



# What are you Grateful for? - Enhancing Gratitude Routines by Using Speech Assistants

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## ABSTRACT

This paper presents an extension for Amazon's Alexa, which provides a gratitude journal, and investigates its effectiveness compared to a regular paper-based version. Decades of research demonstrate that expressing gratitude has various psychological and physical benefits. At the same time, gratitude routines run the risk of being a hassle activity, which diminishes the positive outcome. Speech assistants might help to integrate gratitude routines more easily in an intuitive way using voice input. The results of our 8-day field study with two experimental groups (Alexa group vs. Paper group,  $N = 8$ ) show that users see the benefits, that Alexa was effective in reducing participants' stress and that both groups express their gratitude differently. The positive effect of Alexa was restricted by a security setting (limiting user input to eight seconds) imposed by Amazon, which has now been repealed. The findings give practical and theoretical implications of how verbal gratitude expression affects participants' well-being.

## CCS CONCEPTS

• Human-centered computing → Empirical studies in HCI.

## KEYWORDS

Gratitude Journal, Gratitude Routines, Alexa, Speech Assistant

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## 1 INTRODUCTION

Gratitude is a great gift, not only for social contacts, but for one's own well-being [2], [1]. It has been defined as a fundamental part for human beings to appreciate good things in their lives [23], have a higher relationship satisfaction [2] and better mental [6] and physical health [8]. However, gratitude does not come naturally and has to be trained for many people. The process of being more satisfied with yourself and your surroundings can be difficult. So-called gratitude routines can help to train feelings of gratitude. The idea

of gratitude routines is that one answers gratitude-related questions every day to improve the sense for gratitude and appreciation of positive thinking, life quality and well-being [17]. Long term studies [11], [19] found that practicing daily gratitude exercises increase the gratitude perception and therefore positive thinking. Gratitude interventions have hence been successfully used in clinical and therapy-related contexts for physical [10] and mental health (depression and anxiety [5]) and psychological well-being [6].

A popular way of using gratitude routines is a gratitude journal or diary. Such a journal basically consists of a few pre-made gratitude-related questions for each day. Questions like "What are you grateful for today?" are very beneficial [17] because the person needs to think about their life and needs to focus on their gratitude feelings. Seligman et al. also investigated the long term benefits of gratitude journals [17]. The participants had to write down three good things every day, write a gratitude letter to a kind person and they had to think about their strengths. Over time their happiness increased and their depressive symptoms decreased. The participants were so enthusiastic about those exercises, that they even continued to use them after the study was finished.

On the other hand, Wood et al. suggest that the use of gratitude related interventions can end up being a hassle activity that may rather increase stress than foster mental health [24]. People might be triggered by the pressure to fill in the diary daily or have problems integrating the exercise in their daily life. Especially when they have mental illness issues, this can have reverse effects.

One way to counteract this problem could be the use of conversational agents such as Amazon's Alexa. Research shows that speech driven assistants are useful in therapeutic purposes such as healthcare applications [12] and mental health topics [20]. For example, an app for Alexa was developed, which successfully reduced public speaking anxiety by introducing a tutor with whom you can communicate [22]. The assumption is therefore that the use of intelligent speech assistants could have an added value for therapeutic purposes and positive psychological interventions like gratitude routines. Speech-assistants can help integrating the gratitude expression into the daily-life in an intuitive way. Users could express their gratitude verbally during cooking or any routine activity and do not have to change their whole routines. Moreover, verbalizing gratitude out loud and expressing it in a social conversation (which is the case for Alexa due to the media equation theory [15], which claims that people tend to assign human characteristics to computer systems and treat them as real social actors) might have even more positive effects. In terms of accessibility, using speech assistants could help people, who are not able to read or write (e.g. due to aging, cognitive impairments or illiteracy). So far, no study



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investigated the difference of expressing gratitude out loud in conversations compared to the written version. But positive self-talk and speaking self-affirming statements out loud were already found to effectively reduce anxiety [18].

Accordingly, this research presents an implementation of a gratitude journal on Amazon's Alexa. The Alexa gratitude routine works just like the traditional journals, except that users express gratitude by voice communication instead of using a pen. A long-term field experiment was used to investigate if the speech assistant approach can have the same or even an better impact on the perception of well-being on people. We divided our participants in two groups: The first group used the gratitude journal with Amazon's Alexa while the second group used it with pen and paper. This study is intended to investigate whether gratitude interventions can work with a speech assistant and if it can reduce the problem of the hassle activity. We expect that using a gratitude diary with Alexa can be an exciting and efficient variant of gratitude routines, and that using a gratitude diary may offer advantages in perceived usefulness and even in the efficiency of the diary in comparison to the traditional pen and paper version.

