The Effect of Expectations on Experiences and Engagement with an Applied Game for Mental Health

Wols, Aniek; Hollenstein, Tom; Lichtwarck-Aschoff, Anna; Granic, Isabela

Published in:
Games for Health Journal

DOI:
10.1089/g4h.2020.0115

GAMES FOR HEALTH JOURNAL: Research, Development, and Clinical Applications
Volume 10, Number 4, 2021
Mary Ann Liebert, Inc.
DOI: 10.1089/g4h.2020.0115

Original Articles

The Effect of Expectations on Experiences and Engagement with an Applied Game for Mental Health

Aniek Wols, MSc,[1,*] Tom Hollenstein, PhD,[2] Anna Lichtwarck-Aschoff, PhD,[1] and Isabela Granic, PhD[1]

Abstract

Objective: Applied games are considered a promising approach to deliver mental health interventions. Nonspecific factors such as expectations and motivation may be crucial to optimize effectiveness yet have not been examined so far. The current study examined the effect of expectations for improvement on (1) experienced fun and positive affect, and (2) in-game play behaviors while playing MindLight, an applied game shown to reduce anxiety. The secondary aim was to examine the moderating role of symptom severity and motivation to change.
Materials and Methods: Fifty-seven participants (47 females; 17–21 years old) preselected on anxiety symptoms viewed a trailer in which MindLight was promoted as either a mental health or an entertainment game. These trailers were used to induce different expectations in participants. Participants subsequently played the game for 60 minutes. Before playing, participants filled out questionnaires about their general anxiety symptoms, motivation to change, state anxiety, affect, and arousal. While playing, in-game behaviors and galvanic skin response (GSR) were recorded continuously. After playing, state anxiety, affect, and arousal were measured again as well as experienced fun.
Results: Participants in both trailer conditions showed increases in state anxiety, arousal, and GSR. Expectations did not influence experienced fun and positive affect, nor in-game behaviors. In addition, no moderation effects of motivation to change and symptom severity were found.
Conclusion: Experiences and engagement with MindLight were not influenced by expectations, motivation to change, and symptom severity. For future research, it is recommended to examine individual differences in these effects, and long-term and more distal outcomes and processes.

Keywords: Applied games, Nonspecific factors, Anxiety, Expectations, Motivation

Introduction

There has been an increasing interest in the use of applied games to treat and prevent mental health problems.[1,2] Due to their intrinsically motivating features and their high accessibility and potential for scalability, applied games are considered a promising and cost-effective approach to improve access to mental health care.[1,3] The primary focus in the development of applied games has been on translating evidence-based *specific* therapeutic techniques into game mechanics.[4,5] These specific therapeutic techniques are drawn from theories about the working mechanisms responsible for the onset and maintenance of mental health disorders (e.g., relaxation and exposure training in cognitive behavioral therapy [CBT][6]). The underlying assumption is that these specific techniques are responsible for the observed improvements in mental health. There is, however, a consistent and large body of evidence showing that *nonspecific* factors—factors not specific to any psychotherapeutic school, such as individuals' expectations and motivation to change—actually outweigh the role of specific techniques in explaining positive intervention outcomes.[7–11] Additionally, nonspecific factors are associated with patients' engagement in the therapeutic process such as invested time and effort[12–15] and adherence to the treatment regimen (e.g., homework assignments).[16,17] So far, nonspecific factors have largely been neglected in the e-health literature[18,19] and their effects remain unknown. To optimize the effectiveness of applied games to its best potential, it is crucial to examine and harness the benefits of nonspecific factors.[20]

[1]Behavioural Science Institute, Radboud University, Nijmegen, The Netherlands.
[2]Department of Psychology, Queen's University, Kingston, Ontario, Canada.
*ORCID ID (https://orcid.org/0000-0002-4962-0695).

Presumably, the most relevant nonspecific factor to examine in applied games is individuals' expectations for improvement.[21,22] Previous research has shown that expectations drive a large majority of intervention effects,[13] in particular, in experimental game design studies.[23] Although commercial videogames are usually promoted for their entertainment value, applied games are often introduced with an explicit (mental) health aim, which naturally induces expectations for improvement. It is unknown how expectations relate to players' experiences of a game and their engagement with it. Therefore, the primary aims of the current study were to examine the effect of expectations for improvement on (1) experienced fun and affect, and (2) in-game play behaviors while playing an applied game for mental health.

The effect of expectations on players' experiences and in-game engagement may be moderated by two additional nonspecific factors, namely motivation to change (i.e., individuals' willingness to change symptoms or problems they are experiencing)[24] and symptom severity. An individual more motivated to change mental health symptoms and/or experiencing more (severe) symptoms may find an applied game with an explicit mental health aim more personally relevant, possibly leading to higher engagement with the therapeutic techniques and a more positive experience of the game (i.e., experienced fun and affect).[15,25,26] On the other hand, however, it might be that individuals with more (severe) symptoms engage less with the therapeutic techniques as they may fear unwanted confrontation with their mental health problems[27] (e.g., a game aimed at emotion and stress management may imply confrontations with negative emotions and stress for some individuals). The secondary aim of the current study was to examine the moderating role of motivation to change and symptom severity.

Design of the present study

In the current study, we used the applied game MindLight, designed to reduce anxiety symptoms among youth.[28,29] Previous research has compared MindLight with a CBT-based indicated prevention program in children (7–12 years old)[30] and to online CBT-based psychoeducation in adolescents (8–16 years old),[31] finding evidence for its overall effectiveness. Previous research also suggests that both specific and nonspecific factors (expectations and motivation) play a role in MindLight.[32,33]

Expectations for MindLight were experimentally manipulated by showing participants a teaser trailer, in which MindLight was promoted as a mental health game or as a regular entertainment game.[23,34] The primary outcomes were experienced fun, positive affect, and in-game play behaviors. Because MindLight has been specifically designed to induce anxiety to train youth to regulate this anxiety,[30,33] we also examined changes in (self-reported) state anxiety and arousal. The study design, hypotheses, and analyses were preregistered on the Open Science Framework (OSF; https://osf.io/6gmwv)[35] and deviations from the planned methodology are uploaded on OSF (https://osf.io/j7mvu). Exploratory analyses were performed on changes in galvanic skin response (GSR; i.e., the small changes in the amount of moisture or perspiration on the surface of the skin), to have an objective indicator of arousal complementing the self-reported measures.

Methods

Participants

Participants were 57 psychology students, who were between 17 and 21 years old, primarily Caucasian, and indicated to be moderately experienced with playing videogames (see Table 1 for descriptives). All participants were preselected on elevated levels of anxiety (see preregistration). The Queen's University Health Sciences & Affiliated Teaching Hospitals Research Ethics Board (HSREB) granted ethics approval for the current study (code number: 6019310 PSYC-187-16).

Procedure

Participants signed informed consent and filled out a questionnaire measuring demographics, anxiety symptoms, and motivation to change. After that, participants viewed a neutral video to measure their baseline GSR[36] and completed a questionnaire measuring their state anxiety, affect, and arousal. Next, participants viewed a mental health or an entertainment trailer and played MindLight for 60 minutes on a 15.6-inch laptop. After having played the game, participants again filled out questions about their state anxiety, affect, and arousal, as well as questions about their experiences with the game and questions related to the manipulation checks.

