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Understanding User Needs for Digital Aphasia Therapy: Experiences and Preferences of Speech and Language Therapists

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ABSTRACT

Background: Aphasia therapy software applications (apps) can help achieve recommendations regarding aphasia treatment intensity and duration. However, we currently know very little about speech and language therapists' (SLTs) preferences with regards to these apps. This may be problematic, as clinician acceptance of novel treatments and technology are a key factor for successful translation from research evidence to practice.

Aim: This research aimed to increase our understanding of clinicians' experiences with aphasia therapy apps and their perceived barriers and facilitators to the use of aphasia apps. Furthermore, we wanted to explore the influence of some demographic factors (age, country, and SLT availability in the client's hometown) on SLTs' attitudes towards these apps.

Method & Procedures: 35 Dutch and 29 Australian SLTs completed an online survey. The survey contained 9 closed-ended questions and 3 open-ended questions. Responses to the closed-ended questions were summarised through the use of descriptive statistics. The responses to the open questions were analysed and coded into recurring themes that were derived from the data. Logistic regression analyses were performed to explore the relationship between the demographic variables and the responses to the closed-ended questions.

Outcomes & results: Participants were overwhelmingly positive about aphasia therapy apps and saw the potential for their clients to use apps independently. As facilitators of app use, participants reported accessibility and inclusion of different language modalities, while high costs, absence of a compatible device, and clients' potential computer illiteracy were listed as barriers. None of the analysed demographic factors consistently influenced differences in participants' attitudes towards aphasia therapy apps.

Conclusions: The positive, extensive and insightful feedback from speech and language therapists is both useful and encouraging for app developers and aphasia researchers, and should facilitate the development of appropriate, high-quality therapy apps.

KEYWORDS
Telemedicine; mobile applications; user research; speech and language therapy; clinician feedback

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Introduction

People with aphasia benefit from speech and language therapy that is administered at a high intensity (of up to 15 hours per week) and preferably over a long period of time (Brady et al., 2016). In reality, this is often difficult to achieve for reasons such as therapist availability, financial load, and mobility impairments. Mobile applications (apps) for aphasia therapy that can be implemented on smart phones or tablets could be a means of meeting clinical recommendations regarding treatment intensity and duration (Brady et al., 2016). As yet, we know very little about how therapists feel about using such apps and what their preferences and needs are. This information is, however, essential in order to design a product that meets the users' needs (Bannon, 1986; Norman & Draper, 1986; Swales et al., 2016) and that is therefore more likely to be used in clinical practice. This study aims to shed light on this issue, by reporting the results of a survey regarding aphasia therapy apps conducted with speech and language therapists (SLTs).

Gold Standards for Aphasia Therapy

Individuals with aphasia can improve their language skills even after the sub-acute phase through adequate speech and language therapy (Doesborgh et al., 2004; Kendall et al., 2015; Rochon et al., 2005). A Cochrane review found that speech and language therapy for people with aphasia tends to be especially beneficial when it is administered at a high intensity (of up to 15 hours per week) and in some cases for a relatively long duration (of 6-9 months rather than 10-12 weeks; (Brady et al., 2016). While this may be the ideal situation from a theoretical point of view, in practice, such long and intensive therapy is often difficult to implement.

There are several reasons why the recommendations formulated by Brady et al. (2016) are difficult to accomplish in reality. Firstly, even without the provision of high intensity therapy, SLTs work with tight schedules and long waiting lists are not uncommon in many countries (e.g. Australia: Commonwealth of Australia, 2014; Ruggero et al., 2012, The Netherlands: Nederlandse Vereniging voor Logopedie en Foniatrie, 2019). Therefore, the intensive therapy advocated by Brady et al. (2016) is problematic to achieve with only face-to-face intervention in clinical practice. Secondly, in countries where health insurance is required, it may not cover all or any intensive therapy, especially if it is offered in the chronic phase. Thirdly, it can be physically and emotionally draining for people with aphasia and their caregivers to visit a clinic or rehabilitation centre at frequent intervals, due to reduced mobility, the potential financial burden of arranging transport, and the time commitment of caregivers who may need to accompany the individual with aphasia. Indeed, the caregivers of people with aphasia are known to experience a substantial workload as a result of their loved one's disorder (Bakas et al., 2006). These issues may be related to the significantly higher drop-out rates in high-intensity treatment compared to low-intensity treatment (Brady et al., 2016). Based on these observations, it can be concluded that in many cases the recommendations by Brady and colleagues (2016) are not realistically achievable. There thus appears to be a large disparity between the high standards of evidence-based practice therapy and therapy provision in reality.

These considerations lead to the following suggestions for working towards increased treatment provision for people with aphasia: 1) If treatment does not rely on the face-to-face presence of an SLT at all times, the available time a person with aphasia could spend on treatment may be increased (Van de Sandt-Koenderman, 2011); 2) Increased treatment intensity needs to be financially viable, which ties in closely with the amount of SLT contact (e.g. Latimer et al., 2021); and 3) treatment provision needs to bear in mind the physical and emotional toll on both the person with aphasia and their caregiver (see e.g. Bakas et al., 2006). One model of service provision that may help address these issues is the use of telemedicine.

Telemedicine as a Means of Improving Aphasia Therapy

Telemedicine refers to health services that are delivered through some form of telecommunications (Fong et al., 2011). Telemedicine is a broad concept and can range from relatively simple (e.g. healthcare provider and client meeting through videocall) to more complex (e.g. remote surgical operations; Fong et al., 2011). For aphasia therapy, (semi-) independent or asynchronous use of telemedicine is potentially suitable, that is, where the SLT is not necessarily always physically or electronically present (see Van de Sandt-Koenderman, 2011). This type of speech and language therapy often consists of therapy exercises that can be performed independently using a mobile device or computer, often remotely supervised by their SLT. The person with aphasia and their SLT may meet up at pre-specified times for guidance or other assistance. The SLT usually has access to their clients' performance data, which they can then use as a foundation for adapting and revising the advice regarding further therapy. This more independent use of therapy resources is largely used as an addition to rather than a replacement for traditional speech and language therapy. Promisingly, some researchers have found these independent, computer-based therapy solutions to be well-received and effective in people with aphasia (Garcia, 2019; Kurland et al., 2018; Routhier et al., 2016; Thompson et al., 2010).

Adding such independent, computer-based therapy to regular therapy allows people with aphasia to practice therapy exercises whenever and wherever it suits them, regardless of the schedule of their therapist (see e.g. Van de Sandt-Koenderman, 2011). It may also be cost-effective due to reduced therapist presence, although little has been reported on this issue (e.g. Latimer et al., 2021). Finally, it also addresses our third consideration: Not having to travel to a clinic for each therapy session reduces effort for people with aphasia and their caregivers. Independent therapy practice through the use of computers or tablets thus seems like a useful addition to regular speech and language therapy for people with aphasia in the community.

In recent years, tablet computers (tablets) with aphasia therapy apps installed have increased in popularity as a way of administering digital therapy. Tablets have been reported to be easy and intuitive to work with (Routhier et al., 2016). They are also cheaper and easier to transport (compared to computers and/or laptops) for SLTs and their clients alike. Nevertheless, it is important to realise that people with aphasia are different from the average tablet user. For example, motor and perceptual impairments that may be present in aphasia (e.g. hemiplegia, hemianopia) may hinder the use of tablets. We also need to consider the average age and concomitant worsening eyesight of people with aphasia, as well as the so-called digital divide (the phenomenon that certain

groups in society, for example those with language disorders, have disproportionally low access to technology; see e.g. Kelly et al., 2016). Encouragingly, previous research has found that, with the right training, people with aphasia are generally able to master the basic skills necessary to navigate a tablet (Kelly et al., 2016; Sitren & Vallila-Rohter, 2019). There are thus plenty of reasons to believe that tablet-based speech and language therapy could be a feasible option for people with aphasia.

