an informal assessment was made of the acting experience of those individuals who responded. Potential subjects were further evaluated by a means of a questionnaire involving a series of statements about their training (school, college), experience (professional, repertory, stock, university) and their membership in Equity (the union for professional actors). Only those individuals scoring high on this evaluation were retained for further evaluation.

The procedure for classifying subjects with respect to their drinking patterns involved administration of a specialized screening test. The test vehicle was adapted from the Michigan Alcoholism Screening Test (61) and the Cahalan et al. (7) drinking practices scale with a number of specialized questions added (49). It permitted selection of only those subjects who exhibited moderate-to-heavy drinking patterns.

At this juncture, general elimination criteria were applied to all remaining volunteers. Individuals who were light or heavy drinkers, nondrinkers, alcoholics or problem drinkers, or who consumed any type of drugs (prescription medications were included) which might interact with moderate doses of ethanol were eliminated. Finally, volunteers received face-to-face psychiatric and medical examinations conducted in order to ensure that the data from the screening tests were accurate and to eliminate those individuals who exhibited negative physical conditions, stress, fatigue and/or adverse psychological states. Subjects also were required to exhibit a General American dialect, demonstrate the ability to perform the required tasks and to have fasted for 4 to 6 hours before the experiment (28). No (non-intoxicated) control subjects were employed in this case as subjects' performance was compared internally in a repeated measures paradigm.

Speech Samples and Recording Procedures

Four types of speech were produced by all subjects at each of the experimental sessions. Included were: (1) extemporaneous speech in response to questions such as ''What is your favorite TV program?,'' (2) a standard phonemically balanced reading passage, i.e., ''The Rainbow Passage'' (62), (3) sentences drawn from the Fisher-Logemann Test of Articulatory Competence (63), and (4) a modified Fletcher Time-by-Count Test of Diadochokinetic Syllable Rate (64; see also 65) supplemented by two additional oral gestures: (1) ''shapoopie'' (66), and (2) ''buttercup'' (67). Trials were conducted in a quiet laboratory located at the Institute for Advanced Study of the Communication Processes.

Two recordings of all of the speech tasks were made simultaneously. The procedure may be best understood by viewing Fig. 1, one system consisted of a microphone (EV 635A) placed in a positioner and held a constant distance of 6 in. (15.2 cm) from the subjects' mouth (and 4 in. (10 cm from the midline). A second (miniature) microphone can be seen placed on a headband (37). Each microphone was coupled to its own calibrated, grounded

FIG. 1—*Photo of subject being recorded by two research assistants. Note the parallel recording systems.*

TABLE 1—*Summary of the nine conditions produced by each of the 12 actor-subjects.*

Intoxication Level	Experimental Task
BrAC = 0.00	Speak normally
BrAC = 0.00	Speak normally
BrAC = 0.00	Simulate mild intoxication
BrAC = 0.00	Simulate intoxication (legal level)
BrAC = 0.00	Simulate severe intoxication
BrAC = 0.04 to 0.05	Speak normally
BrAC = 0.08 to 0.09	Speak normally
BrAC = 0.12 to 0.13	Speak normally
BrAC = 0.12 to 0.13	Simulate sober speech

TEAC-300R analog tape recorder. This procedure was adopted in order to avoid data loss due to either equipment failure or procedural disruption resulting from subject behavior—a consideration since some trials exceeded ten hours in length and all involved relatively high levels of intoxication.

The sequence of trials may be best understood by observation of Table 1. First, the BrAC level was measured for all subjects to insure that they were completely sober. All material was then recorded nine separate times. The first trial was to familiarize subjects with the speech material itself and let them practice the task, the second to provide the sober-speech baseline material. They then were asked to simulate intoxication and to do so at three ''levels.'' That is, they first were asked to pretend to be mildly intoxicated, then legally intoxicated and finally severely intoxicated. It should be noted that these ''levels'' of intoxication roughly parallel those of BrAC 0.04 to 0.05 (mild), BrAC 0.08 to 0.09 (legal) and BrAC 0.12 to 0.13 (severe). However, subjects did not know this and it was judged that any type of *specific* training would be either counterproductive or misleading. Hence, they were asked to rely on (1) their personal experience with alcohol, (2) the general training (on these states) they had received when acting students, and (3) the general descriptions provided by the experimenters (however, no suggestions about how they should speak were provided). They were provided a short period of time to prepare themselves for each of the three tasks, and when they indicated that they were ready, the session was initiated. The series always was produced in order of increasing ''intoxication'' (i.e., mild, legal, severe) in order to duplicate the normal stages of actual inebriation. After the initial trials were complete (i.e., the second sober run plus the three levels of simulated intoxication), subjects were administered ethanol and were recorded again at the ''actual'' intoxication windows or levels of BrAC 0.04 to 0.05, BrAC 0.08 to 0.09 and BrAC 0.12 to 0.13. Immediately after the speech at the highest window was recorded (and while subjects were still at the BrAC 0.12 to 0.13 level), they were asked to complete a final trial but in this case while attempting to sound completely sober. Finally, subjects were not released until either their BrAC level had decayed to 0.00 or it was well below legal level (BrAC $<$ 0.07). In the second instance, they were escorted to their residence and placed in the care of a responsible adult.

