IMPLICIT INTUITION: HOW HEART RATE CAN CONTRIBUTE TO PREDICTION OF FUTURE EVENTS

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ABSTRACT

Using a well-established methodological paradigm to investigate the presentiment phenomenon and its extension to pre-alerting and guessing tasks, we planned to explore in this study whether participant heart rate signals could be used to predict whether randomly selected future stimuli would be pleasant or unpleasant. After evidence was found in Experiment 1 of different anticipatory signals before the perception of pleasant and unpleasant sounds, we further explored the effect by asking participants to block incoming unpleasant sounds. The prediction was tested in Experiment 2 using an explicit intuitive condition in which participants were informed when their physiological response suggested that the next sound would be unpleasant, and they were able to skip it by pressing the computer mouse. We also included an implicit condition in which incoming unpleasant sounds were automatically skipped, based on physiological response. Experiment 3 used only the implicit intuitive condition. In the implicit intuitive condition, we found an $r = 0.40$ (Expt. 2) and an $rs = 0.69$ (Expt. 3) between the scores on the Tellegen Absorption Scale and the difference between blocked pleasant and unpleasant sounds. The total variance explained by Absorption and a measure of Expected Efficacy was $R^2 corr = 0.105$ (Expt. 2) and 0.57 (Expt. 3). The specific role of absorption in facilitating implicit intuition was confirmed by the low correlation, $r = -0.22$, with the difference between the blocked pleasant and unpleasant sounds in the explicit condition (Expt. 2). When participants were divided into high and low scorers on absorption, high absorbers obtained a statistically significant difference in the means of blocked pleasant and unpleasant sounds (Expt. 2 and Expt. 3), but only in the implicit condition. Overall, these results seem to suggest the possibility of exploiting anticipatory physiological signals to predict future events using implicit intuition.

INTRODUCTION

To explore the possibility that the mind can access its future brain state, Bierman and Radin (1997) and Radin (1997) devised a method to measure unconscious physiological responses to future events. Strictly speaking, such responses would be a subset of precognition known as 'presentiment', a vague sense or feeling of something about to occur without conscious awareness of a particular event. Unconscious physiological measures have been employed mainly because the relevant experimental literature suggests that precognitive perception, like the majority of sensory information, only rarely reaches the level of conscious awareness.

In a typical presentiment study, a participant is connected to an instrument to measure electrodermal activity, and changes in the electrical activity of the skin are measured continuously during the whole session. The participant is seated in a comfortable chair in front of a computer screen and remains passive, except when a signal indicates that he or she can start the next trial by pressing a button. (The number of trials may vary, but is typically around 30.) After the button press, there is a delay of a few seconds until a stimulus is presented, after which there is a 'cool down' period until the next signal. Stimuli are selected randomly from two picture pools (usually drawn from the International Affective Picture System; Lang, Bradley & Cuthbert, 1997): one pool contains calm pictures, like photos of landscapes; the other pool contains arousing pictures with violent (e.g. a bloody car crash) or erotic content. Experiments in mainstream psychology have shown clearly different electrodermal activity responses after exposure to arousing and calm stimuli. Lie-detectors make use of this principle. However, in presentiment studies the focus is on the time interval directly *preceding* the stimulus, from the button press until the picture is presented on the screen. Bierman and Radin (1997) and Radin (1997) have demonstrated that, some seconds *before* the presentation of pictures that arouse different emotions, it is possible to observe differential psycho-physiological signals that are similar to but smaller than those observed after the picture has been presented. This pre-response is termed a 'presentiment' effect.

So far, physiological measures used in presentiment research include skin conductance EDA, both SCL and SCR (Radin, 2004), EEG, heart rate (McCraty, Atkinson & Bradley, 2004a; McDonough, Don & Warren, 2002) and fMRI (Bierman & Scholte, 2002). All have shown a presentiment effect in one or more studies. The conclusion seems warranted that presentiment is distributed throughout the whole body (McCraty et al., 2004b), as is the case with conventional physiological changes involving emotions. After controlling for some possible alternative explanations like expectancy bias (Dalkvist, Westerlund & Bierman, 2002), this phenomenon was considered a real violation of time asymmetry and consequently a sort of 'physiological precognition'.

Since the pioneer studies by Bierman and Radin (1997) and Radin (1997), further research has been accumulating, confirming and extending this phenomenon using conceptually similar paradigms. For example, Warren, McDonough and Don (1992) used a guessing task and confirmed the finding that different categories of future events can give rise to different psycho-physiological signals.

