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Oxytocin and cortisol in hypnotic interaction

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Abstract

The change in the level of oxytocin and cortisol was tested in the participants of hypnotic interaction in standardised laboratory sessions with healthy volunteers.

Pre to posthypnosis changes of oxytocin and cortisol were related to the hypnotic susceptibility of Ss, and to relational experiences reported by subjects and hypnotists on several paper and pencil tests (AIM, DIH, s-EMBU).

Results show that the changes in oxytocin are not related to the hypnotic susceptibility, but to the relational experiences. After the hypnotic interaction, the level of oxytocin increases in the subject if the perceived harmony with the hypnotist is high (DIH), while it increases in the hypnotist if the subject has memories of less warm emotional relationship with his/her parents (s-EMBU).

The results are interpreted within the social psychobiological model of hypnosis.

Introduction

The effect of oxytocin on the *central nervous system* became a subject of scientific analysis in the recent years (Kendrick, 2000; Ludwig & Leng, 2006; Sabatier, Rowe, & Leng, 2007). Oxytocin as a neurotransmitter, a neuromodulator in the brain regulates *social affiliation* (for a summary see Insel (1992), Leng and Ludwin (2008)).

Several **psycho-emotive functions** of oxytocin has been described. Oxytocin regulates affective, social processes: reduces anxiety and fear (Huber, 2005), and decreases depression (Uvnas-Moberg, Bjorkstrand, Hillegaart, & Ahlenius, 1999) reduces antisocial behavior, promotes both the provision and the acceptance of social support (K. M. Grewen, S. S. Girdler, J. Amico, & K. C. Light, 2005), increases trust, strengthens social behaviour (Damasio, 2005; Kosfeld, Heinrichs, Zak, Fischbacher, & Fehr, 2005; Zak & Fakhar, 2006).

As opposed to the fight or flight response, oxytocin-based stress management system is activated mainly in the medium of social support. The individuals face stress calmly and in the proximity of each other. This method of stress management is called *calm and connection*.

It is supposed that this could be the “feminine type” stress management of mothers and their small children in the time of our early ancestors – as opposed to the masculine type of fight or flight response of the men (DeVries, Glasper, & Detillion, 2003; Uvnas-Moberg, Arn, & Magnusson, 2005).

The oxytocin system is connected to the dopamine-system. The estrogen-sensitive oxytocin neurons of the medial preoptic area (MPOA) are projected directly to the ventral tegmental area. The dopamine level in the nucleus accumbens (a part of the mesolimbic dopamine system) increases in the course of caring for the offspring (Cameron et al., 2008). Oxytocin and dopamine also control important reward systems, thus, they play a role in experiencing the pleasure of performing parenting tasks (Esch & Stefano, 2005).

Epigenetic transgenerational animal studies show that the fate of the offspring is not determined by their genetic heritage, but by the quality of postpartum maternal care they experienced (for a summary, see Champagne (2008), Champagne and Curley (2009)). The quality of maternal care also determines the stress-reactivity of the offspring (Fish et al., 2004; Weaver et al., 2004).

Oxytocin studies in humans have greatly accumulated in the past few years, in connection with different social situations and effects. Weisman et al. (2012) reported more than 70 studies where the favorable social and psycho-emotive effects of oxytocin was recorded in healthy persons or in different clinical samples. Research shows increased trust, more sensitive interactions, decreased social fear, and improved social skills.

Hypnosis and the oxytocin system

For hypnosis, as a special social situation, to work well not only a trustful atmosphere should be established but intensified social stimuli are to be tolerated by the members of hypnosis interaction. When the optimal context is set a positive and rewarding experience is reported.

We discussed above that the oxytocin level is closely related to the dopamine system, which is a central element in the neurobiology of social relationships (Esch & Stefano, 2005). Just like one of our earlier studies (Szekely et al., 2010), several other investigations described the association between hypnotizability and COMT, the dopamine-degrading enzyme (catechol-O-methyltransferase) (see Lichtenberg, Bachner-Melman, Ebstein, and Crawford (2004); Lichtenberg, Bachner-Melman, Gritsenko, and Ebstein (2000); Raz (2005); Raz, Fan, and Posner, (2006)).

Australian researchers found that the intranasally administered oxytocin increased the hypnotic responsiveness of subjects originally low in hypnotic susceptibility more than the placebo control did (Bryant, Hung, Guastella, & Mitchell, 2012). According to their interpretation oxytocin shifted the relationship with the hypnotist – i.e., rapport – in a more favorable direction, but no direct proof of this was reported.

Although interaction of hypnosis and the hypothalamic–pituitary–adrenal (HPA) axis has been already investigated by researchers (Sobrinho et al., 2003; Wood, Bughi, Morrison, Tanavoli, & Zadeh, 2003), the relationship is still unclear. For example Zachariae and colleagues (1991) found a decrease in plasma cortisol levels after the hypnotically suggested happiness compared to the pre-hypnosis baseline, while they also reported "non-significant decrease" of the serum cortisol level after suggested anger or depression compared to before hypnosis. One of the limitation of this study was that circadian rhythm of cortisol was not

accounted for in blood sampling or statistical analysis. Conversely, Goodin and colleagues (2012) could not find the expected mitigating effect of hypnosis on the cortisol increase evoked by experimental pain, although they only involved a selected sample of highly hypnotizable subjects and they used a between subjects design where the within subjects comparison of pre- and post-intervention cortisol reactivity to pain would have been also interesting to see. The long term effects of hypnosis on salivary cortisol were also assessed in a previous study (Thompson, et al., 2011) which did not report significant decrease after 10 relaxation hypnosis sessions, although cortisol levels in this study were not measured immediately after hypnosis, rather on a day with no hypnosis within the first week after the last of the hypnosis sessions. Adlercreutz and colleagues (1982) concluded that hypnosis in itself is insufficient to elicit any hormonal change, only hypnotically suggested emotions can affect hormone levels.

