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Letter to the Editor

Therapy based on avatar-therapist synergy for patients with chronic auditory hallucinations: A pilot study

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Dear Editors,

Chronic auditory hallucinations constitute a significant clinical problem and negatively affect the quality of the patients' life. The limited effectiveness of pharmacological treatment has led to developing new therapeutic approaches. There is growing interest in psychological therapies, in particular CBTp (cognitive-behavioral therapy) for the treatment of positive symptoms of schizophrenia (Kreyenbuhl et al., 2009). Recently, computer-aided therapy using avatars has been proposed (Leff et al., 2013, 2014) and verified in a large, randomized controlled trial (Craig et al., 2018). Researchers have also reported analyses of case studies (Dellazizzo et al., 2018) and analysis of the phenomenon of avatar therapy (Fernández-Caballero et al., 2017).

In the AVATAR study (Craig et al., 2018), the patient sat in front of an on-screen avatar, adjusted to resemble the patient's hallucination. The therapist was located in another room and spoke to the patient via a speaker using the natural voice or via the animated avatar, using the converted voice to resemble the auditory hallucination. In the study with 150 patients the authors showed a reduction in the PSYRATS-AH total score after 12 weeks of AVATAR therapy compared to the control group (mean difference: −3.82, SE 1.47).

In this work we would like to present a pilot study on a modified approach: we placed the therapist in the same office with the patient. Since patients during therapy experienced anxiety and a sense of helplessness (Leff et al., 2014), we decided that the therapist would accompany the patient and act in synergy with the avatar. In creating our therapeutic program, we followed the cognitive concept of auditory hallucinations (Chadwick and Birchwood, 1994) and used the cognitive-behavioral therapy based on dialogue with "voices".

We conducted this study at the Institute of Psychiatry and Neurology in Warsaw in 2017 and 2018, having obtained prior approval of the Ethics Committee. We accepted 23 patients with the age ranging from 22 to 50 years (mean 33.2 years, SD=7.3), suffering chronically from auditory hallucinations (mean duration 9.8 years, SD=7.3) and having undergone long-lasting psychiatric treatment (on average 11.2 years, SD=6.8). 87% of the patients were diagnosed with paranoid schizophrenia (ICD-10: F20.0). Detailed characteristics is shown in Table 2.

Having signed an informed consent form, each patient took part in eight therapeutic sessions, out of which six involved the use of the avatar (see the therapy scheme in Table 3). During the therapy, we limited the impact of pharmacotherapy by maintaining the drugs used and their dosage (for 17 patients the pharmacological treatment remained the same, for six patients minor changes were applied). The majority of patients were treated with politherapy using first- and second-generation antipsychotics, such as zuclopenthixolum (daily dose range 10–30 mg), olanzapinum (daily dose 20 mg) or quetiapinum (daily dose range 250–800 mg).

Contrary to the Leff et al. study, the patient sat in the same office with the therapist and the on-screen avatar. The avatar used an animated head with synthetic voice (Sorokosz et al., 2017). No voice conversion nor face modification were applied. During the initial sessions, the avatar's utterances were a reflection of the content of the "voices" heard. In the subsequent sessions, they also contained messages that would help the patients in opposing the "voices".

The patient watched the animations and interacted with the avatar by taking part in the dialogue (Fig. 1). The therapist also conversed with the patient, and, in addition, controlled the avatar, by playing the animations at arbitrary moments. Therefore, the therapist and the avatar acted in synergy, complementing each other and influencing jointly the patient. As the therapist sat close to the patient, s/he assisted the patient during the interactions, supporting them when needed.

The subject of our study was to verify the effectiveness of the proposed short-term therapy based on a synergy between the therapist and the avatar. We conducted the effectiveness test based on the PSYRATS scale (Haddock et al., 1999) and the VPDS questionnaire (Ratcliff et al., 2011), referring to the baseline results obtained prior to the therapy (control point T0). We tested the efficacy immediately after the therapy (T1) and the persistence of the effect three months later (TK).

The study results were statistically analyzed using SAS/STAT v.14.1. We calculated the descriptive statistics, such as means, SDs, medians and 95% confidence intervals (CI). The normality tests were run using the Shapiro-Wilk test. For homogeneity tests between the study and the control group, we used the T-test if the distributions of the parameters were normal, or the Wilcoxon Rank Sum test if otherwise. When analyzing the whole group in a longitudinal study, we used the Wilcoxon Signed Rank test. We assumed the significance level of 0.05.

