Conversational Agents to Provide Couple Therapy for Patients with PTSD

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ABSTRACT
Conversational agents (CAs) like Amazon Alexa can potentially enable a new way to deliver therapy to patients with serious mental illnesses. Specifically, they can be used to provide support for real-time family therapy and interventions in a scalable way. However, this requires significant changes in traditional therapeutic content since interaction with CAs is fundamentally different than reading or using eHealth applications. In this work, we aim to identify challenges in adapting a clinically validated therapy for Post-Traumatic Stress Disorder (PTSD) to conversational agents. Specifically, we describe our initial design and development process to use Amazon Alexa to deliver Cognitive-Behavioral Conjoint Therapy (CBCT) for PTSD. Our initial design process resulted in an interaction model that emphasizes short dialogues and interactivity. This design process and interaction model can potentially be useful for future studies focusing on using conversational agents for therapeutic content delivery.

Author Keywords
Conversation Voice Agents; Mental Health; PTSD; HCI; CSCW.

ACM Classification Keywords
H.5.m. Information interfaces and presentation (e.g., HCI): Miscellaneous.

INTRODUCTION
Post-Traumatic Stress Disorder (PTSD) results from traumatic events and is associated with serious well-being issues, personal challenges, and productivity loss [12]. Approximately 6.8% of adults in the United States suffer from PTSD resulting in a serious public health issue [11]. Despite the advancements in evidence-based PTSD treatments, their availability has been limited and a significant fraction of patients with PTSD do not receive appropriate mental health care.

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Logistical concerns such as cost, cultural and social embarrassment, and individual biases towards treatment can contribute to low adherence to PTSD treatment. Moreover, the resources for mental health support such as professional therapists have not been sufficient to meet on-demand needs of the population [10]. As such, mental health researchers are seeking cost-effective and on demand therapeutic practices that would promote illness tracking, evidence-based and personalized treatments, and family support within the household.

Recently, a number of studies used alternative approaches for population-level interventions focusing on mental health issues. Technological inventions such as mobile apps [16,19], web-based interventions [19], and conversational agents and bots [9] have been used for illness tracking and prevent onset relapses. Such technologies have extended clinician support to the everyday life of patients, enabling treatment using less resources. PTSD Coach [12], for example, is a mobile application that has implemented daily support system, psycho-education, and coaching to for patients with PTSD. While participants found the app to be useful, its effect on reducing symptoms were not significant [12].

Intimacy problems and negative interpersonal relationships are strongly associated with PTSD symptoms [18]. These issues can also hinder recovery process in PTSD [22]. As such, recent therapeutic practices have focused on improving interpersonal relationship issues through family therapy. For example, Cognitive-Behavioral Conjoint Therapy (CBCT) for PTSD [17] — a form of couple therapy — focuses on improving intimate relationship. CBCT has been shown to decrease PTSD symptom severity in patients as well as improving relationship functioning [14,17,21]. However, the wide dissemination of CBCT is limited by a number of logistical issues including multiple clinical visits, long therapy sessions, and requirement of specialized training.

To address these issues, we propose to use conversational agents in home environment for delivering CBCT steps. Specifically, we aim to use Amazon Alexa for interactive, real-time, and personalized delivery of CBCT for patients with PTSD. We believe that the focus of Amazon Alexa ecosystem on home environment makes it particularly useful in this context. Indeed, the private and intimate nature of

household environment provides a good opportunity for personalized and intimate therapeutic practices focusing on couple therapy. Furthermore, the use of Amazon Alexa potentially enables large scale dissemination of CBCT treatment steps of PTSD.

However, current clinical implementation of CBCT mostly relies on paper-and-pen based methods. As such, adapting these steps to Amazon Alexa requires careful design since the successful use of CAs requires a fundamentally different interaction model. In this paper, we will describe our initial design and development process to adapt traditional clinical therapy like CBCT in Amazon Alexa. Specifically, we will focus on designing an Alexa Skill [3] to support out-of-session exercises in CBCT that aim to improve intimate relationship between partners with PTSD.

