

The Personalisation Process for First Time Users

EDITOR OF THIS ISSUE

Marlin Johansson, (MSc), *Clinical Research Audiologist, Oticon A/S*

ABSTRACT

Today, there is an extensive amount of information available about hearing health care for a curious person with hearing loss. However, there is a risk that the information obtained might be difficult to read and/or of low quality (e.g. Levante-Levesque et al., 2012). It can therefore be challenging for a person with hearing loss, to understand what kind of help he/she needs when approaching hearing health care for the first time.

Professionals who are able to adequately communicate that they provide the best available hearing health care are more likely to be successful hearing instrument providers (Kochkin, 2002). Oticon's Personalisation Process assists in finding a set of signal processing parameters suitable for the user's personal preferences, demands and needs. At the same time the user can be involved in active decision-making using a method based on evidence from hearing research.

The questions and dedicated sound files used to find each user's personal preferences were initially tested on experienced users. Since first time users have no experience with listening to sound through a hearing instrument, a study was conducted to find out what questions would be most appropriate to ask them.

This white paper will describe the process of developing new questions and dedicated sound files to obtain information that enables profile prescriptions matching the first time user's preferences, demands and needs. It will also describe the uniqueness of the Personalisation Process. One example is how cognitive factors are taken into account when prescribing sound in the hearing instrument. Furthermore, the latest research of how to best involve the first time user in the fitting process will be presented.

So much more than amplification

Some people understand that they need help with their hearing. However, due to a friend or family member's bad experience with hearing instruments, they are uncertain whether rehabilitation is worth the effort. A lot of professionals have listened to the failed experiences of a potential first time user who has even tried on someone else's hearing instrument.

As professionals we might approach this situation by explaining that the consequences of hearing loss are very individual. A simple explanation for the hearing instrument's poor fit in the ear could be a difference in ear size. This is easy to explain to the person with hearing loss. The terrible sound experience could be due to differences in degree, type and configuration of hearing loss - also easy to explain. However, it is much more difficult to explain that sound experiences and how sound is perceived, varies greatly between individuals, even if they have the same degree, type and configuration of hearing loss. Making sounds audible is no guarantee that the auditory system can make use of the received information. These are difficult concepts to explain and understand.

Our challenge within the audiology field is not just technology - it is connecting the best available technology to a complex and impaired auditory system, which is not yet fully understood. In contrast to direct mail or over-the-counter hearing instruments which focus almost entirely on amplification, Oticon hearing instruments accommodate for individual differences in multiple known areas of listening (e.g. Humes et al., 2013; Kidd et al., 2007). And now, with new questions and

sound files especially developed for first time users, we have even greater potential to match the patient's listening preferences, demands and needs.

Invite the first time user to be an integral part of the fitting process

Oticon offers tools so that the professional, together with the user, can personalise the hearing instrument characteristics and at the same time learn more about the user's needs. The possibilities of involving the user in active decision-making has been an important part of the development of the Personalisation Process, since active participation has shown greater positive impacts on health outcomes, than only listening to the patient's perspective (Michie et al., 2003) (Figure 1).

There have been indications within the audiology field and other health care sectors that there are users/clients who are not invited to take an active part in the rehabilitation process (e.g. Gzil et al., 2007; Laplante-Lévesque et al., 2012). This might be surprising and is definitely unfortunate since the user not only benefits from shared decision-making in terms of improved health status, but it also leads to greater satisfaction and adherence to treatment and an increased willingness to self-manage. The benefits are also seen for the professional in terms of higher job satisfaction and reduced likelihood of malpractice claims (Grenness et al., 2014).

Several studies have shown that shared decision-making is best performed with a personalisation approach - some users may prefer more interaction and decision-

Word list

Personal Profile	A prescribed group of a range of signal processing parameters such as amount of noise management, directionality settings, compression speed, etc.
Personal Profile sub-steps	Personal Profiles can have a plus and/or a minus sub-step creating in-between groups of signal processing parameters between the Personal Profiles. The sub-steps can be used for optimisation in the YouMatic Manager.
Preference Manager	Functionality in Genie where questions can be answered and dedicated sound files can be used in order to predict a Personal Profile.
YouMatic	YouMatic is a core feature for personalisation. In Genie the YouMatic Manager is a user interface where the Personal Profile and sub-step grouping parameters are displayed and the prescribed Personal Profile or sub-step can be altered.
The Personalisation Process	The process of answering questions in the Preference Manager to predict a Personal Profile, which can be further personalised in the YouMatic Manager.

making than others (Laplante-Lévesque et al., 2010; Grenness et al., 2014; Poost-Foroosh et al., 2011). Other aspects that users deem important in shared decision-making can be found in Figure 2.

A deeper look into the Personalisation Process

In addition to the possibilities of inviting the user to take an active part in the fitting, another benefit gained from using the Personalisation Process is the advanced way it prescribes Personal Profiles.

A Personal Profile with a group of signal processing settings can be prescribed according to questions and dedicated sound files in the Preference Manager in Genie (Figure 3). The initial prescription is a good start, but the fitting has the potential of being even better at a follow-up visit. For optimisation, sound files are also available to be played aided in the YouMatic Manager and a new Personal Profile or sub-step can be chosen according to the user's preferences, demands and needs.

Oticon has presented how signal processing settings are grouped together in the Personal Profiles for Alta, Nera and Ria (Neel Weile & Littau, 2014). On one hand the users receive as much help from automatic systems as possible ("Steady"), whereas on the other hand they receive less help and a more natural auditory experience ("Lively") (Table 1). This white paper is designed to provide more background on this unique categorisation of signal processing settings.