## 2 TECHNICAL IMPLEMENTATION

We designed and implemented a custom extension for Alexa called *"My Gratitude Journal"* by using the Amazon Developer Console. The extension contains individual gratitude routines and questions, which are expressed by Alexa to be answered every day. Our interaction model is based on a simple question and answer system. To trigger this model, you need to say "Alexa, open the diary". Alexa then greets the user and asks whether to start with the diary entry. By saying yes, Alexa will start with the first question that needs to be answered e.g. "What are you grateful for today?". As soon as Alexa says: "Please give your answer now!" the users can give their speech input and thus their answer. After 3 to 4 questions the daily session is over and Alexa says goodbye. In order to have a large variety, the diary offers different questions every day which are partly adapted from Sansone et al. [16], but also self-constructed questions, which have a different thematic reference (such as holidays or family activities). When the user finishes their diary, the given answers will be sent to the Intent Handler provided by Amazon, called AWS Lambda. AWS Lambda is an event-driven, serverless computing platform [3], which will be triggered when the user completes a diary entry. In this case, the platform starts a storage instance event within milliseconds to save the user's input. This created instance is driven by our own written back-end code. The code is written in simple JavaScript and it basically handles the sending and receiving of the data to and from the database. Every user has an unique entry in this database and the data is encrypted according to the AES-256 standard. By saving the given answers, users can listen to them again later and in further development instances Alexa could react dynamically to these answers and adapt to them.

## 3 METHODS OF THE EVALUATION STUDY

To figure out the potential of the Alexa gratitude journal compared to the physical and common way of using a diary, we conducted an 8-days field study. Participants of this study were asked to use a

gratitude intervention (Alexa vs. pen and paper) in their own homes for 7 days each day and evaluated their psychological well-being and user experience with questionnaires constructed by the online tool Soscisurvey ([www.soscisurvey.de](http://www.soscisurvey.de)).

### 3.1 Sample

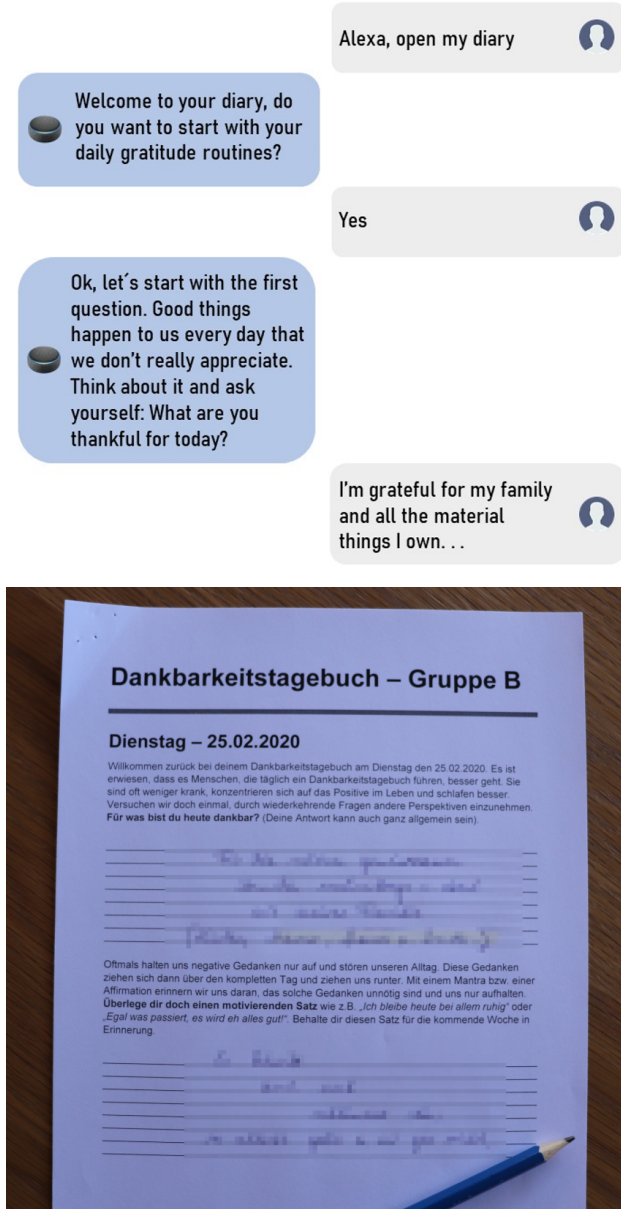
In total 8 people successfully participated in all parts of the study, 4 women and 4 men and the average age was 33 years ( $M = 33.00$ ,  $SD = 15.64$ ). Most participants had a higher education level ( $n = 6$ ), while two had an apprenticeship as the highest education degree. Three participants were employees, one was self employed, another one was in apprenticeship and the other three were students. The assignment of the participants to the groups was random and balanced (two men and women in Alexa group and two men and women in Paper group). The participants had no experience in speech assistants, diaries and gratitude routines. Only one participant had worked with a comparable speech assistant like Alexa.