The aim of the present investigation was firstly to replicate the anticipatory physiological effect observed with pictures of different emotional content (*presentiment effect:* McCraty, Atkinson & Bradley, 2004; Radin, 2004) and with pictures of different reward content (*pre-cognitive effect:* McDonough, Don & Warren, 2002; Sartori, Massaccesi, Martinelli & Tressoldi, 2004) with sounds of different arousal and pleasure values (*pre-alerting effect*) using a modification of the procedure used by May, Paulinyi, and Vassy (2005) in which they presented alerting sounds randomly mixed with silent controls. Our preference for a pre-alerting paradigm instead of a classical pre-sentiment one was dictated first by the fact that pictures considered fearful or erotic can evoke very different emotional responses in different people. These individual differences might mask the effect and would need to be checked at the individual level before each experiment. In contrast, physiological reactions to pleasant or unpleasant (alerting) sounds should differ less from person to person. Secondly, we wanted to test whether anticipatory physiological signals are robust across modalities. Given that the expected physiological reactions were of the phasic type instead of tonic ones, we measured heart rate instead of electrodermal activity. Thirdly, we were interested in 'extracting' the anticipatory information conveyed by the psycho-physiological signals from their background noise at the level of each single trial, so that participants might be able to make use of it to predict future events. If this project succeeds, it will represent a major step towards the goal of exploiting the capacity of our intuition, and perhaps lead to practical applications for anticipatory signals.

EXPERIMENT 1

METHOD

The aim of the first experiment was to test for the presence of differential anticipatory heart rate signals occurring before the subjects heard randomly-selected pleasant or unpleasant sounds.

Participants

Twenty-six participants were recruited from among the students and staff members attending the Department of General Psychology. They were invited to participate in a psycho-physiological experiment aimed at investigating the relationship between heart rate and incoming sounds of different pleasantness. There were twenty-seven females and nine males. Their ages ranged from 18 to 50 years old ($M = 27.6$; $SD = 6.5$).

Procedure and Materials

The experiment took place in a sound-attenuated laboratory. Each participant was seated in a comfortable chair and was informed about the experiment as follows:–

> This is an experiment aimed at investigating how heart rate changes after listening to sounds of different pleasantness. After you have been connected to the apparatus for recording your heart rate, you will wear headphones to listen to twenty brief sounds of two different categories. One category comprises ten sounds labelled pleasant; the other has ten sounds labelled unpleasant. These sounds are not dangerous or extremely loud, so you must not worry about them. These sounds will be presented in a random order so there is no possibility of discovering any rule underlying their presentation. Your task will consist of listening to the sounds without making any movements and breathing regularly so as not to alter your heart rate.

Stimuli

The twenty stimuli finally used were selected after different pilot trials in order to obtain two categories of ten qualitatively different stimuli. Each sound was subsequently edited digitally to a 2-sec presentation. The final pool of sounds was presented to a panel of twenty judges, students and adults recruited randomly, for their classification using a simplified procedure suggested by Bradley and Lang (2000). Ratings were obtained using SAM (Self-Assessment Manikin: Lang, 1980), which involves a graphic figure depicting values along dimensions of pleasure, arousal, and dominance on a continuously varying scale. Figure 1 illustrates the SAM figures used in the paper-and-pencil version of SAM.

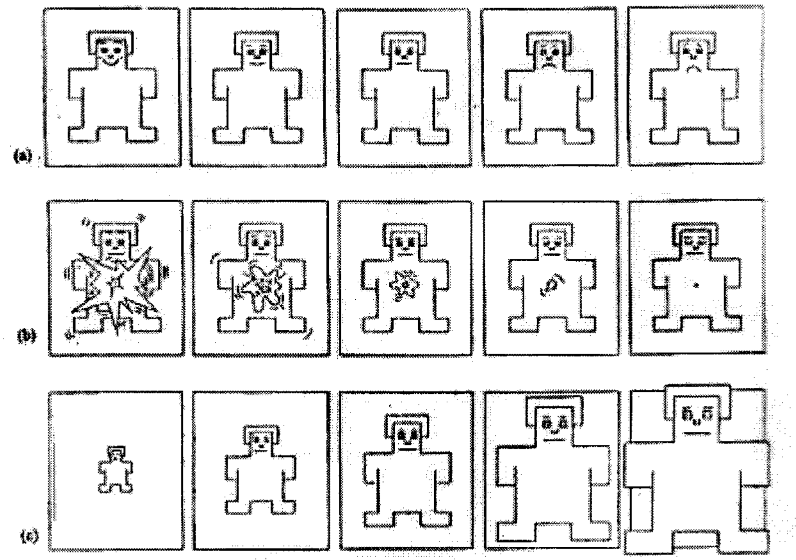

Figure 1. The figure representing the continuum of pleasure (a), arousal (b) and dominance (c).

SAM ranges from a smiling, happy figure to a frowning, unhappy figure when representing the pleasure dimension. For the arousal dimension, SAM ranges from an excited, wide-eyed figure to a relaxed, sleepy figure. For the dominance dimension, SAM ranges from a large figure to a small figure. The subject can place an 'X' over any of the five figures in each scale, or between two adjacent figures, which results in a nine-point rating scale for each dimension. Previous studies (e.g. Bradley & Lang, 1994), have determined that ratings of the three major affective dimensions—pleasure, arousal, and dominance — obtained using SAM are similar to those obtained using the verbal semantic differential scale devised by Mehrabian and Russell (1974). For the present investigation, only the pleasure and arousal scales were requested because dominance was not relevant and always assimilated to the arousal one. The mean rating for the pleasure and arousal scales of the two categories of sounds is presented in Figure 2.

