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From justification to discovery: a conditional testing approach to unorthodox forms of interpersonal interaction

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Abstract

We tested the claim that individuals can interact without deploying orthodox means of communication. A conditional testing approach (CTA) was applied. In four experiments, 11–15 pairs each were physically isolated and one person ('agent') tried to mentally influence another person ('receiver'). Indicators of autonomic arousal of the receiver (EDA, respiration) were recorded. Each experiment consisted of a specific stress inducing instruction (failure-avoiding vs. reinforcing) and a specific type of self-regulation related personality trait (action vs. state orientation). Significant effects were observed for two experiments. Experimental success was negatively correlated with self-regulatory mechanisms. This finding was furthermore supported when various personality functions derived from Personality–Systems Interaction theory were tested. They suggest that a low-level personality system, whose main function serves interpersonal interaction, is indicative of the effect.

Keywords: Action orientation; EDA; DMILS; PSI theory; Regression; Self-regulation

1. Introduction

In the 1990s, two published meta-analyses suggested an allegedly unorthodox form of interaction (Braud & Schlitz, 1991; Schlitz & Braud, 1997). According to experiments on so called Direct Mental Interaction with Living Systems (DMILS) persons ("agents") successfully mentally influenced the autonomic arousal of other persons ("receivers"). In a typical DMILS setting, two participants are located in separate sound-proof chambers and the agent is instructed to mentally

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reduce or increase the arousal level of the "receiver" during these episodes. The "success" of the agents' attempts is usually measured by electrodermal activity (EDA) as an indicator of the arousal. The 1997 meta-analysis with a larger data base (19 experiments) yielded a highly significant effect of Rosenthal $r = 0.25$ ($P = 0.000007$). After having excluded a number of alternative interpretations (e.g. physical information transfer, knowledge about influencing/staring schedule, fraud, etc.) Schlitz and Braud (1997) concluded the existence of a subtle, non-physical form of human interaction.

Apparently, this body of evidence does seem to challenge main-stream science because it is hardly reconcilable with orthodox cause-and-effect principles. Although the DMILS effect is rather small in size according to common conventions (Cohen, 1988), it could still be practically relevant for, as well as effective in, therapeutic settings (Schlitz & Braud, 1997). Thus, such unorthodox forms of interaction, e.g. between therapists and patients, could be effective over and above well known classical psychological effects like, expectancy, self-fulfilling prophecy, causal attribution, self-healing and alike. It was this latter implication which made Schlitz and Braud (1997) conceive the DMILS setting as a healing analogue, and the effect itself as need-induced. According to this conception, any need on behalf of an individual (say, a patient seeking therapeutic help) should increase the likelihood of his/her physiological state to "respond" to another person's caring intentions (i.e. the therapist or doctor). To date, however, this assumption has not been thoroughly tested and the few findings available are inconsistent (Braud & Schlitz, 1983; Schneider, 2002). Hence, DMILS research primarily lacks systematic follow-up studies on the significance of functional variables. This is especially true because there is no elaborated model from which sufficient and/or necessary conditions could be derived to evoke DMILS effects.

Moreover, a recent and thorough re-examination of the DMILS paradigm has raised some critical issues regarding standard psychophysiological methodology and artifact control (Boucsein, 1992; Schmidt & Walach, 2000) which could possibly have biased and obscured the findings (Schneider, Binder, & Walach, 2000). Furthermore, the DMILS studies included in the meta-analyses indicate considerable heterogeneity, with numerical mean effect sizes varying from $r = -0.25$ to 0.72 (Rosenthal's r). Due to these methodological shortcomings, Schmidt, Schneider, Utts, and Walach (2002) re-evaluated the DMILS effect in a new meta-analysis. In a total of 36 DMILS studies, they found a small, but significant effect size of $d = 0.11$ ($P = 0.001$) when the studies were graded according to their methodological quality and weighted by their sample size. Summarizing, the authors conclude that methodological shortcomings do not qualify to unequivocally turn down the existence of a DMILS effect because, e.g. overall study quality and effect size were not correlated. This line of reasoning reflects the view that, for the majority of DMILS experiments, any possible artifact cannot be assumed to systematically have deteriorated the physiological recordings (i.e. exclusive infection of activate epochs). Moreover, the results of a recent re-examination of the DMILS effect in a pilot study with standard psychophysiological methodology and more powerful statistical procedures (Schmidt, Schneider, Binder, Bürkle, & Walach, 2001) yielded effect sizes even larger than the one found by the three meta-analyses ($r = 0.4$).