In addition to monitoring the needs of people with aphasia, we should also keep in mind the other key user for aphasia therapy apps: The SLT, who will have preferences with regards to app design, the user data that is collected and stored, and the kinds of tasks offered. As Bannon (1986) notes, when making design decisions, developers need to emphasise 'understanding and indeed the active involvement of the people who will be affected by the design' (p.29, Bannon, 1986). Hence, if we want to design and develop successful aphasia therapy apps, that are actually used by the target audience, we must consider the needs of both people with aphasia and SLTs. Through this so-called user-centred system design approach (Norman & Draper, 1986) we can create apps that optimally suit the users' needs and that have the potential to be used successfully in clinical practice (see also Swales et al., 2016).

Implementing User-Centred System Design for Aphasia Therapy Apps

In the case of aphasia therapy apps, a good starting point for user-centred design would be to enlist the help of SLTs who work with people with aphasia. These individuals have insights into the capabilities of people with aphasia and can also comment on their own personal preferences. Furthermore, nowadays many SLTs have some experience in using apps and they may thus be able to comment on any shortcomings that they perceive in existing apps. Previous research has found that clinician support is a key factor for successful implementation of telehealth services (Wade et al., 2014). This means that therapy apps that are viewed positively by SLTs are more likely to reach people with aphasia. Obviously, we do not mean to underestimate the significance of co-design with people with aphasia in app development, but as a first step, we believe it is appropriate to focus on SLTs as app users.

There is very little research about the experiences and preferences of SLTs with regards to aphasia therapy apps or computer-based therapy in general. In fact, the only paper that we are aware of is that of Swales et al. (2016). They examined the experiences of ten Australian SLTs through small-scale focus groups and mediator-led discussions on the topic of computer use in aphasia. They focused on five different topics: Therapy tasks, stimuli, cues, access, and progress data. This led to many valuable insights into the wishes and needs of SLTs and people with aphasia for computer-based therapy in all of these five domains. They found that SLTs particularly recommended: 1) having the option to customise and personalise the treatment; 2) including an extensive range of activities, targets, cues, and response options; 3) high usability for a range of clients; 4) availability on several platforms; and 5) allowing remote monitoring by the SLT (Swales et al., 2016). In general, Swales et al. (2016) reported that their participants were positive towards the use of computer-based aphasia therapy but did have high expectations in terms of adaptability of the treatment content and data storage (Swales et al., 2016).

The Current Study

To summarise, semi-independent use of aphasia therapy apps may facilitate meeting Brady et al.'s (2016) therapy recommendations, but for aphasia therapy apps to achieve this goal, the preferences of people with aphasia and SLTs must be considered. However, to date, the only pertinent research involving SLTs on this topic that we are aware of, Swales et al. (2016), took place quite some time ago, with focus groups taking place in 2013 and 2015. This study had a relatively small sample size and almost all of its participants were from urban areas (Swales et al., 2016). The current study, therefore, aimed to build on Swales et al.'s research by investigating how SLTs use aphasia apps and what their attitudes are towards them. We also aimed to examine the influence of demographic factors on participants' attitudes. Our specific research questions were:

(1) What are SLTs' current experiences with regards to aphasia therapy apps?
(2) What are SLTs' perceptions of smartphone/tablet use among people with aphasia and the suitability of independent, tablet-based therapy for this target group?
(3) What do SLTs perceive to be barriers and facilitators to the use of aphasia therapy apps?
(4) Do any demographic characteristics of our sample influence SLTs attitudes towards the use of aphasia therapy apps?

Method

Ethical approval for this research project was provided by the Research Ethics Committee (CETO) of the University of Groningen Faculty of Arts (approval number 70993003).

Materials

The research questions stated above were addressed using an online survey with 3 open questions and 9 closed-ended questions (6 Likert Scale and 3 multiple choice) pertaining to our research questions and was presented in Qualtrics (*Qualtrics*, n.d.). The questions that we report on in this paper are presented in Appendix A. The survey also contained additional questions related specifically to the app development project of which the survey is a part. These questions are not listed in Appendix A and are not further discussed in this article. It was not obligatory to supply an answer to each question. Therefore, not all questions were answered by all participants.

The first part of the survey was concerned with obtaining demographic details from our respondents and their caseload regarding respondents age, gender, country of employment, years of work experience, type of workplace, education, work title, how much time they spend on aphasia therapy on a weekly basis, how often they usually see their clients with aphasia on a weekly basis, and the percentage of their clients that had access to speech and language therapy in their own hometown.

The main survey covered three areas of interest, namely:

1) What was the SLTs' current experience with the use of therapy apps for people with aphasia?

2) How did they perceive tablet use among their clients with aphasia and judge the suitability of independent app-based therapy for this population?

3) What did they feel were ways to make a therapy app as aphasia-friendly as possible?

Participants

Participants were recruited via conferences and workshops, through social media, such as Facebook groups, and via mailing lists for SLTs and aphasia organisations. Finally, the authors' networks were used to maximise the number of respondents. All participants were self-reported registered SLTs or other healthcare professionals working with people with aphasia on language skills.

Procedure

The survey was developed in Dutch and in English and was distributed in The Netherlands between 25 January and 19 March 2020, and in Australia between 1 and 27 July 2020. Participants were able to access the survey through using a weblink or QR-code that was shared with them. After providing informed consent, they were taken to the survey questions. Participants were able to pause the survey and resume at a later time if they wished to do so.

A potentially important difference between the Dutch and Australian surveys is that the Dutch survey took place before the COVID-19 outbreak, while the Australian survey started approximately ten weeks after COVID-19 restrictions were first implemented in Australia.

Analyses

The data were analysed using the *mlogit* and *MASS* packages in statistical software program R (R Core Team, 2021) and using JASP version 0.14.1 (JASP Team, 2020). There was one ambiguous response (10+ years) for the question on work experience, which was removed from subsequent analysis.

We first generated descriptive statistics from the responses to the closed-ended questions, to get a broad overview of participants' general attitude towards aphasia therapy apps. Responses to the open-ended questions were analysed and coded by the first author into recurring themes that were derived from the data.

In order to explore the relation between demographic factors (namely the country of employment, the percentage of their clients who had access to SLT services in their home town, and respondents' age) and the SLTs' responses to the closed-ended questions, we used ordinal and binary logistic regressions. The categories of response to the closed-ended questions were used as categorical outcome variables and the demographic factors as categorical or continuous predictor variables. Ordinal logistic regression was used in the case of more than two outcome categories, and binary logistic regression analysis in the case of two outcome categories. For some questions, response categories were grouped due to low numbers. If this resulted in two outcome categories, a binary logistic regression analysis was subsequently used. The exact set or grouping of response options for each analysis is given in the results

section, along with the corresponding finding. Participants whose data for the independent variables (n = 4) or dependent variables (n = 2 for the question on frequency of tablet use among PWA) were incomplete were not included in the regression analyses. When comparing countries, Australia was used as the reference category. Gender was not included as a predictor variable in the analyses, due to the unequal distribution of participants across genders (with 93.8% identifying as women). Years of work experience was not included as a predictor variable due its strong correlation with age (r = 0.84). Indeed, when we re-ran our analyses using years of work experience instead of age the results were mostly equivalent, where they differed this is noted in footnotes (see Footnotes 2 and 4). We report significant results of the logistic regressions in the text below, with full model outputs provided in Appendix B and C.