### 3.2 Experimental conditions

The participants were divided into two groups: the Alexa group expressed the gratitude diary via voice commands to Amazon's Alexa and the paper group filled in the same diary, but with pen and paper. Figure 1 shows an example for a conversation flow with Alexa (top) and the booklet that was filled in by the paper group (bottom). Both diaries consisted of individual and always alternating questions for each day of the week (3-4 questions a day) and they were the same across the groups. The questions are provided with suggestions and examples to help users find their answer, such as the following question: *"Welcome to your gratitude diary. Today was the first day of a new, perhaps stressful and challenging week. Nevertheless, every day good things happen to us that we don't really appreciate or take for granted. Why don't you think about it for a second? What are you grateful for today? Did you get help from a colleague, or maybe just a compliment?"*.

### 3.3 Measures

The study builds on a mixed-measures approach, in order to get a broad overview of how the participants felt during the experiment and how they evaluate the gratitude journal. To investigate participants' psychological well-being, participants' emotional state and their perceived stress level got queried using questionnaires at three points of measurement (T1 = prior the intervention, T2 = during the intervention and T3 = after the intervention). The German version of the Positive and Negative Affect Schedule (PANAS) [4] is composed of 20 items, 10 of them represent a positive feeling (e.g. "active"), the other 10 represent a negative feeling (e.g. "nervous"). Participants rated their feelings on a 5-point scale. The Perceived Stress Questionnaire (PSQ) [9] consists of 20 items (e.g. "You are full of energy" and "You have a lot of work to do") and five sub-scales (Worries, Tension, Lack of Joy and Overload; 5 items each) which had to be rated on a 5-point scale. In addition, we investigated participants' user experience with the gratitude intervention by using measures stemming from the technology acceptance model and its extensions [7][21]. We used the origin TAM components [7] Intention to use (3 items; e.g. "I would like to have this method at home"), Perceived Usefulness (3 items; e.g. "I think that this method



**Figure 1: Data Input of Alexa group (top) and paper group (bottom)**

is useful for me") and Ease of Use (5 items; e.g. "I think I'll quickly learn how to use Alexa."). Due to the bad internal consistency of the sub-dimension Ease of Use, we did not integrate this scale into the final results. In addition, Enjoyment (5 items; e.g. "I find Alexa exciting") from TAM 3 [21] was used. All those questionnaires had to be rated on a 5-point scale and participants filled them in twice (T2 = during the intervention and T3 = after the intervention). See Table 1 for all values of the internal consistencies. Socio-demographic data such as age, gender and professional background, but also previous

	Cronbach's Alpha		
	T1	T2	T3
<b>PANAS - Positive Affect</b>	0.88	0.93	0.98
<b>PANAS - Negative Affect</b>	0.84	0.79	0.69
<b>PSQ - Worries</b>	0.87	0.86	0.91
<b>PSQ - Tension</b>	0.90	0.89	0.98
<b>PSQ - Lack of Joy</b>	0.87	0.75	0.90
<b>PSQ - Overload</b>	0.77	0.77	0.77
<b>Enjoyment</b>		0.79	<0.4
<b>Ease of Use</b>		<0.4	<0.4
<b>Intention to Use</b>		0.97	0.96
<b>Perceived Usefulness</b>		0.83	0.91

**Table 1: Values of the dependent measures internal consistency using Cronbach's Alpha**

experiences with diaries, gratitude routines and speech assistants were queried with self-constructed questions. To get deeper insights into participants' feelings during the usage, additional qualitative measures were used. Participants explained their experiences with the experiment during the usage ("What is your experience with using Alexa so far?"), advantages of the intervention ("What did you like about the gratitude journal?") as well as disadvantages and potential improvements ("What was not that good, what can be improved in order to have a better user experience?"). Moreover, participants' gratitude expressions itself got stored and analyzed with regard to length and communication style to enrich the above mentioned data with objective results.