Cognitive-Behavioral Conjoint Therapy (CBCT)

CBCT is a form of couple therapy. It employs therapeutic practices that would improve couple's relationship functioning and decreases PTSD symptoms. In CBCT, the relationship is considered as the "patient" instead of differentiating partners as a caregiver and a patient. The structure of CBCT consists of three major phases [17]:

1. Promoting positive behavior in the couple.
2. Enhancing communication to increase satisfaction and supporting trauma-focused cognitive interventions.
3. Modifying emotional sharing behavior.

All three phases of CBCT require training in face-to-face therapy sessions. The couple are also given out-of-session assignments to practice the skills outside of therapy sessions and on an everyday basis. These out-of-session practices are intended for continuous practice on specific skills, such as developing positive interactions between partners.

Out of Session Assignments for PTSD

CBCT contains two major components: psychoeducation and out-of-session assignments [17]. Psychoeducation focuses on learning and understanding the relationship between PTSD and interpersonal relationship. The assignments are used to practice skills that would lead to emotional support and better communication required for improving interpersonal relationship. For example, the out-of-session assignment "You've been Caught Doing Something Nice" is one that has been designed to increase relationship satisfaction by focusing on the positive aspects of the relationship [17]. This assignment is similar to recording a diary. Each partner is asked to notice whenever the other does something nice for them and record the act in a daily diary. Each partner should then comment on the nice act to provide feedback. The diary is shared and open to both partners at all times in order for them to exchange positivity in their relationship. Figure 1 shows such an out-of-session assignment handout used by clinicians and patients. As noted before, the current clinical practices for CBCT use paper-and-pen based methods. However, this creates challenges for longitudinal and large-scale dissemination of treatment steps.

In this article, we aim to implement this out-of-session assignment as an Alexa application. This proof-of-concept allows us to identify the opportunities and challenges in disseminating CBCT steps through CAs. Specifically, Alexa can act as a mediator between the couple to set daily reminders for them to fill in the diary and record the acts and their feedbacks. This could then be used as a systematic data collection strategy for self-monitoring, receiving constructive feedback, and having access to all the past records. In addition, the therapist would have live access to the collected data before the couple's next therapy session.

Deploying Alexa for this assignment requires an initial understanding of how Alexa applications are designed and developed. Taking a User Centered Design (UCD) approach [6,7] we pursue a scenario-based design in which the conversations between Alexa and each of the partners are constructed and adapted for Alexa. Next section will provide a general overview of how Alexa applications are designed and developed. Consequently, we will step into the adaptation processes that translate the CBCT assignment into an Alexa application.

HANDOUT 1.6

Out-of-Session Assignments

Session 1. Introduction to Treatment

1. Review the *Cycle of PTSD Symptoms and Recovery from Trauma* (*Handout 1.2*) together prior to the next session.
2. Read the *Trauma and Relationships* (*Handout 1.4*) together at least once prior to the next session.
3. Each of you should complete the *Trauma Impact Questions–I* (*Handout 1.5*).
4. Each day, catch your partner doing something nice, and let him or her know that you have noticed this positive attitude and/or behavior. Place this form in an obvious place for the two of you and record on the form what you have noticed **each day.** Bring this form with you to the next session.

Next appointment: _____ @ _____.

YOU'VE BEEN CAUGHT DOING SOMETHING NICE

Week of: _____

	Person Caught:	*Person Caught:*
Sunday		
Monday		
Tuesday		
Wednesday		
Thursday		
Friday		
Saturday		

Figure 1: CBCT out-of-session assignment handout for "You've been Caught Doing Something Nice".

AMAZON ALEXA: HOW IT WORKS

Amazon Alexa is an example of existing CAs that are used for everyday household use. Amazon has provided an API to develop applications and use them for personal or public

use. A developer can use this API to perform customized tasks in Alexa. These applications are called "Skills". These Skills enable a novel way to collect data and provide customized intervention through Alexa ecosystem. A user can then access the Alexa API and ask for requests that are supported by the Skill through "Intents". Intents are actions that fulfill users' spoken requests [3]. Intents structure the interaction dialogues. The dialogue models specify the steps for multi-turn conversations between an Alexa Skill and a user. These multi-turn conversations can be used to collect information required to complete a given Intent.