In sum, the findings about an allegedly unorthodox form of interaction suggest two opposite "attitudes" to unorthodox interaction effects. Opponents declare it as chance fluctuation and deny its existence or significance, for example due to the lack of a sufficient number of independent studies. On the other hand, proponents take it as evidence of a hitherto not understood form of complexly determined interaction between living systems about which only fragmentary knowledge is available. From either point of view it is difficult to decide empirically upon the confirmation or rejection of any given research hypothesis. To circumvent this problem we propose a different approach in this paper which we call the conditional testing approach (CTA). CTA puts more emphasis on the discovery of the alleged effect than on its justification (i.e. its proof) by starting from the assumption that there actually is such an effect and by asking under which conditions it would have to be expected to occur. For example, if particular self-regulatory abilities on behalf of the participants do qualify as important factors they have to be expected to show associations with self-regulatory indices. Like any other complexly determined phenomenon, unorthodox effects are difficult to establish, should they exist. Conditional testing may provide a more realistic and indirect way of investigating an unorthodox effect: to the extent that indices of unorthodox communication show theoretically meaningful and statistically unambiguous associations with process variables (e.g. self-regulatory functions), their existence may be demonstrable via an indirect route. Specifically, if this effect is indeed some sort of match or "conformance" between two systems, as outlined by Braud (1980a, 1980b), any good ability to self-regulate one's bodily (emotions, arousal) and cognitive (attention, thoughts) functions should be conducive to the effect. As a consequence, the agent's ability to self-regulate in accordance with the experimental schedule (activate vs. calm) should be an important prerequisite for the receiver's bodily state (arousal) to "conform". This assumption aligns with empirical findings suggesting that anomalistic performances are coupled with the ability (1) to physically and mentally relax, (2) to access internal processes and feelings, and (3) to deploy right-hemispheric functions (Braud, 1975). Yet, according to an *antithesis* of the self-regulation hypothesis, anomalistic performances are based on rather primitive (archetypal or "regressive") mechanisms that require bottom-up processing rather than top-down (i.e. self-regulatory) processing (cf. Wolman, 1986). If this alternative view is correct, indices of self-regulatory functioning should be inversely related to measures of anomalistic performance. Starting from these two opposite assumptions we applied CTA by designing four experiments which examined such moderating influences of self-regulatory abilities.

1.1. *Study's aim*

The aim of this study was two-fold. First, we wanted to examine the DMILS effect by applying standard methodology. Specifically, we examined different EDA parameters. In addition, we explored respiration as a secondary DMILS indicator since it is known to be closely related to EDA (Boucsein, 1992; Schmidt et al., 2001). Second, we wanted to examine the role of self-regulatory mechanisms within the DMILS paradigm. To do so, we applied Personality Systems Interaction theory (PSI theory) by Kuhl (2000a, 2000b, 2001).

1.2. *PSI theory*

Contrary to traditional theorizing on self-regulation (cf. Boekaerts, Pintrich, & Zeidner, 2000), PSI theory describes *functional* mechanisms of psychic systems coalitions rather than global, content-related (i.e. phenomenological) concepts. As can be seen in Fig. 1, PSI theory conceptualizes four systems in terms of cognitive macrosystems with different mechanisms and different levels of

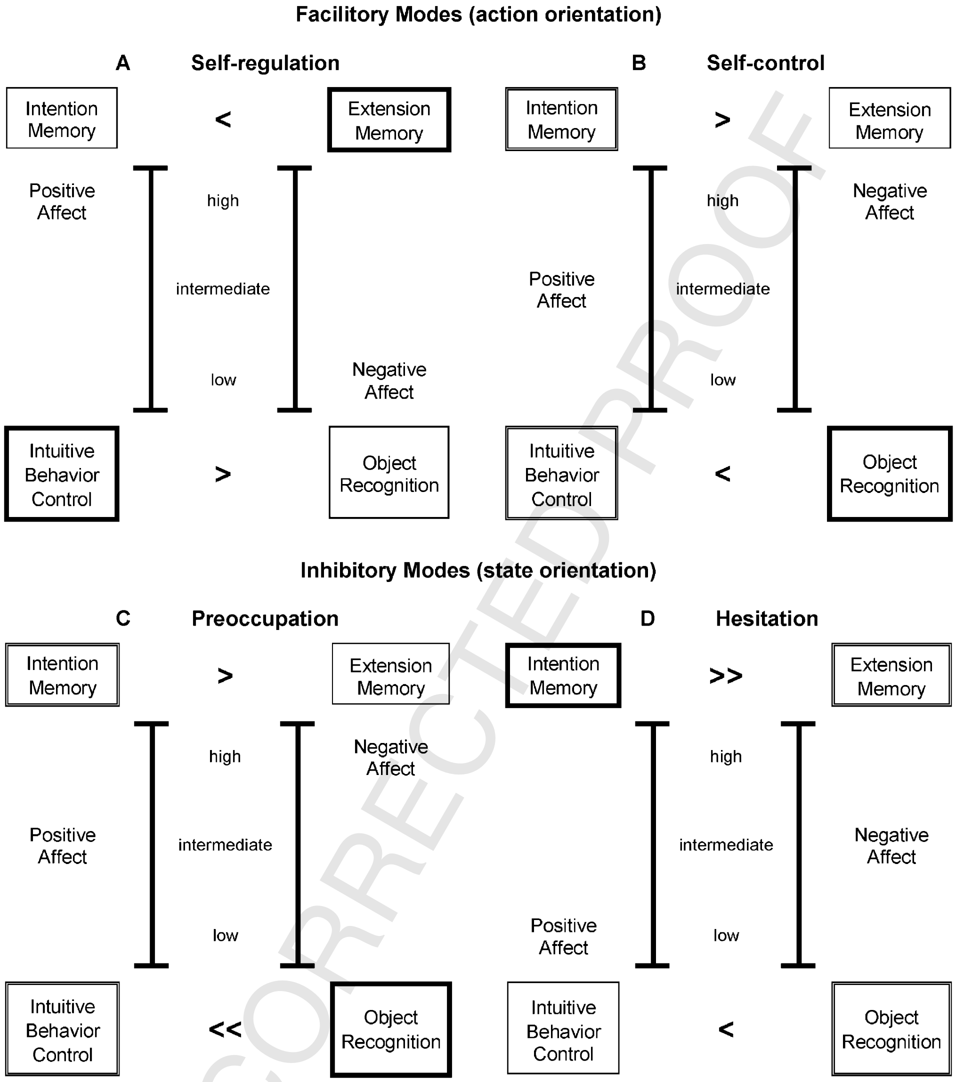

Fig.1. Modes of control and relative activation of PSI systems; > stronger activated; < lesser activated; > > chronically stronger activated; Mode specific dominant personality systems depicted as bold boxes, equally activated personality systems depicted as double-framed boxed, least activated personality systems depicted as single-framed boxes.