MindLight and experimental manipulation. MindLight is a three-dimensional neurofeedback game designed to reduce anxiety symptoms among youth.[28,29] In the game, Little Arty (the player) needs to save his grandma who succumbed to evil forces. He finds a magical hat that teaches him (and the player) how to use his ''mindlight'', a beam of light coming from the antenna attached to the magical hat. The ''mindlight'' is controlled through the one-channel dry-sensor electroencephalogram (EEG) headset that the player wears,[37] and which responds to the real-time relaxation of the player (neurofeedback training[38]): when the player becomes more relaxed, the light becomes brighter providing more light in the game environment, and making it possible to chase away or uncover ''fear events'' (exposure training[39]) and effectively engage with the (attention bias modification[40,41]) puzzles and other objects (e.g., unlock hiding spaces and turn on ceiling lights, which both prevent that fear events will attack the player). For more information, see previous studies on MindLight.[30,32,33,42,43]

Half of the participants ($n = 29$) viewed a teaser trailer in which MindLight was promoted as a mental health game (MH-condition; https://osf.io/zdqs5), emphasizing the beneficial effects of the game on players' emotion regulation and stress reduction. The other half of the participants ($n = 28$) viewed a teaser trailer in which MindLight was promoted as a regular entertainment game (ENT-condition; https://osf.io/jf4ab). Although the trailers differed in their specific message, both trailers included the same video footage and background music and lasted for 1 minute and 11 seconds.

Materials

Experienced fun. Participants answered ''How much did you like playing MindLight?'' on a 10-point scale.

Table 1. Means, Frequencies, and Standard Deviations or Percentages of the Demographic and Study Variables for the Total Sample and for Each Experimental Condition

			Experimental condition						
			Mental health trailer		*Entertainment trailer*				
Variable	*Mean/frequency*	*(SD)/%*	*Mean/frequency*	*(SD)/%*	*Mean/frequency*	*(SD)/%*	χ^2/t[a]	df	*p*
Age	18.23	(0.63)	18.21	(0.77)	18.25	(0.44)	1.05[b]	54	0.30
Gender							0.13[c]	1	0.72
Female	47	82.5	24	82.8	23	82.1			
Male	9	15.8	4	13.8	5	17.9			
Nonbinary	1	1.8	1	3.4	0	0.0			
Race							0.06[d]	1	0.81
White	44	77.2	22	75.9	22	78.6			
Asian	8	14.0	5	17.2	3	10.7			
Arabic	1	1.8	0	0.0	1	3.6			
Multiracial	3	5.3	1	3.4	2	7.1			
Prefer not to say	1	1.8	1	3.4	0	0.0			
Videogame experience[e]	4.46	(2.70)	4.93	(2.70)	3.96	(2.66)	−1.36	55	0.18
Motivation to change	3.91	(0.45)	3.91	(0.42)	3.92	(0.49)	0.01	55	0.99
General anxiety symptoms	1.55	(0.67)	1.54	(0.65)	1.56	(0.70)	0.08	55	0.94
Experienced fun	4.18	(2.12)	4.71	(2.21)	3.64	(1.91)	−1.94	55	0.06
Affect									
Pretest[f]	3.67	(0.61)	3.62	(0.72)	3.73	(0.48)	0.70	55	0.49
Posttest	2.92	(0.90)	2.98	(1.02)	2.86	(0.76)	–0.53	55	0.60
Arousal									
Pretest	2.10	(0.82)	1.91	(0.85)	2.29	(0.76)	1.74	55	0.09
Posttest	2.61	(1.16)	2.57	(1.21)	2.64	(1.13)	0.24	55	0.81
State anxiety									
Pretest	1.88	(0.47)	1.88	(0.57)	1.87	(0.34)	–0.13	45.57[g]	0.90
Posttest	2.26	(0.59)	2.26	(0.60)	2.27	(0.58)	0.12	55	0.90
Engaged in-game play behaviors									
Mindlight—total[f]	0.01	(0.01)	0.01	(0.01)	0.01	(0.01)	–0.86	55	0.39
Exploration	0.65	(0.10)	0.65	(0.10)	0.65	(0.11)	0.08	55	0.94
Fear attempt	0.05	(0.03)	0.05	(0.03)	0.05	(0.04)	0.47	55	0.64
Avoidant/safety in-game play behaviors									
Mindlight—none[f]	0.04	(0.05)	0.04	(0.06)	0.03	(0.04)	–0.93	55	0.36
Inactive[f]	0.04	(0.03)	0.03	(0.03)	0.04	(0.03)	0.70	55	0.49
Ceiling light attempt	0.24	(0.08)	0.24	(0.08)	0.23	(0.07)	–0.46	55	0.65
Inside chest[f]	0.02	(0.01)	0.02	(0.02)	0.02	(0.02)	1.15	55	0.25
Overall GSR percent change[f]	32.92	(51.24)	41.50	(62.36)	25.25	(38.25)	−1.16	51	0.25

[a]Bootstrapping the independent *t*-tests with $n = 1000$ samples showed similar results for all variables.
[b]For the *t*-test, one outlier was removed.
[c]The χ^2-test included males and females (one nonbinary participant was removed); 2 cells (50%) had an expected count <5 (minimum expected count was 4.50).
[d]The χ^2-test included the categories "white" versus "other."
[e]On a 10-point scale ranging from "0 = not at all experienced" to "10 = expert."
[f]One value was winsorized to ±3.5 SD from the mean.
[g]Levene's test was significant and equal variances could not be assumed.
df, degrees of freedom; GSR, galvanic skin response; SD, standard deviation.

Affect and arousal. Participants indicated on two manikin-based scales (ranging from 1 to 5) how they felt at that moment (self-assessment manikin [SAM]).[44] Each manikin is a graphical depiction of various points along the affect/arousal dimension. For affect, the SAM ranged from an unhappy and frowning manikin (1) to a happy and smiling manikin (5). For arousal, the SAM ranged from a sleepy and relaxed manikin (1) to a wide-eyed and excited manikin (5).

In-game play behaviors. While playing MindLight, on-screen output was recorded using the Open Broadcast Software (https://obsproject.com). In-game play behaviors were coded in Noldus Information Technology[45] following an adapted version of the *MindLight Coding System* based on Wols et al.[32] (see preregistration). Reliability was maintained above 75% agreement and 0.65 kappa using a frequency/sequence-based analysis, and above 80% agreement using a duration/sequence-based analysis. The in-game play behaviors can be divided into *engaged* behaviors that support players' practice of relaxation, exposure, and modifying attention biases, and *avoidant/safety* behaviors that interfere with the intervention goals of MindLight and reduce opportunities to practice. Codes of interest included three engaged and four avoidant/safety behaviors. The frequency and duration of the in-game play behaviors were transformed to frequencies per minute and proportions, respectively (for more details see preregistration).

State anxiety. The state scale of the State-Trait Anxiety Inventory[46,47] consists of 20 items ($\alpha_{pre} = 0.90$ and $\alpha_{post} = 0.92$) and asks participants to indicate how they feel at this moment (e.g., ''I am tense''; on a 4-point scale).

Galvanic skin response. During the baseline task (i.e., viewing a neutral video) and while playing MindLight, GSR was recorded continuously with Biopac AcqKnowledge 4.2 software[48] and MP150 amplifier.[36] GSR data files were trimmed to 120 seconds and 3600 seconds for the baseline task and gameplay, respectively, and cleaned and processed using the AcqKnowledge software. No smoothing was applied to the data, but a low-pass filter was used to improve the signal quality of the entire waveform (fixed frequency was set at 0.5 Hz). An overall GSR mean value for baseline and gameplay was calculated, as well as GSR mean values for six 10-minute timebins (i.e., dividing the 60 minutes of gameplay into timebins of 10 minutes). Then, the GSR percent change from baseline was calculated for each participant to control for individual differences and to facilitate interpretation across participants[49,50] (for more details see OSF; https://osf.io/j7mvu).