Initially, we randomly divided the patients into two groups: the tested group (N=13) and the control group (N=10) – see Table 2 for their characteristics. The tested group was exposed to the avatar therapy, while the control group was not. Using the Wilcoxon Signed Rank test we observed statistically significant ($p < 0.05$) improvements in the tested group vs. the control group for PSYRATS-AH-Controllability, PSYRATS-AH-Frequency, VPDS-Power and VPDS-Superiority (mean differences: −1.15, −1.70, −1.31, and −1.16, respectively).

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Table 1
Summary of study results for control points T0, T1 and TK (SD in brackets). MD – Mean Difference, CI – Confidence Interval.

				T1-T0 difference (avatar therapy)			TK-T1 difference (follow-up)		
	T0	T1	TK	MD	95% CI	*p* value	MD	95% CI	*p* value
PSYRATS-Total									
PSYRATS-Total	35.65 (10.42)	22.70 (11.91)	18.83 (11.58)	−12.96	−16.84 to −9.08	<0.0001	−3.87	−7.10 to −0.64	0.0219
PSYRATS-AH (Auditory hallucinations subscale)									
PSYRATS-AH-Total	28.39 (5.92)	17.83 (8.12)	15.09 (8.35)	−10.57	−13.16 to −7.97	<0.0001	−2.74	−4.68 to −0.80	0.0131
Frequency	2.83 (1.15)	1.87 (1.06)	1.78 (0.85)	−1.04	−1.34 to −0.58	0.0001	0.09	−0.36 to 0.19	0.7656
Duration	2.70 (1.11)	1.96 (1.19)	1.78 (0.90)	−0.74	−1.09 to −0.39	0.0005	−0.17	−0.65 to 0.30	0.4409
Perceived location	1.87 (1.14)	1.74 (1.32)	1.78 (1.35)	−0.13	−0.41 to 0.15	0.5625	0.04	−0.37 to 0.46	1.0000
Loudness	2.09 (0.79)	1.70 (0.93)	1.39 (0.72)	−0.39	−0.76 to −0.03	0.0742	−0.30	−0.70 to 0.09	0.2212
Beliefs about origin of voices	2.26 (1.21)	1.04 (0.56)	1.22 (0.85)	−1.22	−1.72 to −0.71	0.0002	0.17	−0.12 to 0.47	0.5000
Amount of negative content	3.22 (0.90)	2.17 (1.64)	1.52 (1.53)	−1.04	−1.65 to −0.43	0.0028	−0.65	−1.21 to −0.09	0.0359
Degree of negative content	2.74 (1.21)	1.52 (1.44)	1.33 (1.22)	−1.22	−1.69 to −0.74	0.0001	−0.39	−0.69 to −0.10	0.0313
Amount of distress	2.83 (1.30)	1.70 (1.46)	0.96 (1.33)	−1.13	−1.73 to −0.54	0.0016	−0.74	−1.28 to −0.20	0.0156
Intensity of distress	2.52 (1.20)	1.39 (1.08)	0.78 (1.03)	−1.13	−1.54 to −0.72	<0.0001	−0.61	−0.99 to −0.22	0.0078
Disruption to life	2.09 (0.95)	1.09 (1.00)	0.96 (0.98)	−1.00	−1.33 to −0.67	<0.0001	−0.13	−0.46 to 0.20	0.6133
Controllability	3.26 (0.92)	1.65 (1.11)	1.78 (1.41)	−1.61	−2.13 to −1.09	<0.0001	0.13	−0.34 to 0.60	0.6715
PSYRATS-D (Delusions subscale)									
PSYRATS-D-Total	7.26 (7.07)	4.87 (6.15)	3.74 (4.85)	−2.39	−4.24 to −0.54	0.0173	−1.13	−3.05 to 0.79	0.2891
Frequency	1.13 (1.25)	0.78 (1.00)	0.61 (0.78)	−0.35	−0.73 to 0.03	0.1250	−0.17	−0.49 to 0.14	0.5313
Duration	1.26 (1.21)	0.83 (1.11)	0.74 (1.01)	−0.43	−0.84 to −0.03	0.0625	−0.09	−0.47 to 0.30	0.8125
Conviction	1.52 (1.47)	0.83 (1.19)	0.74 (1.10)	−0.70	−1.09 to −0.30	0.0039	−0.09	−0.56 to 0.39	0.8281
Amount of distress	1.26 (1.42)	0.91 (1.20)	0.65 (1.03)	−0.35	−0.71 to 0.01	0.1172	−0.26	−0.71 to 0.19	0.3125
Intensity of distress	1.09 (1.28)	0.91 (1.16)	0.57 (0.84)	−0.17	−0.61 to 0.26	0.5156	−0.35	−0.73 to 0.03	0.1250
Disruption to life	1.00 (1.13)	0.61 (0.99)	0.43 (0.79)	−0.39	−0.76 to −0.03	0.0625	−0.17	−0.49 to 0.14	0.5313
VPDS (Voice Power Differential Scale)									
VPDS-Total	26.39 (5.64)	19.22 (5.06)	18.61 (5.64)	−7.17	−9.59 to −4.76	<0.0001	−0.61	−2.05 to 0.84	0.4380
Power	3.74 (1.01)	2.48 (0.99)	2.35 (1.03)	−1.26	−1.77 to −0.75	0.0002	−0.13	−0.49 to 0.22	0.5127
Strength	3.96 (0.77)	2.70 (1.06)	2.48 (1.08)	−1.26	−1.79 to −0.73	0.0003	−0.22	−0.63 to 0.19	0.4219
Confidence	3.65 (1.11)	2.57 (0.99)	2.65 (1.07)	−1.09	−1.56 to −0.61	0.0004	0.09	−0.26 to 0.43	0.8750
Respect	3.61 (0.84)	2.87 (0.92)	2.91 (1.04)	−0.74	−1.20 to −0.27	0.0072	0.04	−0.36 to 0.44	1.0000
Harmfulness	4.26 (0.62)	3.30 (1.06)	3.09 (1.20)	−0.96	−1.43 to −0.49	0.0010	−0.22	−0.54 to 0.11	0.3594
Superiority	3.91 (0.95)	2.78 (0.85)	2.52 (0.99)	−1.13	−1.56 to −0.70	<0.0001	−0.26	−0.59 to 0.07	0.1719
Knowledge	3.26 (1.45)	2.35 (1.23)	2.26 (1.18)	−0.91	−1.54 to −0.29	0.0103	−0.09	−0.53 to 0.36	0.5352