The aim of our study was to investigate the possible role of oxytocin and cortisol in the hypnotic *interaction*. According to our interactional approach of hypnosis (Bányai, 1985; Bányai, Gösi-Greguss, Vágó, Varga, & Horváth, 1990), we extended our measurements to the hypnotist as well, and various paper-and-pencil tests were introduced to tap the development of the relational experiences of the hypnotic interaction.

Methodological difficulties arise in relation to investigation of the *central* oxytocin system. Due to ethical reasons experimental designs used in animal studies (e.g., by injecting oxytocin or its antagonist into the brain) cannot be applied in humans. Therefore indirect methods are used in human studies: (1) With the expectation that Oxytocin will pass the blood-brain barrier and can have a central effect, it is administered through *nasal spray* with placebo as a control, (2) measurement of oxytocin levels from the *cerebrospinal* fluid, and (3) the third possibility is that the level of oxytocin is measured in the *periphery* (plasma, saliva, or urine).

In our study we tracked the changes in the levels of oxytocin in the 3rd way, as that is the least invasive, and do not intervene with the natural flow of the interaction. According to the literature, saliva samples are suited to determine the level of oxytocin (Zak, Kurzban, et al., 2005; Feldman, Gordon, and Zagoory-Sharon, 2010; Weisman, Zagoory-Sharon, and Feldman, 2012).

We hypothesize that oxytocin and cortisol levels will correlate with the relational experiences, rather than with the behavior-based scores of hypnotic susceptibility. In this exploratory study, however, no distinct hypothesis can be proposed about the nature of the correlation.

METHODS

Participants: 24 subjects were recruited to the study all of whom were found in the database of the Department of Affective Psychology's Hypnosis Laboratory and contacted via phone. The contacted subjects had a prior group hypnosis in which their hypnotisability was determined with the Harvard Group Scale of Hypnotic Susceptibility: Form A (HGSHS:A) (Shor & Orne, 1962). The recruitment process was carried forward until the desired sample of 8 low (score: 1-4) 8 medium (score: 5-9) and 8 high (score: 10-12) hypnotizable subjects were reached.

On the basis of the SHSS:C scores – measured in the main session - the final sample of subjects proved to contain 11 low (0-4), 10 medium (5-9) and 3 high (10-12) scorers.

We recruited 4 hypnotists as well, two of them with high hypnotic susceptibility, the remaining two low hypnotizable.

The enrolment criteria for both subjects and hypnotists included: adult male; no medical or recreational drug use; no acute or chronic disease; fluent in Hungarian; literate. Aside from this all hypnotists were experienced in administering Stanford Hypnotic Susceptibility Scale: Forms C (SHSS:C) (Weitzenhoffer & Hilgard, 1962). Women were not eligible for the study because of the impact of menstrual cycle and oral contraceptives on the studied hormones would have caused high heterogeneity in this small sample-size study (Kirschbaum, Kudielka, Gaab, Schommer, & Hellhammer, 1999; Salonia et al., 2005).

Procedure: All of the participants were instructed to abstain from caffeine and alcohol intake on the day of the study, not to eat or drink (except for water) and not to smoke 2 hours prior to the study. Hypnotists and subjects waited in separate rooms prior to the hypnosis session. Baseline saliva samples were obtained from both of them 15 minutes after their arrival. During this 15 minute waiting period informed consent was obtained and the state anxiety questionnaire from State Trait Anxiety Inventory was filled (see below).

Following saliva sampling (see below), SHSS-C was administered by the hypnotist and the hypnosis session was video recorded. According to the SHSS-C protocol hypnosis induction was a standard relaxational induction with eye fixation, eye closure and countup from one to twenty. The hypnotist-subject dyads were pre-determined based on the prior HGSHS:A scores of the subjects to get a balanced design where all 4 hypnotists were paired with 2 low, 2 medium and 2 high susceptibility subjects. The hypnotists were not informed concerning the hypnotisability of the subjects or the specific aim of the study. Both hypnotists and subjects were informed that the study is focusing on “various neuroendocrine correlates of hypnosis”.

After the hypnosis subject and hypnotist returned to their separate rooms and filled the following questionnaires (see details below): Archaic Involvement Measure (AIM), Phenomenology of Consciousness Inventory (PCI), Dyadic Interactional Harmony (DIH), State Trait Anxiety Inventory (STAI). Subsequently another saliva sample was obtained (approximately 20 minutes after the termination of the hypnosis, $M = 19\text{min}$ $SD = 3\text{min}$).

Subjects also filled in the s-EMBU (short version of Egna Minnen Beträffande Uppfostran [My memories of upbringing]) and the trait questionnaire of STAI at the conclusion of the study session. Hypnotists only did so at the end of their first study session.

All of the saliva samples were collected between 11:00 am and 3:30 pm to avoid bias from hormone circadian variations.