Motivation to change. The contemplation subscale of the University of Rhode Island Change Assessment questionnaire[51] consists of eight items ($\alpha = 0.73$), measuring the extent to which participants are aware of their ''problems'' (as identified with the Beck Anxiety Inventory [BAI], *Symptom severity*) and have the intention to change (e.g., ''I think I might be ready for some self-improvement''; on a 5-point scale).

Symptom severity. The BAI[52,53] measures various symptoms of anxiety with 21 items ($\alpha = 0.94$). Participants indicated the degree to which they were bothered by each symptom on a 4-point scale.

Trailer manipulation check. To examine whether the two trailers induced different expectations, participants answered two open questions: ''What were your impressions of MindLight right after you watched the trailer?'' and ''What did you expect from MindLight based on the trailer (before you played the game)?'' In addition, participants answered the following *Yes/No* question: ''Did you notice that the message in the trailer were focused on [game enjoyment (ENT-condition)] *or* [on how MindLight could help people who feel stressed/anxious or have some mental health difficulties (MH-condition)]?''.

Statistical analyses

First, trailer manipulation and randomization were checked. Bootstrapped Pearson correlations between study variables are reported in Table 2. Bootstrapped paired t-tests were used to examine changes in affect, state anxiety, and arousal. The remaining preregistered research questions were examined within a (hierarchical) regression framework (controlled for high correlations; see preregistration).[54] Univariate outliers were winsorized to ±3.5 standard deviation from the mean before conducting the analyses. Because some study variables were not normally distributed, all regression models were bootstrapped with $n = 1000$ samples.

For GSR, univariate outliers were winsorized to ±3.5 standard deviation from the mean, both for the overall GSR percent change value and the timebin values. The exploratory analyses for GSR included (1) a bootstrapped one-sample *t*-test to examine whether overall GSR percent change during gameplay was higher than zero, (2) bootstrapped regression analyses to examine differences between the experimental conditions and the interactions with motivation to change and anxiety symptoms on overall GSR percent change, and (3) a Repeated Measures analysis of variance (ANOVA) with the six 10-minute timebins to examine (polynomial) changes in GSR during gameplay, with experimental condition as between-subjects factor.

Results

General manipulation, trailer manipulation, and randomization check

Participants who were aware of the study aims ($n = 0$) and/or knew MindLight before the experiment ($n = 1$) were excluded from the analyses. The two trailers induced expectations as intended with our manipulation (see Table 3 and the pilot study in the preregistration[35]). Descriptive statistics for the entire sample and for each experimental condition are provided in Table 1. Randomization was successful indicating no differences between the experimental conditions on any study variables.

Experienced fun and change on affect

Experienced fun did not significantly differ between the two trailer conditions. The interactions between trailer condition and motivation to change or anxiety symptoms did not have a significant effect on experienced fun (Table 4). For positive affect, we found a significant decrease from pre- to

Table 2. Pearson Correlations between the Study Variables

Variable[a]	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*	*12*	*13*	*14*	*15*	*16*	*17*
1. Age[b]	—																
2. Experienced fun	0.14	—															
3. Affect pretest[c]	0.08	0.07	—														
4. Affect posttest	0.23	**0.55**	0.22	—													
Engaged in-game play behaviors																	
5. Mindlight—total[c]	0.08	0.19	0.17	0.08	—												
6. Exploration	0.17	−0.06	**−0.30**	−0.16	0.04	—											
7. Fear attempt	−0.07	0.10	0.19	0.21	−0.18	**−0.31**	—										
Avoidant/safety in-game play behaviors																	
8. Mindlight—none[c]	**−0.24**	0.10	−0.08	0.17	**0.31**	−0.17	−0.02	—									
9. Inactive[c]	−0.11	**−0.23**	0.13	0.03	0.07	−0.23	0.03	**0.28**	—								
10. Ceiling light attempt	−0.15	−0.08	0.09	**0.23**	−0.12	−0.16	−0.06	0.10	0.01	—							
11. Inside chest[c]	0.01	−0.18	−0.06	0.04	−0.15	−0.02	−0.16	−0.16	−0.17	−0.11	—						
12. Motivation to change	**0.24**	−0.00	0.13	−0.06	0.07	0.05	−0.11	0.08	0.10	−0.02	−0.04	—					
13. General anxiety symptoms	0.03	0.07	**−0.32**	0.09	**−0.31**	0.19	−0.00	0.16	0.07	−0.19	0.02	0.11	—				
14. State anxiety pretest	−0.11	−0.14	**−0.68**	−0.22	0.06	**0.39**	−0.06	0.06	−0.19	−0.15	0.10	−0.10	**0.28**	—			
15. State anxiety posttest	−0.17	**−0.36**	−0.12	**−0.58**	0.15	0.18	−0.03	−0.14	0.03	**−0.29**	0.00	0.14	0.11	**0.36**	—		
16. Arousal pretest	−0.04	0.12	0.06	−0.00	0.11	−0.09	0.09	−0.00	−0.16	−0.06	0.09	−0.06	0.06	0.20	0.07	—	
17. Arousal posttest	−0.09	0.03	−0.02	−0.07	0.24	0.01	−0.02	−0.10	−0.21	−0.02	0.22	0.07	0.05	0.08	**0.46**	**0.27**	—
18. Overall GSR percent change[c,d]	−0.04[e]	−0.04	0.22	−0.06	−0.06	−0.12	**0.25**	**−0.19**	0.10	−0.17	−0.09	−0.01	0.02	−0.12	0.05	−0.12	−0.07

[a]All correlations were bootstrapped with $n = 1000$ samples. Correlations in bold have a 95% CI that does not include zero.
[b]$n = 56$ because one outlier was removed.
[c]One value was winsorized to ±3.5 SD from the mean.
[d]$n = 53$.
[e]$n = 52$.
CI, confidence interval; GSR, galvanic skin response.

Table 3. Trailer Manipulation Check

	Experimental condition	
	Mental health trailer	*Entertainment trailer*
Expectations reported	62.1% mentioned mental health benefits of the game and/or that the game was a mental health game	82.1% mentioned the entertainment value of the game and/or was positive about the game 14.3% was negative about the game For 1 participant it remained unclear whether (s)he was positive or negative about the game
Trailer message awareness	93.1% noticed that the message in the trailer was focused on how MindLight could help people who feel stressed/anxious or have some mental health difficulties 6.9% did not notice this	50% noticed that the message in the trailer was focused on game enjoyment 42.9% did not notice this For 2 participants their answers were missing

Table 4. Hierarchical Linear Regression Analyses Predicting Experienced Fun and Affect at Posttest