The two dimensions, pleasantness and arousal, are clearly different between the two categories of sounds. These differences are in agreement with some physical parameters, such as loudness measured by an external Sound Level Meter. Max pick level: pleasant sounds, $M = 76.8$; $SD = 2.6$, unpleasant sounds, $M = 91.3$; $SD = 2.7$; Mean Power (RMS), pleasant sounds, $M = -28.11$; $SD = 10.1$; unpleasant sounds, $M = -13.9$; $SD = 5.03$.

APPARATUS

Heart Rate Sampling

The software for heart rate data acquisition was original and devised for experiments like this one (Massaccesi, 2001). Briefly, the apparatus for heart rate acquisition consisted of an optoelectronic sensor for a photoplethysmographic measurement by infrared light applied to the index finger of the left

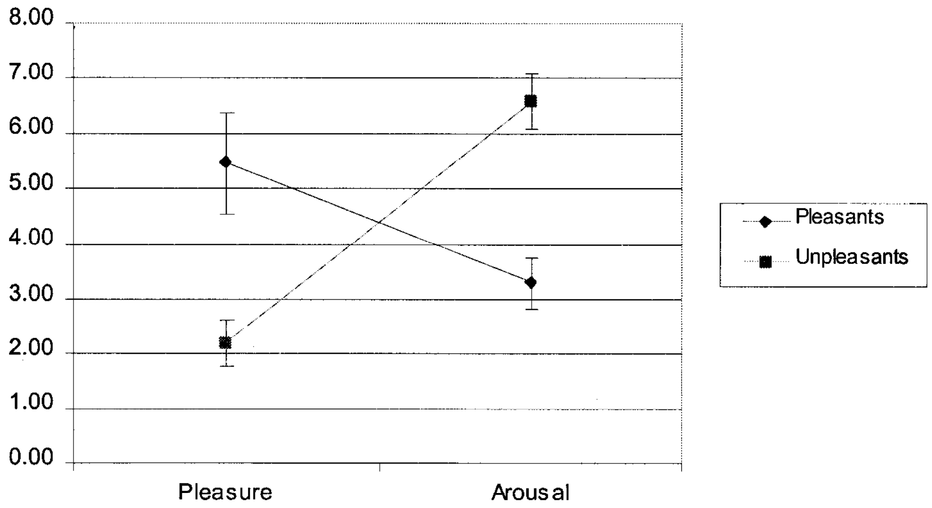

Figure 2. Means and CI 95% of pleasure and arousal for the two categories of sounds.

hand. The signal was subsequently conveyed to a Pulse Monitor 701 and to an SCB–68 National Instrument card converting the analogue signal to digital, and was fed to a PC for online data acquisition. Heart rate per minute was automatically estimated using the formula P (pulse) = 60,000 ms/IBI (inter-beat interval). If the research assistant noticed some artifacts during the experiment (for example, anomalous heart rate registrations or apparatus malfunctioning), the task was interrupted and started again.

Sound Presentation

Sounds were stored in a PC and presented by headphones (model Inno Hit SH–154) by software using a randomized algorithm, written in C++, for these experiments (it returns a random number from 1 to 20 after initialization with a random value obtained from the system clock). The sequence of the events is illustrated in Figure 3.

The experiment was started by the participant clicking with the mouse. All twenty sounds were then presented, always with the time sequence shown schematically in Figure 3. The total time for the presentation of all the stimuli was approximately 6 minutes.

RESULTS

Data Analysis

In the pre-stimulus phase, the null hypothesis is a zero difference between the heart rate means for pleasant and unpleasant sounds. A priori there were no hypotheses on the direction of these differences so, considering the individual reactivity differences, we decided to compare the absolute differences statistically. The raw data are presented in Table 1.

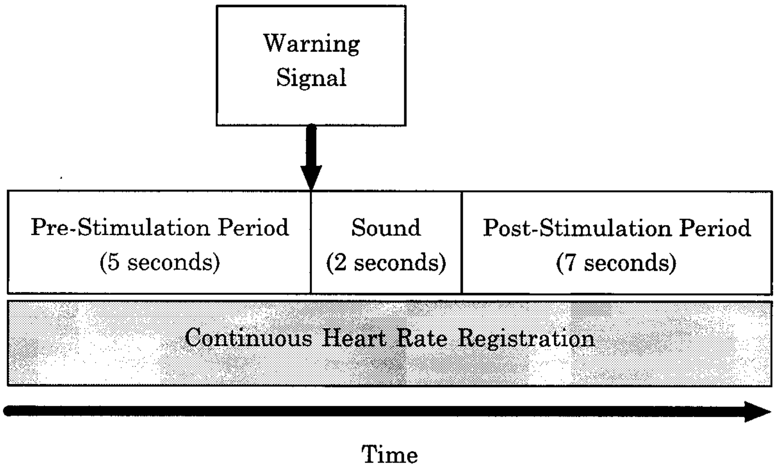

Figure 3. Sequence of events in the experiment.