Saliva collection and sample processing¹. Unstimulated saliva samples were obtained by using oral swabs (Salivette Sarstedt®, Germany). Subjects were asked not to eat or drink at least 30 minutes prior to sampling. Oral swabs were held in the mouth for 1 minute then placed into coded collection tubes and immediately frozen and stored at -20°C until analysis. Salivary oxytocin was measured by enzyme immune assay (EIA) (ENZO Life Sciences ADI-900-153). 1.5 ml saliva was precipitated by 1xVol 0.1 M trichloroacetic acid (TCA) followed by C18 SepPack column extraction using acetonitrile: TCA 1.1 mixture. The final eluate was lyophilized by Speed-Vac concentrator and the sample was reconstructed in 300 μl assay buffer (5x concentrate of the original saliva). Salivary cortisol concentration and alpha amylase activity was assessed from the original saliva samples. Salivary cortisol was measured by commercially available EIA kit (cat number: 1-3002; Salimetrics, State College, PA, USA). Samples were assayed in duplicate using 25 μl saliva per well according to the manufacturer instructions. The sensitivity of the assay is 0.003 $\mu\text{g/dL}$. Intra- and interassay coefficients (CV) were 3,35% and 3,75-6,41 respectively. The assay does not show significant cross reactivity with other corticosteroid hormones or sex steroids. The correlation with plasma is 0.91.

¹ We are grateful to dr. Krisztina Kovács for running the laboratory analyses of saliva samples.

Questionnaires:

AIM The Archaic Involvement Measure (AIM)(Nash & Spinler, 1989) is designed to assess the archaic experiences arising between hypnotist and subject. The questionnaire uses a 7 point Likert scale. According to the interactional framework of our laboratory we used a modified version of the original AIM (Bányai, et al., 1990). In this modified version subjects and hypnotists get separate questionnaires with 22 questions (3 negative items are added to the original 19 positive items). In our present study we used the total AIM score in the analyses which is based on the 19 positive items. Crombach's alpha in the subjects' sample (α_s) = .937.; Crombach's alpha in the hypnotists' sample (α_h) = .923.

PCI The subjective alteration of consciousness of the participants is assessed with the Hungarian version (Szabo, 1993; Szabó, 1989) of Phenomenology of Consciousness Inventory (Pekala, 1986, 1991). Phenomenology of Consciousness Inventory is a 53 item questionnaire which quantifies phenomenal experience of the subjects through 12 major and 14 minor dimensions using a Likert type scale (0-6) on which subjects have to indicate their agreement with two dipolar statements. The dimensions are as follows (minor dimensions in parenthesis): Altered experience (altered body image, perception, meaning and time sense), Positive affect (joy, sexual excitement and love), Negative affect (anger, sadness and fear), Visual imagery (amount and vividness), Attention (direction and concentration), Self-awareness, Altered state of awareness, Internal dialogue, Rationality, Volitional control, Memory and Arousal.

DIH The Dyadic Interactional Harmony Questionnaire (DIH) (Varga, Józsa, Bányai, & Gósi-Greguss, 2006) is a 50-item Likert-type scale ranging from 1 to 5 designed for measuring the interactive phenomenological relationship between hypnotist and subject. In our experiment we used a shorter (40 item) version of DIH. DIH has 4 subscales: Intimacy (α_s = .86; α_h = .82), Communion (α_s = .87; α_h = .93), Playfulness (α_s = .874; α_h = .894) and Tension (α_s = .0; α_h = .858).

s-EMBU The short version of Eгна Minnen Beträffande Uppfostran [My memories of upbringing]) (Arrindell et al., 1999; Perris, Jacobsson, Lindstrom, von Knorring, & Perris, 1980) measures the adults' perceptions of their parents' rearing behaviour. Through 23 items respondents score the rearing behaviour of the mother and the father separately. It contains 3 subscales: Rejection, Emotional warmth and Overprotection.

- *Rejection*: Punishment, shame, emotional coldness or criticism characterized the behavior of parents in the memory of the already adult child; (α_s = .801; α_h = .600),
- *Emotional warmth*: The person remembers the experience of love, acceptance, and security with respect to parental rearing; (α_s = .936; α_h = .890)
- *(Over)Protection*: Excessive fear and anxiety characterizes the childhood memories. (α_s = .841; α_h = .0)

STAI Spielberger's State-Trait Anxiety Inventory (STAI)(Spielberger, Gorsuch, & Lushene, 1970) is a 40 item questionnaire which measures the level of anxiety state and trait anxiety. State anxiety (STAI - state) refers to anxiety related to the present moment while trait anxiety is a more or less stable dimension of personality and indicates general anxiety levels (STAI - trait) Both the state and trait questionnaires present 20 statements describing anxiety to which subjects can answer by one of four descriptors best indicating their degree of emotion (score 1-4; minimum possible score = 20, maximum = 80).

In the present paper we will focus on the relational measures (AIM, DIH, s-EMBU), and the hypnotic susceptibility value. Data of PCI, STAI and amylase concentrations will not be analyzed.

Subscales of low internal consistency values (DIH Tension and s-EMBU overprotection) are also omitted from further analysis)

Statistical analysis:

Paired sample t-test was applied to assess the effect of hypnosis on the salivary oxytocin and cortisol concentrations. The association of the questionnaires and the hormone concentration changes was tested with Pearson correlation. The s-EMBU data of the hypnotists showed a skewed distribution. In these cases Spearman correlation was used. The statistical tests were performed using SPSS 17.1.

Results

Due to too small amount of saliva in the samples of hypnotists only 12 sessions were suitable for the hormone level analysis. The descriptive statistics for the demographic variables of the twelve subjects are displayed in table 1. In this final sample 5 subjects had low, 5 medium and 2 high hypnotizability distributed between the four hypnotists as shown in table 2. **insert Tables 1 and 2 here**

Table1 Descriptive statistics of subject characteristics

Table2 Distribution of subjects with different levels of hypnotizability (SHSS-C) among the hypnotists in the study

Our data show that oxytocin levels slightly decreased in the subjects from pre- to post-hypnosis, while they increased slightly in the hypnotists, but none of these changes reached statistical significance. Cortisol levels, however, decreased significantly after hypnosis both in the subjects ($t(11) = 7.67$; $p < .001$) and in the hypnotists ($t(11) = 2.51$; $p < .05$] (see Figure 1. and Table 3.).

insert Figure 1 here

Figure 1. Baseline and change of oxytocin and cortisol levels (pre- to post hypnosis)

insert Table 3 here

Table 3. Mean oxytocin and cortisol levels and standard deviations before and after hypnosis in subjects and hypnotists, t-values of testing the significance of the amount of change, degrees of freedom (df) and p values.