### 3.4 Procedure

The field experiment was evaluated using online questionnaires. On day 1 of the study (before the gratitude diary usage), participants filled-in the first one, which introduced participants into the overall goal and procedure of the experiment, collected informed consent, queried socio-demographic data and the baseline of participants psychological well-being. After the first questionnaire, the experimenter introduced the gratitude intervention and the overall procedure of the field experiment to all participants in their homes. Especially in the Alexa condition, they ensured that participants are familiar with the general use of Alexa and that the technological infrastructure works sufficiently. All participants were asked to use the gratitude intervention daily, but were free to choose when and where. In case of (technical) problems the participants could reach out to the experimenter, however, this was not the case during the field experiment. In the middle of the test-trail (day 4) and at the end of the experiment (day 8) further questionnaires measured participants feelings and perceptions. Like in the first questionnaire, their emotional state and stress level got measured. Moreover, the user experience was queried and qualitative questions were used to gather deeper insights. At the end of the experiment, the experimenter debriefed all participants.

From a scale from 1 (totally disagree) to 5 (totally agree)												
	Alexa group						Paper group					
	Survey 1		Survey 2		Survey 3		Survey 1		Survey 2		Survey 3	
	M	SD	M	SD	M	SD	M	SD	M	SD	M	SD
<b>PANAS - Positive Effect</b>	3.15	.93	3.48	1.01	3.53	1.39	3.73	.45	4.05	.97	3.88	1.84
<b>PANAS - Negative Effect</b>	1.55	.54	1.5	.46	1.45	.39	1.28	.26	1.23	.26	1.23	0.29
<b>PSQ - Worries</b>	2.6	.82	2.05	.66	1.7	.35	1.7	.6	1.8	.94	1.75	.98
<b>PSQ - Tension</b>	2.6	1.10	2.15	.91	1.9	.84	2.05	0.85	2.2	.97	2.05	1.33
<b>PSQ - Lack of Joy</b>	2.2	.94	2.05	.66	1.95	.44	1.9	.58	1.8	.54	1.95	1.24
<b>PSQ - Overload</b>	2.25	.44	1.95	.53	2	.52	2.2	.49	2.25	.60	2.25	.66
<b>Enjoyment</b>	-	-	3.85	.38	4.15	.34	-	-	4.45	.64	4.2	.43
<b>Intention to Use</b>	-	-	3.41	.96	2.83	1.04	-	-	4.08	.83	4.17	.58
<b>Perceived Usefulness</b>	-	-	3.58	.92	3.17	1.17	-	-	4.25	.69	4.25	.57

Table 2: Descriptive values of the subjective questionnaire data

## 4 RESULTS OF THE EVALUATION STUDY

### 4.1 Subjective Questionnaire Data

To investigate the effect of both gratitude methods (Alexa vs. pen and paper) on participants emotional state, two mixed ANOVAs with the experimental condition as a between factor, the point of measurement of positive and negative affect (measured by the PANAS scale) as repeated measures were calculated. Results indicated no significant differences. Neither the experimental condition, nor the point of measurement, nor an interaction of both turned significant. The descriptive values (see Table 2) indicate that the emotional state was rather constant over time. To investigate the impact of the gratitude intervention in more depth, we calculated the change in percent points between participants emotional state before (T1) and after (T3) the intervention method for the positive and negative effect. Two t-tests confirmed prior findings and showed no differences between the Alexa and paper group. Overall, the positive state increased only little ( $M_{\text{Alexa}} = 9.38$ ,  $SD_{\text{Alexa}} = 15.05$ ;  $M_{\text{Paper}} = 3.75$ ,  $SD_{\text{Paper}} = 35.62$ ), while the negative effect ( $M_{\text{Alexa}} = -2.50$ ,  $SD_{\text{Alexa}} = 5.40$ ;  $M_{\text{Paper}} = -1.25$ ,  $SD_{\text{Paper}} = 3.23$ ) decreased. However, referring to the height of the change and results of the inference-statistical results, so far the emotional effect was not affected by the gratitude intervention.