complexity and two subcognitive motivational reward and punishment systems (cf. Kuhl, 2001 for a detailed introduction). The two elementary systems are Intuitive Behaviour Control (IBC) and Object Recognition (OR). The most prominent characteristics of IBC are parallel processing of sensorimotor routines and integration of information from various sensory modalities and situational contexts. The IBC operates on a subconscious level, i.e. the operations involved are not readily explicable. In contrast, the primary functions of OR are separation of information from various sensory modalities and recognition of objects. OR isolates perceptual information from its context (decontextualization and figure-ground contrast) as a prerequisite for recognizing objects across varying contexts and for forming internal and external categories (e.g. verbalized emotions, ‘‘black-and-white thinking’’, etc.). Thus, OR operates on a conscious level and indicates mismatches between what is expected and what is perceived.

The two high-level macrosystems are Intention Memory (IM) and Extension Memory (EM). The most important properties of IM are to form and to store explicit representations of intended actions and to plan, e.g. when intuitive programs are not readily available or need to be modified (i.e. ‘‘difficult’’ intentions). Thus, IM is required whenever a problem needs to be reflected and solved or premature, automatic responding needs to be delayed. The second high-level macrosystem (EM) is based on parallel-holistic processing. High-level intuitive-holistic processing constitutes the basis of extended implicit self-representations integrating representations of internal states such as needs, emotions, values, preferences, or somatic feelings. One important functional characteristic of extension memory stems from its connectedness with the autonomic system (emotional reactions) and relates to its inherent function to regulate affective states. The self-portion of EM is based on implicit, parallel-holistic abstractions from autobiographical episodes. The non-self portion contains extended polysemantic fields making alternative meanings of a word or alternative options for an action in a given situation simultaneously available (on an implicit level of processing).

These four macrosystems form a mutually antagonistic relationship. For example, IBC and EM are inhibited as a function of the relative activational strength of IM and OR. In order for the macrosystems to form a coalition, PSI theory postulates seven modulation assumptions which describe dynamic systems properties according to the subcognitive (i.e. not consciously accessible) generation of positive and negative affect. To understand the basic principle of affective modulation the two core modulation assumptions are briefly sketched.

1. According to the *volitional facilitation assumption* positive affect (A+) releases the inhibition of the pathway between IM and IBC that is associated with an intention to prevent premature action and facilitate problem-solving (i.e. analytical thinking). Inhibited positive affect [A(+)] promotes the maintenance of intentions in IM by strengthening the inhibitory relationship between IM and IBC as long as enactment needs to be postponed until a good opportunity for enactment is encountered and volitional inhibition can be released again through (self-regulated) activation of positive affect (i.e. through ‘‘self-motivation’’).
2. According to the *self-facilitation assumption* downregulation of negative affect [A(−)] facilitates access to (implicit) self-representations and other aspects of EM by inhibiting sensory input (unexpected or unwanted information) provided by the OR. On the other hand, negative affect [A−] impedes self-access and EM and strengthens sensory input from the OR (e.g. unexpected perceptions, unwanted thoughts, task-irrelevant emotions, etc.).

Furthermore, PSI theory distinguishes two self-regulatory modes, a facilitatory and an inhibitory one. From the two facilitatory modes, one is consciously accessible (self-control) whereas the other is mainly implicit in nature (self-regulation). In Fig. 1, the facilitatory systems coalitions, as well as their relative activational strength, are denoted as A and B. In the self-regulatory mode, largely implicit processes integrate various subsystems and processes. Typical self-regulatory functions are, e.g. emotion regulation, attention regulation, arousal regulation, or motivation regulation. In the mode of self-regulation negative affect is downregulated due to the activation of the EM, and the impact of the IM is reduced due to high positive affect (reversal of the second modulation assumption).

In contrast, in the mode of self-control many subsystems and processes are suppressed to sustain the maintenance and the enactment of a difficult intention (this configuration relates to the classical conception of "will"). Mechanisms associated with self-control are planning, impulse control, or initiative. As can be seen in Fig. 1, the dominant system in the self-control mode is OR as indicated by the high level of negative affect. Contrary to the self-regulatory mode, however, the relative activation of the IM and IBC is counterbalanced because of the intermediate level of positive affect associated with this mode.

The two inhibitory modes are preoccupation (C) and hesitation (D). Preoccupation describes a systems configuration where OR 'dominates', with negative affect being high. Here, self-access is (chronically) inhibited because negative affect cannot be downregulated (through the activation of the EM). As a consequence, uncontrollable rumination occurs because OR (e.g. amplification of incongruencies) is especially active. In the mode of hesitation, access to the EM is still available (intermediate negative affect) but the IM is chronically more strongly activated than the EM (downregulated positive affect). Although maintenance of a difficult intention is an adaptive mechanism when premature action is to be avoided, excessive activation of the IM impedes the initiation of intended actions which explains phenomena such as forgetfulness and procrastination (for a summary see Kuhl & Beckmann, 1994).