Table 1

Heart Rate Means (and standard deviations) for Pleasant and Unpleasant Sounds Pre and Post their Presentation

Phase	*Pleasant Sounds*	*Unpleasant Sounds*
Pre presentation	79.5 (12.4)	80.6 (12.5)
Post presentation	79.8 (12.4)	80.9 (12.3)

For the whole group, the comparison of the absolute differences in the pre presentation phase was: $t(25) = 4.8$[1], $p = 0.000006$, corr. $r = 0.95$, $ES(d) = 0.13$.

In the post-presentation phase, the results were almost identical: $t(25) = 4.7$; $p = 0.000007$, corr. $r = 0.95$, $ES(d) = 0.13$. Use of the Wilcoxon non-parametric statistic yielded the same statistical results. This difference is in line with those observed in normal healthy people (i.e. Anttonen & Surakka, 2005).

Of particular interest, 20 out of 26 participants (77%) showed the same difference between the two sound categories, both at the pre- and post-stimulation phases. Of these participants, 15 showed a higher HR mean with the unpleasant sounds, and the remaining 5 the opposite. It is interesting that almost the same percentage of consistent individual differences was observed by Bierman (2004b), studying EDA. The other 6 participants showed an inverse difference between the pre- and post-stimulus phases (i.e. higher heart rate for unpleasant sounds in the pre-stimulus phase and the opposite in the post-stimulus one).

[1] Although there are relatively large individual differences in HR, as evidenced by the large SDs in Table 1, intra-individual measures are quite consistent, so that the relatively small difference of 1.1 beats per minute between pleasant and unpleasant sounds can still be highly significant using a within-subjects analysis.

Discussion

The observed statistical difference at the pre-stimulation phase between the two sound categories is very similar to the difference observed in the post-stimulus phase, and suggests the existence of a 'pre-alerting' effect similar to that observed by other authors with different stimuli (May, Paulinyi & Vassy, 2005; Spottiswoode & May, 2003), adding further evidence for the reliability of this phenomenon. Furthermore, these results underline the importance of individual differences of physiological reactions to emotional and alerting stimuli. If a task requires attention to external stimuli, there will be a heart rate deceleration, but if the task requires rejection of external stimuli, there will be heart rate acceleration (Lacey, Kagan, Lacey & Moss, 1963; van der Molen, Somsen & Orlebeke, 1984). Thus, different coping strategies for external unpleasant stimuli lead to different HR modifications. What this experiment adds to the existing literature is the recommendation to consider the individual differences when presenting stimuli aimed at modifying certain psycho-physiological parameters. The assumption of identical variation in response to different categories of stimuli, i.e. images, sounds, etc., among different people is probably wrong in most cases. If these differences are not considered, it is very probable that data averaging will result in a null difference. It is then recommended that these individual differences be checked for and, if they are present, that the data be averaged using the absolute differences of the physiological parameters between the different categories considered in the experiments.

Experiment 2: Comparison Between Explicit And Implicit Intuition

In the first experiment, the paradigm used has shown itself able to detect possible pre-alerting effects in close agreement with what was obtained with the classical pre-sentiment paradigm. One could speculate that pre-alerting in the real world could serve to prepare the percipients for potentially adverse stimuli to enable them to avoid or block them. Study 2 was intended to explore the hypothesis of whether it is possible to use anticipatory signals to 'help' participants to know the category of the incoming stimuli before their presentation and consequently avoid unpleasant sounds and receive only pleasant ones. We think that, given the reliability of this paradigm, the possibility of using these anticipatory signals as a sort of biofeedback will represent a significant shift in this line of investigation with promising practical applications. In order to achieve this goal, we thought it necessary to proceed as follows:–

- firstly, to obtain for each participant a sort of 'physiological signature' of anticipatory signals related to the two sound categories, by extracting two 'anticipatory prototypes';
- secondly, to predict the category of subsequent incoming sounds by comparing each anticipatory vector of physiological signals with the two 'prototypes'.

The first step was achieved by informing each participant that ten pleasant and ten unpleasant sounds would be delivered randomly, as in Experiment 1. With these data, special software averaged the normalized means of each point of the vector of data collected in the anticipatory phase,[2] extracting a sort of 'anticipatory prototype' for each sound category. The second step was achieved by repeating the experimental session and correlating *each* normalized data vector in the anticipatory phase with the two 'prototypes'.

We chose to repeat the experimental session comparing an explicit and an implicit intuitive condition. In the explicit condition, if the correlation result was higher with the prototype of the unpleasant stimuli, a visual signal was shown on the monitor to inform the participant that an unpleasant sound was very probably about to be heard, so the computer mouse should be pressed to stop its delivery. In the 'implicit intuition', participants were informed that the software would automatically skip the incoming sound (further details are given in the Procedure). The choice of comparing these two forms of intuition is completely exploratory, since no evidence of their characteristics and differences is available, as far as we know.