Using four mixed measures ANOVA with the experimental conditions as between factor and the different points of measurement of all four subscales of the PSQ scale (Worries, Tension, Lack of Joy and Overload), we analysed the effect of the gratitude interventions on participants' stress. Analysis for perceived worries indicate no significant difference for the point of measurement, but a significant interaction effect of the point of measurement with the experimental condition ( $F(2,6) = 4.57$ ,  $p = .034$ ,  $\eta^2 = .43$ ). The descriptive values (see Table 2) demonstrate, that participants in the Alexa condition report that their worries decrease, while in the paper condition participants' perceived worries were rather stable. This effect got further explored analysing the change in the percent points of the perceived worries before and after the gratitude interaction. A t-test indicates a significant difference between both gratitude methods,  $t(6) = -3.02$ ,  $p = .023$ ,  $d = .45$ . As seen in

the means, the worries of the Alexa group decreases by 30 percent points ( $M_{\text{Alexa}} = -30.00$ ,  $SD_{\text{Alexa}} = 15.87$ ), while the perceived worries of participants using pen and paper were stable from the beginning to the end of the intervention ( $M_{\text{Paper}} = 1.67$ ,  $SD_{\text{Paper}} = 13.74$ ).

For the sub-dimension tension, no significant effects of the time or the experimental group were found. Although the differences are not significant, the means (see Table 2) show a tendency that, like the worries, participants' tension decreased in the Alexa condition, while this was not the case for the paper group. This got further explored using a t-test to compare the change in percent points of the groups' perceived tension. This again, shows no significant difference between both groups, although the perceived tension of participants in the Alexa group decreased from beginning to end by 23 percent points ( $M_{\text{Alexa}} = -23.33$ ,  $SD_{\text{Alexa}} = 26.94$ ), while the tension has not changed on the paper condition ( $M_{\text{Paper}} = 0.00$ ,  $SD_{\text{Paper}} = 26.11$ ).

Similar results were found for the sub-dimension Lack of Joy: the mixed measures ANOVA demonstrated no significant differences. See the means of both group for all point of measures in Table 2. Overall, participants lack of Joy was rather stable over time. Comparing the groups' change in percent points, a t-test showed also no significant difference. The change in percent points showed, that for the Alexa group the tension decreased by 8 percent points ( $M_{\text{Alexa}} = -8.33$ ,  $SD_{\text{Alexa}} = 19.15$ ), while in the paper condition it increased by 2 percent points ( $M_{\text{Paper}} = 1.67$ ,  $SD_{\text{Paper}} = 26.87$ ). However, the differences are not statistically significant and rather small with a high standard deviation.

Analysing the last sub-dimension overload with a mixed-measures ANOVA led to similar results, since no significant effects were found (see Table 2). In addition, the change in participants' perceived overload during the gratitude intervention was analysed using a t-test. There was no significant difference between the Alexa and paper group in their change of the perceived overload during the gratitude intervention. However, the tendencies found for the other sub-dimensions are observable: participants' overload decreased by 8 percent points in the Alexa condition ( $M_{\text{Alexa}} = -8.33$ ,  $SD_{\text{Alexa}} = 11.39$ ) and increased of 2 percent points in the paper condition ( $M_{\text{Paper}} = 1.67$ ,  $SD_{\text{Paper}} = 27.42$ ). In addition, for the intervention

Coded Categories		
	Number of Codings	
	Alexa	Paper
<b>Advantages of the Gratitude Journal with the used Method</b>		
Ease of Use - " <i>Otherwise the use is very simple</i> "	4	-
Good structure - " <i>The diary is extremely well thought out</i> "	2	8
Positive effect of diary - " <i>You perceive your life more intensively and probably more positively</i> "	-	4
Comfortable input via voice - " <i>Voice input is good</i> "	1	-
Localization and time advantage - " <i>You can start at any time without pen and paper</i> "	7	-
Extensions and wishes - " <i>Good would be day-shaped tables. Early, noon, evening</i> "	1	5
<b>Disadvantages of the Gratitude Journal with the used Method</b>		
Insufficient time for input - " <i>I do not have enough time to give an answer</i> "	7	-
Security - " <i>Some people do not use voice assistants because of security</i> "	1	-
Inflexible and static processing - " <i>You're not flexible in your location</i> "	-	2
Boring - " <i>Always the same questions. Does get a little boring</i> "	-	2
Impractical paper usage - " <i>The diary in this format is very unwieldy</i> "	-	2

Table 3: Coded Categories and the Number of Codings for each sub-category

methods' effect on participants' psychological well-being, we investigated the user experience (intention to use, perceived usefulness and enjoyment) of both intervention methods. We ran three mixed measures ANOVA with two points of measurements (T2 and T3) of intention to use, perceived usefulness and enjoyment as repeated measure and the experimental condition as a between subject factor. Results for participants' intention to use show no significant differences, neither for the point of measurement nor for the intervention method. However, the descriptive values show that the intention of usage is higher for the paper condition than for the Alexa group (see table Table 2). We investigated the change from the usage intention in the middle of the usage (T2) to the end of the intervention (T3) using a t-test. Again, no significant difference appeared. Although there is no significant difference, the descriptive values show that for the Alexa group participants' intention to use decreased by 14 percent points ( $M_{\text{Alexa}} = -14.23$ ,  $SD_{\text{Alexa}} = 14.23$ ), while for the paper group it increased by 2 percent points ( $M_{\text{paper}} = 2.08$ ,  $SD_{\text{paper}} = 10.49$ ).