With regard to the different modes of self-regulation two types of personality can be differentiated: action orientation and state orientation (Kuhl & Beckmann, 1994). Action-oriented individuals mainly access the facilitatory mode of self-regulation (A and B in Fig. 1) under stressful circumstances (i.e. difficult implementation of intentions, risk of failure, uncertainty, anxiety). On the other hand, in the absence of stress, e.g. when negative affect induced by failure or uncertainty is not present, action-oriented individuals cannot effectively dispose of their self-regulatory resources. For state-oriented individuals, the reverse is true. They perform better than their action-oriented counterparts in non-threatening situations, but less well when exposed to stressful situations. Thus, differences in self-regulatory efficiency are primarily to be expected as personality–situation interactions. Consequently, for the DMILS context it is to be expected that mental interaction effects should only be found for certain combinations of personality traits and situational contexts. Based on the assumption that improved access to self-regulatory functions (i.e. the EM) is an important prerequisite on behalf of the agent for the effect to be brought about (self-regulation hypothesis), there should be significantly more arousal for the receiver in activate than in calm periods (i.e. a DMILS effect) only for action-oriented agents in a stressful (failure-avoiding) condition, and for state-oriented agents in a non-stressful (success-reinforcing) experimental condition. Here, any statistically significant deviation between activate and calm recordings should be positively associated with self-regulatory mechanisms (e.g. arousal control, emotion control) provided by EM. Analogously, no such difference should be expected for action-oriented agents in the non-stressful experimental condition and for state-oriented individuals in a stressful experimental condition because under these circumstances they have problems to access self-regulatory capabilities. Alternatively, to the extent that the *regression hypothesis* is correct, the reverse predictions can be derived. Here, deployment of self-regulatory mechanisms should be counterproductive because in this mode, decoupling from top-down processing is regarded as being conducive to the DMILS effect. We thus experimentally produced four pairings of traits and situational context, for only two of which effects were expected.

To further answer the questions which factors best maximize the DMILS effect, we explored various additional issues. Specifically, we explored the role of motive-specific experimental successes to ‘‘influence’’. We hypothesized that in the stressful condition the power motive would be prevalent whereas in the non-stressful condition the affiliation motive should prevail. In addition, we examined the functional locus for experimental success. Specifically, since self-regulatory mechanisms should be associated with the agents' influencing efforts (experimental success), retrieval of the EM was expected to be necessary for the DMILS effect.

2. Method

2.1. Experimental design

The study comprised four separate experiments to examine four different personality–experimental condition combinations (Table 1). This was done because the DMILS effect is best tested by comparing the physiological recordings of activate and calm periods, as indicated by the systematic power testing of various statistical procedures (Schmidt et al., 2001). Thus, rather then applying a factorial design to test for differences between the groups, dependent *t*-tests for each combination were applied to test within differences (activate vs. calm). The primary dependent variable was EDA operationalized by skin conductance level (SCL), the number of non-specific skin conductance reactions (NS.SCR freq), and the sum of the amplitude of skin conductance reactions (Sum NS.SCR amp). The secondary dependent variable was respiration activity operationalized by the frequency of respiration (RF), the amplitude of respiration (RA), and the frequency-independent shape of respiration (RS). Since this was the first study to explore the functional significance of the physiological parameters for DMILS effect, the level of significance was not adjusted.

2.2. Participants

The sample sizes of the four experiments varied due to divergent numbers of valid psychophysiological recordings. Likewise, within each experiment the number of dependent variables also differed because some of the participants did not show electrodermal reactions (so called ‘‘non-responders’’). Sample sizes and demographics are depicted in Table 2. None of the participants

Table 1
The four personality-trait combinations

	Personality trait	Experimental context
Experiment 1	State orientation	Stressful (i.e. failure-avoiding)
Experiment 2	Action orientation	Stressful (i.e. failure-avoiding)
Experiment 3	State orientation	Non-stressful (i.e. success-reinforcing)
Experiment 4	Action orientation	Non-stressful (i.e. success-reinforcing)

Table 2
Sample sizes and demographics of the four DMILS-experiments

	N			Sex						Mean age[a]			Range		
				f	m	f	m	f	m						
	A	B	C	A		B		C		A	B	C	A	B	C
Exp. 1	12	13	13	7	5	7	6	7	6	28(9)	29(9)	29(9)	18–47		
Exp. 2	12	16	17	6	6	9	7	9	8	31(10)			17–42	17–46	
Exp. 3	15	15	18	11	4	11	4	13	5	28(9)			17–45		16–45
Exp. 4	11	11	11	8	3	8	3	8	3	29(14)			16–57		

[a] (standard deviation); A = electrodermal reactions; B = electrodermal level; C = respiration.

had previously taken part in a DMILS experiment. Participants were recruited by newspaper ads and came as pairs (acquaintances, friends, relatives) to the lab. They were remunerated with €20 each (approx. $ 20). The newspaper advertisement addressed a general public interested in anomalistic phenomena. However, inclusion of pairs of participants in the study was dependent on classifying the agents as action or state oriented in both categories (i.e. A & B or C & D in Fig. 1).

2.3. Procedure

Participants expressing interest in the study completed the questionnaires 3 weeks prior to the DMILS experiment. They were asked to specify whether they wanted to act as agent or receiver in the DMILS experiment. They were informed by a short flyer about the setup of the experiment. However, they were not given information about the specific experimental conditions. On return of the questionnaires, the agents were randomly assigned to two experimental conditions (failure-avoiding vs. success-reinforcing) according to their action orientation score. During the experiment, the agent and the receiver were physically separated and housed in the two electromagnetically shielded and sound attenuated chambers. The receiver's task was to relax and not to dwell on any particular thought content (e.g. trying to guess what the partner was doing). He/she had no knowledge about the specific experimental condition the agent was in. The agent was informed about the experimental condition only shortly before the receiver's physiological arousal was recorded. The agent's task was to "influence" the receiver according to the instructions (calm, activate, or rest) presented on the bottom of a monitor screen. In the stressful condition (failure-avoiding), however, the experimenter instructed the agent to "avoid" mismatches between his/her influencing efforts and the receivers' physiological fluctuations which were additionally fed back on the monitor screen. If mismatches occurred he/she should even try harder to succeed. In order to continuously remind him/her of the task, the instruction was also provided in written form by a large signboard placed next to the monitor. In the non-stressful (success-reinforcing) condition, the experimental task involved no instructions to excel. In addition, the subject was told that the experimental success was not solely dependent on his/her efforts, but instead, as well on the partner. This instruction was also provided in written form. The design was a completely balanced within subjects design with 20 influencing epochs (10 activate, 10 calm) of one min duration interspersed by 20 s pause epochs. The sequence of epochs was generated by an algorithm prior to the physiological recording and randomly chosen from a set of all activate/calm sequences. Furthermore, the order of activate/calm pairs was balanced such that any drift in the receivers' arousal could not produce an artifact (e.g. through matches between decreasing arousal and increasing number of calm epochs towards the end of the recording). During the recording, both experimenter and receiver were blind to the sequence of the epochs. All data handling was done under blind conditions.