Results

After deleting incomplete responses (NL: n = 6/45, AU: n = 9/39) and those from participants who were not part of the target population (i.e. not SLTs; NL: n = 4/45, AU: n = 1/39), responses were analysed for a total of 35 respondents for the Dutch survey and 29 respondents for the English survey (all of whom worked in Australia). Participants could terminate the questionnaire at any point without providing an explanation. Therefore, we cannot be certain about the reasons, but we believe that the incomplete responses may be due to the length of the survey as well as the generally busy time schedules of SLTs.

On average, participants took 96.4 minutes (SD = 408.7) to complete the survey, however, this was reduced to 31.2 minutes (SD = 49.3) with the removal of two outliers (3102.1 minutes, 1133.4 minutes respectively). These outliers are likely due to the participants pausing (but not exiting) the survey and finishing it at a later time.

Table 1 shows the characteristics of the participant groups. Mann-Whitney U tests showed no significant differences between Dutch and Australian participants for age (W = 487.0, p = 0.882) or mean years of work experience (W = 436.5, p = 0.463). Australian respondents did, however, report a significantly higher average percentage of clients with access to speech and language therapy in their home town than the Dutch participants (W = 625.5, p = 0.02).

SLT Experiences and Preferences Regarding Aphasia Therapy Apps

Figure 1 summarises the response frequencies to the questions pertaining to SLT experiences and preferences. 93% of Australian respondents and 97% of Dutch respondents indicated that they were 'quite a bit' or 'definitely' open to using aphasia therapy apps with their clients. All of the respondents felt that therapy apps contributed to reaching therapy goals for people with aphasia. We found no significant effects of demographic factors on the responses to these questions related to openness to aphasia therapy apps or the potential for therapy apps to contribute to therapy goals (see Appendix B).

Table 1. Overview of participant characteristics

Number of respondents	Australian survey	Dutch survey
	29	35
Mean age of respondents (years)	35.50 (SD = 9.54, n = 28)	36.18 (SD = 10.94, n = 34)
Gender (F/M/Prefer not to say)	28/1/0	32/2/1
Type of workplace		
Care home	0	7
Community	9	0
Hospital (inpatient or outpatient)	10	3
Private SLT practice	2	5
Rehabilitation centre	6	8
Other/several selected	2	12
Mean years of experience working with people with aphasia	10.13 (SD = 9.43, n = 28)	11.49 (SD = 8.62, n = 35).
Hours per week spent on aphasia treatment	10.01 (SD = 6.88, n = 27)	15.56 (SD = 8.96, n = 34)
Frequency of seeing clients with aphasia		
Less than once a week	2	0
Once a week	15	7
2-3 times a week	5	14
More than three times a week	7	14
Average % of clients that have access to speech and language therapy in their home town	83.76% (SD = 20.48, n = 29)	74.09% (SD = 21.19; n= 32)

Note. Numbers in parentheses (n=) refer to the number of participants providing a complete response to a question.

All of the Australian SLTs and 89% of Dutch respondents currently used therapy apps with at least some of their clients. The ordinal logistic regression analyses showed significant effects on the likelihood of app usage of SLT accessibility in clients' hometown with therapy app use decreasing as SLT accessibility increased (*B(SE)* = -0.04(0.01), odds ratio = 0.96, 95% CI of the odds ratio = 0.93 – 0.98, $p = 0.001$) and country of employment (Dutch participants less likely to use therapy apps; *B(SE)* = -1.64(0.60), odds ratio = 0.19, 95% CI of the odds ratio = 0.06 – 0.60, $p = 0.006$). SLT age did not have a significant effect on app usage (see Appendix B for full model output).

There was a general sense that employers were interested in these forms of therapy, with 72% of Australian respondents and 86% of Dutch respondents indicating that they thought their employer would be willing to invest in the use of therapy apps. An additional further 21% of Australian respondents and 11% of Dutch respondents expressed the opinion that their employer would be interested, but only if the therapy apps were free. A subsequent binary logistic regression revealed no significant effects of any of the demographic variables[1] (see Appendix C).

Whether or not therapy apps were used with a client depended on numerous factors, with respondents most frequently indicating an influence of the cognitive status of the client (listed by 83% of Australian and 89% of Dutch respondents) and the availability of an appropriate app (93% of Australian, 74% of Dutch participants) (see Figure 2). Fisher exact tests showed no significant difference between Dutch and Australian SLTs in terms of whether they felt a factor influenced their use of therapy apps with a client (all $p > 0.09$; see Appendix D for full results).

[1]For this analysis we grouped the outcome categories 'no' and 'my employer would only be interested in free apps' together due to the small number of 'no' category responses (resulting in a combined group of n = 13).

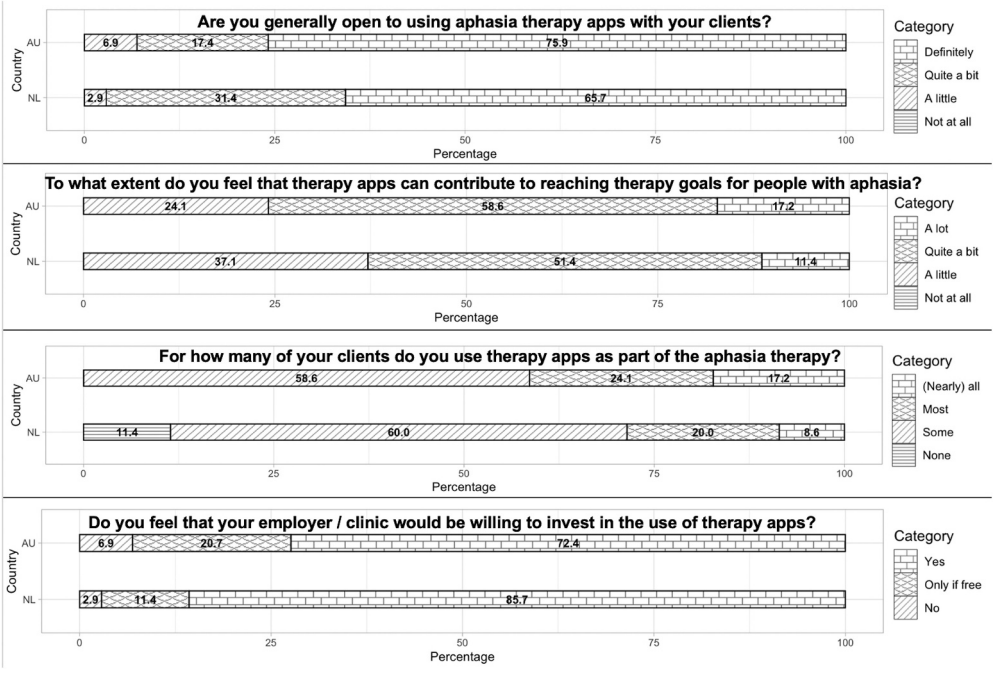

Figure 1. Summary of responses to the questions regarding SLT experiences and preferences.
Note: AU = Australia (n = 29), NL = The Netherlands (n = 35).