This pattern was also found for participants perceived usefulness of the method: The mixed measures ANOVA and the t-test showed no significant differences. However, the means (see Table 2) and changes in percent points indicate that the perceived usefulness decreases for Alexa ( $M_{\text{Alexa}} = -10.42$ ,  $SD_{\text{Alexa}} = 7.98$ ), but not in the paper group ( $M_{\text{paper}} = 0.00$ ,  $SD_{\text{paper}} = 18.00$ ). Nevertheless, analyses reveal a different pattern for the enjoyment participants experienced during the usage. The mixed measures ANOVA indicated a significant interaction effect of the point of measurement and the experimental condition,  $F(1,6) = 7.72$ ,  $p = .032$ ,  $\eta^2 = .563$ . Based on the means (see Table 2), for the Alexa group the enjoyment increases over time, while in the paper group participants' enjoyment decreases. However, the enjoyment was higher in the paper condition, but this difference was not significant. To explore this data more deeply, a t-test with the change in percent points was calculated. This also turned significant,  $t(6) = 2.78$ ,  $p = .032$ ,  $d = .28$ . While the enjoyment of participants in the Alexa condition increased by 8 percent points ( $M_{\text{Alexa}} = 7.5$ ,  $SD_{\text{Alexa}} = 2.89$ ), in the

paper condition it decreased by 6 percent points ( $M_{\text{paper}} = -6.25$ ,  $SD_{\text{paper}} = 9.46$ ).

## 4.2 Qualitative Data

Apart from subjective questionnaire data, we analyzed participants' qualitative statements. In order to have a structured overview, we created an inductive coding scheme [14] based on the statements, which can be seen in Table 3 and consists of 11 categories. The data suggests that the Alexa group appreciated the localization and time advantage with seven accompanying statements, the Ease of Use with four statements and the comfortable voice input. On the other hand, they stated that there is insufficient time for voice input with seven statements and a single person has expressed security concerns with Alexa. The paper group found the structure of the diary great with eight related statements and that the gratitude diary had a positive effect on their wellbeing. They criticized with two statements each the inflexible and static processing of the questions, the impractical use of paper and that it was boring.

## 4.3 Objective Data: Content Analysis

Looking at both groups in terms of data input, the Alexa group used far fewer words for their journal entries. They used on average 192.7 words for the whole week. The diary had 24 questions in total so they only used 8 words per question. In comparison to this, the paper group had a total of 428.4 words on average for the whole diary. So the participants from the paper group wrote more than half as much.

Moreover, the comparison of both groups' gratitude statements indicated that the paper and pen group mostly used bullet points to note their statements, while users of Alexa expressed their gratitude using whole sentences. To quantify this observation we coded all statements, whether they are grammatically whole sentences (consisting of subject and verb and not necessarily with a definite article) or not. For example "I am thankful that I am currently consistently carrying out what i set out to do" is a whole sentence as opposed to punctual answers e.g. "Work, Family,...", which are grammatically

not sentences and thus represent a pure enumeration of different topic points to the gratitude questions. The coded data confirmed our observation, since in the Alexa condition about 72 percent ( $M = 71.88$ ,  $SD = 7.11$ ) of the statements were sentences and in contrast to that only 29 percent ( $M = 28.60$ ,  $SD = 9.55$ ) of the statements noted with pen and paper were identified as whole sentences. A t-test showed that this difference is statistically significant,  $t(6) = 7.27$ ,  $p < .001$ ,  $d = 8.42$ .

## 5 DISCUSSION AND FUTURE WORKS

To compare the use of a gratitude diary using a speech assistant with a paper and pen based routine for efficiency and feasibility, we conducted a field experiment. The participants used the respective version of the diary for one week each and completed a total of three questionnaires.