Developing an interaction model would not only specify the dialogue between Alexa and the user but would identify the Skill's structure and decision processes. In the case of "Have you caught her/him doing something nice?", we would want to design a Skill that acts like a shared diary for the couple to add records of nice acts they have noticed from one another. The diary will record the input information, so it could be accessed by either user and then can be shared in clinical sessions later. This interaction scenario must adhere to interaction models supported by Alexa. Specifically, it is important to make sure that interactions are short, easy to follow, and engaging. It is also important to make sure that the implementation can handle diverse commands since voice interactions tend to be more flexible than eHealth applications (e.g., users can say 'no', 'cancel', 'stop' or provide no response at all to cancel an ongoing activity).

Toward the implementation of our interaction model, we developed a flow chart of the interactions that include user commands, Alexa's responses, and the interactions between the two. This would help clarifying user intents, Alexa's capabilities in responding to the intents, and then designing a response that would be appropriate for the user's intent. After finalizing the step by step interaction between the user and Alexa, the model can then be computationally coded as a Skill and deployed at a scale.

IDEATION

To implement the out-of-session assignment in Alexa, we started off by developing methods to design hypothetical conversations between a couple and Alexa when interacting with the Skill. Our user centered approach requires an iterative design process, design interactions and scenarios, implementation of a Skill using Alexa ecosystem, evaluating the Skill, and re-appropriating the interaction scenario for next design iteration. In this paper, we will focus on the first stage — designing an interaction models that translates the "You Have Been Caught Doing Something Nice" out-of-session assignment into an Alexa Skill.

Adapting CBCT

In adapting the out-of-session practice of "You have been Caught Doing Something Nice" we constructed a network of Intents that would identify user requests as shown in Figure 2. Throughout the development phase, we will focus on smart and dynamic handling of conversations so that we can adapt to different user-initiated scenarios and contexts ("branching"), and system generated content and messages grounded in clinical evidence-based approaches. We will also ensure that the conversational agents are personalized reflecting individuals' needs.

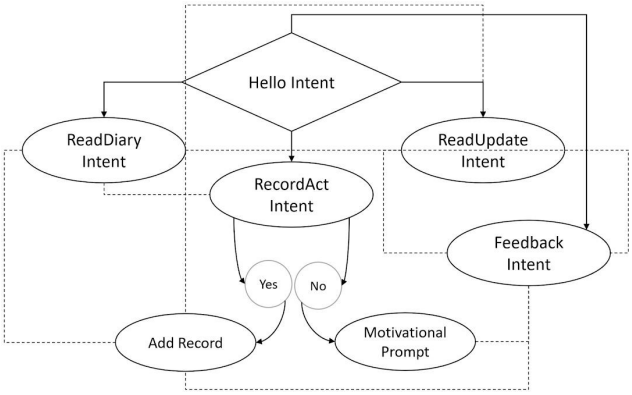

Figure 2: Intent network flow chart. The dashed lines indicate a flow between intents.

Developing an Interaction Model

The interaction model starts off with defining Intents for the Alexa Skill. We have defined four major interaction Intents as follow:

- Recording events
- Reading updates (if an act has been recorded previously and the user wants to hear it)
- Going back to the diary history
- Receiving or providing feedback

By outlining the Intents, the interaction model between the users and Alexa could be better developed in detail. In Figure 2 we demonstrated a general overview of a possible Intent network: the flow indicates what a user would ask to access different functionalities of the skill. While this overview does not contain the detailed conversation scenario, it is essential in structuring the commands and responses between the users and Alexa. This is what we define as branching. The flowchart is then branched out towards detailed conversations between Alexa and the users based on requests, context, and feedbacks. Figure 3 is an example of branch that contains a conversation between a partner and Alexa for adding a record to the diary.

One of the major challenges in developing conversations with CAs is identifying the most appropriate responses to the user's requests and commands. Using CAs for interventions require a different interaction model compared to eHealth or mHealth systems. This is due to the fact that text-based communication is fundamentally different from voice-based interactions. Interactions with CAs should be short and direct in order to clearly request user information within the context of a conversation. Providing options when asking for information (limiting the options to three at a time) is also essential for a more effective interaction [4]. It is also necessary to ensure consistent mental models for interactions and learning from errors through feedback loops [8]. To achieve these goals, we have designed hypothetical scripts and scenarios to develop a conversational flow that incorporates brief turn-taking between the user and Alexa. The flow specifically focuses on natural interactions (how people talk versus how people read) in developing Alexa's responses. We believe this design process of identifying Intents and developing an interaction model from traditional therapeutic content is necessary for effective use of CAs in mental health support.