Dosage

Traditional dosage procedures (9,25,29,68–72) were not employed in this research. Rather, they were modified somewhat in order to permit better control over both the level of intoxication and the speed of its increase; the procedures developed also enhanced subject comfort and sharply reduced the number of unsuccessful trials due to subject nausea and related discomfort. This modified procedure has been described in some detail elsewhere (49, and C. A. Martin, H. Hollien. Effects of potassium containing mixing solutions on ethanol levels in humans, submitted); however, a brief review would appear useful here. Specifically, the dosage administered consisted of one-third each: (1) 40% rum or vodka, (2) Gatorade, as the potassium it contains acts as an antagonist to the inhibiting effects of alcohol (49,73,74) and a soft drink (orange juice with the vodka or caffeine-free cola with the rum). The drinks were prepared with 3-oz of each ingredient for a total of 9-oz per dose. Subjects were requested to pace each drink over a 10 to 15 min period in order to prevent negative physical effects and to avoid missing the specified windows of intoxication. A detailed record was kept of their progress, i.e., when they started/finished a drink, time when reaching/leaving windows, and so on. A copy of a typical log—in this case for subject A202—can be found in Table 2. A representative curve, portraying a subject's level of intoxication through completion of the experimental tasks, can be seen in Fig. 2.

Monitoring BrAC Level

A rigorous monitoring procedure was followed in order to accurately identify the specified levels or ''windows'' of inebriation. The BrAC level was taken every 10 to 15 min after dosage was initiated and during the entire set of the trials. It was accomplished by one or more of four calibrated Alcopro, Inc., AlcoSensor IV breath analyzers. These are chemically fueled (electrolytes) devices controlled by a microprocessor; their recovery time is about two minutes. To avoid measuring alcohol left in the oral tissues, the subjects had to rinse their mouths at least six times with tap water just prior to measurement. The recording sessions were initiated only after confirmation that the experimental BrAC window had been reached. It should be stressed that breath analyzers had to be employed because it was necessary to determine *immediately* when a subject had reached a specified level (window) of intoxication and when he/she had left it. Thus, neither blood nor urine assessment could be used, primarily due to analysis latencies. Moreover, BrAC has been established as one of the primary ways of assessing intoxication (14,75–81) and has been employed successfully in numerous studies of this genre (see, in addition, 80,81).

Response Procedure

Two aural-perceptual ABX forced choice experiments were conducted. Both involved having listeners compare paired samples of a talker and then identifying the one for which the speaker sounded more intoxicated; these speech pairs were made up of three sentences drawn from the Rainbow Passage. In the first experiment, the speaker was highly intoxicated when speaking one sample (BrAC $=$ 0.12 to 0.13) but was totally sober while simulating severe intoxication in the other. Each pair was presented twice in a semi-randomized, counterbalanced pattern. The stimuli for the second experiment involved effort contrasts. In this case, the speaker was intoxicated (BrAC $=$ 0.12 to 0.13) for both conditions within the pair; however, he or she tried to sound sober for one of them. The experimental procedure here was structured in the same counterbalanced manner as was the first.