2.4. Apparatus and material

2.4.1. Physiological assessment

The experiments were run in two electromagnetically and acoustically shielded chambers at about 10 m distance (Industrial Acoustics Company Niederkrüchten, Germany). Skin conductance (SC) was measured with a constant voltage of 0.5 V. Skin conductance responses were coupled to an AC amplifier with a high pass filter (10 s time constant) and fed forward to a bioamp system (I-410 BCS by J&J Engineering, USA). The signals were digitized at 16 Hz to a resolution of 12 bit digital signals. Ag/AgCl electrodes (8 mm in diameter), filled with an isotonic paste of 0.5% NaCl electrolyte in a neutral base (TDE-246), were attached to the thenar and hypothenar eminencies of the non-dominant hand. The skin was pretreated with methyl alcohol (70%) 15 min prior to the measurement. Respiration was monitored by applying a strain gauge attached to a Velcro belt wrapped around the upper abdominal region for recording of both chest and abdominal respiration. The average ambient temperature was kept at about 25 °C (average humidity about 48%).

2.4.2. Psychological assessment

Action orientation was measured by the Action Control Scale (ACS) by Kuhl (1994). The scales of the ACS describe rather concrete situations and require the subject to choose between two response alternatives. The Preoccupation Scale captures thoughts frequently associated with processing of information of past, present, or future states related to failure, worry or uncertainty. The Hesitation Scale describes impairments to initiate an intended, or change an ongoing activity in difficult or frustrating situations.

Self-regulation was measured by applying the Volitional Components Inventory, short form (VCI-S) by Kuhl and Fuhrmann (1998). The VCI-S consists of three scales comprised of three sub-scales each. Each sub-scale can further be divided into an additional sub-set of two scales. The first scale describes mechanisms associated with self-regulation, e.g. self-motivation, self-determination, and self-relaxation. The second scale comprises symptoms of volitional inhibition such as lack of energy, prospective state orientation, or passivity. The third scale describes self-inhibition like rumination, conformity, or alienation.

Prevalence of motives and implementation of motives was assessed by the Motive Implementation Test, short form (MIT-S). The MIT-S (Kuhl, 1999) consists of three scales which assess the degree to which each of the three basic motives (power, affiliation, achievement) is implemented by the functions of the four cognitive systems. Thus, for each scale (motive) four motive implementing combinations can be differentiated.

All scales show good internal consistencies and have been sufficiently validated (cf. Biebrich & Kuhl, 2002; Fuhrmann & Kuhl, 1998; Kuhl, 2000c, 2001; Kuhl & Beckmann, 1994; Kuhl &

Fuhrmann, 1998; Rosahl, Tennigkeit, Kuhl, & Haschke, 1993; Schapkin, Gusew, & Kuhl, 2000).

3. Results

The results for the primary dependent variable EDA are depicted in Table 3. As can be seen, the effect sizes for the various electrodermal parameters differed considerably. In experiment 3 (state-oriented agents in the non-stressful condition), the number of non-specific electrodermal reactions in activate and calm conditions differed significantly (ES = –0.49, P = 0.03). However, the effect was negative indicating more arousal during the agents' calming efforts (also see Fig. 2). Experiment 2 (action-oriented agents in the stressful condition), on the other hand, did not yield a significant effect. The results for experiment 1 (state-oriented agents in the stressful condition), is consistent with expectations of no significant results derived from the self-regulation hypothesis (which states that under conditions when volitional top-down control is reduced, any mental interaction effect should disappear). However, in experiment 4 the effect for the EDA parameter NS.SCR freq was significant (ES = 0.52, P = 0.04). The direction of this effect is more consistent with the *regression than with the self-regulation hypothesis*.

The results for the secondary parameter, respiration, yielded a comparable pattern of results (see Table 4). Yet, the only significant effect sizes were found in experiment 3 for respiration frequency (r = 0.43, P = 0.03) and respiration amplitude (r = –0.44, P = 0.03). However, the latter parameters indicated deeper breathing during the agents' calming efforts and not, as expected, in activate efforts.

