A DIRECT COMPARISON OF THE ‘WET’ AND ‘DRY’ FLOTATION ENVIRONMENTS

DONALD G. FORGAYS, DEBORAH K. FORGAYS, MIKI PUDVAH and DREX WRIGHT

Department of Psychology, University of Vermont, Burlington, Vermont 05405, U.S.A.

Abstract

The present study was an attempt to evaluate the relaxation potential of the recently introduced ‘dry’ float environment and to compare it systematically with the ‘wet’ float environment available for 20 years. In a balanced design, 10 female and 14 male young adult subjects spent one hour in a wet tank and one hour in the same tank modified to be a dry tank. Pre-/post-change measures included heart rate and POMS and SPI scales. Extensive post-float interview data were also obtained. Both environments were found to be relaxing and pleasant and both were associated with heart rate decreases. The wet tank, however, was somewhat superior in each of these regards and especially so for female subjects. Brief discussion is made of the use of these two environments for purposes of therapeutic intervention.

Introduction

Early work in isolation studies has been summarized well by Zubek (1969, 1973). This research became associated with the stereotype that isolation from a full sensory environment led to negative alterations in consciousness, cognitive functioning and affective responses. This stereotype persisted for some time, even though many studies did not report evidence for such widespread disturbance. In fact, recent research has reported positive benefits associated with some forms of isolation (e.g. Forgays & McClure, 1974; Suedfeld, 1980; Forgays & Belinson, 1986).

Lilly (1977) described a new isolation environment in which he felt all persons could thoroughly relax, namely the flotation tank. He characterized this environment as more relaxing than the sound-proof room and logistically more practical than the deep immersion technique which he had also pioneered. Lilly’s book provided many testimonials to the advantages of floating, but included no research support for these claims.

The flotation method has been employed recently as a therapeutic intervention for essential hypertension (Fine & Turner, 1982), to lower arousal level (Jacobs et al., 1984), to decrease plasma cortisol (Turner & Fine, 1983), as a relaxation method (Belinson & Forgays, 1984), to decrease cigarette smoking ( Forgays, 1987), as a pain control technique (Turner & Fine, 1984a), and to modify heart rate (Turner & Fine, 1984b). Suedfeld et al. (1983) have summarized some of the earliest research in this area. All of these studies indicate relaxation benefits of flotation, including a reduction of physiological arousal and of subjective stress. Floating does appear to be a pleasant experience for many. However, many of these studies employed small numbers of
subjects and less than rigorously controlled experimental conditions. It was not until 1986 that a well-controlled examination of the suspected benefits of the flotation environment was made (Forgays & Belinson, 1986). That research used an adequate number of subjects and measured both physiological, test and subjective responses to flotation.

Most of these subjects reported that floating was pleasant and time passed quickly; they frequently slept and looked forward to further floats. They remained for most of the maximum 150 min periods in each of their three floats and the heart rate data collected before, during and after each float was consistent with a picture of relaxation. However, sex, age and personality characteristics of these subjects were related to the degree of relaxation experienced. While those who would use the flotation technique as a therapeutic intervention should be aware of the likely influence of individual differences, it appears clear that this environment has a good deal of potential for health-related intervention.

A few years ago, a new isolation environment appeared on the commercial market—the dry flotation technique. In it the user is not in direct contact with the salt solution of the wet tank, but rather is confined to a physical space similar in size to the wet tank but rests on a waterbed mattress filled with water which may or may not be salted. Advertising brochures state that this environment provides all of the benefits of the wet tank but without the inconvenience of contact with the salt solution. According to this publicity, enhanced awareness, improved learning and performance, stress reduction and creativity increase, among other advantages, are associated with the use of this environment.

The claims of the dry tank manufacturers about the positive features of this environment raise important issues concerning why these types of environments are relaxing. Suedfeld (1980) has suggested that the essential characteristic of all isolation is the reduction of stimulation in the various environments. Lilly (1977) is more explicit with respect to the float tank. He says that the stimulation which is attenuated includes the absence of other persons and the reduction of light and sound stimulation, and that gravitational, heat flow and temperature patterns, and tactile and pressure stimulation changes also contribute importantly to the effects obtained. The wet and dry tanks should be quite similar with respect to social stimulation reduction and the absence or increased homogeneity of light and sound stimulation. It is possible that heat flow and temperature patterns are also similar in these two environments. However, wet and dry tanks should be quite different with respect to gravitational patterns and tactile and pressure stimulation of the skin and subcutaneous tissue. In the wet tank, floating distributes countergravity pressure over the maximum area of the body, while in the dry tank positioning on a waterbed mattress cannot provide so even a distribution of countergravitational forces. Similarly, in the wet tank the air-water-skin interface (the meniscus) is unique and the separation of a subject from a supporting mattress is not at all a similar experience.