	Dependent variable			
	Experienced fun		*Affect at posttest*	
	Unstandardized estimate b *[95% CI]*	*(SE)*	*Unstandardized estimate* b *[95% CI]*	*(SE)*
Step 1[a]				
Constant	0.39 [−1.05 to 1.87]	(0.74)	2.93 [1.14 to 4.53]**	(0.85)
Affect at pretest (control variable)			0.21 [−0.07 to 0.53]	(0.15)
Affect at posttest (control variable)	1.30 [0.83 to 1.72]**	(0.23)		
State anxiety post (control variable)			−0.65 [−1.00 to −0.31]**	(0.18)
Experienced fun (control variable)			0.16 [0.06 to 0.27]**	(0.05)
Step 2[b]				
Constant	0.03 [−1.35 to 1.65]	(0.76)	2.95 [1.13 to 4.51]**	(0.85)
Affect at pretest (control variable)			0.21 [−0.07 to 0.53]	(0.15)
Affect at posttest (control variable)	1.26 [0.78 to 1.67]**	(0.22)		
State anxiety post (control variable)			−0.64 [−1.00 to −0.29]**	(0.18)
Experienced fun (control variable)			0.17 [0.06 to 0.28]**	(0.06)
Trailer condition[c]	0.91 [0.05 to 1.83]	(0.45)	−0.04 [−0.39 to 0.31]	(0.18)
Step 3a[d]				
Constant	−0.03 [−1.38 to 1.54]	(0.75)	2.93 [1.06 to 4.57]**	(0.90)
Affect at pretest (control variable)			0.20 [−0.07 to 0.56]	(0.16)
Affect at posttest (control variable)	1.28 [0.81 to 1.69]**	(0.22)		
State anxiety post (control variable)			−0.63 [−1.00 to −0.27]**	(0.19)
Experienced fun (control variable)			0.17 [0.06 to 0.28]**	(0.06)
Trailer condition[c]	0.90 [−0.07 to 1.87]	(0.46)	−0.04 [−0.42 to 0.30]	(0.19)
Motivation to change	0.32 [−1.07 to 1.82]	(0.73)	−0.07 [−0.66 to 0.46]	(0.28)
Interaction: motivation to change X trailer condition	−0.45 [−2.65 to 1.68]	(1.06)	0.10 [−0.72 to 1.13]	(0.45)
Step 3b[e]				
Constant	0.20 [−1.36 to 1.84]	(0.84)	2.81 [1.09 to 4.32]**	(0.83)
Affect at pretest (control variable)			0.28 [−0.05 to 0.62]	(0.17)
Affect at posttest (control variable)	1.21 [0.72 to 1.69]**	(0.25)		
State anxiety post (control)			−0.68 [−1.00 to −0.27]**	(0.19)
Experienced fun (control)			0.15 [0.05 to 0.26]**	(0.05)
Trailer condition[c]	0.91 [−0.00 to 1.81]	(0.48)	−0.01 [−0.35 to 0.31]	(0.18)
General anxiety symptoms	0.49 [−0.48 to 1.51]	(0.50)	0.27 [−0.17 to 0.58]	(0.19)
Interaction: general anxiety symptoms X trailer condition	−0.88 [−2.53 to 0.61]	(0.80)	−0.07 [−0.56 to 0.44]	(0.25)

Note: $^{**}p < 0.01$, 1.000 bootstrap samples. Steps 1 until 3a were performed within the same bootstrapped regression model.
[a]$R^2 = 0.30$ and 0.49 for experienced fun and affect at posttest, respectively.
[b]$R^2 = 0.35$ and 0.49 for experienced fun and affect at posttest, respectively.
[c]Trailer condition was coded as 0 = entertainment trailer, 1 = mental health trailer.
[d]$R^2 = 0.35$ and 0.49 for experienced fun and affect at posttest, respectively.
[e]$R^2 = 0.37$ and 0.52 for experienced fun and affect at posttest, respectively.
CI, confidence interval; SE, standard error.

Table 5. Hierarchical Linear Regression Analyses Predicting the Engaged In-Game Play Behaviors

	Dependent variable					
	Mindlight total		*Exploration*		*Fear attempt*	
	Unstandardized estimate b *[95% CI]*	*(SE)*	*Unstandardized estimate* b *[95% CI]*	*(SE)*	*Unstandardized estimate* b *[95% CI]*	*(SE)*
Step 1[a]						
Constant	0.01 [0.01 to 0.01]**	(0.00)	0.65 [0.61 to 0.69]**	(0.02)	0.05 [0.04 to 0.07]**	(0.01)
Trailer condition[b]	0.00 [–0.00 to 0.01]	(0.00)	–0.00 [–0.06 to 0.05]	(0.03)	–0.00 [–0.02 to 0.01]	(0.01)
Step 2a[c]						
Constant	0.01 [0.01 to 0.01]**	(0.00)	0.65 [0.61 to 0.69]**	(0.02)	0.05 [0.04 to 0.07]**	(0.01)
Trailer condition[b]	0.00 [–0.00 to 0.01]	(0.00)	–0.00 [–0.06 to 0.05]	(0.03)	–0.00 [–0.02 to 0.01]	(0.01)
Motivation to change	0.01 [–0.01 to 0.02]	(0.01)	0.05 [–0.03 to 0.10]	(0.03)	–0.03 [–0.05 to –0.00]*	(0.01)
Interaction: motivation to change X trailer condition	–0.01 [–0.02 to 0.01]	(0.01)	–0.09 [–0.19 to 0.04]	(0.06)	0.06 [0.02 to 0.09]**	(0.02)
Step 2b[d]						
Constant	0.01 [0.01 to 0.01]**	(0.00)	0.65 [0.61 to 0.69]**	(0.02)	0.05 [0.04 to 0.07]**	(0.01)
Trailer condition[b]	0.00 [–0.00 to 0.01]	(0.00)	–0.00 [–0.05 to 0.05]	(0.03)	–0.00 [–0.02 to 0.01]	(0.01)
General anxiety symptoms	–0.01 [–0.01 to 0.00]	(0.00)	0.01 [–0.05 to 0.09]	(0.03)	0.00 [–0.03 to 0.02]	(0.01)
Interaction: general anxiety symptoms X trailer condition	–0.00 [–0.01 to 0.01]	(0.01)	0.04 [–0.05 to 0.12]	(0.04)	0.00 [–0.02 to 0.04]	(0.02)

Note: *$p < 0.05$, **$p < 0.01$, 1.000 bootstrap samples. Steps 1 and 2a were performed within the same bootstrapped regression model.
[a]$R^2 = 0.01$, 0.00, and 0.00 for mindlight total, exploration, and fear attempt, respectively.
[b]Trailer condition was coded as 0 = entertainment trailer, 1 = mental health trailer.
[c]$R^2 = 0.04$, 0.04, and 0.19 for mindlight total, exploration, and fear attempt, respectively.
[d]$R^2 = 0.11$, 0.06, and 0.00 for mindlight total, exploration, and fear attempt, respectively.
CI, confidence interval; SE, standard error.

posttest [$t(56) = 5.87$, $p = 0.001$; 95% confidence interval (CI) mean difference (0.50 to 0.99)]. Furthermore, affect at posttest did not significantly differ between the two trailer conditions. The interactions between trailer condition and motivation to change or anxiety symptoms did not have a significant effect on affect at posttest (Table 4).

In-game play behaviors

Trailer condition did not significantly predict any of the in-game play behaviors (Tables 5 and 6). The interaction between trailer condition and motivation to change did not have a significant effect on any of the in-game play behaviors, with the exception of fear attempt (Table 5). A significant positive effect of motivation to change on fear attempts was found in the MH condition, $b = 0.03$, 95% CI (0.01 to 0.05), $p = 0.025$, and a significant negative effect was found in the ENT condition, $b = -0.03$, 95% CI (–0.05 to –0.00), $p = 0.013$. Finally, the interaction between trailer condition and anxiety symptoms did not have a significant effect on any of the in-game play behaviors (Tables 5 and 6).

Change in state anxiety and arousal

Participants in both trailer conditions reported increased state anxiety [$t(56) = -4.85$, $p = 0.001$; 95% CI mean difference (–0.54 to –0.25)], and increased arousal [$t(56) = -3.13$, $p = 0.002$; 95% CI mean difference (–0.82 to –0.23)] after playing MindLight. There were no significant differences on state anxiety and arousal at posttest between the two trailer conditions (Table 7). The interactions between trailer condition and motivation to change or anxiety symptoms did not have a significant effect on state anxiety and arousal at posttest (Table 7).