SLT Perceptions of Tablet Use by, and Online Therapy Suitability for, People with Aphasia

Figure 3 summarises the responses to the questions on the topic of SLT perceptions of PWA tablet use by people with aphasia and suitability of online therapy methods. The majority of our respondents (69% of Australian respondents and 64% of Dutch respondents) felt that their clients with aphasia used smartphones or tablets on a daily basis, with only 1 respondent in each country indicating that they believed their clients did not use smartphones or tablets at all. Ordinal logistic regression (combining the categories 'never' and 'monthly' due to low numbers in both categories) showed a statistically significant effect of SLT accessibility in clients' hometown on the SLTs perception (*B(SE)* = -0.02(0.01), odds ratio = 0.98, 95% CI of the odds ratio= 0.95 – 1.00, $p = 0.05$)[2], with SLTs' perceptions of app use decreasing as SLT accessibility increased. No significant effect was found of country of employment or age.

A majority of respondents (55% of Australian respondents and 89% of Dutch participants) indicated that they felt the SLT need only be present 'every now and then' when a person with aphasia used a therapy app. No respondents indicated that they believed the SLT should 'never' or 'always' be present when an individual with aphasia used a therapy app. In the binary logistic regression, SLT country of employment significantly predicted response, with Australian respondents favouring closer

[2]For this analysis, SLT accessibility in clients' hometown was no longer significant when we substituted the predictor 'age' for 'years of experience' (*B(SE)* = -0.02(0.01), odds ratio = 0.98, 95% CI of the odds ratio= 0.95 – 1.00, $p = 0.056$)

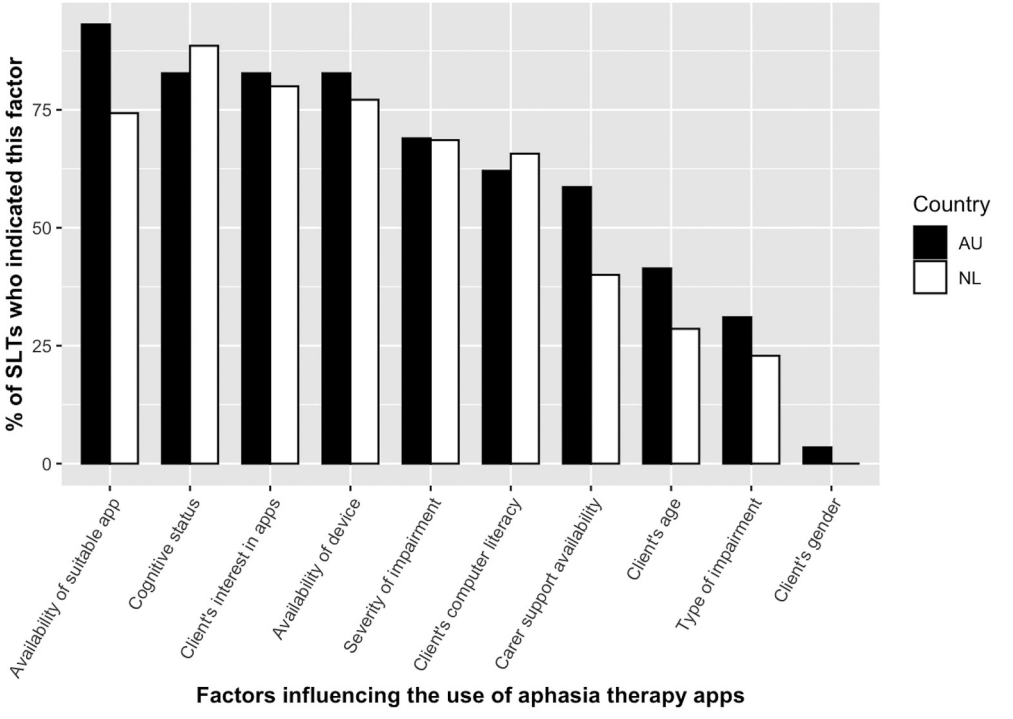

Figure 2. Summary of the responses to the question "which factors influence your decision to use apps as part of your therapy for a particular client?"
Note: Respondents could select multiple answers to this question. AU = Australia (n = 29), NL = The Netherlands (n = 35).

supervision of clients than Dutch respondents (*B(SE)* = -2.39(0.78), odds ratio = 0.09, 95% CI of the odds ratio = 0.02 – 0.37, p = 0.002), but age and SLT accessibility in clients' hometown did not (see full model output in Appendix C).

Nevertheless, all but three of our respondents (97% of Australian respondents and 94% of Dutch respondents) indicated that they felt people with aphasia would be able to use a therapy app independently twice per week or more. Ordinal logistic regression[3] found that Australian respondents were more positive than Dutch respondents[4] (*B(SE)* = -1.12(0.52), odds ratio = 0.33, 95% CI of the odds ratio = 0.11 – 0.89, p = 0.03), but their age and SLT availability in the hometown did not predict response.

[3]For this analysis, the response categories 'never', 'monthly', 'once a week', and 'three times per week or less' were combined into a single response category, due to low numbers.
[4]Country did not have a significant effect when the predictor variable 'age' was substituted by 'years of work experience (*B(SE)* = -0.95(0.52), odds ratio = 0.38, 95% CI of the odds ratio = 0.14 – 1,04, p = 0.06).

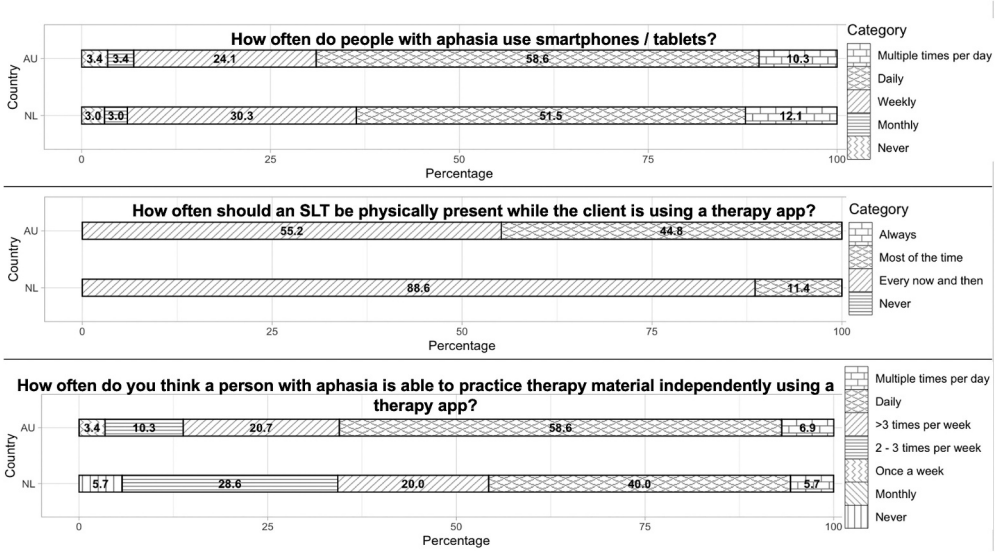

Figure 3. Summary of responses to the questions regarding SLT perceptions of tablet use among people with aphasia and digital therapy suitability.
Note: AU = Australia (n = 29), NL = The Netherlands (n = 33) for "how often do people with aphasia use smartphones / tablets?", Australia: n = 29 and The Netherlands: n = 35 for the two other questions

Table 2. Overview of characteristics of an ideal therapy app as described by our respondents