The changes in oxytocin and cortisol levels were calculated in both the subjects and the hypnotists: on the basis of the difference between the pre- and posthypnosis values (pre-hypnosis values subtracted from post-hypnosis values).

The descriptive statistics of the relational measures are summarized in table 4. The correlation of these „change” values of oxytocine and those of cortisol with the hypnotic susceptibility of the subjects, and with the relational tests filled out after hypnosis, including the ones administered to the hypnotists (AIM, DIH, and s-EMBU) were calculated.

insert Table 4. here

Table 4 Descriptive statistics of the relational measures

Because of the small sample size, the majority of the correlations were not significant statistically, so no significant correlations were found between the hypnotic susceptibility of the subjects and the level of either oxytocin or cortisol of the participant. (see Table 5.).

insert Table 5. here

Table 5. The correlations (Pearson's r) between the subject's hypnotic susceptibility (SHSS:C) and the change in oxytocin and cortisol levels of subjects and hypnotists. None of the correlations are significant.

The data of relational questionnaires yielded significant correlations. The *Communion* factor of DIH showed a relatively high and significant correlation with the subject's increase in oxytocin level ($r(9) = .61$; $p < .05$). Furthermore, the *Emotional Warmth* factor of s-EMBU in the subjects with respect to their parents showed a high and significant negative correlation with the level of oxytocin increase in the hypnotist ($r(7) = -.90$; $p < .01$).

None of the correlations between cortisol level changes and the relational tests (AIM, DIH, s-EMBU) proved to be significant.

Discussion

Due to the unfortunately small sample size and the relatively large number of statistical tests, the probability of making type I and type II errors is great, so our results should be treated with great caution.

It is remarkable, however, that the change in oxytocin level – even at this small sample size – showed highly significant correlations with the variables reflecting *relational* experiences, and not with the hypnotizability of the subjects. Significant correlations were found with the harmony between the interactants (as perceived by the subject and expressed on DIH) and with the indices that show how the subjects remember the emotional warmth they experienced with their parents (s-EMBU). It is especially interesting that the increase of the oxytocin level of the subjects is not connected to the archaic charge of the *current* relationship (as measured by AIM), but to the level the subject's perceived communion with the hypnotist (DIH).

In the hypnotists we found that the less emotional warmth the subjects remembers in relation to their parents the greater the increase of the hypnotists' salivary oxytocin concentration. The same was not related to the subjects' own oxytocin levels.

The subjects filled out s-EMBU at the *very end* of the experimental session, after hypnosis, following the „post“ saliva sample collection. No questions primed the subject regarding early childhood experiences before or during hypnosis. (The childhood experiences could be touched by the age-regression test-suggestion of SHSS:C, but this suggestion calls for school-memories, not parental experiences).

This could be interpreted as if the subject brought his/her early relational experiences implicitly into the hypnotic situation, and in the hypnotist, the oxytocin changes appear in relation to the subjects' parental emotional warmth recalled of the period of early childhood on s-EMBU. This pattern may imply that hypnosis might provide a corrective experience: If the subject lacks emotional warmth with his/her parents, there is an increased level of oxytocin in the hypnotist. This change in oxytocin level in the hypnotist corresponds to the “calm and connection” stress management reaction pattern of oxytocin. Perhaps, the hypnotic relationship can offer the subject a model of acceptance based on trust. The decreased cortisol levels of both parties also reflect decreased stress level. The adaptive nature of “calm and connection” stress response was emphasized by several authors (e.g., DeVries, Glasper, and

Detillion (2003) Uvnäs-Moberg (1998a, 1998b); Uvnäs-Moberg and Petersson (2004) Uvnäs-Moberg, Arn, and Magnusson (2005).

Unfortunately as there were no control conditions used in the study, we cannot be sure that the changes in the hormone levels were initiated by the hypnosis induction itself, but a hypnotic interaction is a complex phenomenon components of which have already been indicated to moderate cortisol and oxytocin levels. Alterations in salivary cortisol levels might be related to the relaxed state during the hypnosis session (Pawlow & Jones, 2002), although there is considerable debate in the literature concerning relaxation's effects on cortisol (Kirschbaum & Hellhammer, 1994). There are also reports indicating decreased cortisol levels after warm social contact (Karen M Grewen, Susan S Girdler, Janet Amico, & Kathleen C Light, 2005). Further, oxytocin levels are reported to be affected by trust in a dyadic interaction (Zak, Kurzban, & Matzner, 2005), which is a key element in a hypnotic dyad as well. Thus the high level of trust needed from the participants to engage in a one-on-one hypnosis session can be one of the moderators of oxytocin responses.

Clearly, several other – non hypnosis-specific – aspects of the relational experience may contribute to similar findings (e.g., establishing rapport, expressing empathy, matching on various client-therapist background variables, etc.). Contrasting hypnosis interactions and non-hypnotic ones can clarify the specific contribution of hypnosis to the results.