If the dry tank can be shown to be the equivalent of the wet tank for relaxation and other purposes, the gravitational and tactile/pressure properties would then appear to be relatively unimportant and the social and light/sound properties relatively more important to the isolation effects of the tank environment. In short, ‘floating’ may not be the critical component of the flotation tank. Comparison of these two environments, then, is important theoretically in that it will allow us to specify more exactly what makes these environments relaxing. There will also be practical significance to the
finding of equivalency, since future use of this form of isolation would make use of the simpler technology of the dry environment. The present study then, is the first systematic attempt to compare the relative efficacy of these two environments in a controlled protocol.

Method

Subjects
Subjects were 16 male and 16 female undergraduate students at the University of Vermont. They were between 18 and 22 years of age and had volunteered to participate in order to obtain extra credit in the Introductory Psychology course. Each had responded to word-of-mouth announcements in the class. Of the original 32 subjects, on a first-come basis from well over 50 who had responded to the recruitment program, 24 completed all of the study procedures, 10 females and 14 males. The remaining eight subjects, six females and two males, had difficulty in scheduling their second ‘float’, five in the ‘wet’ and three in the ‘dry’ condition, after having completed their first float. The time frame of the study did not permit scheduling these subjects several weeks beyond the time when the other subjects had completed the two floats. There was nothing unusual about these lost subjects, other than their scheduling difficulties.

Apparatus
The flotation environment used was that supplied by the Samadhi Tank Co. Inc. of Los Angeles, California. This closed tank was 1.22 x 2.39 m and held approximately 380 l of water; it was automatically filtered and its heating system was set to keep the water solution at 34°C. The water is saturated with 350 kg of magnesium sulfate which allows the subject to float easily in the 0.28 m water depth with close to one third of the body and most of the face above the water. The tank is located in a quiet room which is part of an isolation laboratory. The tank and the room are completely dark when the subject is in the tank. Additionally, the subject wears earplugs.

The dry environment made use of the same Samadhi tank. Approximately 300 l of the salt solution were drained from the tank and pumped into a twin-size water bed mattress which was ‘floated’ on top of the remaining tank solution of about 0.05 m depth, and covered with a high quality cotton full-size sheet. Temperature and other conditions of the tank environment remained much the same as in the wet condition except that the subject did not come into contact with the salt solution. Thus, prominent cues were essentially the same for the wet and dry trials except for salted-water contact.

The subject’s heart rate was monitored through surface electrodes connected to a Narco Bio-Systems FM-1100 E2 Transmitter which sent the signal to the matching biotelemetry receiver FM-1100-7 in an adjacent room where an experimenter recorded the rate.

Details of the procedure were explained to each subject, who then signed a consent form. Each made two ‘floats’, one wet and one dry with about one week separating them. A balanced design was used so that half of the subjects had the wet float first and half the dry float first. Maximum time in the tank was 60 min per float and it was made clear that the subject could terminate the experiment at any time for any reason.

Each float began with the subject filling out the Profile of Mood States (POMS) (McNair et al., 1971) and the State Personality Inventory (SPI) (Spielberger, 1979).
After this, the subject showered and then entered the tank room. Each subject had been trained to attach surface electrodes to the sub-maxillary area bilaterally and did so while sitting next to the tank with the light on. The experimenter was in touch with the subject from the adjacent room through an inter-communication system. After 2 min of clean recording the subject removed the electrodes and entered the tank, closing the tank door. The experimenter turned off the room light from the next room leaving on a small wattage blue light for safety purposes. This light could not be seen from within the tank. The subject usually floated nude in the tank in a supine position with hands at the side or under the head. If the subject remained in the tank for the full 60 min the experimenter announced the end of the trial over the inter-com and requested that the subject leave the tank, sit on the seat again and replace the two electrodes with clean adhesives. After 2 min of clean recording the experimenter asked the subject to remove the electrodes and to proceed to the adjacent bathroom for a shower. After showering and dressing, the subject again filled out the POMS and the SPI in the waiting area and the experimenter returned to administer a brief 20 question interview about the float experience. At the end of the second float, eight questions comparing the two floats were added to the second interview. The interviews were attempts to assess subjective reactions to the float experiences.

These procedures were the same for the two types of floats, including the pre and post showers and the use of earplugs.

Results

As indicated above, eight subjects were lost to the design because of scheduling difficulties. Of the 24 who completed all procedures, 12 were in the dry-wet order and 12 were in the wet-dry order. The final 24 subjects were 10 females and 14 males, and all remained in each of the two environments for the full 60 min trials.