Theme	Characteristic	% of respondents that named characteristic
Treatment content	The user should be able to practice different language skills beyond the single word level (e.g. sentence or discourse level)	31
	The therapist should be able to adjust difficulty and type of exercises as needed and as their client user improves	16
	Personalisable (e.g. upload personal content)	11
	The difficulty of the therapy material should change automatically based on the user's performance	9
	Many different lexical items available in the app	9
	Range of cueing possibilities	7
	Many different exercises	6
	The therapist should be able to select items that will be included in treatment	6
Visuals/ presentation of treatment	Easy to use and accessible	51
	Clear, modern, visually attractive images or videos	16
	Few visual distractions	13
	Large and aphasia-friendly font	9
	Clear and short instructions	9
	Pleasant, natural voice with appropriate accent	7
	Photos rather than line drawings	7
App use by SLT and client	Can be used independently as an addition to regular therapy	22
	Track user performance (e.g. accuracy, error type, time spent on app, audio recordings of the user's response)	20
	Cheap or free	18
	Suitable for full range of aphasia severity	7
	User should receive real-time feedback as they work on an exercise	6

Note: This question was answered by 29 Dutch respondents and 26 Australian respondents. Only characteristics that were named by at least 3 respondents (5.5%) are included in this table.

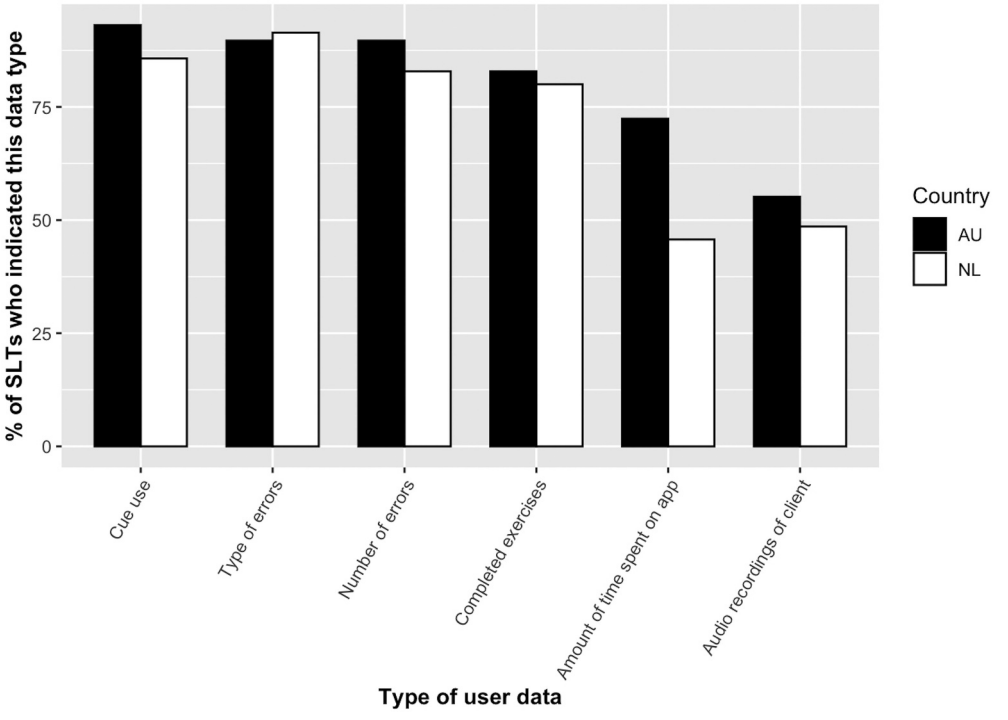

Figure 4. Summary of the responses to the question 'which user data would you want to have access to when your client uses a therapy app?'
Note: Respondents could select multiple answers to this question. AU = Australia (n = 29), NL = The Netherlands (n = 35)

Facilitators and Barriers for the Use of Aphasia Therapy Apps

As part of the open questions, respondents were asked to describe their ideal therapy app. Table 2 summarises SLTs' descriptions and what they perceived to be facilitators for the use of aphasia therapy apps. The most frequently cited characteristic of the 'ideal' therapy app was that it should be easy to use and accessible for people with aphasia. Other popular suggestions included practicing more complex language skills within the app, clients being able to use the app independently, the app tracking user performance, having the app be cheap or free, and the therapist being able to adjust the difficulty and the type of exercises for their clients.

When asked to choose what user data they would want access to, all available options were selected by many respondents (see Figure 4). Cue use, Type of errors, Number of errors; and Completed exercises were all selected by over 75% of respondents. Even the least popular options were selected by over 45% of respondents (amount of time spent on app; audio recordings of client). Dutch SLTs were significantly less concerned than Australian SLTs about knowing how long participants had spent on the app (p = .04, Fisher exact test). No other factor was influenced by their country of employment (all $p > 0.44$, see Appendix D).

Table 3. The barriers to increasing aphasia therapy app use and potential solutions as described by the survey respondents

Barriers	% of respondents that named barrier	Solution(s) to facilitate app use as proposed by SLTs
High costs of tablet and app (for client and/or health provider)	42	• Keep prices low. • Have the costs of apps reimbursed by health insurance companies. • Reimburse health providers for app set-up time. • Introduce a free trial period, so the therapist can get a good understanding of an app before investing. • Continue developing apps and increasing awareness so that investing in apps becomes less of a hurdle for clinics.
Clients may not own a tablet/iPad	31	• Set up a "tablet library", so people with aphasia can borrow a tablet during the therapy. • Make apps available on Android as well as iOS devices.
Potential difficulty using iPads/tablets among people with aphasia (due to age or computer illiteracy)	31	• Familiarise the client with hardware//software with the SLT present, before practicing independently. • Provide clear instructions throughout app. • Several respondents indicate that they think this will improve in years to come, as more of their clients become familiar with technology.
Cognitive problems may make independent app use difficult for clients.	17	• Clear instructions and initially use apps in the presence of a therapist, to lie the foundation for independent app use and make this less intimidating. • Involve carers in app introduction process.
Creating and/or maintaining motivation for app use among clients	14	• Making results "measurable" for people with aphasia, for example through showing progress graphs. • Add gaming elements to motivate the user.
Clients may not have someone (e.g. a partner) available who can help them when they run into app-related problems at home.	14	No solutions suggested by respondents.
Apps may not be helpful in terms of improving functional communication (i.e. too impairment-specific).	10	• Include role-play activities that target functional communication.
Apps or app features (e.g. cueing or feedback) may be too general to be useful for a particular client.	8	• Be able to tailor app content and difficulty to specific client.
The functionality of buttons and menus and the content of images may be unclear to the client.	8	• Use large buttons and letters throughout app.
Client's (fine) motor skills may not be sufficient	8	• Use large and clear buttons throughout app.
Requiring access to a WIFI connection	6	• Be able to use app without an internet connection.
Clients may not understand the app when they use it independently outside of therapy.	6	• Make sure app is easy to use and reduce visual distractions.

Note: 26 Dutch respondents and 26 Australian respondents supplied an answer to the barriers question. Only barriers that were named by at least 3 respondents (6%) are included in this table.

Table 3 presents the 'barriers' to the use of aphasia therapy apps as signalled by our respondents and the solutions that they proposed. The most frequently stated barriers were the costs associated with therapy apps, clients not having access to a tablet, potentially insufficient computer literacy among people with aphasia to use such apps independently, and the concern that cognitive problems may make independent app use difficult for some clients.