Next, the control group also underwent the avatar therapy, therefore the subsequent analyses are presented for all participants (N=23) in a longitudinal way. For the PSYRATS auditory hallucinations (PSYRATS-AH) subscale, at the T1 point, we observed a statistically significant improvement – mean difference −10.57, 95% CI −13.16 to −7.97; $p < 0.0001$ (Table 1). A statistically significant decrease in scores was observed also in the majority of PSYRATS-AH items: frequency, duration, beliefs about the origin of the voices, number and level of negative content, distress and, especially clearly (mean difference −1.61, 95% CI −2.13 to −1.09; $p < 0.0001$), the feeling of being under the control of the voices (controllability). At the follow-up control point TK, PSYRATS-AH score decreased even further,

which suggests a further post-therapy improvement. The improvements in PSYRATS delusion (PSYRATS-D) subscale were only minor or statistically insignificant.

As for the VPDS scale, the results indicated a statistically significant score decrease at T1 for all VPDS items, with the highest change observed for power, strength and superiority.

In contrast to previous studies showing computer-based therapies for people with chronic auditory hallucinations, we placed the therapist next to the avatar in the same office. Such a constant therapist presence with the patient increased the sense of safety in patients, and the dialogue with the avatar was fully controlled by the therapist. The patients were very positive about the therapist's presence during interaction with the avatar – in a follow-up questionnaire they all agreed it was important for them. We think that the improvements in the majority of the PSYRATS auditory hallucination subscale scores and in the VPDS scores could have been caused by the synergy effect of the therapist and the avatar.

The lower PSYRATS-AH and VPDS scores were also confirmed three months after the end of the therapy, which indicated the durability of the effect. It is noteworthy that the participating patients belonged to the heavily burdened and dominated group, and the majority had experienced hallucinations for about 10 years, despite the fact that most of them had been treated with many medications, including antipsychotics, antidepressants, benzodiazepines and GABAergic drugs. The proposed therapeutic program, however, did not turn out to be effective in relation to delusional experiences assessed using the PSYRATS-D subscale, which further underlines its specificity related to the experience of hallucinatory voices.

Small sample, lack of "no-synergy" control group, lack of PANSS evaluation and lack of blinded PSYRATS assessment are the limitations of this study. Nevertheless we believe that these preliminary findings will foster further research on therapeutic methods for schizophrenic patients based on therapist-computer synergy.

Authors contribution

Dr. Stefaniak designed the study, wrote the protocol and conducted the therapeutic sessions. Prof. Wciórka proposed the methodology of the study. Dr. Janicki with Mr. Sorokosz elaborated the concept of the talking head, generated animations and avatar dialogs. Dr. Stefaniak and Dr. Janicki undertook the statistical analysis. All authors contributed to and have approved the final manuscript.

Supplementary data to this article (Fig. 1, Table 2 and Table 3) can be found online at https://doi.org/10.1016/j.schres.2019.05.036.

Declaration of competing interest

The authors have no conflicts of interest to declare in relation to this work.

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