Test measures included the POMS scales (Tension, Vigor, Anger, Confusion, Depression and Fatigue) and the SPI scales (Anxiety, Curiosity and Anger) which were obtained before and after each of the two floats. The physiological measure was heart rate, also obtained pre- and post-float. The subjective measures included responses to the interview questions after each float and to the final interview comparison questions. We tested initially for order effects on all of these measures and found that none were significant. It did not matter whether subject floated ‘wet’ or ‘dry’ for the first or the second trial. Thus, the data will be presented only by environmental condition. Means and standard deviations for the POMS scales, the SPI scales, and for heart rate for both pre and post measures in the two environments are presented for each sex group and for the combined sample in Table 1.

As can be seen there, pre/post decreases in the Tension, Anger and Depression scales and increases in the Vigor, Confusion and Fatigue scales of the POMS generally occur for both sexes in both environments. Decreases for all three scales of the SPI generally occur for both sexes and in both environments. Pre/post heart rate decreases also occur in both environments for both sexes.

Pre/post difference scores were analysed by MANOVA for each of the 10 measures, the six POMS scales, the three SPI scales, and the Heart Rate measure. There were 10 MANOVAS in all. Since the scales of the POMS and the SPI are treated as essentially orthogonal measures, we treated them as such in the present analyses. In each MANOVA, the only between subjects variable was that for gender; the within subjects
Wet' and 'Dry' Flotation Environments

TABLE 1

Means and standard deviations (in parentheses) for the various POMS and SPI scales and the heart rate measure for the two environments by gender and for combined gender

<table>
<thead>
<tr>
<th></th>
<th>Wet environment</th>
<th>Dry environment</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Male subjects</td>
<td>Female subjects</td>
</tr>
<tr>
<td></td>
<td>Pre</td>
<td>Post</td>
</tr>
<tr>
<td>Tension</td>
<td>14.14</td>
<td>7.14</td>
</tr>
<tr>
<td></td>
<td>(8.07)</td>
<td>(2.96)</td>
</tr>
<tr>
<td>Vigor</td>
<td>6.07</td>
<td>10.00</td>
</tr>
<tr>
<td></td>
<td>(2.84)</td>
<td>(4.87)</td>
</tr>
<tr>
<td>Anger</td>
<td>4.36</td>
<td>1.50</td>
</tr>
<tr>
<td></td>
<td>(4.28)</td>
<td>(1.77)</td>
</tr>
<tr>
<td>Confusion</td>
<td>2.36</td>
<td>6.29</td>
</tr>
<tr>
<td></td>
<td>(2.13)</td>
<td>(1.20)</td>
</tr>
<tr>
<td>Depression</td>
<td>10.71</td>
<td>7.07</td>
</tr>
<tr>
<td></td>
<td>(5.64)</td>
<td>(4.76)</td>
</tr>
<tr>
<td>Fatigue</td>
<td>4.64</td>
<td>6.50</td>
</tr>
<tr>
<td></td>
<td>(3.34)</td>
<td>(6.49)</td>
</tr>
<tr>
<td>Anxiety</td>
<td>21.00</td>
<td>20.86</td>
</tr>
<tr>
<td></td>
<td>(2.75)</td>
<td>(1.51)</td>
</tr>
<tr>
<td>Curiosity</td>
<td>22.79</td>
<td>22.71</td>
</tr>
<tr>
<td></td>
<td>(6.29)</td>
<td>(5.77)</td>
</tr>
<tr>
<td>Anger</td>
<td>12.57</td>
<td>10.42</td>
</tr>
<tr>
<td></td>
<td>(12.75)</td>
<td>(10.06)</td>
</tr>
<tr>
<td>Heart rate</td>
<td>79.14</td>
<td>73.43</td>
</tr>
<tr>
<td></td>
<td>(3.92)</td>
<td>(4.03)</td>
</tr>
</tbody>
</table>

variables included environment (the wet vs dry conditions) and the single interaction term reflecting gender by wet/dry environment. No pre/post differences were found to be significant at the \( p = <0.05 \) level of confidence for the six POMS scales. The closest to significance was that for the Depression scale \( (p = <0.12) \), there was a greater decrease in the wet over the dry environment across gender. For the State Personality Inventory, a close to significant gender difference \( (p = <0.10) \) was found for the Anxiety scale; there was a greater pre to post anxiety decrease in female subjects over male subjects for both environments. For the Curiosity scale a close to significant gender by wet/dry environment interaction was found \( (p = <0.06) \), reflecting a greater pre/post decrease in curiosity among female subjects in the wet environment and a greater decrease in curiosity among male subjects in the dry environment. No reliable effects were found for the Anger scale.

