the hypnotists and for the subjects. So on the level of subjective experiences nothing differentiated reals from simulators. There were however some interesting comments in the hypnotists' experiences connected with simulators regarding ambivalence, asynchrony, inconsistency, subject's "overdoing". To demonstrate these features some verbatim quotation are given below:

Asynchrony: "... her non-verbal signs was not consistent with the subjective experiences she said during the hypnosis."

Inconsistency: "... I felt that his hypnotic depth fluctuated during the hypnosis. But through the age regression I think he was in a deep hypnosis."

Subject's "overdoing": "... when she was talking about her inner feelings she had just a few words for them..., and now she talks a lot, more vivid and intense about this curtain, colour, shade, ruffles, etc., So it is quite interesting" (transparent hallucination).

Summing up the results the only difference we have found between reals and simulators - including both the reports of the subjects and the hypnotists - was that the inter-rater reliability of the global ratings was acceptable in the case of real dyads, while not in the case of simulator ones.

All of the other measures and levels of analysis failed to show distinction between real and simulated hypnosis interaction. This implies that the phenomenological reports can be simulated, just like behavioural manifestation. We think that in the future hypnosis research should consider this possibility much more carefully, than it did so far.

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Acoustic analysis of the hypnotist's voice. A preliminary study

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The preparation of this paper was supported in part by grant No. T-34454 from OTKA (Országos Tudományos Kutatási Alap, Hungarian Scientific Research Support Foundation) to Éva I. Bányai, where the present author is a participant.

It has been demonstrated in the literature that the communication between hypnotist and subject changes characteristically in the hypnosis interaction. The voice of the hypnotist is an important channel in this interaction. Modern computer technology made voice analysis more easily available only recently. In the present paper we wish to show the possibility of describing the changes in the hypnotist's voice by objective, physical measures. The preliminary acoustic analysis of the hypnotist's voice seems to indicate that the fundamental frequency and the intensity of the hypnotist's voice generally decreases during hypnosis, but this general trend may be moderated as a function of the nature of the hypnotic suggestion.

Introduction

Ever since Bernheim considered suggestion as the essence of hypnosis, words seem to be the most important element in eliciting hypnosis. As Jay Haley has pointed out (1963), hypnosis is the outcome of an interpersonal relationship brought about by communication between hypnotist and patient, and this communication is mediated by the verbal and nonverbal behavior of the participants.

Jakobson (1958) described the following six functions of verbal communication:

- *referential function:* talking about the facts of the world
- *conative function:* addressing and calling upon the listener
- *attentional function:* eliciting and controlling the listener's attention
- *emotive function:* expressing the speaker's emotions and attitude toward the topic under discussion
- *meta-linguistic function:* communication regarding speech and communication
- *poetic function:* exerting aesthetic influence on the listener

All of thsese functions seem to play a part in the verbal communication of the hypnotist. Let me illustrate this by examples taken from the different forms of the Stanford scales (Weitzenhoffer and Hilgard, 1959), as the method that is the most widely used in hypnosis research. One of the most evident functions is the referential function; when the hypnotist gives feedback about the changes in the outside world or inside the

body of the hypnotized person: "the target may become blurry, or changes in color", or "your breathing becomes slow and regular".

Conative function - addressing and calling upon the listener - is similarly evident, when giving either instructions: "Please extend your left arm in front of you", or suggestions: "Your fingers are tightly interlocked. Just try to take them apart."

Attentional function is also easy to notice when the hypnotist directs the attention of the hypnotized person: "Something very interesting is going to happen to your arm."

The emotive function is seen - or rather heard - through the changes in the voice of the hypnotist. When, for instance, administering the arm catalepsy suggestion, the voice of the hypnotist also becomes tense, expressing how "impossible it is to bend a bar of iron, like your arm." Unintentional expression of tension, like slips of the tongue, can also be listed here.

When the hypnotist talks about some aspects of the communication between him- or herself and the hypnotized person, he/she utilizes the meta-linguistic function of speech. This can be found mostly during the transition phase of hypnosis, namely, during hypnotic induction and dehypnosis: "Even my voice may seem to come from far away", or "Soon, I will stop talking."