We additionally performed post hoc analyses to examine the relationship between the physiological parameters. The results revealed that NS.SCR freq and RA correlated higher during calm periods than during activate periods (r = 0.22 vs. r = 0.08). Additionally, RA and RF showed a negative correlation for both activate periods (r = –0.11) and calm periods (r = –0.30). This pattern of results indicated that calming effects were mediated by deeper, but less frequent,

Table 3
t-Values, *P*-values and effect sizes for the EDA parameters[c]

Hypotheses[a]			SCL				NS.SCR freq				Sum NS.SCR amp			
Exp	VI	SR	t	df	P*	ES (S.D.)[b]	t	df	P	ES (S.D.)	t	df	P	ES (S.D.)
1	A > C	A = C	–1.16	12	0.14	–.32 (0.28)	–0.07	11	0.48	–.02 (0.32)	–1.34	11	0.12	–.37 (0.29)
2	A = C	A > C	–0.37	15	0.36	–.10 (0.27)	0.65	11	0.26	0.19 (0.31)	0.32	11	0.38	0.10 (0.31)
3	A = C	A > C	–0.14	14	0.45	–.04 (0.28)	–2.13	14	0.03	–0.49 (0.25)	–1.29	14	0.11	–.33 (0.27)
4	A > C	A = C	0.89	10	0.10	0.27 (0.32)	1.94	10	0.04	0.52 (0.30)	–0.88	10	0.08	–.27 (0.34)

[a] Expected direction of arousal (A = Activate; C = Calm; VI = volitional inhibition or *regression* hypothesis; SR = self-regulation hypothesis).

[b] According to $r = \sqrt{\frac{t^2}{t^2 + \mathrm{df}}}$ (Rosenthal, 1991).

[c] Standard deviation of [b] according to $\sigma_r = \sqrt{\frac{(1 - r^2)}{(N - 2)}}$ (Rosenthal, 1994).

* P = 0.05.

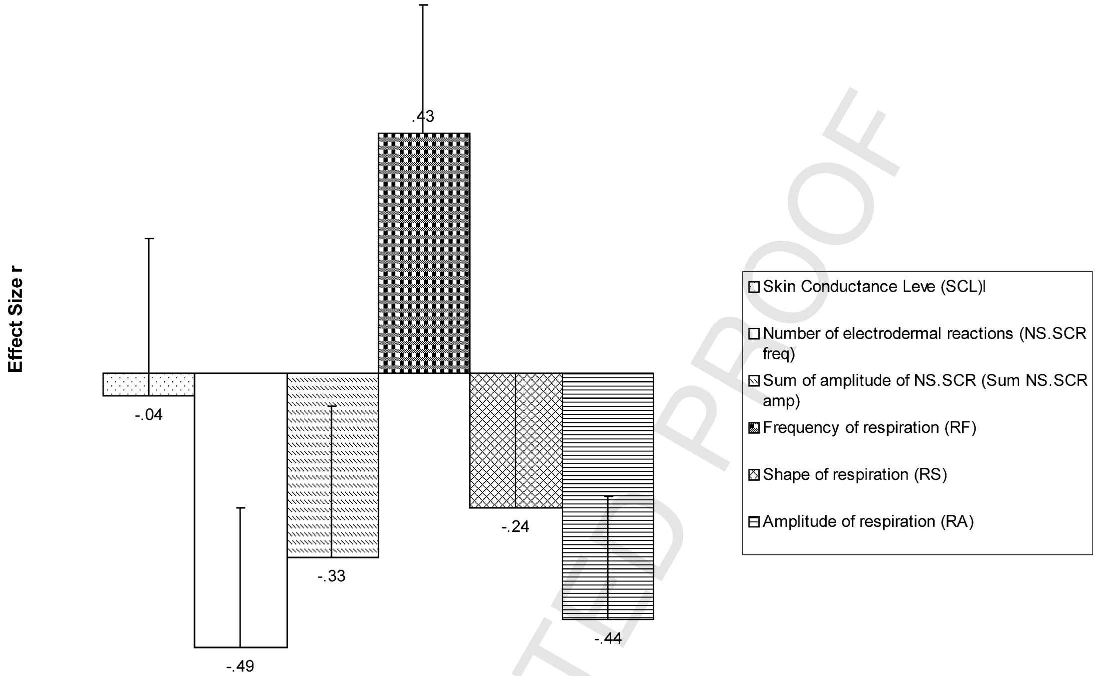

Fig. 2. Effect sizes and standard deviations for state-oriented agents in the non-stressful condition.

Table 4
t-Values, *P*-values and effect sizes for the respiration parameters

Hypotheses[a]			RF				RS				RA			
Exp	VI	SR	*t*	df	*P*	ES (S.D.)	t	df	*P*	ES (S.D.)	t	df	*P*	ES (S.D.)
1	A > C	A = C	0,56	12	0.30	0.16 (0.30)	−0,66	12	0.26	−0.19 (0.30)	−1,58	12	0.07	−0.42 (0.27)
2	A = C	A > C	−0,04	16	0.48	−0.01 (0.26)	−0,23	16	0.41	−0.06 (0.26)	1,22	16	0.12	0.29 (0.25)
3	A = C	A > C	1,95	17	0.03	0.43 (0.23)	−1,01	17	0.16	−0.24 (0.24)	−2,04	17	0.03	−0.44 (0.22)
4	A > C	A = C	0,50	10	0.32	0.15 (0.33)	−0,45	10	0.33	−0.14 (0.33)	1,03	10	0.17	0.31(0.32)

[a] RF = respiration frequency; RS = respiration shape; RA = respiration amplitude; formula of ES and SD see Table 2.

breathing (e.g. in meditative techniques). Deeper breathing, however, is often related to electrodermal reactions (Schneider, Schmidt, Binder, Schäfer, & Walach, submitted for publication) and would therefore cause more electrodermal reactions in calm periods.