The results of our 8-day field study ( $N = 8$ ) show, that people appreciate the usage of a gratitude journal by voice, that the Alexa intervention is more effective in decreasing participants' worries over time, that the enjoyment increases with the usage of Alexa and that people express their gratitude for both methods in a different manner. Although positive outcomes are observable, the usage intention decreases for the Alexa intervention. Participants of the Alexa group appreciated the localization and time flexibility, while on the contrary paper group criticized the missing flexibility. The argumentation that one has to take extra active time for editing the diary in paper form and that one does not need the full attention while editing the diary with Alexa and can do something else at the same time could underline the results of Wood et al. according to which editing gratitude interventions quickly becomes a hassle activity [24]. Thus, one could conclude that using a gratitude diary with Alexa is indeed an effective alternative and, most importantly, does not reflect the hassle activity problem of the pen and paper approach. Based on the qualitative statements, both groups liked the structure of the diary, the Ease of Use and that it possibly could have a positive effect on themselves. This could indicate that a gratitude diary with a speech assistant can work in an efficient way.

However, participants from the Alexa group also stated, that they had insufficient time for their voice input. This is due to some critical technical limitations from Amazon. Participants of this group could not use the gratitude diary the way it was intended. Almost everyone mentioned, that there is not enough time to give a useful entry to the diary and that they were under pressure. This is due to Alexas standard eight second timeout span for the speech input [13], which means practically that Alexa expected user answers within eight seconds. The reason for this is security, so third parties and developers cannot eavesdrop on their customers and users in general.

This limitation is represented by the fact that the Alexa group used far fewer words for their entries and showed a reduced usage intention. However, these limitations are no longer an obstacle, since Amazon has recently given developers the freedom over the response time of the users. Besides this technical limitation, the qualitative and quantitative results of the study suggest that the use of a gratitude diary with a voice assistant can be an useful

alternative, since perceived stress decreases more than for the paper condition. The fact that one can give commands with one's own voice could be a crucial factor due to accessibility and also important for gratitude routines in general. Additionally, the way people expressed their gratitude was different in both groups: users of Alexa used whole sentences, while the paper group wrote down bullet points. Future studies should address this difference in expressing gratitude. In the next iterations we want to investigate this context with an even larger sample size, longer intervention time, the inclusion of different age groups and a more heterogeneous sample, which will give more reliable results and also new insights into the participants' perception of a speech assistant based gratitude diary.

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## REFERENCES

- [1] Sara B. Algoe, Barbara L. Fredrickson, and Shelly L. Gable. 2013. The social functions of the emotion of gratitude via expression. *Emotion (Washington, D.C.)* 13, 4 (2013), 605–609. <https://doi.org/10.1037/a0032701>
- [2] Sara B. Algoe, Shelly L. Gable, and NATALYA C. MAISEL. 2010. It's the little things: Everyday gratitude as a booster shot for romantic relationships. *Personal Relationships* 17, 2 (2010), 217–233. <https://doi.org/10.1111/j.1475-6811.2010.01273.x>
- [3] Inc. Amazon.com. 2022. Amazon Web Services Lambda. Retrieved 10.01.2022 from <https://aws.amazon.com/de/lambda/>
- [4] Bianca Breyer and Matthias Bluemke. 2016. Deutsche Version der Positive and Negative Affect Schedule PANAS (GESIS Panel). Zusammenstellung sozialwissenschaftlicher Items und Skalen (ZIS). <https://doi.org/10.6102/zis242>
- [5] David R Cregg and Jennifer S Cheavens. 2021. Gratitude interventions: effective self-help? A meta-analysis of the impact on symptoms of depression and anxiety. *Journal of Happiness Studies* 22, 1 (2021), 413–445.
- [6] Don E Davis, Elise Choe, Joel Meyers, Nathaniel Wade, Kristen Varjas, Allison Gifford, Amy Quinn, Joshua N Hook, Daryl R Van Tongeren, Brandon J Griffin, et al. 2016. Thankful for the little things: A meta-analysis of gratitude interventions. *Journal of counseling psychology* 63, 1 (2016), 20.
- [7] Fred D. Davis. 1989. Perceived Usefulness, Perceived Ease of Use, and User Acceptance of Information Technology. *MIS Quarterly* 13, 3 (1989), 319–340. <http://www.jstor.org/stable/249008>
- [8] Robert A. Emmons and Michael E. McCullough. 2003. Counting blessings versus burdens: an experimental investigation of gratitude and subjective well-being in daily life. *Journal of personality and social psychology* 84, 2 (2003), 377–389. <https://doi.org/10.1037/0022-3514.84.2.377>
- [9] Herbert Fliege, Matthias Rose, Petra C. Arck, Susan Levenstein, and Burghard F. Klapp. 2009. PSQ - Perceived Stress Questionnaire. <https://doi.org/10.23668/psycharchives.351>
- [10] Lilian Jans-Beken, Nele Jacobs, Mayke Janssens, Sanne Peeters, Jennifer Reijnders, Lilian Lechner, and Johan Lataster. 2020. Gratitude and health: An updated review. *The Journal of Positive Psychology* 15, 6 (2020), 743–782. <https://doi.org/10.1080/17439760.2019.1651888>
- [11] Shelley L. Kerr, Analise O'Donovan, and Christopher A. Pepping. 2015. Can Gratitude and Kindness Interventions Enhance Well-Being in a Clinical Sample? *Journal of Happiness Studies* 16, 1 (2015), 17–36. <https://doi.org/10.1007/S10902-013-9492-1>
- [12] Liliana Laranjo, Adam G. Dunn, Huong Ly Tong, Ahmet Baki Kocaballi, Jessica Chen, Rabia Bashir, Didi Surian, Blanca Gallego, Farah Magrabi, Annie Y. S. Lau, and Enrico Coiera. 2018. Conversational agents in healthcare: a systematic review. *Journal of the American Medical Informatics Association : JAMIA* 25, 9 (2018), 1248–1258. <https://doi.org/10.1093/jamia/ocy072>
- [13] Henry Lee. July 2018. *Voice user interface projects: Build voice-enabled applications using Dialogflow for Google Home and Alexa Skills Kit for Amazon Echo*. Packt, Birmingham, UK and Mumbai.