Moreover, considering the mediating role of some personality characteristics (Braud, 2002; Dalton, Zingrone & Alvarado, 1999; Del Prete & Tressoldi, 2005) and of the estimated efficacy towards the task (Bierman & van Ditzhuijzen, 2006) on psi effects, the participants completed the Tellegen Absorption Scale (Tellegen & Atkinson, 1974) and rated their estimated efficacy (EE) on being able to block the unpleasant sounds, using a Likert scale of 1 (not at all) to 5 (absolutely sure).

METHOD

Participants

Twenty-two persons were recruited from among the students and people attending the Faculty of Psychology.

Apparatus

We used the same apparatus as in the first experiment.

Procedure

Participants were asked to participate in an experiment on intuition taking place in two sessions. In the first session, they were requested simply to listen to twenty sounds, half pleasant and half unpleasant, delivered randomly through headphones, while their heart rate was being monitored. Moreover, they were asked to remain as calm as possible to prevent artifacts.

In the second session, participants were required to block the unpleasant sounds and listen to the pleasant ones in two ways, either using their overt intuition, by clicking the mouse after the warning signal, or using their implicit intuition, wishing to block the unpleasant sounds. The explicit and implicit conditions were presented in separated blocks balanced among the participants.

The only difference with respect to the first experiment was the insertion

[2] For each trial, the anticipatory heart rate vector was normalized and associated with its sound category. After the twenty trials, a single vector for each category was obtained by averaging the values of each data point of the ten vectors of the same length. All the software was developed in LabView® by one of the authors, S.M.

of a time window of two seconds after the warning signal to allow blocking of the incoming sound manually or automatically (see Figure 4). In the explicit intuition condition, a red light informed the participant that an unpleasant sound was probably arriving. The participant should click the mouse to block it. In the implicit intuition condition, the participant did not receive any feedback about the probability of the arrival of an unpleasant sound, because the sound was blocked automatically.

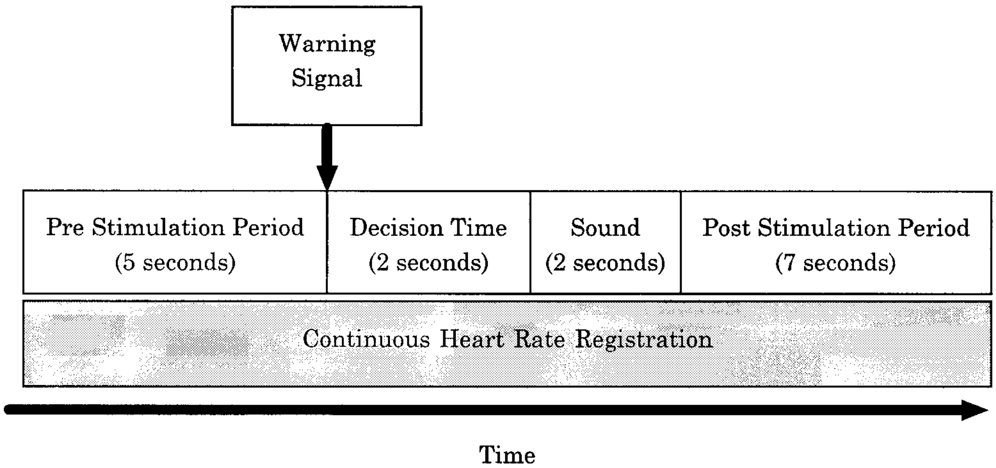

Figure 4. Sequence of events in Experiment 2.

RESULTS

Absorption Level Comparison

To test the effects of individual differences in absorption level upon the capacity to predict future sounds accurately, we divided all the participants into two groups: those with a low absorption level (with scores equal to or below 20) and those with a high absorption level (with scores above 20). The mean differences between blocked unpleasant and pleasant sounds in the two intuitive conditions for each absorption level are presented in Figure 5.

Using the bootstrap procedure implemented with SimStat® (Péladeau & Lacoutre, 1993) in order to allow for the low number of participants in each group, after 1000 resamplings, only the comparison between the two groups in the implicit condition was statistically significant ($z = 2.14$; $p = 0.016$ (1-tailed); 95% CI: 3.5 – 0.42; $ES(d) = 1.03$.

Differences Between Pleasant and Unpleasant Sounds

To further analyse the source of this effect, Table 2 reports the descriptive statistics of the numbers of blocked sounds in the two intuitive conditions for each level of absorption.