Finally, poetic function is the least evident in the standardized scales of hypnotic susceptibility: The hypnotist does not have a great choice in exerting aesthetic influence on the hypnotized person, since he/she has the freedom of choosing his/her words only in free hypnoses. Nevertheless, we had the opportunity of seeing that this function is present even in standard hypnosis when translating the Stanford scales into Hungarian: Often we picked a word or expression from several other equally correct ones on the basis of the subjective "beauty" or the word, how pleasant it felt to our ears. Poetic rhythm and alliteration were also important aspects of consideration. (I am sure the choice of words from this aspect was also important when the scales were originally developed by Weitzenhoffer and Hilgard in 1959).

We have been reporting the changes in some of these functions of speech at the various ISH and ESH Congresses since the 12th ISH meeting in Jerusalem (Gösi-Greguss et al., 1992, 1993, 1996, 1997). In those studies, we investigated the hypnotists' deviation from the standard text and the slips of their tongue and other speech disturbances during standard hypnoses. The individual patterns of the deviations from the standard text - affected by the characteristics of both the hypnotists and the subjects - suggested that hypnotists use deviation as a verbal tool for effective hypnotic communication; while speech disturbance was related only to the characteristics of the hypnotists, and was independent from the subjects' characteristics, thus, speech disturbance reflects only the current anxiety level of the hypnotist. Therefore, we concluded that deviation from the standard text and speech disturbance have different effects in the hypnotic communication.

In the course of our investigations of hypnosis, however, we could also see that hypnotists use other tools besides changing the lexical elements of speech in the course of

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hypnosis. Namely, they change the pitch, the loudness, and the speed of their speech - these are the very elements of speech that are called together prosody.

We particularly noted changes of prosody in the hypnoses of a low susceptible hypnotist. We had the impression that her voice became deeper and much softer during hypnotic induction when hypnotizing high susceptible subjects. However, when she hypnotized lows, there were some similar changes initially, but soon her voice returned to her normal tone (Bányai, 1985). Unfortunately, we could not study these changes systematically, as the judges were unavoidably influenced by the fact that they understood the words of the hypnotist. Lacking technical facilities, we attempted to make these impressions more objective by asking an English language teacher who spoke no Hungarian whatsoever to describe the changes in the hypnotist's voice over 15 standard hypnosis sessions. Unfortunately, the work could not be finished, because in the course of these few weeks when this teacher was evaluating the records, he picked up so much Hungarian, that he began to understand the text and began making more and more remarks about the identity of the content of the sessions. Nevertheless, on the basis of the first few sessions he evaluated, the following parameters of the voice seemed to be worth looking at by more objective methods: the deepening of the voice, the changes in melody, the changes in the speed of speech and the pauses. These are the very parameters that are important in the literature on affective prosody.

Where can we place affective prosody?

Monrad-Krohn (1963) divided prosody into four basic types: linguistic prosody, intellectual prosody, emotional or affective prosody, and inarticulate prosody. Linguistic prosody is used to clarify the meaning of the sentence: Compare - *The hypnotist, and the subject wet to the skin from rain, arrived to the laboratory ten minutes ago. vs. The hypnotist and the subject, wet to the skin from rain, arrived to the laboratory ten minutes ago. In the first sentence only the subject was wet, in the second both were.* Pauses help us clarify the meaning in this case.

Intellectual prosody communicates attitudinal information: We can say in a normal tone: *He is very susceptible to hypnosis,* or stress the word "is": *He is very susceptible to hypnosis.* The first sentence is a simple statement of fact, while in the second we express our surprise.

Emotional prosody inserts moods and emotions into speech, like happiness, anger, fear, etc. The term, affective prosody, refers to the combination of attitudinal and emotional prosody. Thus, we can even change the original meaning of the sentence if we say ironically: *He is very susceptible to hypnosis.* Thus, if prosody and linguistic meaning are in opposition, we usually believe the message conveyed by prosody.

Inarticulate prosody contains paralinguistic elements like sigh, chuckle, etc., making our conversation more lively.

The effect of affective prosody in the development of hypnosis seems to be particularly important, since both affective prosody and hypnosis are considered to be related to the right cerebral hemisphere.