Discussion

The goal of the current study was to better understand the current use of aphasia therapy apps by speech and language therapists and to investigate how implementation of such apps in clinical practice can be facilitated in the future. We also aimed to describe the effect of demographic factors on SLT attitudes towards aphasia therapy apps. With these goals in mind, we conducted a survey among Australian and Dutch SLTs.

We found that SLTs were overwhelmingly positive about using therapy apps as a part of their aphasia therapy. Even if they did not necessarily do so already, they were open to using such apps and a large majority felt that semi-independent app use would be feasible for their clients. Although SLTs quite clearly identified barriers to the use of therapy apps, they also suggested potential solutions to these barriers. Overall, our results confirm that aphasia apps were generally welcomed and appreciated by the SLT community. These results are encouraging for app developers and aphasia researchers for several reasons.

Firstly, it was apparent that there was a discrepancy between the percentage of SLTs indicating that they were 'definitely' or 'quite a bit' open to using therapy apps (93% in Australia and 97% in The Netherlands) and the percentage of SLTs indicating that they were currently using therapy apps with '(nearly) all' or 'most' of their clients (41% in Australia and 29% in The Netherlands; see full model output in Appendix B). This difference was significant (McNemar's $\chi^2(\text{df}) = 37.03(1)$, $p < 0.01$) and leads us to believe that there is room for growth with regards to aphasia app use. Combined with a majority of SLTs indicating that they believed their employers would be willing to invest in aphasia therapy apps, it seems that there is still place in the market for more aphasia apps that ideally should address the barriers and facilitators that were raised by the SLTs surveyed. This is especially important since clinician acceptance is an important factor for successful implementation of telehealth services (Wade et al., 2014).

Secondly, our respondents quite clearly indicated that they believed their clients with aphasia were generally capable of practicing therapy material independently using an aphasia therapy app, which is in line with previous research (Kelly et al., 2016; Routhier et al., 2016; Sitren & Vallila-Rohter, 2019). The SLTs therefore seemed in favour of semi-independent use of therapy apps, that is, with the SLT providing face-to-face therapy at regular intervals, supported by independent home-use of aphasia therapy apps. Such semi-independent use of therapy apps would help to increase the intensity of therapy exposure. This approach would address one of the most important recommendations by Brady et al. (2016) and bring us a step closer to improving aphasia therapy service provision overall, without adding to the waiting lists reported in several countries (Nederlandse Vereniging voor Logopedie en Foniatrie, 2019; Ruggero et al., 2012).

Thirdly, although we did find some influence of demographic factors for certain questions, we did not find a consistent or substantial negative attitude in any demographic group. It was the case that respondents' age consistently did not have an effect on their responses to the closed-ended questions, and consequently both younger and older SLTs have similar views regarding aphasia therapy apps. However, we did find some effects of the SLTs country of employment and the proportion of their clients with access to SLT services in their home town.

For example, Australian respondents more strongly believed that SLTs should be present most of the time during therapy app use compared to Dutch respondents, although not a single respondent indicated that they felt an SLT should be present all of the time. We cannot definitively cite a cause for this discrepancy, although it could be a result of different amounts experience with aphasia therapy apps (with 0% of Australian versus 11% of Dutch respondents using therapy apps with 'none' of their clients).

It is noteworthy to mention here that there is likely greater availability and wider range of aphasia therapy apps in English versus in Dutch, due to there being a larger market for English language products. It may therefore be that Australian SLTs have a more varied experience with therapy apps, which may also have influenced their attitudes. We also cannot definitively exclude the possibility that attitudes differed across the two countries as a result of COVID-19 restrictions. It could be that Australian respondents were not satisfied with online therapy in the early days of the pandemic and therefore at the time favoured significantly closer supervision of their clients than Dutch respondents. Conversely, however, the Australian respondents indicated that their clients could practice independently significantly more frequently compared to the Dutch SLTs. In addition, Australian respondents also reported using aphasia therapy apps with a significantly larger proportion of their clients than Dutch respondents, which also may be a result of the Dutch data being obtained pre-pandemic (see full model output in Appendix B). So, while Australian participants favoured closer supervision of therapy app use more strongly than their Dutch counterparts, they are not consistently more negative and therefore this should not be of concern to app developers. We cannot, however, comment in more detail on the role of cultural and/or linguistic background or diversity, as we did not explore this more closely in our survey.

Similar trends were found for questions where the proportion of clients with access to SLT services in their home town had an effect. It could be that SLTs in areas with poorer access to SLT services used aphasia therapy apps more as these apps allow for independent practice (Van de Sandt-Koenderman, 2011), which might be more relevant when the distance between SLT and their clients increases (see also Swales et al., 2016). However, here too, the differences were small in size and not consistent across questions. For future research we would recommend exploring this issue further with, for example, the inclusion of more detailed questions, which could, amongst other things, provide further information on the influence of rural versus urban contexts on SLT attitudes.

A potential limitation of the current study is that we cannot exclude the possibility that our participants were to some extent self-selected, that is, those who had strong opinions on the topic may have been more likely to respond to our survey. However, we might then also expect those who had strong negative feelings towards therapy apps to have responded to our survey, which clearly is not the case. Due to the sample size of the

current study, we also cannot guarantee that our sample fully reflects the SLT community as a whole. Yet, considering the diverse nature of our participant group, with regards to, for example, country, age, workplace, and years of work experience, we believe that it reasonable to conclude that the SLT community seems generally positive towards the use of aphasia therapy apps. Nevertheless, our respondents clearly indicated barriers that they have experienced in their use of therapy apps. We will therefore now address potential ways that aphasia therapy apps might be improved.

How to Improve Aphasia Therapy Apps?

To an extent, it is to be expected that there will be room for app improvement in a rapidly-evolving field that in many ways is still in its infancy. Importantly, our respondents (most of whom had previous aphasia app experience) had concrete suggestions for the facilitation of app design and ways to reduce the barriers they had encountered in the past. This clearly shows the potential merit of user-centered system design (Norman & Draper, 1986) and of involving users throughout the app development process (as also advocated by Swales et al., 2016). We hope that our results encourage aphasia researchers working on app development to also consult SLTs for more specific feedback.

In terms of the preferences of SLTs with regards to therapy apps, many of the suggested features should be within app developers' power to implement. Some of the most frequently listed features that we believe are relatively easy to implement were:

1) Making the app easy to use for therapists and their clients;
2) Allowing the SLT to customise the treatment content;
3) Ensuring the app is visually attractive for its users;
and, 4) Enabling tracking of the user's performance.

However, some of these features (e.g., 'easy to use') may be difficult to interpret for app developers with limited understanding of and/or experience with aphasia. Similarly, while there is extensive research on how to customise treatment (for example through selecting personally relevant items; e.g. Mason et al., 2011; McKelvey et al., 2010), this research is likely unfamiliar to app developers. However, in cooperation with clinicians, aphasia researchers, and people with aphasia, these features (and others that were listed less frequently) should be relatively easy for app developers to implement. If app developers and aphasia researchers are serious about increasing the outreach of aphasia therapy apps, addressing these relatively easy to implement features would be a good place to start.

Not all of the suggestions by our SLT respondents are easy to satisfy. For example, computer illiteracy of people with aphasia and their caregivers is an issue that is not easily solved by app developers or aphasia researchers, yet is a widespread concern among SLTs. As the SLTs indicated, part of their role will likely be to provide initial training and continued support so that people with aphasia can then use therapy apps independently at home. Previous research has found that such training can be effective (Kelly et al., 2016; Sitren & Vallila-Rohter, 2019). In some countries, a more financially viable alternative might be to have speech therapy assistants provide these trainings. It has also been reported that caregiver support can help when people with aphasia encounter difficulties with online therapies (e.g. Wade et al., 2003). Consequently, another solution might be to actively involve the PWA's partner or caregiver in the therapy, although this would increase their burden.