To explore the significance of self-regulatory mechanisms during the agents' influencing effort, experimental success for the most sensitive electrodermal parameter of each experiment was correlated with the volitional mechanisms assessed by the VCI. To obtain an index for experimental success we applied the following formula to standardize EDA from activate and calm periods (Mean = 0, S.D. = 1).

$$q = \ln \frac{A + \frac{1}{2}}{B + \frac{1}{2}} \left(\sqrt{\frac{\left(A + \frac{1}{2}\right)\left(B + \frac{1}{2}\right)}{A + B + 1}} \right)$$

Interestingly, a meaningful pattern of correlations were only found for experiment 3. As can be seen in Table 5, experimental success was solely related to components of volitional inhibition ($r = 0.44$–0.78) and self-inhibition ($r = 0.44$–0.61). Hence, contrary to the self-regulation hypothesis and in accordance with the regression hypothesis, experimental success (DMILS effect) was modulated by inhibitory rather than facilitatory self-regulatory mechanisms.

To test the assumption of experimental condition-dependent motives (i.e. dominance of the affiliation motive in the non-stressful condition and dominance of the power motive in the stressful condition), correlations of the primary outcome parameter (EDA) and experimental success were performed. Interestingly, for both conditions we found significant correlations for the power motive and the sum of the amplitudes of electrodermal reactions (Sum NS.SCR amp) in the stressful condition ($r = 0.38$, $P = 0.035$) and in the non-stressful condition ($r = 0.51$, $P = 0.004$).

To examine which system of PSI theory was most adaptive for the implementation of the power motive within the DMILS context, we performed correlations between experimental success (EDA) and the implementation of the power motive with one of the four PSI systems (i.e. IM, EM, IBC, OR). Contrary to the self-regulation hypothesis, significant correlations were only found for the scale assessing intuitive implementation of the power motive (i.e. through the IBC system) for the SCL ($r = 0.25$, $P = 0.033$). The correlation with the number of NS.SCR freq was marginally significant ($r = 0.23$, $P = 0.058$). To further explore this relationship we performed a regression analysis with experimental success (q-index SCL) as the dependent variable and intuitive implementation of

Table 5
Correlations of volitional (self-regulatory) components in state oriented agents under relaxing conditions with experimental success[a]

Volitional component	Experimental success[a]
Volitional inhibition a	0.54 *
Prospective State Orientation (SOP) b	0.56 *
Lack of Initiative (SOP) c	0.55 *
Volitional Passivity (VP) b	0.61 **
Procrastination (VP) c	0.44 *
External Control (VP) c	0.78 **
Self-inhibition a	
Conformity (CO) b	0.44 *
Negative self-motivation (CO) c	0.50 *
Failure related State Orientation (SOF) b	0.61 **
Failure related Inhibition (SOF) c	0.56 *

[a] Formula see text; a total score; b sub-score of a; c sub-score of b.
* $P < 0.05$.
** $P < 0.01$.

the power motive (IP), external control, and the respective interaction term (IP×EC) as independent variables. The results showed a highly significant regression coefficient for IP×EC ($\beta = 0.35$; $P = 0.008$) indicating that the alternative hypothesis according to which unorthodox communication is mediated by low-level intuitive mechanisms was confirmed ($R^2 = 0.35$; $P = 0.008$). This interaction was based on the fact that the measure of communicational effect reaches its maximum when a disposition towards intuitive implementation of power combines with a disposition towards external control (i.e. when high inferential mechanisms are inhibited).

4. Discussion

In this series of four experiments we had a two-fold aim: (1) to test the claim of an allegedly unorthodox form of interaction and (2) to decide between the self-regulation and the regression hypothesis on the basis of volitional indices derived from PSI theory. Specifically, the self-regulation hypothesis predicted significant deviations in two of the four experiments due to the assumption that these unorthodox forms of interaction occur, if at all, when self-regulatory efficiency is strong. The results of four experiments exploring the claim of allegedly unorthodox forms of interpersonal interaction yielded only very limited support for this claim. We found significant deviations of the receivers' arousal in one of two experiments where an effect was expected on the basis of the self-regulation hypothesis for specific personality-condition combinations (i.e. in experiment 3). Such an effect was found for both EDA and respiration parameters. However, contrary to the self-regulation hypothesis and to the findings of the Schmidt et al. (2001) EDA pilot study the effect in experiment 3 was found for only one EDA parameter and the effect showed more arousal (i.e. electrodermal reactions) during the agents' calming efforts. A similar reversal could be found for one of two significant respiration parameters (RA), indicating deeper breathing during calming periods. Post-hoc analyses showed that this pattern of results could reflect less overall arousal during calm epochs than during activate epochs: the receivers more frequently breathed in activate periods, but more deeply in calm periods. Given that deep inhalation is associated with more electrodermal reactions, the latter more frequently occurred in calm periods. However, our findings show that the concept of arousal in DMILS experiments might be more complex, and focusing on only one physiological indicator, as done by the majority of DMILS experiments, might not suffice. For example, no effect would have been found in this study if, as it was common standard in most DMILS studies, only the electrodermal level (SCL) had been taken as the dependent variable. From this we can conclude that future experiments on DMILS will benefit from applying standard psychophysiological methodology to more thoroughly explore the concept of arousal. It is arguable whether the larger effects obtained are due to the methodological improvements of the recordings. It is interesting to note, though, that they compare with the ones reported in the Schmidt et al. (2001) EDA pilot study. Yet, the sample sizes of the four experiments were rather small and therefore, the experiments were underpowered. On the basis of the effects found in the pilot study from Schmidt et al. (2001), the power of the four experiments was $1-\beta = 0.25$ to 0.35 ($\alpha = 0.05$), and the optimal sample size for a DMILS experiment would require to be at least three times larger to obtain a sufficient power of $1-\beta = 0.80$. However, the results from three meta-analyses show that no firm conclusions can as yet be drawn as to how large the "true" DMILS effect is.