Results for the heart rate measure were more robust. The overall gender difference was close to significant \( (p = <0.12) \), with females decreasing heart rate more than males pre to post. The wet/dry environment effect was highly reliable \( (p = <0.001) \) reflecting a greater decrease in the wet tank pre/post than in the dry tank for both males and females. The interaction of these two variables was also close to significant \( (p = <0.10) \), reflecting the fact that female subjects decreased heart rate pre to post more in the wet tank over the dry tank in contrast to male subjects whose pre to post decrease was more similar in the two environments. Two further MANOVA analyses were
accomplished with the heart rate data for each of the environments separately. For the wet tank data, gender differences were significant for the pre and for the post measures \((p = < 0.0001\) in each case). Females had significantly higher heart rates than males at both times. In the pre-/post-difference analysis the gender effect was significant \((p = < 0.0001\), again reflecting the higher heart rate of females over males. The pre to post decrease was significant at the \(p = < 0.06\) level of confidence, and the gender by environment interaction was significant \((p = < 0.0001\). This latter result reflects female subjects decreasing heart rate more than male subjects in this wet environment.

In the dry environment, the higher heart rate for females over males was again found to be significant for both the pre and the post measurements \((p < 0.0001\). The pre-/post-difference analysis again displays a significant gender effect, females higher than males \((p = < 0.0001\). The pre to post decrease was found to be significant \((p = < 0.0001\), but the interaction term was not.

The remaining measures were the results of the two interviews made after the paper-and-pencil inventories were completed. The basic post-float interview of 20 questions inquired into the float experience. Eight questions comparing the two float conditions were added at the end of the second post-float interview. Responses to the various questions were scaled either on the basis of apparent a priori dimensions or on the basis of the specific response patterns of the subjects. Where appropriate, data from the 20 question interviews were subjected to ANOVA with sex and float type and the interaction of these two terms as the effects studied. Significant differences were found for seven of the questions.

The first question asked how the float went. Wet floats were rated as better than dry floats \((p = < 0.03\), but both types were viewed quite highly, with 48% rated as good and 28% as excellent. Three questions inquired into irritating aspects of the isolation. Eighty-seven percent of the responses indicated some irritation, usually the hot temperature in both environments, the salt in the wet tank and the sheets in the dry tank. Subjects, however, reported that the irritations had little effect on having a pleasant relaxed period, especially in the wet tank. Ninety-six percent of responses indicated that the floats were pleasant, with the wet experience being superior to the dry \((p = < 0.03\). Two questions asked about sleeping and dreaming. Responses were vague with half of the subjects saying they did not sleep and most of the sleepers saying they did not dream. Three questions inquired into thinking patterns during isolation. Subjects thought about many things during the floats, but only erotic thoughts occurred significantly more frequently in one environment—the wet tank \((p = < 0.05\). Most subjects said that it was relatively difficult to think and that constructive thought occurred only rarely. Fifty percent of subjects reported that time passed quickly whereas only 20% reported time to pass slowly. Most subjects were unaware of reasons for time passing the way that it did and also reported that they largely guessed at the post-run time estimates. About three-quarters of these subjects reported hearing something during isolation, with two-thirds of the sounds coming from outside the tank and about one-fifth from inside their own bodies. These sounds were not judged to be unpleasant experiences, with half of the subjects reporting them to be positive and the other half neutral. Females reported more pleasant auditory experiences than male subjects \((p = < 0.05\). About half of the subjects indicated that they saw something during isolation, with females reporting more sightings than males \((p = < 0.01\). At least half of the subjects having such experiences reported them to be positive and the other half neutral.
At the end of the second interview, an additional eight questions were asked. Responses to these questions were not analysed statistically. The first question asked which of the two floats was preferred. Seventy percent of all subjects preferred the wet tank and 24% the dry; the remainder stated no preference. Seventy-three percent of the female subjects preferred the wet and 27% the dry tank. For males, 67% preferred the wet, 22% the dry, and 11% indicated no preference. Roughly the same relationships were found for a question which asked whether the subject preferred the effects of the wet vs the dry tank. To another question, 10% of all subjects said that problems they experienced were similar in the two environments. However, 53% said there were problems in the dry tank they did not have in the wet, while 37% said the opposite. Similarities in the two environments included relaxation effects, temperature, isolation, weightlessness and physical sensations. Differences in the two environments included novelty, relaxation effects and physical sensations. In this latter regard, females reported more relaxation in the wet environment over male subjects, four to one, while male subjects reported more physical sensations, due to sheet contact, in the dry environment than females, three to one. Problems in the dry tank were reported to be few and usually concerned the temperature or touching the sheets. The final question inquired into which float left the subject feeling better. Responses of the two sexes were quite similar with 80% of all subjects saying the wet tank and 20% the dry.