The data in bold represent a statistically significant difference (Wilcoxon $z = 1.65$; $p = 0.049$ (one-tailed); 95% CI = –2.6 – 0.15). It seems that in the condition of implicit intuition, participants with higher levels of absorption

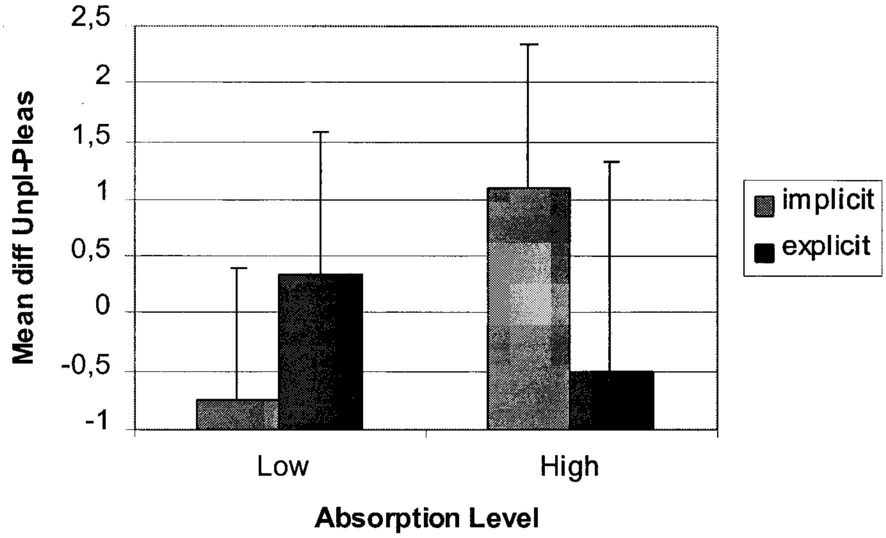

Figure 5. Means and CI 95% of the difference between blocked unpleasant and pleasant sounds of the two absorption groups for the two intuition conditions.

Table 2

Descriptive statistics of the numbers of blocked sounds in the two intuitive conditions obtained by the two groups with different level of absorption

Absorption Level		*Implicit Intuition*		*Explicit Intuition*	
		Pleasant	Unpleasant	Pleasant	Unpleasant
Low (N = 12)	Mean	5.25	4.50	3.83	4.17
	SD	1.54	1.31	1.34	1.47
High (N = 10)	Mean	**4.00**	**5.10**	4.10	3.60
	SD	1.56	1.91	1.45	1.51

were better able to permit the pleasant sounds to be delivered than to block the unpleasant ones. Further support for this hypothesis derives from the correlation between absorption scores and the number of pleasant and unpleasant sounds blocked: $r(20) = 0.42$, $p = 0.05$, and $r(20) = 0.066$, $p = 0.76$, respectively in the implicit intuition condition and $r(20) = 0.13$, $p = 0.56$ and $r(20) = -0.21$, $p = 0.35$, respectively in the explicit intuition condition.

Correlation Between Absorption and Expected Efficacy with Blocked Sounds

We correlated the total scores on the Tellegen Absorption Scale and the EE score with the difference between blocked unpleasant and pleasant sounds (where a positive score indicates that more unpleasant sounds than pleasant ones were blocked). In the automatic blocking (implicit intuition) condition, the parametric correlations with absorption and EE scores were respectively $r(20) = 0.40$; $p = 0.06$ and $r = 0.27$; $p = 0.22$; corrected $R^2 = 0.105$; the correlation between absorption and EE was $r(20) = 0.26$; $p = 0.24$.

In the manual blocking (explicit intuition) condition, the same correlations were respectively: $r(20) = -0.22$ with absorption, $p = 0.32$ and $r(20) = 0.03$, $p = 0.89$, with EE; corrected $R^2 = 0.04$; the correlation between absorption and EE was $r(20) = 0.32$.

The comparison between these correlations suggest that absorption plays a significant role when sounds are automatically blocked (0.40 vs. –0.22; $z = 2.65$), whereas EE play a stronger role (0.27 vs. 0.44) with overt intuition.

Discussion of Experiment 2 and Introduction to Experiment 3

The possibility of predicting the category of two groups of sounds seems to be supported by the present results even if the difference is only around 10%. However, this difference is obtained only in a condition of 'implicit intuition' and for participants with a high level of absorption. The attempt to interpret these findings is postponed until the General Discussion of this paper and after a replication of Experiment 2.

Results obtained with Experiment 2 were obtained with an exploratory approach. Before their interpretation, it was deemed necessary to examine with a confirmatory approach the reliability of the main results; that is, the role of absorption on implicit intuition to predict future pleasant or unpleasant sounds.

Method

Participants

Fifteen participants were recruited as in the second experiment.

Apparatus and Procedure

We used the same apparatus described in Experiments 1 and 2. As to the procedure, the only difference with respect to Experiment 2 was that only the implicit intuition condition was applied.

Results

One participant obtained an anomalous difference of six between the two categories of blocked sounds and was considered an outlier because this score is more than two standard deviations from the mean of the whole sample. As a consequence this value was eliminated from the subsequent analysis.

Comparison Between Levels of Absorption

The mean differences between blocked pleasant and unpleasant sounds obtained by the groups with Low (score ≤ 20) and High (score > 20) level of absorption are presented in Figure 6. The nonparametric statistical comparison after the bootstrap procedure was significant, $z = 1.96$; $p = 0.025$ (1-tailed); 95% CI = 3.2 – 0.20, $ES(d) = 1.4$, and very similar to that observed in Experiment 2.