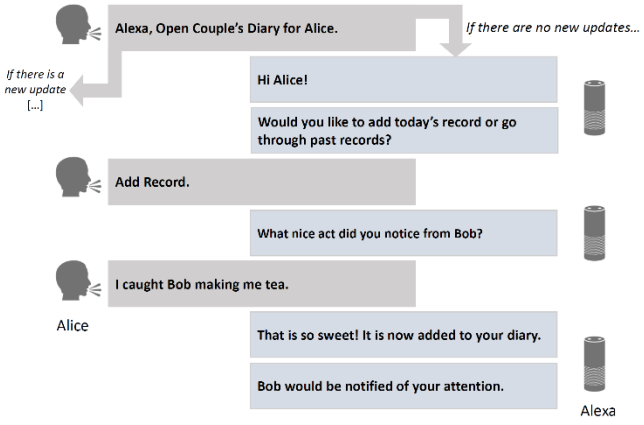

Figure 3: Sample conversation branch for the Record Intent. Short and directed conversations with explicit options are essential for successful interaction models.

FUTURE STEPS

In this pilot work, we have focused on adapting an out-of-session CBCT assignment for Amazon Alexa. For this, we have identified the required set of Intents and a dialogue model supporting different user interactions. Our next step involves implementing these Intents and interaction model in Amazon Alexa ecosystem. We then plan to conduct a pilot study to understand the acceptability and usability of our developed system. We will also focus on addressing privacy concerns of patients in using our system. Amazon Alexa is a commercialized platform. It is crucial to account for transparency and privacy concerns with such technologies. Based on future studies and evaluations, we will make necessary updates in our system and deploy it to patients with PTSD for assessing its efficacy in reducing symptoms and improving interpersonal relationship.

CONCLUSION

In this paper, we described a design method for developing an interaction model for an out-of-session assignment in CBCT that could be later implemented as an Alexa Skill. Our scenario-based approach was described in three steps:
1. Intents 2. Interaction flow, and 3. Interaction model (detailed conversation script) as shown in Figure 2 and 3. Our design process resulted in a detailed conversational flow that emphasized short and interactive dialogue with users. We think this design process and the resultant interaction model could be used by future studies focusing on adapting traditional therapeutic content to conversational agents.

REFERENCES

1. Anders, G. (2017, August 14). Amazon's Alexa is a bet that in the future we will be talking to our computers. Retrieved from https://www.technologyreview.com/s/608571/alex a-understand-me/
2. Anderson, M. (2015). Technology device ownership: 2015. Pew Research Center. Retrieved from http://www.pewinternet.org/2015/10/29/ technology-device-ownership-2015
3. Amazon Developer. (n.d.). Build Skills with the Alexa Skills Kit. Retrieved from https://developer.amazon.com/docs/ask-overviews/build-skills-with-the-alexa-skills-kit.html
4. Amazon Developer. (n.d.). How Alexa Responds. Retrieved from https://developer.amazon.com/designing-for-voice/what-alexa-says/#prompt-with-guidance-for-the-user
5. Brunette, M. F., Rotondi, A. J., Ben-Zeev, D., Gottlieb, J. D., Mueser, K. T., Robinson, D. G., ... & Meyer-Kalos, P. (2016). Coordinated technology-delivered treatment to prevent rehospitalization in schizophrenia: a novel model of care.
6. Choe, E. K., Consolvo, S., Jung, J., Harrison, B., Patel, S. N., & Kientz, J. A. (2012, September). Investigating receptiveness to sensing and inference in the home using sensor proxies. In *Proceedings of the 2012 ACM Conference on Ubiquitous Computing* (pp. 61-70). ACM.
7. Dabbs, A. D. V., Myers, B. A., Mc Curry, K. R., Dunbar-Jacob, J., Hawkins, R. P., Begey, A., & Dew, M. A. (2009). User-centered design and interactive health technologies for patients. *Computers, informatics, nursing: CIN*, *27*(3), 175.
8. Frank E. Ritter, Gordon D. Baxter, and Elizabeth F. Churchill. 2014. Foundations for Designing User-Centered Systems What System Designers Need to Know about People, *Springer*.
9. Fitzpatrick, K. K., Darcy, A., & Vierhile, M. (2017).