Exploratory analyses

Overall GSR percent change during gameplay was significantly higher than zero with a mean difference of 32.92 [$t(52) = 4.68$, $p = 0.002$; 95% CI mean difference (19.77 to 47.54)]. Trailer condition did not significantly predict overall GSR percent change during gameplay, nor did the interactions between trailer condition and motivation to change or anxiety symptoms (Table 8).

For the Repeated Measures ANOVA, Mauchly's Test of Sphericity indicated that the assumption of sphericity had been violated, $\chi^2(14) = 117.92$, $p < 0.001$, and therefore a Greenhouse–Geisser ($\varepsilon = 0.53$) correction was used. There was no significant effect of time [$F(2.67, 133.62) = 2.11$, $p = 0.109$, $\eta^2_p = 0.04$] and no significant interaction effect between time and experimental condition [$F(2.67, 133.62) = 0.16$, $p = 903$. $\eta^2_p = 0.00$]. See Table 9 for the GSR mean per timebin and separately for experimental condition, including post hoc (bootstrapped) independent *t*-tests to examine the differences between conditions per timebin (all nonsignificant).

Within-subjects polynomial contrasts, however, showed a significant quadratic trend for GSR [$F(1, 50) = 6.67$, $p = 0.013$, $\eta^2_p = 0.12$], and this trend did not differ between

Table 6. Hierarchical Linear Regression Analyses Predicting the Avoidant/Safety In-Game Play Behaviors

	Dependent variable							
	Mindlight none		*Inactive*		*Ceiling light attempt*		*Inside chest*	
	Unstandardized estimate b *[95% CI]*	*(SE)*	*Unstandardized estimate* b *[95% CI]*	*(SE)*	*Unstandardized estimate* b *[95% CI]*	*(SE)*	*Unstandardized estimate* b *[95% CI]*	*(SE)*
Step 1[a]								
Constant	0.03 [0.01 to 0.05]**	(0.01)	0.04 [0.03 to 0.05]**	(0.01)	0.23 [0.21 to 0.27]**	(0.01)	0.02 [0.02 to 0.03]**	(0.00)
Trailer condition[b]	0.01 [–0.01 to 0.04]	(0.01)	–0.01 [–0.02 to 0.01]	(0.01)	0.01 [–0.03 to 0.05]	(0.02)	–0.01 [–0.01 to 0.00]	(0.00)
Step 2a[c]								
Constant	0.03 [0.02 to 0.04]**	(0.01)	0.04 [0.03 to 0.05]**	(0.01)	0.23 [0.21 to 0.27]**	(0.01)	0.02 [0.02 to 0.03]**	(0.00)
Trailer condition[b]	0.01 [–0.01 to 0.04]	(0.01)	–0.01 [–0.02 to 0.01]	(0.01)	0.01 [–0.03 to 0.05]	(0.02)	–0.01 [–0.01 to 0.00]	(0.00)
Motivation to change	–0.02 [–0.06 to 0.03]	(0.02)	–0.00 [–0.03 to 0.03]	(0.02)	–0.03 [–0.09 to 0.03]	(0.03)	–0.00 [–0.02 to 0.01]	(0.01)
Interaction: motivation to change X trailer condition	0.06 [–0.00 to 0.14]	(0.04)	0.02 [–0.02 to 0.06]	(0.02)	0.06 [–0.01 to 0.15]	(0.04)	0.00 [–0.02 to 0.02]	(0.01)
Step 2b[d]								
Constant	0.03 [0.02 to 0.05]**	(0.01)	0.04 [0.03 to 0.05]**	(0.01)	0.23 [0.21 to 0.27]**	(0.01)	0.02 [0.02 to 0.03]**	(0.00)
Trailer condition[b]	0.01 [–0.01 to 0.04]	(0.01)	–0.01 [–0.02 to 0.01]	(0.01)	0.01 [–0.03 to 0.05]	(0.02)	–0.01 [–0.01 to 0.00]	(0.00)
General anxiety symptoms	0.01 [–0.01 to 0.02]	(0.01)	0.00 [–0.02 to 0.01]	(0.01)	–0.03 [–0.07 to 0.00]	(0.02)	–0.00 [–0.01 to 0.01]	(0.01)
Interaction: general anxiety symptoms X trailer condition	0.01 [–0.01 to 0.05]	(0.02)	0.01 [–0.02 to 0.03]	(0.01)	0.02 [–0.04 to 0.07]	(0.03)	0.00 [–0.01 to 0.01]	(0.01)

Note: **$p < 0.01$, 1.000 bootstrap samples. Steps 1 and 2a were performed within the same bootstrapped regression model.
[a]$R^2 = 0.02$, 0.01, 0.00, and 0.02 for mindlight none, inactive, ceiling light attempt, and inside chest, respectively.
[b]Trailer-condition was coded as 0 = entertainment trailer, 1 = mental health trailer.
[c]$R^2 = 0.10$, 0.04, 0.03, and 0.03 for mindlight none, inactive, ceiling light attempt, and inside chest, respectively.
[d]$R^2 = 0.05$, 0.02, 0.05, and 0.03 for mindlight none, inactive, ceiling light attempt, and inside chest, respectively.
CI, confidence interval; SE, standard error.

Table 7. Hierarchical Linear Regression Analyses Predicting Arousal and State Anxiety at Posttest

	Dependent variable			
	Arousal at posttest		*State anxiety at posttest*	
	Unstandardized estimate b [95% CI]	*(SE)*	*Unstandardized estimate b [95% CI]*	*(SE)*
Step 1[a]				
Constant	1.80 [1.00 to 2.67]**	(0.41)	2.69 [1.90 to 3.53]**	(0.40)
Arousal at pretest (control variable)	0.38 [0.02 to 0.75]*	(0.18)		
State anxiety at pretest (control variable)			0.31 [0.05 to 0.58]*	(0.13)
Affect at posttest (control variable)			–0.34 [–0.48 to –0.21]**	(0.07)
Step 2[b]				
Constant	1.75 [0.76 to 2.80]**	(0.53)	2.69 [1.90 to 3.58]**	(0.41)
Arousal at pretest (control variable)	0.39 [0.01 to 0.77]*	(0.19)		
State anxiety at pretest (control variable)			0.31 [0.05 to 0.58]*	(0.14)
Affect at posttest (control variable)			–0.35 [–0.49 to –0.21]**	(0.07)
Trailer condition[c]	0.07 [–0.56 to 0.72]	(0.33)	0.02 [–0.23 to 0.24]	(0.12)
Step 3a[d]				
Constant	1.73 [0.70 to 2.65]**	(0.51)	2.64 [1.87 to 3.51]**	(0.40)
Arousal at pretest (control variable)	0.40 [0.03 to 0.80]*	(0.19)		
State anxiety at pretest (control variable)			0.31 [0.05 to 0.58]*	(0.14)
Affect at posttest (control variable)			–0.33 [–0.47 to –0.19]**	(0.07)
Trailer condition[c]	0.08 [–0.53 to 0.74]	(0.33)	0.02 [–0.23 to 0.25]	(0.12)
Motivation to change	0.33 [–0.87 to 1.22]	(0.54)	0.27 [–0.18 to 0.67]	(0.21)
Interaction: motivation to change X trailer condition	–0.25 [–1.61 to 1.46]	(0.79)	–0.23 [–0.79 to 0.39]	(0.29)
Step 3b[e]				
Constant	1.58 [0.51 to 2.57]**	(0.51)	2.81 [1.97 to 3.72]**	(0.42)
Arousal at pretest (control variable)	0.47 [0.10 to 0.86]*	(0.19)		
State anxiety at pretest (control variable)			0.27 [–0.05 to 0.58]	(0.15)
Affect at posttest (control variable)			–0.37 [–0.50 to –0.24]**	(0.07)
Trailer condition[c]	0.10 [–0.52 to 0.68]	(0.31)	0.02 [–0.22 to 0.27]	(0.12)
General anxiety symptoms	–0.34 [–1.17 to 0.36]	(0.39)	0.17 [–0.24 to 0.50]	(0.19)
Interaction: general anxiety symptoms X trailer condition	0.80 [–0.20 to 1.83]	(0.50)	–0.17 [–0.60 to 0.30]	(0.23)