Differences Between Pleasant and Unpleasant Sounds

The means of the blocked sounds, divided for the two categories of absorption level, are presented in Table 3. The data in bold represent a statistically

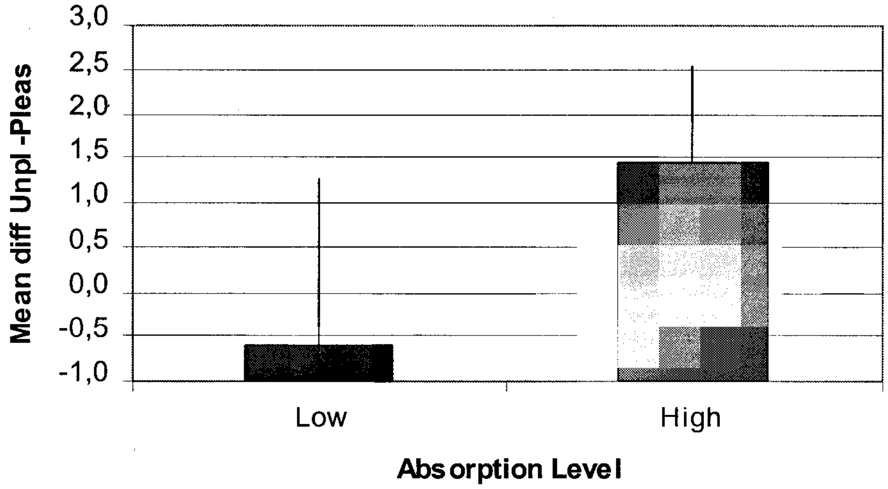

Figure 6. Means and CI 95% of the differences between blocked unpleasant and pleasant sounds obtained by the two groups of absorption level.

significant difference (bootstrap Wilcoxon $z = 2.23$, $p = 0.01$, one-tailed; 95% CI = 2.6–1.2). Our earlier interpretation of a mediating role for absorption in facilitating the hearing of pleasant sounds under conditions of implicit intuition is confirmed here by the differential correlation between absorption scores and the number of blocked pleasant and unpleasant sounds, respectively $rs(12) = -0.70$, $p = 0.005$ and $rs(12) = 0.002$, $p = 0.99$, in close agreement with that obtained in the second experiment.

Table 3

Descriptive Statistics of the Number of Blocked Sounds, Divided for the Two Categories of Absorption Level

Absorption Level		*Implicit Intuition*	
		Pleasant	Unpleasant
Low (N = 5)	Mean	6.00	5.40
	SD	1.41	2.07
High (N = 9)	Mean	**3.89**	**5.33**
	SD	1.27	1.73

Correlation Between Absorption and Expected Efficacy with Blocked Sounds Difference

The nonparametric correlations between absorption and EE with the difference between the two categories of blocked sounds was respectively

$rs(12) = 0.69$, $p = 0.007$ and $rs(12) = 0.65$, $p = 0.012$, corrected $R^2 = 0.57$; the correlation between absorption and EE was $rs(12) = 0.38$, $p = 0.17$. Figure 7 illustrates the scatterplot of the first two correlations.