In our earlier study (Varga, Bányai, Józsa, & Gösi-Greguss, 2008), however, we reported the relationship between *hypnosis style* and interactional experiences (DIH). In the cases of maternal style hypnoses, there was no correlation between subjects' DIH scores and hypnosis style, but the same correlations were high in the hypnotists. The more maternal the style of hypnosis, the higher the level of intimacy. In our twin study (Varga, Bányai, Gösi-Greguss, & Tauszik, n.d.), our data showed that the experiences rating the hypnotic interaction (DIH) of monozygotic twins were correlated more *with each other* than with their actual interactional partners (the hypnotists). This harmony was *not* present in their behavioral (hypnotizability scores) or phenomenological (PCI) response-patterns. We interpreted these findings such that the hypnotic settings provides the possibility for the subject to have a relationship experience by or along the line of his or her own (early) interactional experience-pattern.

It is also demonstrated that the hypnotist can be deeply involved at the level of experiences (Varga, Bányai, & Gösi-Greguss, 1999) as well. In other studies we found on the basis of inter-related analysis of data of subjects and hypnotists points and periods of concordances in the contents of their minds. It was demonstrated by the harmony between the experiences as assessed independently by Parallel Experiential Analysis Technique (PEAT)(Varga, Banyai, & Gosi-Greguss, 1994) or by the occurrence of Visual Imaginative Synchrony (Varga S & Varga, 2009).

All of these interactional results can well be interpreted in accordance with the predictions of the social psychobiological model of hypnosis (Bányai, 1998, 2002a, 2002b). According to this model, a hypnosis situation can provide the opportunity for the activation (bringing to the surface) of early relationship patterns, which in turn may create corrective experience.

The possibility to support the oxytocin system by corrective experiences is significant because it has been proven that the memory-effects of oxytocin facilitate the forgetting of adverse social experiences while activates the unconscious network of social memories (Macdonald & Macdonald, 2010). Especially in cases of early neglect or abuse: the problem is not simply the low levels of oxytocin (Heim et al., 2009), but also the decreased oxytocin responses to social

support (Macdonald & Macdonald, 2010). If remained un-corrected, the unfavorable attachment styles and oxytocin patterns can be transferred to the next generation (Barnett, Buckroyd, & Windle, 2005; Brethelton & Munholland, 1999; Champagne, 2008; Ward et al., 2001). The aim of the correction is to restore the balance between the *defense* system (activated as a result of threat and uncertainty) and the *attachment* system (built on the experiences of proximity, trust, and care in a social context). So the provision of corrective experiences may improve the affiliative processes not only for the given person, but to his/her offspring, too.

Norcross (2011) pointed out that at least 100 studies in the past 5 years got to the conclusion that according to the clients in psychotherapy the success of their treatment is attributed not to the technique or the method, but to their *relationship* with the therapist. The special context and appropriate atmosphere of psychotherapy give a chance for the modification of the pattern of representation of important relationships (Ludwig-Körner, 1999). This corrective experience may well be provided in hypnosis, due to the extremely enhanced mutual emotional attunement, in which the hypnotist perceives, understands, and appropriately responds even to unexpressed feelings (Bányai, 2002a, 2008; Varga, Józsa, Bányai, & Gösi-Greguss, 2009).

Among the limitations of the study we see the small sample size, the high probability of type I and II errors, the involvement of only male subjects / hypnotists. The biggest question is how the level of oxytocin measured in the periphery relates to the central level (which is difficult to be measured directly in human). It is also a shortcoming that we could not replicate the balanced distribution of the sample created on the basis of the subjects' previous hypnotizability indexes, as in the study SHSS-C scores differed from the initial HGSHS:A scores.

We think however, on the basis of these preliminary results that it would be definitely worthwhile to study the relationship between hypnosis and the levels of oxytocin and cortisol systematically within an *interactional* framework. It is highly probable that *free* hypnosis experimental sessions (as opposed to standardised ones) and *clinical* situations could be better settings to investigate the importance of the actual and early relational experiences.

References

- Adlercreutz, H., Kuoppasalmi, K., Narvanen, S., Kosunen, K., & Heikkinen, R. (1982). Use of hypnosis in studies of the effect of stress on cardiovascular function and hormones. *Acta Med Scand Suppl*, 660, 84-94.
- Arrindell, W. A., Sanavio, E., Aguilar, G., Sica, C., Hatzichristou, C., Eisemann, M., . . . van der Ende, J. (1999). The development of a short form of the EMBU: Its appraisal with students in Greece, Guatemala, Hungary, and Italy. *Personality and Individual Differences*, 27, 613–628.
- Bányai, É. (1985). A social psychophysiological approach to the understanding of hypnosis: The interaction between hypnotist and subject. *Hypnos. Swedish Journal of Hypnosis in Psychotherapy and Psychosomatic Medicine*(12), 186-210.
- Bányai, É. (1998). The interactive nature of hypnosis: research evidence for a social-psychobiological model. *Contemporary Hypnosis*, 15(1), 52-63.
- Bányai, É. (2002a). Communication in different styles of hypnosis. In C. A. L. Hoogduin, C. P. D. R. Schaap & H. A. A. de Berk (Eds.), *Issues on hypnosis* (pp. 1-20). Nijmegen: Cure & Care.