Note: *$p<0.05$, **$p<0.01$, 1.000 bootstrap samples. Steps 1 until 3a were performed within the same bootstrapped regression model.
[a]$R^2=0.07$ and 0.39 for arousal at posttest and state anxiety at posttest, respectively.
[b]$R^2=0.07$ and 0.39 for arousal at posttest and state anxiety at posttest, respectively.
[c]Trailer-condition was coded as 0 = entertainment trailer, 1 = mental health trailer.
[d]$R^2=0.08$ and 0.42 for arousal at posttest and state anxiety at posttest, respectively.
[e]$R^2=0.13$ and 0.41 for arousal at posttest and state anxiety at posttest, respectively.
CI, confidence interval; SE, standard error.

experimental conditions [$F(1, 50)=0.08$, $p=0.785$, $\eta^2_p=0.00$]. Paired samples *t*-tests were used to make post hoc comparisons between the different timebins, suggesting that GSR increased during the first 40 minutes of gameplay and decreased after that (Table 10).

Discussion

The current study examined the effect of participants' expectations for improvement (i.e., playing a mental health game or a regular entertainment game) on the following outcomes: (1) experienced fun and positive affect, and (2) in-game play behaviors while playing MindLight, an applied game shown to reduce anxiety symptoms in several randomized controlled trial (RCT) studies.[30,31,33,43] We also investigated changes in state anxiety, arousal, and GSR. The secondary aim was to test the moderating role of motivation to change and symptom severity.

Our findings that expectations did not influence experienced fun and affect, are in line with previous research showing that young adults experiencing mental health symptoms found a commercial videogame promoted as a mental health game similarly attractive and fun as the same game being promoted for its entertainment value.[55] More importantly, players' game experiences and affect were not influenced by the mental health messaging.[55] We also found that expectations did not predict in-game behaviors and that participants in both trailer conditions showed similar increases in state anxiety, arousal, and GSR. Although players can explore and progress through the game in a variety of ways, MindLight's design seems to ensure that players engage similarly with the game, regardless of their expectations about the game. Because engagement with the therapeutic techniques is necessary to be successful at the game, players who are unaware of the mental health aim still end up playing the game in a similar way as players who are aware of the

Table 8. Hierarchical Linear Regression Analyses Predicting overall GSR Percent Change

	Dependent variable	
	Overall GSR percent change	
	Unstandardized estimate b *[95% CI]*	*(SE)*
Step 1[a]		
Constant	25.25 [11.67 to 40.90]**	(7.32)
Trailer condition[b]	16.25 [−9.82 to 47.91]	(14.63)
Step 2a[c]		
Constant	25.26 [10.62 to 40.91]**	(7.33)
Trailer condition[b]	16.56 [−9.53 to 50.74]	(15.10)
Motivation to change	− 6.34 [−41.29 to 37.75]	(20.28)
Interaction: motivation to change X trailer condition	15.42 [−66.11 to 87.64]	(38.67)
Step 2b[d]		
Constant	25.15 [11.81 to 39.61]**	(7.14)
Trailer condition[b]	16.02 [−12.61 to 46.60]	(15.05)
General anxiety symptoms	13.49 [−2.69 to 30.47]	(8.03)
Interaction: general anxiety symptoms X trailer condition	−25.67 [−69.94 to 32.48]	(25.67)

Note: **$p < 0.01$, 1.000 bootstrap samples. Steps 1 and 2a were performed within the same bootstrapped regression model.
[a]$R^2 = 0.03$.
[b]Trailer condition was coded as 0 = entertainment trailer, 1 = mental health trailer.
[c]$R^2 = 0.03$.
[d]$R^2 = 0.06$.
CI, confidence interval; SE, standard error; GSR, galvanic skin response.

Table 9. Mean Galvanic Skin Response Percent Change for the Six Timebins for the Total Sample and for Each Experimental Condition

	Experimental condition					
Timebin	*Mean (SD) [95% CI[c]]*	*Mental health trailer*[a] *Mean (SD) [95% CI[c]]*	*Entertainment trailer*[b] *Mean (SD) [95% CI[c]]*	t[d]	df	*p*
1	26.45 (38.50) [15.73 to 37.17]	34.64 (44.25) [19.02 to 50.26]	19.43 (31.95) [6.08 to 36.50]	−1.44	50	0.16
2	32.90 (46.21) [20.03 to 45.76]	40.98 (54.83) [22.10 to 59.85]	25.97 (36.94) [10.72 to 40.73]	−1.17	50	0.25
3	34.16 (50.23) [20.18 to 48.15]	41.54 (59.95) [20.94 to 62.14]	27.84 (40.19) [14.37 to 41.78]	−0.98	50	0.33
4	35.71 (62.20) [18.40 to 53.03]	45.81 (80.77) [20.35 to 71.27]	27.06 (39.78) [15.94 to 53.44]	−1.04	32.37[e]	0.31
5	31.11 (58.29) [14.88 to 47.33]	40.15 (71.51) [16.26 to 64.03]	23.36 (43.90) [15.76 to 49.34]	−1.04	50	0.31
6	31.43 (57.21) [15.50 to 47.36]	39.39 (67.97) [15.91 to 62.88]	24.60 (46.29) [17.22 to 46.80]	−0.93	50	0.36

[a]$n = 24$.
[b]$n = 28$.
[c]Bootstrapped with $n = 1000$ samples.
[d]Bootstrapping the independent t-tests with $n = 1000$ samples showed similar results for all timebins.
[e]Levene's test was significant and equal variances could not be assumed.
SD, standard deviation, CI, confidence interval; *df*, degrees of freedom; GSR, galvanic skin response.

mental health aim and may also benefit from it. Similarly, a previous study showed that initial anxiety levels were not associated with in-game play behaviors.[32] Given the current findings, game designers may want to design applied games in such a way that players are encouraged to engage with the therapeutic techniques, regardless of their expectations about the game.

Regarding the secondary aim, we found no moderation of motivation to change and symptom severity, with the exception of one significant interaction between expectations and motivation to change on fear attempts. Given the small sample and multiple interactions that were tested, it could well be a chance finding and hence will not be further elaborated on. It might be that no moderation effects were found because individual differences have cancelled out some of the effects. For example, not all participants with equal levels of anxiety may have perceived the mental health message as personally relevant.[25,26,35] In addition, expectations may not only be affected by an explicit mental health aim but may depend on other personal characteristics, such as gender, age, race, dispositional optimism, personality, treatment history, and beliefs about and experiences with applied games.[20,26,35,56] Future research may want to

Table 10. Paired Samples *t*-Tests for Galvanic Skin Response Between the Different Timebins