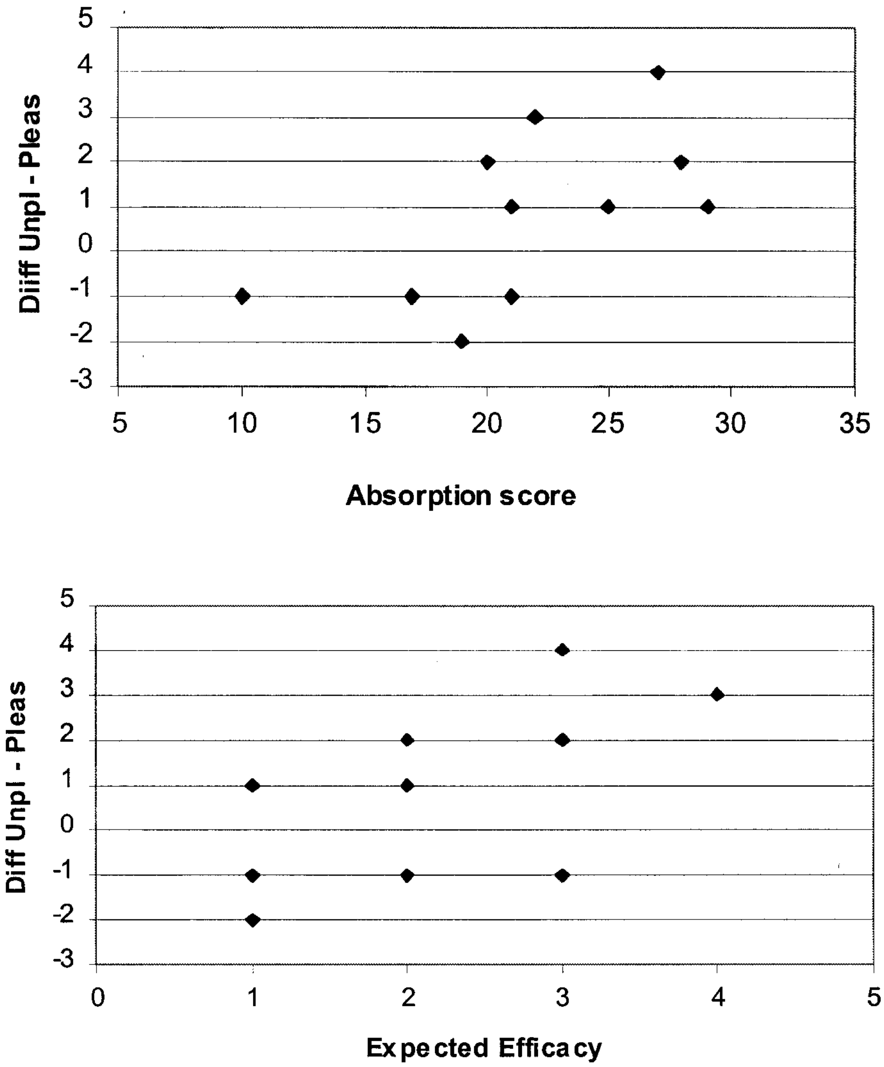

Figure 7. Scatterplots of the absorption and EE scores with the difference between the blocked unpleasant and pleasant sounds.

General Discussion

The main results obtained in these three experiments may be summarized as follows. First, we found a differential anticipatory response to sounds of different categories of pleasantness and arousal, adding converging evidence of the reliability of the pre-alerting phenomenon studied by May, Paulinyi and Vassy (2005) and indirectly supporting the general paradigm of studying precognition using physiological information (Lobach, 2008). Second, on studying this phenomenon, we observed opposing individual differences in the physiological reactions to the two categories of stimuli, a condition probably not always considered in these kinds of experiments. These differences were analysed, taking into account the absolute difference between them (Experiment 1). Third, and most interesting, taking into account physiological individual differences and level of absorption we have demonstrated for the first time the possibility of exploiting the physiological anticipatory information to predict the category of sounds to be heard by contrasting one explicit and one implicit condition of intuition.

In the first condition, after the information that an unpleasant sound was probably arriving, participants had to make an explicit decision to block its appearance. In the second condition, they were simply invited to wish to block these sounds, while the task was executed automatically (Experiment 2).

Only in the implicit intuition condition did absorption scores correlate with the difference between blocked pleasant and unpleasant sounds. Furthermore, the absorption scores correlated more strongly with the number of pleasant sounds blocked than with unpleasant sounds blocked, adding further support to the hypothesis of the mediating role of absorption in intuition, considering that the main characteristic of this personality trait is a desire to experience positive immersion in pleasant sensations. The role of positive emotions in an associative intuitive task has also been demonstrated by Bolte, Goschke and Kuhl (2003). The reliability of these results was confirmed in the third experiment, where only the implicit condition was used.

Further support for the role of absorption in facilitating the implicit prediction of future sounds was demonstrated by comparing the mean differences between the blocked pleasant and unpleasant sounds of two groups with different levels of absorption (below or above 20). In both Experiment 2 and Experiment 3 we found that only in the implicit condition did the group with a high level of absorption obtain a statistically significant difference (*ES(d)* 1.03 and 1.4 respectively).

To summarize, a special role of absorption emerges in facilitating the perception of pleasant information even when it is presented randomly, but this facilitation seems to work only when the mental state is free of overt activity, confirming similar evidence obtained, for example, under ganzfeld conditions. In the condition we defined as implicit intuition, it is probably easier to obtain and maintain a mental state free of every thought and worry. This mental state is the most favourable one for taking advantage of the informative value of the subtle and very labile physiological anticipatory signals. If this mental state is also supported by a high level of absorption, it seems possible to obtain a very favourable mental condition for solving tasks whose probability is random.

From the theoretical point of view, our observation that it may be possible to avoid listening to unpleasant sounds and therefore to listen only to pleasant ones may have implications for the intervention paradox, which highlights logical problems in using precognitive information to change the future event being precognised. However, if you look at the data reported in Tables 2 and 3 related to the groups with a high absorption level, we see that the differences between the two sound categories arise only from the lower number of pleasant sounds blocked, the sounds that the participants will actually be listening to. On the other hand, the numbers of blocked unpleasant sounds, those that will not be listened to in the future, are at chance level.

With only two experiments we prefer not to expand our interpretations of the main results obtained. Further studies are obviously necessary to confirm the 'robustness' of the effect and methodological improvements, i.e. the algorithms to predict future events, will need to be devised to improve the accuracy of prediction.

If the data we obtained are free of artifacts and our interpretation of the results is correct, we think we have opened up a new and very promising way of using anticipatory signals to assist our implicit intuition in predicting random events.

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