It has been shown (Ross, 1981, 1985; Ross and Mesulam, 1979; Springer and Deutsch, 1998; Scherer & Zei, 1988, etc.) that after damage to the right hemisphere affective aprosodia may develop, where the emotional function of speech is damaged. Depending on the location and extent of the damage, these patients cannot interpret or produce emotional messages, while they speak in grammatically correct and meaningful sentences. This "flatness" of speech was also demonstrated during right-sided Wada test, when the right side of the brain is anaesthetized for a few minutes (Ross et al., 1988).

Changes in focal cerebral blood flow and pathological data have shown that the functional anatomical organization of affective language in the right cerebral hemisphere is analogous to that of propositional language in the left hemisphere (Ross, 1981, 1993; Fischer et al., 1991).

Regarding hypnosis and laterality, an increasing amount of evidence has accumulated since the 1970s that supports the hypothesis that hypnosis is accompanied by the general activation of the right cerebral hemisphere. MacLeod-Morgan (1982), Crawford et al. (1989), Mészáros et al. (1989) showed greater activity (mostly alpha activity increase) in the parieto-occipital region. (We could also see this yesterday in Helen Crawford's and in Pierre Rainville's keynote addresses.) Our own former investigations have shown that if moderately susceptible subjects achieve deep hypnosis, their right hemispheric activity is greater in the alpha and beta range than their left hemispheric activity, while in superficial hypnosis, there is a left hemispheric preponderance (Bányai et al., 1985; Mészáros et al., 1985). As Crawford and Gruzelier (1992) summarized on the basis of the performance of different tactile, mathematical and imaginative tasks, we can say that hypnosis is a right hemispheric task.

It can be assumed that the activation of the right hemisphere is produced by the joint effect of several factors. One of them may be the text of the induction itself, but it can also be assumed that changes in the affective prosody of the hypnotist play an equally important role.

Affective prosody is spontaneously related to the emotional and physiological state of the speaker, nevertheless, it can also be influenced consciously and volitionally by the speaker, and it is related to the attitudes and interactional strategy of the speaker.

How can affective prosody be studied objectively? The past 10-15 years of technical development has made the acoustic analysis of the voice much faster and more available to research. The field of the acoustical analysis of the voice expressing different emotions is a rapidly developing area of research, although the association between the portrayal of different emotions and the patterns of acoustic cues is not distinct enough yet (Banse & Scherer, 1996; Ross et al., 1986). Nevertheless, there are some acoustic parameters that are found to be important:

- F0 or fundamental frequency, which is mainly perceived as pitch of the voice. Changes of the fundamental frequency are perceived as changes in melody or intonation.
- F0 contours, or the pattern of F0 changes over the course of an utterance,

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- Vocal intensity, which is mainly perceived as loudness of the voice, and
- Duration, which is perceived as the length of the utterance, influencing the tempo of speech.

Across studies, portrayals of emotions where the level of arousal is high mean F0, F0 variability and vocal intensity increase, while low level of arousal is associated with lower F0, F0 variability and vocal intensity.

Since in emotion research, usually short, one-sentence long utterances are studied and compared across different emotions, the question arose, whether it is possible and worth studying the acoustical parameters of the hypnotist's voice. In the present paper I would like to report the very first steps in this direction.

Method

In a long study at our Laboratory in cooperation with Zoltán Vassy, we had to measure the hypnotic susceptibility of a hundred healthy volunteers by SHSS, Form A. I do not want to go into the details of that experiment, as it is enough to mention here that a moderately susceptible, female hypnotist conducted all of these hypnosis sessions. As a preliminary study, we used five subjects' hypnosis sessions where the hypnotist's voice was digitally recorded from the very beginning to the very end of the hypnosis session. Recording was made in wave format on a computer (sampling rate 16 kHz), and saved on a CD for off-line analysis. The subjects were all female, one of them scored 5 on SHSS, the others proved to be high susceptibles (scoring 9, 10, 10, 11).