- Bányai, É. (2002b). *Hypnosis and mainstream psychology*. Paper presented at the The 15th International Congress of Hypnosis, Munich.
- Bányai, É. (2008). A hipnózis szociálpszichobiológiai modellje. In É. Bánai & L. Benczúr (Eds.), *A hipnózis és hipnoterápia alapjai. Szöveggyűjtemény*. (pp. 379-429). Budapest: ELTE Eötvös Kiadó.
- Bányai, É., Gösi-Greguss, A. C., Vágó, P., Varga, K., & Horváth, R. (1990). Interactional Approach to the Understanding of Hypnosis: Theoretical Background and Main Findings. . In R. Van Dyck, P. Spinhoven, A. J. W. Van der Does, Y. R. Van Rood & W. De Moor (Eds.), *Hypnosis: Current theory, research and practice*. (pp. 53-69). Amsterdam: Free University Press.
- Barnett, S., Buckroyd, J., & Windle, K. (2005). Eating disorders from parent to child: Mothers' perceptions of transgenerational effect. *Counselling and Psychotherapy Research*, 5(3), 203-211.
- Brethelton, I., & Munholland, K. A. (1999). Internal working models in attachment relationships. A construct revisited. In J. Cassidy & P. R. Shaver (Eds.), *Handbook of attachment. Theory, research and clinical applications*. (pp. 89-111). New York, London: Guilford Press.
- Bryant, R. A., Hung, L., Guastella, A. J., & Mitchell, P. B. (2012). Oxytocin as a moderator of hypnotizability. *Psychoneuroendocrinology*, 37(1), 162-166.
- Cameron, N. M., Shahrokh, D., Del Corpo, A., Dhir, S. K., Szyf, M., Champagne, F. A., & Meaney, M. J. (2008). Epigenetic programming of phenotypic variations in reproductive strategies in the rat through maternal care. *J Neuroendocrinol*, 20(6), 795-801.
- Champagne, F. A. (2008). Epigenetic mechanisms and the transgenerational effects of maternal care. *Front Neuroendocrinol*, 29(3), 386-397.
- Champagne, F. A., & Curley, J. P. (2009). Epigenetic mechanisms mediating the long-term effects of maternal care on development. *Neurosci Biobehav Rev*, 33(4), 593-600.
- Damasio, A. (2005). Human behaviour: brain trust. *Nature*, 435(7042), 571-572.
- DeVries, A. C., Glasper, E. R., & Detillion, C. E. (2003). Social modulation of stress responses. *Physiol Behav*, 79(3), 399-407.
- Esch, T., & Stefano, G. B. (2005). The Neurobiology of Love. *Neuro Endocrinol Lett*, 26(3), 175-192.
- Fish, E. W., Shahrokh, D., Bagot, R., Caldji, C., Bredy, T., Szyf, M., & Meaney, M. J. (2004). Epigenetic programming of stress responses through variations in maternal care. *Ann N Y Acad Sci*, 1036, 167-180.
- Goodin, B. R., Quinn, N. B., Kronfli, T., King, C. D., Page, G. G., Haythornthwaite, J. A., . . . McGuire, L. (2012). Experimental pain ratings and reactivity of cortisol and soluble tumor necrosis factor-alpha receptor II following a trial of hypnosis: results of a randomized controlled pilot study. *Pain Med*, 13(1), 29-44.
- Grewen, K. M., Girdler, S. S., Amico, J., & Light, K. C. (2005). Effects of partner support on resting oxytocin, cortisol, norepinephrine, and blood pressure before and after warm partner contact. *Psychosom Med*, 67(4), 531-538.
- Grewen, K. M., Girdler, S. S., Amico, J., & Light, K. C. (2005). Effects of partner support on resting oxytocin, cortisol, norepinephrine, and blood pressure before and after warm partner contact. *Psychosomatic Medicine*, 67(4), 531-538.
- Heim, C., Young, L. J., Newport, D. J., Mletzko, T., Miller, A. H., & Nemeroff, C. B. (2009). Lower CSF oxytocin concentrations in women with a history of childhood abuse. *Mol Psychiatry*, 14(10), 954-958.

- Huber, D., Veinante, P., Stoop, R. (2005) Science, 308(5719), . (2005). Vasopressin and Oxytocin Excite Distinct Neuronal Populations in the Central Amygdala. . *Science*, 308(5719), 245–248.
- Insel, T. R. (1992). Oxytocin--a neuropeptide for affiliation: evidence from behavioral, receptor autoradiographic, and comparative studies. *Psychoneuroendocrinology*, 17(1), 3-35.
- Kendrick, K. M. (2000). Oxytocin, motherhood and bonding. *Exp Physiol*, 85 Spec No, 111S-124S.
- Kirschbaum, C., & Hellhammer, D. H. (1994). Salivary cortisol in psychoneuroendocrine research: recent developments and applications. *Psychoneuroendocrinology*, 19(4), 313-333.
- Kirschbaum, C., Kudielka, B. M., Gaab, J., Schommer, N. C., & Hellhammer, D. H. (1999). Impact of gender, menstrual cycle phase, and oral contraceptives on the activity of the hypothalamus-pituitary-adrenal axis. *Psychosomatic Medicine*, 61(2), 154-162.
- Kosfeld, M., Heinrichs, M., Zak, P. J., Fischbacher, U., & Fehr, E. (2005). Oxytocin increases trust in humans. *Nature*, 435(7042), 673-676.
- Leng, G., & Ludwig, M. (2008). Neurotransmitters and peptides: whispered secrets and public announcements. *J Physiol*, 586(Pt 23), 5625-5632.
- Lichtenberg, P., Bachner-Melman, R., Ebstein, R. P., & Crawford, H. J. (2004). Hypnotic susceptibility: multidimensional relationships with Cloninger's Tridimensional Personality Questionnaire, COMT polymorphisms, absorption, and attentional characteristics. *Int J Clin Exp Hypn*, 52(1), 47-72.
- Lichtenberg, P., Bachner-Melman, R., Gritsenko, I., & Ebstein, R. P. (2000). Exploratory association study between catechol-O-methyltransferase (COMT) high/low enzyme activity polymorphism and hypnotizability. *Am J Med Genet*, 96(6), 771-774.
- Ludwig-Körner, C. (1999). Effects of Severely Disturbed Parents on Early Parent-Infant Interaction. *International Forum of Psychoanalysis*, 8(1), 25-31.
- Ludwig, M., & Leng, G. (2006). Dendritic peptide release and peptide-dependent behaviours. *Nat Rev Neurosci*, 7(2), 126-136.
- Macdonald, K., & Macdonald, T. M. (2010). The peptide that binds: a systematic review of oxytocin and its prosocial effects in humans. *Harv Rev Psychiatry*, 18(1), 1-21.
- Nash, M. R., & Spinler, D. (1989). Hypnosis and transference: a measure of archaic involvement. *Int J Clin Exp Hypn*, 37(2), 129-144.
- Norcross, J. C., & Wampold, B. E. (2011). Evidence-based therapy relationships: research conclusions and clinical practices. *Psychotherapy (Chic)*, 48(1), 98-102.
- Pawlow, L. A., & Jones, G. E. (2002). The impact of abbreviated progressive muscle relaxation on salivary cortisol. *Biological Psychology*, 60(1), 1-16.
- Pekala, R. J. (1986). Measurement of phenomenological experience: Phenomenology of Consciousness Inventory. *Perceptual and Motor Skills*, 63, 983-989.
- Pekala, R. J. (1991). *Quantifying Consciousness: An Empirical Approach*. New York: Plenum.
- Perris, C., Jacobsson, L., Lindstrom, H., von Knorring, L., & Perris, H. (1980). Development of a new inventory assessing memories of parental rearing behaviour. *Acta Psychiatr Scand*, 61(4), 265-274.
- Raz, A. (2005). Attention and hypnosis: neural substrates and genetic associations of two converging processes. *Int J Clin Exp Hypn*, 53(3), 237-258.
- Raz, A., Fan, J., & Posner, M. I. (2006). Neuroimaging and genetic associations of attentional and hypnotic processes. *J Physiol Paris*, 99(4-6), 483-491.
- Sabatier, N., Rowe, I., & Leng, G. (2007). Central release of oxytocin and the ventromedial hypothalamus. *Biochem Soc Trans*, 35(Pt 5), 1247-1251.