Delivering cognitive behavior therapy to young adults with symptoms of depression and anxiety using a fully automated conversational agent (Woebot): a randomized controlled trial. *JMIR mental health*, 4(2).

10. Kazdin, A. E., & Rabbitt, S. M. (2013). Novel models for delivering mental health services and reducing the burdens of mental illness. *Clinical Psychological Science*, *1*(2), 170-191.
11. Kessler, R. C., Berglund, P., Demler, O., Jin, R., Merikangas, K. R., & Walters, E. E. (2005). Lifetime prevalence and age-of-onset distributions of DSM-IV disorders in the National Comorbidity Survey Replication. *Archives of general psychiatry*, *62*(6), 593-602.
12. Kuhn, E., Kanuri, N., Hoffman, J. E., Garvert, D. W., Ruzek, J. I., & Taylor, C. B. (2017). A randomized controlled trial of a smartphone app for posttraumatic stress disorder symptoms. *Journal of consulting and clinical psychology*, *85*(3), 267.
13. Ma, M., Skubic, M., Ai, K., & Hubbard, J. (2017, July). Angel-Echo: A Personalized Health Care Application. In *Connected Health: Applications, Systems and Engineering Technologies (CHASE), 2017 IEEE/ACM International Conference on* (pp. 258-259). IEEE.
14. Macdonald, A., Pukay-Martin, N. D., Wagner, A. C., Fredman, S. J., & Monson, C. M. (2016). Cognitive–behavioral conjoint therapy for PTSD improves various PTSD symptoms and trauma-related cognitions: Results from a randomized controlled trial. Journal of Family Psychology, 30(1), 157.
15. McCurdie, T., Taneva, S., Casselman, M., Yeung, M., McDaniel, C., Ho, W., & Cafazzo, J. (2012). mHealth consumer apps: the case for user-centered design. *Biomedical instrumentation & technology*, *46*(s2), 49-56.
16. Mohr, D. C., Tomasino, K. N., Lattie, E. G., Palac, H. L., Kwasny, M. J., Weingardt, K., ... & Caccamo, L. (2017). IntelliCare: An eclectic, skills-based app suite for the treatment of depression and anxiety. *Journal of medical Internet research*, *19*(1).
17. Monson, Candice M., et al. "Effect of cognitive-behavioral couple therapy for PTSD: A randomized controlled trial." Jama 308.7 (2012): 700-709.
18. Price, M., Gros, D. F., Strachan, M., Ruggiero, K. J., & Acierno, R. (2013). The role of social support in exposure therapy for Operation Iraqi Freedom/Operation Enduring Freedom veterans: A preliminary investigation. *Psychological Trauma: Theory, Research, Practice, and Policy*, 5(1), 93.
19. Schlosser, D., Campellone, T., Kim, D., Truong, B., Vergani, S., Ward, C., & Vinogradov, S. (2016). Feasibility of PRIME: a cognitive neuroscience-informed mobile app intervention to enhance motivated behavior and improve quality of life in recent onset schizophrenia. *JMIR research protocols*, *5*(2).
20. Schwartz, S. W. (2009). Adolescent mental health in the United States: Facts for policymakers. *Retrieved March*, *27*, 2015.
21. Shnaider, P., Pukay-Martin, N. D., Fredman, S. J., Macdonald, A., & Monson, C. M. (2014). Effects of cognitive–behavioral conjoint therapy for PTSD on partners' psychological functioning. *Journal of Traumatic Stress*, 27(2), 129-136.
22. Tarrier, N., Sommerfield, C., & Pilgrim, H. (1999). Relatives' expressed emotion (EE) and PTSD treatment outcome. Psychological Medicine, 29(4), 801-811.