Pair	*Mean difference (SD) [95% CI]*	t[a]	df	*p*
Timebin 1				
Timebin 2	−6.45 (17.92) [−11.44 to −1.46]	−2.59	51	0.01
Timebin 3	−7.71 (21.64) [−13.74 to −1.69]	−2.57	51	0.01
Timebin 4	−9.26 (31.67) [−18.08 to −0.45]	−2.11	51	0.04
Timebin 5	−4.66 (27.38) [−12.28 to 2.97]	−1.23	51	0.23
Timebin 6	−4.98 (27.87) [−12.74 to 2.78]	−1.29	51	0.20
Timebin 2				
Timebin 3	−1.27 (12.64) [− 4.79 to 2.25]	−0.72	51	0.47
Timebin 4	−2.82 (22.87) [−9.18 to 3.55]	−0.89	51	0.38
Timebin 5	1.79 (23.84) [−4.84 to 8.43]	0.54	51	0.59
Timebin 6	1.47 (23.19) [−4.99 to 7.92]	0.46	51	0.65
Timebin 3				
Timebin 4	−1.55 (21.86) [−7.63 to 4.53]	−0.51	51	0.61
Timebin 5	3.06 (22.66) [−3.25 to 9.36]	0.97	51	0.34
Timebin 6	2.73 (22.01) [−3.39 to 8.86]	0.90	51	0.38
Timebin 4				
Timebin 5	4.61 (19.02) [−0.69 to 9.90]	1.75	51	0.09
Timebin 6	4.28 (21.04) [−1.58 to 10.14]	1.47	51	0.15
Timebin 5				
Timebin 6	−0.32 (9.99) [−3.10 to 2.46]	−0.23	51	0.82

[a]Bootstrapping the paired samples *t*-tests with $n = 1000$ samples showed similar results for all comparisons.
SD, standard deviation; CI, confidence interval; *df*, degrees of freedom; GSR, galvanic skin response.

examine the role of perceived personal relevance[26,57] in combination with other individual differences. Future research may also investigate the role of nonspecific factors on the long-term as well as more ecological valid contexts, such as voluntary choice for, prolonged engagement with, and ongoing use of an applied game for mental health.

A limitation of the study is the modest sample size, only allowing detection of medium-sized effects. Second, participants were preselected on elevated levels of anxiety but there was no criterion regarding the time window between screening and participation in the laboratory, resulting in 54.4% of participants who did not meet the initial inclusion criterion anymore when they came to the laboratory. Finally, MindLight is an applied game in which the mental health aim is integrated in the story and cut scenes of the game. Thus, for participants receiving the ENT trailer it became clear while playing the game that it was aimed at reducing arousal and anxiety through relaxation, undermining their expectations that the game was a pure entertainment game.

Although MindLight has been developed for and tested for efficacy in a younger age group, we expected that the 1st year psychology students in the current study would still enjoy playing the game based on our previous experiences with an older age group.[31] In addition, recent reviews have shown that biofeedback interventions work for youth and young adults,[58,59] but may be more effective for young people when the feedback is integrated in an applied game, increasing their motivation and engagement.[60] Because 1st year students often experience elevated levels of anxiety,[61–63] we considered MindLight an appropriate and relevant applied game for this specific age group and to test our research questions.

Notwithstanding the aforementioned limitations and remaining questions for future research, the current study integrated research on applied games with research on nonspecific factors and suggests that promoting an applied game as a mental health or entertainment game does not influence participants' experiences and engagement with the game, regardless of participants' motivation to change and symptom severity.

Acknowledgments

The authors would like to thank Tiffany Tsui, Kalee De France, Owen Hicks, and Ashley Patterson for their help with the data collection, data cleaning, and preparations for data analyses. They would also like to thank Nastasia Griffioen for her feedback on earlier drafts of the article. Finally, they would like to thank all the students who participated in the study.

Author Disclosure Statement

MindLight was produced by the PlayNice Institute. I.G. is cofounder of this institute. A.W., T.H., and A.L-A. declare that they have no competing (financial) interests.

Funding Information

The authors acknowledge the financial support from the Ontario Mental Health Foundation for purchasing the equipment used in the current study. The current research was further supported by the Netherlands Organization for Scientific Research (NWO; grant number 406-16-524 for A. Wols). The funding sources had no role in the design of the study, data collection, analysis, interpretation of data, writing the article, and in the decision to submit the article for publication.

References

1. Granic I, Lobel A, Engels RC. The benefits of playing video games. Am Psychol 2014; 69:66–78.
2. Lau HM, Smit JH, Fleming TM, Riper H. Serious games for mental health: Are they accessible, feasible, and effective? A systematic review and meta-analysis. Front Psychiatry 2017; 7:209.
3. Kazdin AE. Technology-based interventions and reducing the burdens of mental illness: Perspectives and comments on the special series. Cogn Behav Pract 2015; 22:359–366.
4. Eichenberg C, Schott M. Serious games for psychotherapy: A systematic review. Games Health J 2017; 6:127–135.
5. Fleming TM, Bavin L, Stasiak K, et al. Serious games and gamification for mental health: Current status and promising directions. Front Psychiatry 2017; 7:215.
6. Kendall PC. *Child and Adolescent Therapy: Cognitive-Behavioral Procedures*. New York, NY: Guilford Press; 2011.
7. Ahn HN, Wampold BE. Where oh where are the specific ingredients? A meta-analysis of component studies in counseling and psychotherapy. J Counsel Psychol 2001; 48:251.
8. Lambert MJ. Early response in psychotherapy: Further evidence for the importance of common factors rather than ''placebo effects.'' J Clin Psychol 2005; 61):855–869.
9. Lambert MJ. Psychotherapy research and its achievements. In: Norcross JC, vandenBos GR, Freedheim DK, eds. *History of Psychotherapy: Continuity and Change* (2nd ed.). Washington, DC: American Psychological Association; 2011:299–332.
10. Messer SB, Wampold BE. Let's face facts: Common factors are more potent than specific therapy ingredients. Clin Psychol Sci Pract 2002; 9:21–25.
11. Wampold BE. *The Great Psychotherapy Debate: Models, Methods, and Findings*. Mahwah, NJ: Lawrence Erlbaum Associates; 2001.
12. Boettcher J, Renneberg B, Berger T. Patient expectations in internet-based self-help for social anxiety. Cogn Behav Ther 2013; 42:203–214.
13. Greenberg RP, Constantino MJ, Bruce N. Are patient expectations still relevant for psychotherapy process and outcome? Clin Psychol Rev 2006; 26:657–678.
14. Meyer B, Pilkonis PA, Krupnick JL, Egan MK, et al. Treatment expectancies, patient alliance and outcome: Further analyses from the National Institute of Mental Health Treatment of Depression Collaborative Research Program. J Consult Clin Psychol 2002; 70:1051.
15. Dean S, Britt E, Bell E, et al. Motivational interviewing to enhance adolescent mental health treatment engagement: A randomized clinical trial. Psychol Med 2016; 46:1961–1969.
16. Constantino MJ, Arnkoff DB, Glass CR, et al. Expectations. J Clin Psychol 2011; 67:184–192.
17. Westra HA, Dozois DJ, Marcus M. Expectancy, homework compliance, and initial change in cognitive-behavioral therapy for anxiety. J Consult Clin Psychol 2007; 75:363.
18. Enck P, Klosterhalfen S, Weimer K. Unsolved, forgotten, and ignored features of the placebo response in medicine. Clin Therapeut 2017; 39:458–468.
19. Torous J, Firth J. The digital placebo effect: Mobile mental health meets clinical psychiatry. Lancet Psychiatry 2016; 3:100–102.
20. Enck P, Bingel U, Schedlowski M, Rief W. The placebo response in medicine: Minimize, maximize or personalize? Nat Rev Drug Discov 2013; 12:191–204.
21. Schakel L, Veldhuijzen DS, Middendorp HV, et al. The effects of a gamified approach avoidance training and verbal suggestions on food outcomes. PLoS One 2018; 13:e0201309.
22. Schwarz KA, Pfister R, Buchel C. Rethinking explicit expectations: Connecting placebos, social cognition, and contextual perception. Trends Cogn Sci 2016; 20:469–480.
23. Boot WR, Simons DJ, Stothart C, Stutts C. The pervasive problem with placebos in psychology: Why active control groups are not sufficient to rule out placebo effects. Perspect Psychol Sci 2013; 8:445–454.
24. Prochaska JO, DiClemente CC. Transtheoretical therapy: Toward a more integrative model of change. Psychotherapy 1982; 19:276.
25. Buday R. Games for health: An opinion. Games Health J 2015; 4:38–42.
26. Oliver MB, Krakowiak KM. Individual differences in media effects. In: Bryant J, Oliver MB, eds. *Media Effects: Advances in Theory and Research* (3rd ed.). New York, NY: Routledge; 2009:517–531.
27. Poppelaars M, Lichtwarck-Aschoff A, Kleinjan M, Granic I. The impact of explicit mental health messages in video games on players' motivation and affect. Comput Hum Behav 2018; 83:16–23.
28. GainPlay Studio. MindLight. 2014. https://www.gainplaystudio.nl/mindlight (accessed December 13, 2019).
29. PlayNice Institute. MindLight. 2014. https://www.theplayniceinstitute.com (accessed December 13, 2019).
30. Schoneveld EA, Lichtwarck-Aschoff A, Granic I. Preventing childhood anxiety disorders: Is an applied game as effective as a cognitive behavioral therapy-based program? Prevent Sci 2018; 19:220–232.
31. Tsui TYL, DeFrance K, Khalid-Khan S, et al. Reductions of anxiety symptoms, state anxiety, and anxious arousal in youth playing the video game MindLight. Games Health J 2021; in press.
32. Wols A, Lichtwarck-Aschoff A, Schoneveld EA, Granic I. In-game play behaviours during an applied video game for anxiety prevention predict successful intervention outcomes. J Psychopathol Behav Assess 2018; 40:655–668.
33. Schoneveld EA, Malmberg M, Lichtwarck-Aschoff A, et al. A neurofeedback video game (MindLight) to prevent anxiety in children: A randomized controlled trial. Comput Hum Behav 2016; 63:321–333.
34. Kazdin AE. Treatment outcomes, common factors, and continued neglect of mechanisms of change. Clin Psychol Sci Pract 2005; 12:184–188.
35. Wols A, Hollenstein T, Lichtwarck-Aschoff A, Granic I. Preregistration: The effect of expectations on experienced fun, mood, state-anxiety and in-game play behaviours while playing MindLight. 2019. https://osf.io/6gmwv (accessed April 21, 2021).
36. Biopac Systems Inc. Electrodermal response (EDR) with a MP system. 2007. www.biopac.com/Manuals/app_pdf/app187.pdf (accessed April 21, 2021).
37. Neurosky Inc. MindWave Headset (Version 1.1.28) [Apparatus and software]. Silicon Valley, California; 2011.
38. Price J, Budzynski T. Anxiety, EEG patterns, and neurofeedback. In: Budzynski T, Kogan Budzynski H, Evans JR, Abarbanel A, eds. *Introduction to Quantitative EEG and*