The speech samples produced by the subjects were presented to a group of 40 listeners (7 males, 33 females) who were essentially untrained university students. Several preliminary steps were carried out prior to the aural-perceptual runs: First, all listeners were required to demonstrate hearing levels appropriate for the task. In order to do so, they were administered a group speech discrimination test based on the Griffiths word lists (82); this test (or a parallel one) has been used in most CSL/IASCP ''perceptual'' experiments since 1968. In order to qualify as a listener, a subject had to score 92% or better on the test. Second, an investigator played a brief

TABLE 2—*A simplified copy of the tracking data drawn from the subject A202 form. Time and time elapsed are logged on the first and last columns; BrAC level and the point at which the speech samples were made are found in the middle two. Please note that additional information was obtained originally; it is not included because it relates to other studies.*

Subject: A202		Date: 9/19/96	
Time	BrAC After Rinse	Rec.	Time Elapsed
18:43	0.000	X	0
19:53	0.019		73
20:08	0.021		88
20:23	0.040		103
20:34	0.040	X	114
20:45	0.043		125
21:15	0.048		155
21:30	0.071		170
21:45	0.086		185
21:56	0.076		196
22:15	0.091	X	215
22:36	0.078		236
22:46	0.096		246
22:58	0.107		258
23:13	0.109		273
23:23	0.126		283
23:46	0.124	X	306
00:03	0.124		323
00:35	0.101		355
00:45	0.097		365
00:56	0.077		376
01:07	0.081		387
01:16	0.083		396
01:21	0.078		401

Drink mix:	Vodka	Vodka Dosage:	Start	Finish
	Orange J.	3 oz	19:34	20:30
	Gatorade	3 oz	21:00	21:40
		3 oz	22:01	22:57
		3 oz	23:03	23:46

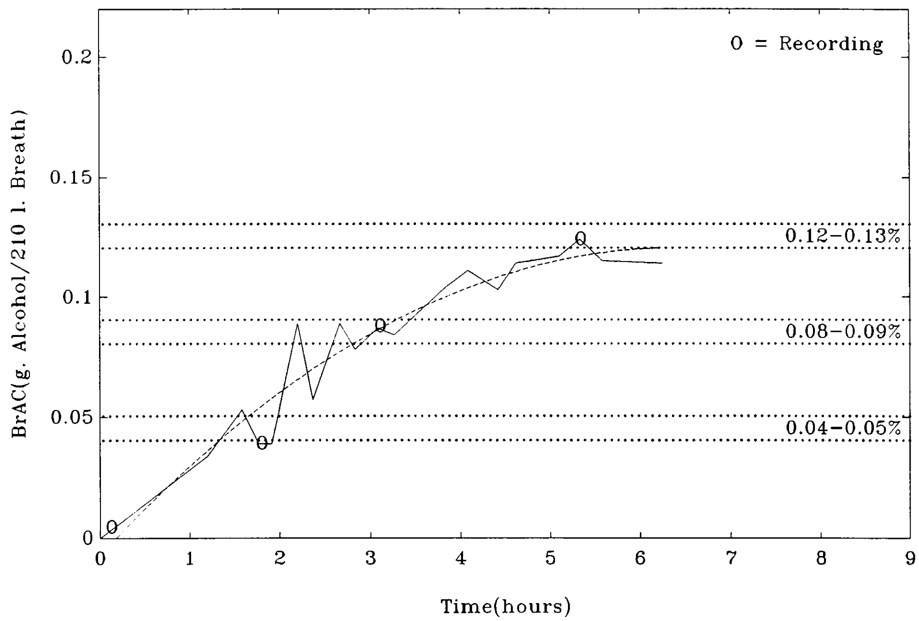

FIG. 2—*Curve of subject A107's progress relative to increasing and decreasing levels of intoxication from the beginning to the completion of the experimental portion of the run (BrAC readings were not always recorded after the trial). Note that the speech samples were taken when he was in each of the windows. The smooth curve is a second-order polynomial.*

tape recorded explanation of the tasks required. Third, two sets of samples (similar to those which would be heard during the experiment) were played in order to acquaint listeners with the type of stimuli they were going to hear. However, no feedback or training of any kind was administered with this third element as listeners were required to develop their own response strategies.

Results and Discussion

Simulated Intoxication

As stated, the first experiment was designed to determine if actors could realistically imitate intoxication and, perhaps more importantly, if their performance would be perceptually more compelling than their actual physiological state. The results of this study can be found in summary Table 3. As may be seen, the listeners consistently chose the ''simulated'' sample in the pair as showing a higher level of intoxication (than they did the sample where the subject actually was inebriated) and they did so over 88% of the time. These data then serve to answer the first question in the affirmative ($\chi^2 = 276$; $df = 1$, $p < 0.01$). That is, it may be said that at least some individuals can effectively simulate intoxication even when they are sober. Of course, the subjects in this instance were actors, so it is not yet clear as to what proportion of an untrained talker population can do so also. However, since at least 75% of the actors show very strong tendencies toward high levels of simulation (and all did so at far better than chance levels), there is little question but that simulated intoxication is possible by speakers of this type. Indeed, at least some evidence now is available supporting the speculation that actor stereotypes of intoxicated speakers may influence how the lay public ''should'' perceive such behavior.