- Salonia, A., Nappi, R. E., Pontillo, M., Daverio, R., Smeraldi, A., Briganti, A., . . . Montorsi, F. (2005). Menstrual cycle-related changes in plasma oxytocin are relevant to normal sexual function in healthy women. *Hormones and Behavior*, 47(2), 164-169.
- Shor, R. E., & Orne, E. C. (1962). *The Harvard Group Scale of Hypnotic Susceptibility*. Palo Alto, California: Consulting Psychologists Press.
- Sobrinho, L. G., Simoes, M., Barbosa, L., Raposo, J. F., Pratas, S., Fernandes, P. L., & Santos, M. A. (2003). Cortisol, prolactin, growth hormone and neurovegetative responses to emotions elicited during an hypnoidal state. *Psychoneuroendocrinology*, 28(1), 1-17.
- Spielberger, C. D., Gorsuch, R. L., & Lushene, R. E. (1970). *Manual for the State-Trait Anxiety Inventory*. Palo Alto, California.
- Szabo, C. (1993). The phenomenology of the experiences and the depth of hypnosis: comparison of direct and indirect induction techniques. *Int J Clin Exp Hypn*, 41(3), 225-233.
- Szabó, C. (1989). *Szubjektív élmények különböző indukciós technikákkal létrehozott hipnózisokban, [Subjective experiences induced by various hypnosis techniques]*. Debrecen, Hungary: Doktori értekezés, KLTE, [Unpublished doctoral dissertation, Kossuth Lajos University].
- Szekely, A., Kovacs-Nagy, R., Banyai, E. I., Gosi-Greguss, A. C., Varga, K., Halmai, Z., . . . Sasvari-Szekely, M. (2010). Association between hypnotizability and the catechol-O-methyltransferase (COMT) polymorphism. *Int J Clin Exp Hypn*, 58(3), 301-315.
- Thompson, T., Steffert, T., Steed, A., & Gruzelier, J. (2011). A randomized controlled trial of the effects of hypnosis with 3-D virtual reality animation on tiredness, mood, and salivary cortisol. *Int J Clin Exp Hypn*, 59(1), 122-142.
- Uvnas-Moberg, K. (1998a). Antistress Pattern Induced by Oxytocin. *News Physiol Sci*, 13, 22-25.
- Uvnas-Moberg, K. (1998b). Oxytocin may mediate the benefits of positive social interaction and emotions. *Psychoneuroendocrinology*, 23(8), 819-835.
- Uvnas-Moberg, K., Arn, I., & Magnusson, D. (2005). The psychobiology of emotion: the role of the oxytocinergic system. *Int J Behav Med*, 12(2), 59-65.
- Uvnas-Moberg, K., Bjokstrand, E., Hillegaart, V., & Ahlenius, S. (1999). Oxytocin as a possible mediator of SSRI-induced antidepressant effects. *Psychopharmacology (Berl)*, 142(1), 95-101.
- Uvnas-Moberg, K., & Petersson, M. (2004). [Oxytocin--biochemical link for human relations. Mediator of antistress, well-being, social interaction, growth, healing...]. *Lakartidningen*, 101(35), 2634-2639.
- Varga, K., Bányai, É., & Gösi-Greguss, A. C. (1999). Hypnotists' Phenomenology: Toward the Understanding of Hypnotic Interactions. *Hypnos*, 26(4), 181-193.
- Varga, K., Bányai, É., Gösi-Greguss, A. C., & Tauszik, K. (n.d.). Phenomenological Aspects of Hypnotic Interactions: The Effect of Kinship. *Paper to be submitted to International Journal of Clinical and Experimental Hypnosis*.
- Varga, K., Bányai, É., Józsa, E., & Gösi-Greguss, A. C. (2008). Interactional Phenomenology of Maternal and Paternal Hypnosis Styles. *Contemporary Hypnosis*, 25(1), 14-28.
- Varga, K., Banyai, E. I., & Gosi-Greguss, A. C. (1994). Parallel application of the experiential analysis technique with subject and hypnotist: a new possibility for measuring interactional synchrony. *Int J Clin Exp Hypn*, 42(2), 130-139.
- Varga, K., Józsa, E., Bányai, É., & Gösi-Greguss, A. C. (2006). A New Way of Characterizing Hypnotic Interactions: Dyadic Interactional Harmony (DIH) Questionnaire. . *Contemporary Hypnosis*, 23(4), 151-166.