Since we are basically interested in the effect of the hypnotist's voice on the subject, we did not attach the microphone at a fixed distance from the hypnotist's mouth, but it was placed next to the hypnotized person's head. This way, if the hypnotist - talking at a uniform level of loudness - leaned toward or away from the subject, the measured intensity of the hypnotist's voice changed in harmony with what the hypnotized person could actually hear. We selected 30-second samples from 8 phases of the experiment:

- rapport formation (when the hypnotist explained to the subject that there will be nothing personal in what she would have to do under hypnosis),
- the beginning of hypnotic induction (just after giving the instruction of watching the target and asking for cooperation),
- the end of hypnotic induction (the beginning of the count from 1),
- arm lowering suggestion,
- arm catalepsy suggestion,
- the very beginning of dehypnosis,
- the last 30 seconds of dehypnosis, and
- debriefing, when the subject was told her score and the hypnotist explained what it meant.

We performed the acoustic analysis of these periods by a voice analyzing computer program called Praat, a research tool developed by Paul Boersma at the Institute of Phonetic Sciences at the University of Amsterdam (www.fon.hum.uva.nl/praat).

Table 1: Mean fundamental frequency (F0) of the hypnotist's voice in different phases of SHSS:A

Phases of SHSS:A	mean F0	SD
rapport formation	245.1 Hz	26.3
induction (early)	227.5 Hz	23.3
induction (late)	221.4 Hz	18.0
arm lowering	251.4 Hz	29.3
arm catalepsy	203.2 Hz	19.0
dehypnosis (early)	211.9 Hz	21.7
dehypnosis (end)	262.7 Hz	20.7
debriefing	218.8 Hz	36.7

One way ANOVA: F(7,31)=3.52, p<.001.
Significant pairwise comparisons:

rapport formation vs.arm catalepsy t(4)=4.5, p<.01;
rapport formation vs. dehypnosis (early) t(4)=2.79, p<.05;
induction (late) vs. dehypnosis (end) t(4)=8.09, p<.001;
arm lowering vs. arm catalepsy t(4)=3.14, p<.05;
arm lowering vs. dehypnosis (end) t(4)=7.36, p<.001;
arm catalepy vs. dehypnosis (end) t(4)=4.28, p<.01

Results

As a first step we calculated the mean fundamental frequency of the hypnotist's voice for the 30-second samples of each phase. These values can be seen in Table 1.

The initial pitch of the hypnotist's voice is 245.1 Hz, which falls within the normal female voice range. As the human ear notices a difference in fundamental frequency of as little as 5Hz, the 40Hz difference in the range of F0 seems to be meaningful psychologically as well. Paired t-tests have shown a general tendency of decrease of the fundamental frequency during hypnosis, returning to its original level by the end of dehypnosis. There was an exception to this general decline in F0, to this general deepening of the voice: Contrary to our original impression of a general deepening of the voice during the arm lowering suggestion, the pitch of the hypnotist's voice returned to its normal level - which in this case was a relative increase in pitch. A possible reason for this might be that this positive motor suggestion of holding a weight calls for an increase in the level of arousal. By increasing the pitch of the voice (showing effort), the hypnotist's verbal and non-verbal communication becomes more congruent. Voice is the deepest during arm catalepsy suggestion. I'll come back to this issue shortly.

We also checked how the intensity of the hypnotist's voice changes over the course of hypnosis (see Table 2).

The initial intensity of the hypnotist's voice falls within the normal loudness range: During rapport formation it is 66dB. Paired t-tests have shown that during hypnosis the general level of vocal intensity also decreases during the whole hypnosis part of the experimental session. Here, it is arm catalepsy suggestion that is different from the other phases of the hypnosis session: The hypnotist's voice is louder than either at the end of hypnotic induction or during dehypnosis. Considering that dominant individuals tend to have deeper and louder voices, the deeper and louder voice during arm catalepsy may be congruent with the nature of the challenge suggestions; the hypnotist's voice may convey that the hypnotized person may try to do something, but is not expected to succeed against a greater power.