A number of relationships may be observed by consideration of the data. First, the overall responses to the male and female speakers are virtually identical ($T = -0.147$; $df = 22$, $t_{0.05} = 1.717$ with $p = 0.885$). Although it was not hypothesized that male actors

TABLE 3—*Perceived speaking contrasts for the actor-subjects. In one instance they spoke when simulating severe intoxication; in the other, they spoke when actually experiencing this state. All values are in percent; the data are based on the responses by 40 auditors. The stimulus pairs were randomly presented twice with the ''intoxicated-simulated'' sample order counterbalanced.*

	Experimental Condition	
Subjects	Intoxicated	Simulated
Males:		
A101	38.8	61.3
A102	6.3	93.8
A103	5.0	95.0
A104	6.3	93.8
A105	2.5	97.5
A106	25.0	75.0
A107	3.8	96.3
Mean	12.5	87.5
Females:		
A201	1.3	98.8
A202	3.8	96.3
A204	6.3	93.8
A207	41.3	58.8
A208	3.8	96.3
Mean	11.3	88.8
All Subjects:	12.0	88.0

would imitate intoxication differently from female actors, it was necessary to determine if a gender difference actually existed. Of course, sample size is rather small if the total cohort is subdivided by gender; fortunately, it is not necessary to do so. Secondly, although not shown, a slight order effect was observed with the second sample in a pair judged more severely than the first. However, this effect was not significant ($t = 1.754$; $df = 10$, $t_{0.05} = 1.812$, $p = 0.107$), hence, it was judged to be too weak to bias the main effects.

Another relationship also is apparent. Note that, when graphically portrayed, the data found in Fig. 3 (see also Table 3) are

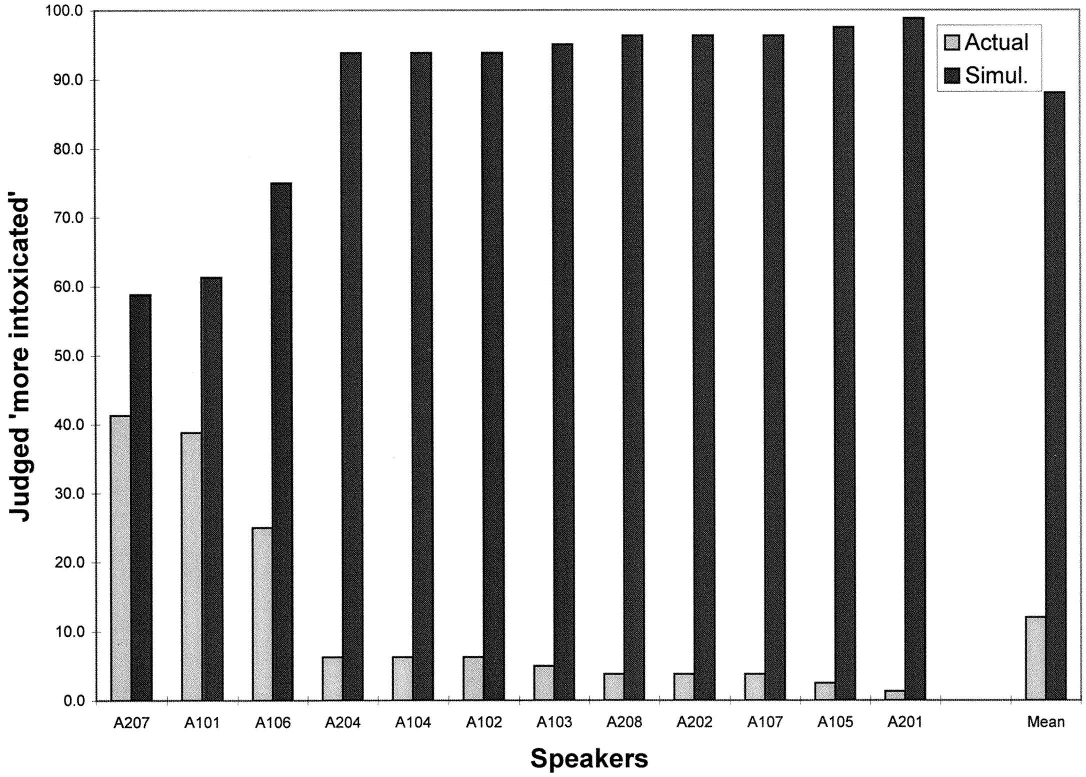

FIG. 3—*Graphic portrayal of the actual-simulated intoxication contrasts as perceived by 40 listeners. Subjects were 12 actors; data are ordered from highest to lowest judgments for the intoxication condition.*