- [14] P. Mayring. 2010. *Qualitative Inhaltsanalyse: Grundlagen und Techniken*. Beltz. <https://books.google.de/books?id=BJlxSQAACAAJ>
- [15] B Reeves and C Nass. 1996. Media equation theory. Retrieved March 5 (1996), 2009.
- [16] Randy A. Sansone and Lori A. Sansone. 2010. Gratitude and well being: the benefits of appreciation. *Psychiatry (Edgmont (Pa. : Township))* 7 11 (2010), 18–22.
- [17] Martin E. P. Seligman, Tracy A. Steen, Nansook Park, and Christopher Peterson. 2005. Positive psychology progress: empirical validation of interventions. *The American psychologist* 60, 5 (2005), 410–421. <https://doi.org/10.1037/0003-066X.60.5.410>
- [18] David Shadinger, John Katsion, Sue Myllykangas, and Denise Case. 2020. The Impact of a Positive, Self-Talk Statement on Public Speaking Anxiety. *College Teaching* 68, 1 (2020), 5–11.
- [19] Steven Toepfer and Kathleen Walker. 2009. Letters of Gratitude: Improving Well-Being through Expressive Writing. *Journal of Writing Research* 1, 3 (2009), 181–198. <https://doi.org/10.17239/jowr-2009.01.03.1>
- [20] Aditya Nrusimha Vaidyam, Hannah Wisniewski, John David Halamka, Matcheri S. Kashavan, and John Blake Torous. 2019. Chatbots and Conversational Agents in Mental Health: A Review of the Psychiatric Landscape. *Canadian journal of psychiatry. Revue canadienne de psychiatrie* 64, 7 (2019), 456–464. <https://doi.org/10.1177/0706743719828977>
- [21] Viswanath Venkatesh and Hillol Bala. 2008. Technology Acceptance Model 3 and a Research Agenda on Interventions. *Decision Sciences* 39, 2 (2008), 273–315. <https://doi.org/10.1111/j.1540-5915.2008.00192.x>
- [22] Jinping Wang, Hyun Yang, Ruosi Shao, Saeed Abdullah, and S. Shyam Sundar. 04212020. Alexa as Coach: Leveraging Smart Speakers to Build Social Agents that Reduce Public Speaking Anxiety. In *Proceedings of the 2020 CHI Conference on Human Factors in Computing Systems*. ACM, New York, NY, USA, 1–13. <https://doi.org/10.1145/3313831.3376561>
- [23] Philip C. Watkins, Kathrane Woodward, Tamara Stone, and Russell L. Kolts. 2003. Gratitude and Happiness: Development of a Measurement of Gratitude, and Relationships with Subjective Well-being. *Social Behavior and Personality: an international journal* 31, 5 (2003), 431–451. <https://doi.org/10.2224/sbp.2003.31.5.431>
- [24] Alex M. Wood, Jeffrey J. Froh, and Adam W. A. Geraghty. 2010. Gratitude and well-being: a review and theoretical integration. *Clinical psychology review* 30, 7 (2010), 890–905. <https://doi.org/10.1016/j.cpr.2010.03.005>