- Varga, K., Józsa, E., Bányaí, É., & Gösi-Greguss, A. C. (2009). Patterns of interactional harmony: The phenomenology of hypnosis interaction. In G. D. Koester & P. R. Delisle (Eds.), *Hypnosis Theories, Research and Applications*. (pp. 53-98). New York: Nova Science Publishers Inc.
- Varga S, K., & Varga, K. (2009). Visual Imaginative Synchrony. *Contemporary Hypnosis*, 26(3), 146-158.
- Ward, A., Ramsay, R., Turnbull, S., Steele, M., Steele, H., & Treasure, J. (2001). Attachment in anorexia nervosa: a transgenerational perspective. *Br J Med Psychol*, 74(Pt 4), 497-505.
- Weaver, I. C., Cervoni, N., Champagne, F. A., D'Alessio, A. C., Sharma, S., Seckl, J. R., . . . Meaney, M. J. (2004). Epigenetic programming by maternal behavior. *Nat Neurosci*, 7(8), 847-854.
- Weisman, O., Zagoory-Sharon, O., & Feldman, R. (2012). Intranasal oxytocin administration is reflected in human saliva. *Psychoneuroendocrinology*, 37(9), 1582-1586.
- Weitzenhoffer, A. M., & Hilgard, E. R. (1962). *Stanford Hypnotic Susceptibility Scale, Form C*. Palo Alto, California: Consulting Psychologists Press.
- Wood, G. J., Bughi, S., Morrison, J., Tanavoli, S., & Zadeh, H. H. (2003). Hypnosis, differential expression of cytokines by T-cell subsets, and the hypothalamo-pituitary-adrenal axis. *Am J Clin Hypn*, 45(3), 179-196.
- Zachariae, R., Bjerring, P., Zachariae, C., Arendt-Nielsen, L., Nielsen, T., Eldrup, E., . . . Gotliebsen, K. (1991). Monocyte chemotactic activity in sera after hypnotically induced emotional states. *Scand J Immunol*, 34(1), 71-79.
- Zak, P. J., & Fakhar, A. (2006). Neuroactive hormones and interpersonal trust: International evidence. *Economics & Human Biology*, 4(3), 412-429.
- Zak, P. J., Kurzban, R., & Matzner, W. T. (2005). Oxytocin is associated with human trustworthiness. *Hormones and Behavior*, 48(5), 522-527.

Table 1. Descriptive statistics of subject characteristics

	Mean	SD
Age	29.62	6.69
STAI-trait	43.46	14.66
Hypnotizability (SHSS:C)	5.33	3.31

Table 2. Distribution of subjects with different levels of hypnotizability (SHSS-C) among the hypnotists in the study

	low	medium	high
hypnotist 1	0	1	1
hypnotist 2	4	2	0
hypnotist 3	1	1	1
hypnotist 4	0	1	0

Table 3. Mean oxytocin and cortisol levels and standard deviations pre- and post hypnosis in subjects and hypnotists, t-values of testing the significance of the amount of change, degrees of freedom (df) and p values.

			Mean	SD	t	df	p
Oxytocin	Subject	pre	1.97	2.14	0.65	10	.528
		post	1.48	1.48			
	Hypnotist	pre	3.03	1.84	-1.32	8	.223
		post	4.17	3.48			
Cortisol	Subject	pre	5.23	1.92	7.67	11	.001
		post	2.74	1.23			
	Hypnotist	pre	4.68	2.54	2.55	11	.027
		post	2.92	0.83			

Table 4. Descriptive statistics of the relational measures

	subjects			hypnotists		
	N	Mean	SD	N	Mean	SD
AIM total	12	3.15	1.28	12	3.10	0.94
DIH intimacy	12	1.83	0.54	12	2.13	0.64
DIH communion	12	3.34	0.49	12	3.79	0.64
DIH playfulness	12	2.64	0.72	12	2.62	0.67
DIH tension	Low internal consistency			12	2.19	0.82
s-EMBU rejection	12	21.69	7.37	4	21.00	3.19
s-EMBU emotional warmth	12	33.00	7.97	4	34.75	6.90
s-EMBU over protection	12	40.67	9.86	Low internal consistency		

Note: Hypnotists filled the AIM and DIH questionnaires for every session separately, but they only filled EMBU once. That is why N = 12 for AIM and DIH subscales and N = 4 for EMBU subscales for the hypnotists' relational measure descriptive statistics.

Table 5. The correlations (Pearson's r) between the subject's hypnotic susceptibility (SHSS:C) and the oxytocin and cortisol levels of subjects and hypnotists. None of the correlations are significant.

		Subject	Hypnotist
Oxytocin change	Pearson's r	.43	.05
	df	9	7
Cortisol change	Pearson's r	.42	-.10
	df	10	10