even more impressive when subjects A101, A106 and A207 are removed from consideration; in that case, the actors sounded more impaired when they simulated intoxication (than when they really were) nearly 96% of the time. Indeed, the three actors cited (two males and one female) account for nearly two-thirds of the instances where the intoxication samples were judged more impaired than the simulated ones. At this juncture, it is not possible to tell if these three individuals were not as good actors as were the other nine or if they exhibited extensive involvement when they were intoxicated. What is apparent is that, even unseen and with their speech material controlled, the talkers in this experiment could appear more inebriated when sober than when they actually were drunk.

What implications—or, at least, what speculations—result from these data? First, impairments in motor speech and voice may play a lesser role in the detection of the presence, and/or the severity, of intoxication than is commonly thought; intoxication-based shifts in a talker's speech features are far from predictable, as they *vary* from person to person. Also, auditors do not seem to be able to focus on those aspects of the signal which are most important in making judgments about an individual's level of intoxication or, alternatively, that the proper attributes have not yet been identified or tapped. Another outcome of this research is that it appears to be easier to detect the presence of intoxication in a person's speech than it is to estimate its level. Along these lines also, it is possible to speculate that the public's experience with actors tends to inappropriately distort their (perceptual) expectations of such behavior. Finally, it can be claimed that most actors can detect those speech features most salient to intoxication and portray—or even exaggerate—them to an extent that they are reasonably recognizable to nearly anyone. It may even be possible that we are so indoctrinated by their performing techniques that our judgment of those individuals who actually are intoxicated is muted.

Effort

The second experiment was designed to determine if actors could convince listeners that they were not intoxicated when actually they were. If the data suggest that they can, then support would be provided for the second postulate, namely, that individuals can appear to be markedly less intoxicated than they actually are by consciously controlling their motor speech.

The results of the second study can be found in Table 4. It shows that the listeners chose the pretended-sober sample (of the pair) to exhibit greater ''intoxication'' than the sample of real intoxication only about 39% of the time ($\chi^2 = 22.5$; $df = 1, p < 0.01$). Hence, their attempts to sound less intoxicated were successful nearly two-thirds of the time. However, since they did not succeed at a higher level, the hypothesis here is only partly supported.

Other relationships also can be seen by consideration of Table 4. There appears to be no gender effect; both the male and female speakers performed at about the same level. A two-sample t-test confirmed this observation ($t = -0.40$, $df = 22$, $p = 0.70$). Again, the order in which the samples were presented to the listeners could have interfered with the main effects of the research. As with the first experiment, a slight effect of this type was observed, but a paired-comparison t-test ($t = -2.135$; $df = 10$; $t_{0.05} = 2.228$) resulted in a nonsignificant difference. Thus, while there was a tendency for a listener to judge the second sample of a pair somewhat more severely than the first, the trend did not prove to be robust enough to bias the main effects.

So as to permit better evaluation, the data in Table 4 are displayed also in Fig. 4. They demonstrate that over 60% of the speakers were able to convince listeners that they were less intoxicated than they really were. While four of the speakers (A204, A106, A201, A107) proved not to be as adept at the task as the others, the data nevertheless suggest that many intoxicated speakers can control their motor gestures for this purpose. Of course, even those actors who succeeded in their goal were not equally successful. There appears to be quite a range of effectiveness in this case; for example, A105 exhibited a difference of less than 10% between the ''Actual'' and ''Effort'' conditions, whereas A101 was able to sound less intoxicated almost all of the time. These data suggest that while it may be possible for some speakers to appear less intoxicated than they actually are, this relationship is not a universal one. Moreover, it is not yet clear if individuals from the lay public also can perform as effectively as did the actors.