Neurofeedback: Advanced Theory and Applications. Amsterdam: Academic Press; 2009:453–470.
39. Feske U, Chambless DL. Cognitive behavioral versus exposure only treatment for social phobia: A meta-analysis. Behav Ther 1995; 26:695–720.
40. Bar-Haim Y. Research review: Attention bias modification (ABM): A novel treatment for anxiety disorders. J Child Psychol Psychiatry 2010; 51:859–870.
41. Bar-Haim Y, Morag I, Glickman S. Training anxious children to disengage attention from threat: A randomized controlled trial. J Child Psychol Psychiatry 2011; 52:861–869.
42. Wijnhoven LA, Creemers DH, Engels RC, Granic I. The effect of the video game Mindlight on anxiety symptoms in children with an Autism Spectrum Disorder. BMC Psychiatry 2015; 15:1–9.
43. Wijnhoven LA, Creemers DH, Vermulst AA, et al. Effects of the video game 'Mindlight' on anxiety of children with an autism spectrum disorder: A randomized controlled trial. J Behav Ther Exp Psychiatry 2020; 68:101548.
44. Bradley MM, Lang PJ. Measuring emotion: The self-assessment manikin and the semantic differential. J Behav Ther Exp Psychiatry 1994; 25:49–59.
45. Noldus Information Technology. The Observer XT (Version 11.5) [Computer software]. Wageningen, The Netherlands; 2013.
46. Spielberger C. *State-Trait Anxiety Inventory: Bibliography* (2nd ed.). Palo Alto, CA: Consulting Psychologists Press; 1989.
47. Spielberger C, Gorsuch R, Lushene R, et al. *Manual for the State-Trait Anxiety Inventory*. Palo Alto, CA: Consulting Psychologists Press; 1983.
48. Biopac Systems Inc., AcqKnowledge (Version 4.2) [Computer software]. Canada; 2011.
49. Boucsein W. *Electrodermal Activity*. Springer Science & Business Media; New York, NY: 2012.
50. Eastabrook JM, Lanteigne DM, Hollenstein T. Decoupling between physiological, self-reported, and expressed emotional responses in alexithymia. Personal Individ Diff 2013; 55:978–982.
51. McConnaughy EA, Prochaska JO, Velicer WF. Stages of change in psychotherapy: Measurement and sample profiles. Psychotherapy 1983; 20:368–375.
52. Beck AT, Epstein N, Brown G, Steer RA. An inventory for measuring clinical anxiety: Psychometric properties. J Consult Clin Psychol 1988; 56:893–897.
53. Beck AT, Steer RA. *Manual for the Beck Anxiety Inventory*. San Antonio, TX: Psychological Corporation; 1993.
54. IBM Corp. *IBM SPSS Statistics for Windows* (Version 25). Armonk, NY: IBM Corp; 2017.
55. Poppelaars M, Wols A, Lichtwarck-Aschoff A, Granic I. Explicit mental health messaging promotes serious video game selection in youth with elevated mental health symptoms. Front Psychol 2018; 9:1837.
56. Zhou L, Wei H, Zhang H, et al. The influence of expectancy level and personal characteristics on placebo effects: Psychological underpinnings. Front Psychiatry 2019; 10:20.
57. De Haan AM, Boon AE, de Jong JT, et al. A meta-analytic review on treatment dropout in child and adolescent outpatient mental health care. Clin Psychol Rev 2013; 33:698–711.
58. Lantyer AdS, Viana MdB, Padovani RdC. Biofeedback in the treatment of stress and anxiety-related disorders: A critical review. Psico-USF 2013; 18:131–140.
59. Schoenberg PL, David AS. Biofeedback for psychiatric disorders: A systematic review. Appl Psychophysiol Biofeedback 2014; 39:109–135.
60. Weerdmeester J, van Rooij MM, Engels RC, Granic I. An integrative model for the effectiveness of biofeedback interventions for anxiety regulation. J Med Internet Res 2020; 22:e14958.
61. Farrer LM, Gulliver A, Bennett K, et al. Demographic and psychosocial predictors of major depression and generalised anxiety disorder in Australian university students. BMC Psychiatry 2016; 16:241.
62. Stallman HM. Psychological distress in university students: A comparison with general population data. Aust Psychol 2010; 45:249–257.
63. Storrie K, Ahern K, Tuckett A. A systematic review: Students with mental health problems—A growing problem. Int J Nurs Pract 2010; 16:1–6.

Address correspondence to:
Aniek Wols, MSc
Behavioural Science Institute
Radboud University
P.O. BOX 9104
Nijmegen 6500 HE
The Netherlands

E-mail: a.wols@psych.ru.nl