Other issues, such as the costs associated with digital therapy and particularly of app development, require an interdisciplinary approach. Ideally, health insurance companies and funding bodies would financially support aphasia app development and research. This in turn requires app developers and aphasia researchers to develop evidence-based therapy apps and to further convince clinicians and their clients of the merit of such apps. It is of note that apps being evidence-based was not a factor mentioned frequently by our respondents in the open questions. This may well be a result of earlier questions focusing largely on the user experience, rather than underlying research on treatment effectiveness. We would advocate that future app development needs to be strongly evidence-based. Apps will have to be tested thoroughly by people with aphasia, with the help of SLTs. SLTs and people with aphasia worldwide experienced the importance and the advantages of telerehabilitation during the COVID-19 pandemic. This seems to be a good opportunity to further develop and improve digital aphasia therapy. By working together, SLTs, app developers, aphasia researchers, health insurance companies and funding bodies, with the help of people with aphasia, will be able to make evidence-based therapy apps more widely available and accessible for people with aphasia.

Conclusion

Our results clearly show that there was overwhelming support for the use of aphasia therapy apps in the SLT community. Aphasia therapy apps could potentially serve as a way of providing more intensive therapy while simultaneously avoiding an increase in workload for SLTs, and making therapy more accessible for people with aphasia (Brady et al., 2016). With these goals in mind, we hope that our results will inspire other app developers and aphasia researchers, as well as SLTs, health insurance companies, and funding bodies, to work together and to monitor user needs as they are developing aphasia therapy apps. Clearly, clinicians are ready for aphasia therapy apps, so the onus is now on app developers and aphasia researchers to provide the SLT community with the tools to administer digital therapy of the highest possible quality.

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Data availability statement

The aggregated data is openly available here: https://doi.org/10.34894/DAPIKO

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References

Bakas, T., Kroenke, K., Plue, L. D., Perkins, S. M., & Williams, L. S. (2006). Outcomes among family caregivers of aphasic versus non aphasic stroke survivors. *Rehabilitation Nursing*, *31*(1), 33–42.

Bannon, L. J. (1986). Issues in Design: Some Notes. In D. A. Norman & S. W. Draper (Eds.), *User entered system design*. Lawrence Erlbaum Associates, Inc., Publishers.

Brady, M. C., Kelly, H., Godwin, J., Enderby, P., & Campbell, P. (2016). Speech and language therapy for aphasia following stroke (Review). *Cochrane Database of Systematic Reviews*, *6*, 1–314. 10.1002/14651858.CD000425.pub4

Commonwealth of Australia. (2014). *Prevalence of different types of speech, language and communication disorders and speech pathology services in Australia*. https://www.aph.gov.au/Parliamentary_Business/Committees/Senate/Community_Affairs/Speech_Pathology/Report

Doesborgh, S. J. C., van de Sandt-Koenderman, M. W. E., Dippel, D. W. J., van Harskamp, F., Koudstaal, P. J., & Visch-Brink, E. G. (2004). Effects of semantic treatment on verbal communication and linguistic processing in aphasia after stroke: A randomized controlled trial. *Stroke*, *35*(1), 141–146. 10.1161/01.STR.0000105460.52928.A6

Fong, B., Fong, A. C. M., & Li, C. K. (2011). *Telemedicine technologies: Information technologies in medicine and telehealth*. John Wiley & Sons, Ltd.

Garcia, M. B. (2019). A speech therapy game application for aphasia patient neurorehabilitation - A pilot study of an mHealth app. *International Journal of Simulation: Systems, Science & Technology*, *20*(2), 1–9. 10.5013/IJSSST.a.20.S2.05

JASP Team. (2020). *JASP* (*Version 0.14.1*).

Kelly, H., Kennedy, F., Britton, H., McGuire, G., & Law, J. (2016). Narrowing the "digital divide" - facilitating access to computer technology to enhance the lives of those with aphasia: a feasibility study. *Aphasiology*, *30*(2–3), 133–163. 10.1080/02687038.2015.1077926

Kendall, D. L., Oelke, M., Brookshire, C. E., & Nadeau, S. E. (2015). The influence of phonomotor treatment on word retrieval abilities in 26 individuals with chronic aphasia: An open trial. *Journal of Speech, Language, and Hearing Research*, *58*(3), 798–812. 10.1044/2015

Kurland, J., Liu, A., & Stokes, P. (2018). Effects of a tablet-based home practice program with telepractice on treatment outcomes in chronic aphasia. *Journal of Speech, Language, and Hearing Research*, *61*(5), 1140–1156. 10.1044/2018_JSLHR-L-17-0277

Latimer, N. R., Bhadhuri, A., Alshreef, A. O., Palmer, R., Cross, E., Dimairo, M., Julious, S., Cooper, C., Enderby, P., Brady, M. C., Bowen, A., Bradley, E., & Harrison, M. (2021). Self-managed, computerised word finding therapy as an add-on to usual care for chronic aphasia post-stroke: An economic evaluation. *Clinical Rehabilitation*, *35*(5), 703–717. 10.1177/0269215520975348

Mason, C., Nickels, L., McDonald, B., Moses, M., Makin, K., & Taylor, C. (2011). Treatment of word retrieval impairments in aphasia: Evaluation of a self-administered home programme using personally chosen words. *Aphasiology*, *25*(2), 245–268. 10.1080/02687038.2010.489258

McKelvey, M. L., Hux, K., Dietz, A., & Beukelman, D. R. (2010). Impact of Personal Relevance and Contextualization on Word-Picture Matching by People With Aphasia. *American Journal of Speech-Language Pathology*, *19*(1), 22–33. 10.1044/1058-0360(2009/08-0021)

Nederlandse Vereniging voor Logopedie en Foniatrie. (2019). *Uitkomsten 2018: problematiek neemt toe*. https://www.nvlf.nl/actueel/2019/openbaar/problematiek-rond-logopedie-neemt-toe

Norman, D. A., & Draper, S. W. (Eds.). (1986). *User entered system design*. Lawrence Erlbaum Associates, Inc., Publishers.

Qualtrics. (n.d.). https://www.qualtrics.com

R Core Team. (2021). *R: A language and environment for statistical computing*. R Foundation for Statistical Computing.