TABLE 4—*Summary of responses to subjects speaking first while severely intoxicated and then, immediately after, when attempting to sound sober. All values are in percent; there were 40 listeners. The stimulus pairs were randomly presented twice with the ''intoxicated-effort'' sample order counterbalanced.*

	Experimental Condition	
Subjects	Intoxicated	Effort
Males:		
A101	95.0	5.0
A102	82.5	17.5
A103	78.8	21.3
A104	91.3	8.8
A105	53.8	46.3
A106	35.0	65.0
A107	5.0	95.0
Mean	63.0	37.0
Females:		
A201	30.0	70.0
A202	70.0	30.0
A204	42.5	57.5
A207	82.5	17.5
A208	63.8	36.3
Mean	57.8	42.3
All Subjects:	60.8	39.2

Further Discussion

What is now clear is that reasonably effective simulation of both intoxication and soberness (while intoxicated) is within the realm of possibility for some (perhaps many) individuals. These findings are of some consequence to professionals (and others also) who have the responsibility of controlling or judging individuals that are (or suspected of being) intoxicated. In the first instance, the belief that a person is inebriated, when he or she is not, could leave the professional in a vulnerable position. The significance of the second case could be just as grave. For example, consider the problems that might result if a motorist could convince the police that he or she was sober when actually seriously inebriated. Nevertheless, even here, certain relationships are not very well understood. To illustrate: information is needed about (1) the speech strategies employed which were more—or less—effective, (2) the percepts which were most efficiently employed by the listeners, and (3) if ordinary talkers can be as successful with these tasks as were the actors. These issues will be addressed in future reports.

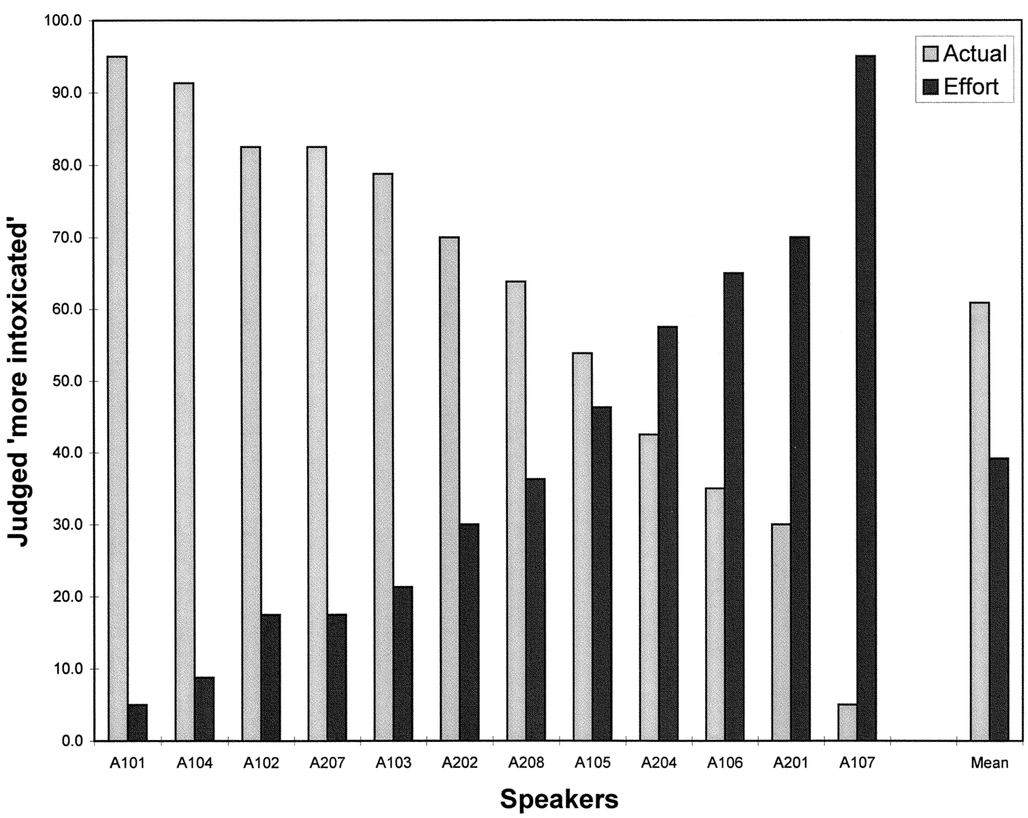

FIG. 4—*Graphic portrayal of the actual-effort intoxication contrasts as perceived by 40 listeners. Subjects were 12 actors; data are ordered from highest to lowest judgments for the intoxication condition.*