Overall the pattern of findings does match neither the regression nor the self-regulation hypotheses as long as these hypotheses are derived from the model postulating an interaction between action orientation and induced success vs. failure (or stress) manipulation. However, the pattern of results does appear consistent with an interpretation which places more emphasis on the success vs. failure induction than on the action vs. state distinction: unorthodox mental interaction effects were obtained in the two experiments involving relaxing, success-oriented instructions (experiments 3 and 4). This finding is consistent with the general practice that unorthodox effects are usually sought in quiet and relaxed settings (Braud, 1975; Irwin, 1999; Wolman, 1986). On the basis of findings discussed until this point it is not possible to decide what psychological mechanisms might explain the possible relationship between relaxation and unorthodox mental interaction effects.

An answer to this question may be found in the findings related to the second aim of our study that was directed at exploring effect maximizing conditions. Applying PSI theory (Kuhl, 2001), we obtained tentative support for the assumption that some personality-condition combinations might be more conducive to an unorthodox interaction form than others. One of the most interesting findings was that the significant DMILS effect (experimental success) found in experiment 3 was exclusively mediated by inhibitory modes of self-regulation in agents: Experimental success dropped to a non significant level ($t < 0.001$, $P = 0.5$) when the inhibitory component "external control" (see Table 5), which had the strongest predictive value in a linear regression analysis ($\beta = 0.7$, $P = 0.004$), was partialled out. This result suggests that any deployment of high inferential (i.e. rational) functions (e.g. arousal control or emotion control) is rather counter-productive for such an effect to occur. These findings amount to a clear-cut confirmation of the regression hypothesis. We found further support for this line of reasoning from the correlation analyses which showed that the power motive, predominating in both experimental conditions, was only associated with experimental success when it was 'implemented' by the elementary PSI system IBC. Moreover, this effect was especially strong in combination with external control. According to PSI theory, IBC primarily serves to provide predominantly unconscious routines for interpersonal exchange, that is, when top-down mechanisms based on conscious intentions (IM and self-control) or even unconscious volitional processing (EM and self-regulation) are attenuated or impeded. Hence, there is preliminary, yet convergent support that the DMILS effect could be based on ontogenetically determined programs which come into play when high inferential systems (IM and EM) are decoupled from low-level systems. The finding that intuitive behaviour control is especially conducive to DMILS effects when it is associated with a strong power motive is consistent with the definition of this motive in terms of a need to have an impact on other people (Winter, 1996). Moreover, the fact that the relationship between intuitive power motivation and the DMILS effect was observed when external control grew stronger during the experiment is consistent with PSI theory according to which low-level, intuitive systems predominate when high inferential systems are not deployed (Kuhl, 2000a). The inhibition of high-level control of experience and behaviour can be related to Freud's concept of regression and modern neurobiological evidence demonstrating that the impact of neocortical system decreases when hippocampal activity is inhibited, e.g. through excessive concentrations of the stress hormone *cortisol* (Sapolsky, 1992).

It remains an open question why the VCI-indices for volitional inhibition and inhibited self-access (self-inhibition) are especially conducive to mental interaction effects for state-oriented individuals when exposed to a relaxing instruction and why the mental effects are reversed in direction (experiment 3). Suffice it to say that on the basis of the results reported here we can state that when state-oriented individuals are exposed to relaxing conditions, they seem to have increased access to low-level (phylogenetically old) intuitive capabilities for reasons that should be explored in future research. A guiding hypothesis can be formulated for future endeavours to explore the mediating mechanisms: since intuitive processing did show an association with direct mental interaction effects *in the expected direction* when intuition was associated with power motivation, the reversed effect observed in state-oriented individuals may be attributable to an inhibited power motive which is indeed more likely to be associated with state than with action orientation. Interestingly, inhibited power motivation is assessed by counting the number of *negations* participants produce in fantasy stories that are coded for motive content (McClelland, 1985; Winter, 1996). Therefore, the reversal (''negation'') of mental interaction effects observed in state-oriented individuals (experiment 3) might be a result of their inhibited power motivation. We consider this an interesting guide to be followed up in future research.

Our experiments show that unorthodox, ''direct'' mental interaction as exemplified by the standard experimental paradigm DMILS may occur. This is more easily demonstrated when the experimental context of justification is complemented by a context of discovery, that is when applying a CTA: assuming, for the sake of the argument, that DMILS effects do exist and assuming that, if they exist, they are complexly determined, conventional statistical procedures may lack the power to demonstrate them with small sample sizes (cf. the problem of demonstrating complex determination of systemic diseases such as certain forms of cancer). From this point of view, a conditional testing procedure may be a fairer and more powerful way of examining the existence of unorthodox phenomena indirectly: In light of the highly significant relationships between the DMILS indices obtained and various parameters of personality functioning, it is hard to argue that the phenomenon does not exist (a non-existing phenomenon can hardly show reliable relationships with measures of psychological functioning). The conditional testing approach has the additional advantage that it provides further information concerning the psychological processes that might be involved in unorthodox forms of communication. In concluding, our findings suggest that unorthodox communication effects are not a universally deployable mode of functioning. Instead they seem to be associated with some form of unconscious control of intuitive behaviour. Moreover, deployment of rational forms of dealing with the DMILS task (i.e. willing) seems to be counterproductive. Furthermore, it is difficult to operationalize the DMILS effect as change in only one parameter, or towards one direction. On the contrary, the effect seems to work holistically, showing simultaneous deviations in an array of parameters connected to automatic arousal. We suggest for future experiments to take into account both the moderating effect of self-regulatory mechanisms as predicted by PSI theory, as well as the multiplicity of channels through which this effect can show.

5. Uncited reference

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