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Table 2. Mean intensity (dB) of the hypnotist's voice in different phases of SHSS:A

Phases of SHSS:A	Mean intensity	SD
rapport formation	66.2 dB	6.2
induction (early)	62.2 dB	6.7
induction (late)	61.4 dB	9.4
arm lowering	62.0 dB	6.1
arm catalepsy	64.3 dB	7.5
dehypnosis (early)	61.0 dB	7.0
dehypnosis (end)	59.1 dB	7.7
debriefing	68.4 dB	7.6

One way ANOVA: F(6, 31)=0.77. p n.s.
Significant pairwise comparisons:

rapport formation vs. induction (early) t(4)=3.68, p<.05;
rapport formation vs.induction (late) t(4)=2.83, p<.05;
rapport formation vs. arm lowering t(4)=4.84, p<.001;
rapport formation vs. dehypnosis (early) t(4)=4.94, p<.001;
rapport formation vs. dehypnosis (late) t(4)=5.13, p<.01;
arm catalepsy vs. induction (late) t(4)=3.18, p<.05;
arm catalepsy vs. dehypnosis (early) t(4)=5.16, p<.001;
arm catalepsy vs. dehypnosis (end) t(4)=3.13, p<.05

Discussion

We haven't analyzed the changes of the tempo of the speech of the hypnotist yet, but even from these preliminary results it can be seen that it is worth doing a more thorough analysis of the changes of the hypnotist's voice in the course of standard hypnosis.

Our original impression that the pitch and intensity of the hypnotist's voice change seems to be reinforced by acoustic analysis, but more research is needed to confirm this finding and to determine the nature of these changes. The possibility arises that different mechanisms operate during hypnotic induction and test suggestions. It is also necessary to widen the range of acoustic parameters.

Considering that the speech behavior of men and women have been shown to be different, we also expect that there might be differences between male and female hypnotists, and even as a function of hypnosis styles (maternal or paternal) (Bányai, 1991).

It is also worth investigating how changes in the hypnotist's voice influence the effectiveness of hypnosis, if it affects the behavioral, phenomenological or archaic involvement dimensions of hypnotic depth. This is what we are planning to do next.

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Altered-state experiences during relaxation: Do they depend on hypnotic susceptibility?

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This research was funded by the National Fund of Scientific Research (OTKA) N: T 023153

The purpose of this work was to examine whether hypnotic susceptibility affects subjective experience during a short relaxation. After listening to relaxation music, the subjects were asked to report their experiences in a short questionnaire (Relaxation Experiences Questionnaire). Hypnotic susceptibility was measured by the Harvard Group Scale of Hypnotic Susceptibility (Shor & Orne, 1962). An altered-state index was calculated from the Relaxation Experiences Questionnaire. It was surmised that high, medium and low hypnotic susceptibilities might correlate with different values of the altered-state index. However, it was found that subjects with low hypnotic susceptibility do have altered-state experiences if the situation is called "listening to music" and not "hypnosis".

There are three crucial kinds of phenomena in hypnosis: hypnotizability, the hypnotic context, and alteration in subjective experiences (Woody, Bowers & Oakman, 1992). Hypnotizability is a capacity that varies from one individual to another (Spiegel & Maldonado, 1999), and these individual differences are critical factors in defining hypnosis (Hilgard, 1973). According to the state theories of hypnosis, hypnotic susceptibility is a remarkably stabile trait (Hilgard, 1991, 1992), which was supported by several follow up studies (Morgan, Johnson & Hilgard, 1974; Piccione, Hilgrad & Zimbardo, 1989; Weitzenhoffer & Hilgard, 1959). However, others have found that hypnotic susceptibility can be modified through special training methods (Gorassini, Sowerby, Creighton & Fry, 1991; Gorrassini & Spanos, 1986, 1999), or by various contextual manipulations (Wickless & Kirsch, 1989). Contextual factors of hypnosis have important effects on hypnotic experience (Bányai, 1985, 1991, 1998; Lynn, Rhue & Weekes, 1990; Sheehan, 1992; Woody, Bowers & Oakman, 1992) and they can be particularly important in the development of personal experiences. Contextual factors include definition of the situation as hypnosis (Barber & Carverley, 1964; Lynn, Rhue & Weekes, 1990; Spanos & Coe, 1992) and the hypnotic communication style (Bányai, 1991, 1998; Erickson, Rossi & Rossi, 1976; McConkey, 1991; Szabó, 1993, 1996; Zeig, 1985).