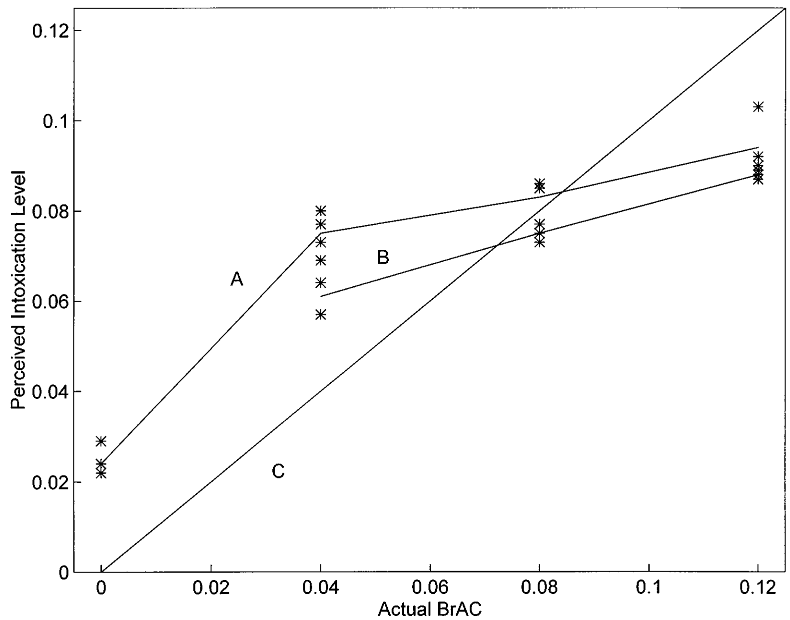

FIG. 5—*Perceived intoxication level, contrasted to the physiologically measured levels (Curve C) from sober to severely intoxicated (BrAC 0.12 to 0.13). Six studies are represented, four involving 5-point scaling of intoxication severity (Curve A) and two employing a direct magnitude scaling approach (Curve B). Data are summed for 35 talkers and 85 listeners in the first case and 36 talkers and 52 listeners in the second.*

The first of them will provide data on how the present subjects' speech shifted as a function of paralinguistics—that is, with respect to the suprasegmentals of speaking fundamental frequency, speaking rate/duration and vocal intensity. Subsequently, segmentals (phoneme shifts, nonfluencies) will be examined; all data will be applied to questions about both individual and group performance.

One of the relationships that already is reasonably apparent is the effect of listener judgments on the level of their responses. That is, the relationships cited above may not be as linear as would be expected. Note the patterns found in Fig. 5 (50). These curves are drawn from another major study in the area. They are based on six separate aural-perceptual experiments in which listeners were randomly presented subjects' speech samples as they spoke when sober and at the mild, moderate and severe states of intoxication represented in Curve C (i.e., ascending BrAC levels of 0.04 to 0.05, 0.08 to 0.09, 0.12 to 0.13). In those experiments, listeners were requested to make judgments as to the severity of involvement, either using a 5-point scale (the four studies that comprise Curve A) or by a direct magnitude procedure (the two summed to create Curve B); the combined curves are based on nearly 20K judgments in all. Note that, *overall,* the talkers were judged to be slightly intoxicated when sober, more intoxicated than they were at the mild level and just about at the actual level when judged as ''legally'' intoxicated. On the other hand, auditors tended to class the severely inebriated as less speech impaired than would be predicted by the physiological measures. Thus, it is possible that, when auditors are required to respond to the motor speech efforts of a large number of inebriated talkers, they can pretty much determine which speakers are so involved but not at what level. Alternatively, it also may be possible that speech degradation occurs early in the intoxication process and changes but little over its course—at least for the levels studied in this research. Admittedly, this speculation is not particularly consistent with certain earlier reports (48,52) in which the authors suggest that mild levels of intoxication can be associated with the *upgrading* of motor speech. For whatever the reason, the present listeners apparently did not judge the subjects as being as impaired as they were; hence, the simulated speech gestures and patterns established by the actors may have been controlling. On the other hand, this factor (if biasing) would have operated to lower the perceived involvement when the actors attempted to appear sober when they were, in reality, severely intoxicated. In short, either the biasing by listeners noted in Fig. 5 or the fact that speech degradation does not linearly parallel increased intoxication may have served to somewhat inflate the response levels in the first study and lower them in the second.

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