Rochon, E., Laird, L., Bose, A., & Scofield, J. (2005). Mapping therapy for sentence production impairments in nonfluent aphasia. *Neuropsychological Rehabilitation*, *15*(1), 1–36. 10.1080/09602010343000327

Routhier, S., Bier, N., & Macoir, J. (2016). Smart tablet for smart self-administered treatment of verb anomia: two single-case studies in aphasia. *Aphasiology*, *30*(2–3), 269–289. 10.1080/02687038.2014.973361

Ruggero, L., McCabe, P., Ballard, K. J., & Munro, N. (2012). Paediatric speech-language pathology service delivery: An exploratory survey of Australian parents. *International Journal of Speech-Language Pathology*, *14*(4), 338–350. 10.3109/17549507.2012.650213

Sitren, A., & Vallila-Rohter, S. (2019). How well do we use our technology? Examining iPad navigation skills in individuals with aphasia and older adults. *American Journal of Speech-Language Pathology*, *28*(4), 1523–1536. 10.1044/2019_ajslp-19-0004

Swales, M. A., Hill, A. J., & Finch, E. (2016). Feature rich, but user-friendly: Speech pathologists' preferences for computer-based aphasia therapy. *International Journal of Speech-Language Pathology*, *18*(4), 315–328. 10.3109/17549507.2015.1081283

Thompson, C. K. H., Choy, J. J., Holland, A., & Cole, R. (2010). Sentactics®: Computer-automated treatment of underlying forms. *Aphasiology*, *24*(10), 1242–1266. 10.1080/02687030903474255

van de Sandt-Koenderman, W. M. E. (2011). Aphasia rehabilitation and the role of computer technology: Can we keep up with modern times? *International Journal of Speech-Language Pathology*, *13*(1), 21–27. 10.3109/17549507.2010.502973

Wade, V. A., Eliott, J. A., & Hiller, J. E. (2014). Clinician acceptance is the key factor for sustainable telehealth services. *Qualitative Health Research*, *24*(5), 682–694. 10.1177/1049732314528809

Wade, J., Mortley, J., & Enderby, P. (2003). Talk about IT: Views of people with aphasia and their partners on receiving remotely monitored computer-based word finding therapy. *Aphasiology*, *17*(11), 1031–1056. 10.1080/02687030344000373

Appendix A

Overview of questions that are included in the survey

Questions	Answer options
Demographic questions	
What is your gender?	• Female • Male • Other • Prefer not to say
In what setting do you work predominantly?	• A private SLT practice • A hospital (inpatient) • A hospital (outpatient) • A rehabilitation center (inpatient or outpatient) • Community • Residential care home • A research institution • Other (please specify)
What is your current job title?	Open question
How many years of work experience do you have working with people with aphasia?	Open question
How many hours per week do you approximately work with people with aphasia?	Open question
If you have a client with aphasia, how often do you usually see them (face to face or virtually; for assessment/treatment or other)?	• Less than once a week • Once a week • 2-3 times a week • More than three times a week
What percentage of your clients (approximately) have access to SLT services in their local area?	Slider ranging from 0-100%
SLT Experiences and Preferences Regarding Aphasia Therapy Apps	
Are you generally open to using therapy apps for people with aphasia?	• Not at all • A little • Quite a bit • Definitely
To what extent do you feel that therapy apps can contribute to the achievement of therapy goals for people with aphasia?	• Not at all • A little • Quite a bit • A lot
What proportion of your clients (if any) do you use therapy apps with as part of your aphasia therapy?	• None of my clients • Some of my clients • Most of my clients • (Nearly) all of my clients
Do you feel that your employer/clinic would be willing to invest in the use of therapy apps?	• Yes • No • My employer would only be interested in free apps
Which of the following factors influence your decision to use therapy apps? Please select all that apply.	• Severity of the impairment • Cognitive status of the client • Age • Gender • Type of impairment (e.g. semantic, phonological output) • Computer literacy of client • Availability of device (e.g. tablet) • Availability of suitable app • Availability of carer to support app use at home • Client's interest in apps • Other (please specify)

(*Continued*)

(Continued).

Questions	Answer options
SLT Perceptions of Tablet Use by, and Online Therapy Suitability for, People with Aphasia	
On average, how often do your clients with aphasia use smartphones/tablets?	• Never • Monthly • Weekly • Daily • Multiple times per day
How often should an SLT be present while the client is using a therapy app?	• Never • Every now and then • Most of the time • Always
How frequently do you think a person with aphasia would be able to practice therapy material independently using a therapy app?	• Never • Monthly • Once a week • Two to three times a week • More than three times a week • Daily • Several times per day
Facilitators and Barriers for the Use of Aphasia Therapy Apps	
Can you describe your ideal aphasia therapy app?	Open question
Which user data would you want to have access to if your client uses a therapy app independently? Please select all that apply.	• The amount of time that the app is used • Cues that the client needs to give an answer • Which exercises the client finishes • The number of errors • The type of errors • Audio recordings of the client's input • Other (please specify)
What do you perceive as barriers to the use of apps in aphasia therapy?	Open question
What do you perceive as facilitators to the use of apps in aphasia therapy?	Open question

Appendix B

Full model output for ordinal logistic regressions

		95% CI for odds ratio			
Demographic factor	*B (SE)*	*Lower*	*Odds ratio*	*Upper*	*p*
Are you generally open to using aphasia therapy apps?					
Country	-0.64 (0.61)	0.15	0.52	1.69	0.29
Age	0.00 (0.03)	0.95	1.00	1.06	0.97
% of clients with SLT access in hometown	-0.03 (0.02)	0.94	0.97	1.00	0.11
To what extent do you feel that therapy apps can contribute to reaching therapy goals for people with aphasia?					
Country	-1.04 (0.55)	0.12	0.35	1.01	0.06
Age	-0.01 (0.03)	0.94	0.99	1.04	0.71
% of clients with SLT access in hometown	-0.01 (0.01)	0.97	0.99	1.01	0.49
For how many of your clients do you use therapy apps as part of the aphasia therapy?					
Country	-1.64 (0.60)	0.06	0.19	0.60	0.006
Age	0.00 (0.03)	0.95	1.00	1.06	0.96
% of clients with SLT access in hometown	-0.04 (0.01)	0.93	0.96	0.98	0.001

(*Continued*)

(Continued).

Demographic factor	B (SE)	95% CI for odds ratio Lower	Odds ratio	Upper	p
How often do people with aphasia use smartphones/tablets?					
Country	-0.36 (0.52)	0.25	0.70	1.93	0.49
Age	0.01 (0.03)	0.96	1.01	1.07	0.65
% of clients with SLT access in hometown	-0.02 (0.01)	0.95	0.98	1.00	0.05
How often do you think a person with aphasia is able to practice therapy material independently using a therapy app?					
Country	-1.12 (0.52)	0.11	0.33	0.89	0.03
Age	0.02 (0.03)	0.98	1.03	1.08	0.33
% of clients with SLT access in hometown	0.01 (0.01)	0.98	1.01	1.03	0.68

Appendix C

Full model output for binary logistic regressions

Demographic Factor	B (SE)	95% CI for odds ratio Lower	Odds ratio	Upper	p
Do you feel that your clinic/employer would be willing to invest in the use of therapy apps?					
Country	0.78 (0.72)	0.55	2.18	9.75	0.28
Age	-0.02 (0.03)	0.92	0.98	1.05	0.59
% of clients with SLT access in home town	-0.01 (0.02)	0.95	0.99	1.02	0.57
How often should an SLT be physically present while the client is using a therapy app?'					
Country	-2.39 (0.78)	0.02	0.09	0.37	0.002
Age	-0.03 (0.04)	0.90	0.97	1.04	0.41
% of clients with SLT access in home town	-0.02 (0.02)	0.95	0.98	1.01	0.22

Appendix D

Differences between Australia and Netherlands in participant responses: Fisher exact test results

Which factors influence your decision to use therapy apps as part of your therapy for a particular client?

Factor	*p*
Availability of suitable app	0.09
Client's cognitive status	0.72
Client's interest in apps	1.00
Availability of suitable device	0.76
Severity of the impairment	1.00
Client's computer literacy	0.80
Availability of carer support	0.21
Client's age	0.30
Type of impairment	0.57
Client's gender	0.45

Which user data would you want to have access to when your client uses a therapy app?

Factor	*p*
Cue use	0.44
Type of errors	1.00
Number of errors	0.49
Completed exercises	1.00
Audio recordings of client	0.62