**Discussion**

In an earlier study (Forgays & Belinson, 1986), we had set out to answer the question: is flotation isolation in the wet tank relaxing? We answered that question in the affirmative. Our data, both subjective and objective, indicated that this environment afforded a relaxing and pleasant experience for most of our subjects. In the present study we set out to discover if the dry tank experience was relaxing and whether the wet and dry isolation experiences were essentially equivalent with respect to relaxation and pleasantness. These latter questions are answered in the affirmative, but, as before, there are important individual differences.

The pre-/post changes on the POMS and the SPI scales show little statistical significance. They do suggest however, that both environments are associated with a reduction in negative emotional states, with perhaps a bit more reduction for female over male subjects. It is interesting to note that the Curiosity scale of the SPI shows a close to significant interaction between float type and gender. Females decreased curiosity pre to post more in the wet tank and males more in the dry. This suggests that female subjects might have been more relaxed in the wet tank over the dry and male subjects the reverse. The heart rate data are generally in agreement with this possibility. All subjects decrease heart rate after either type of float. Female subjects display higher heart rates than male subjects at every point of measurement. However, females decrease heart rate significantly more than males in the wet tank only. While pre to post decreases are significant in the dry tank, there are no gender differences here.

The interview data confirm the above results and extend them. Floats of either type are rated highly, but wet floats are rated more highly than dry and they are reported to produce more consistently high degrees of relaxation. Both environments produced irritations, salt in the wet, sheets in the dry, and high temperature in both. Such irritations, however, did not mitigate the positive effects of isolation in either environment.
The interview data suggest that the isolation experience is a vague one. Many subjects are uncertain as to whether they have slept, dreamed or even thought, or how time passed. This uncertainty, however, did not detract from the positive nature of the experience. Many subjects reported visual and/or auditory experiences in both environments. Again, these experiences were vague but were not bothersome; rather, they were viewed as neutral or positive.

When asked to compare the two tank experiences, most subjects said that they had preferred the wet tank. Males elaborated that they preferred the effects of the dry tank while females remained consistent in their wet tank preferences. Females appear to be reflecting the greater relaxation they experience in the wet tank and males the physical sensation differences they perceive in the dry tank. It seems clear that the wet tank is a more novel experience than the dry tank while the sheets in the dry tank cause some problems. The wet tank, however, left more subjects feeling better than the dry.

So, how do the two environments compare for relaxation and pleasantness? They both appear to be acceptable with respect to their potential utility as therapeutic intervention environments. Since it is far easier to produce and maintain a dry environment, this one would seem to be indicated for many purposes. However, generally the wet environment was superior in terms of pleasantness and relaxation ratings and also in terms of heart rate decrease, especially for female subjects. For certain purposes, then, such as producing a relaxed state, especially for male subjects, the dry environment is acceptable, while for the modification of physiological process, especially for female subjects, the wet environment is indicated. Further research with additional test and physiological measures needs to be done to evaluate the efficacy of such possibilities.

We must emphasize that we compared a typical commercial wet tank with the same tank made ‘dry’. We did this to keep as many environmental cues as possible the same in both environments, for control purposes. The principal difference in the two environments was contact with the salt solution, on the one hand, and with the water mattress and sheets, on the other. Our dry tank, however, is not the same as the commercially available dry tanks, and thus our results cannot be generalized to those environments. Additional research would have to be accomplished to evaluate the qualities of the commercial dry tank environment.

It is important to note that overall differences in the two environments are few. This suggests that the salt solution and the attendant counter-gravitational and tactile/pressure qualities associated with it are not necessary to produce the positive features of these isolation environments. An exception to this statement seems to exist for the female subject, whose heart rate decrease is greater in the wet tank than in the dry. Is it the salt solution features which have led to this result or some other quality of the wet tank that seems to interact with gender? Again, additional research needs to be done to evaluate further this important finding.

Notes

(1) This research was supported in part by a grant from the Institutional Grants Program of the Graduate College, University of Vermont. Name and address to be used for reprint requests: D. G. Forgays, Department of Psychology, University of Vermont, Burlington, Vermont 05405, U.S.A.

(2) John Turner and Thomas Fine of the Medical College of Ohio are also researching these two environments. In contrast to the present study, they are comparing a commercial wet tank with a
commercial dry tank. They will publish their results in future. (Personal Communication, February 1990).

References