Finding a balance between preferences and needs

Although the user is the one having the most experience with his/her own hearing, the user is most often not an expert in audiology. To get the most out of the

fittings we professionals typically find out what the user prefers - and guide them to what they need. Finding what the user needs is not a simple task, since many psychoacoustic and cognitive considerations have to be taken into account.

The Personalisation Process is designed to provide tools that connect the best possible technology to what we know about the impaired auditory system and how different perceptual preferences apply. Did you know, for instance, that working memory capacity has typically been found to be at least as important as hearing loss when accounting for individual differences in aided speech-understanding performance? (Akeroyd, 2008; Humes et al., 2013; Lunner & Sundewall-Thorén, 2007) Taking cognitive factors into account is something that has been part of Oticon's evidence based personalisation for a decade (Gatehouse et al., 2003). However, it was not until the release of the Inium platform that the Personal Profiles became visible in Genie and could be optimised in the YouMatic Manager.

Individual differences in working memory capacity can especially influence speech understanding in noise (e.g. Lunner, 2003; Humes, 2007; Wong et al., 2010; Meister et al., 2013). Lunner (2003) also found that subjects with higher working memory capacity were better than those with lower working memory capacity at identifying and reporting specific processing effects in hearing instruments. The results indicate that the advantage gained by hearing impaired people from signal processing in hearing instruments is very individual - and that working memory capacity can influence these individual differences. More insights into how working memory is taken into consideration along with other parameters can be found in Info box 1.

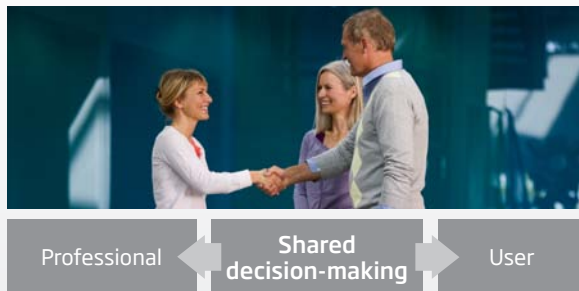


Figure 1. Shared decision-making. The user taking an active part in the rehabilitation process and the professional supporting the user in decision-making is beneficial for both user and professional (e.g. Grenness et al., 2014).

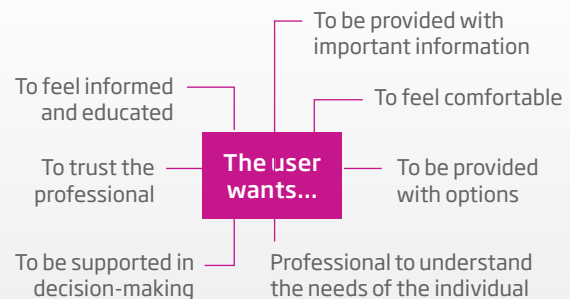


Figure 2. Important factors for hearing instrument users in shared decision-making. The factors are taken from interviews with users (Laplante-Lévesque et al., 2010; Poost-Foroosh et al., 2011).

News for first time users

The first time user's mindset is often considerably different from the experienced user's when they enter the hearing clinic. The first time user is unfamiliar with sound through a hearing instrument. For many first time users a hearing instrument is not just a purchase - it can be a life-changing investment. The hearing instrument can change the individual's whole perception of the world and sacrifices might have been made in order to purchase it (Knudsen et al., 2013).

With the strengths of the Personalisation Process - tools supporting shared decision-making and prescribing signal processing features accommodating for individual differences in numerous known areas of listening - it is not surprising that the combination of Alta Pro and the Personalisation Process have shown significant improvements on multiple dimensions of satisfaction (Schum & Pogash, 2014). Nevertheless, the Personalisation Process was developed based on data from experienced users.

Because of the positive outcomes of the Personalisation Process and the first time user's lack of experience with sound through a hearing instrument, questions and sound files have now been developed specifically for first time users, available in the Preference Manager in Genie. These sound files are recommended to be presented unaided at an audible level. Since the sound files in the YouMatic Manager are constructed to be used aided at a follow up visit, the same sound files can be used for first time users as for experienced users.

New questions based on a first time user survey

In order to choose questions suitable for first time users, a survey was designed by Oticon Inc. The survey was answered by 192 first time users. Of the participants, 92 were fitted with Oticon Inium-based instruments. The mean age of the participants was 73 years (ranging from 49 to 93 years). The study consisted of 13 questions similar to the ones for experienced users with two alternative forced-choice questions designed to obtain a sense of the first time user's daily hearing experiences, hearing preferences and hearing perception.

Based on the statistical analysis (descriptive statistics, analysis of variance, correlations) of the answers from the first time user survey and the prescribed Personal Profile - 4 questions were chosen from the 13 to be used in the Preference Manager (Table 2). The goal was to find a set of questions that best predicts differences in individual needs and preferences, in order to best predict the amount of support needed from help systems in the hearing instrument.

Question 1 is the same as for experienced users. If a person prefers sound to be sharp and distinct, a small increase in higher frequencies can deliver more details in sound. The question was chosen because it gives information about sound quality preference and the preferred setting varied greatly between the test subjects.

Question 2 covers loudness preference, which is known to vary among listeners (e.g. Kidd et al., 2007). It was chosen based on a tendency to separate users from the groups "Gentle" and "Exact" as seen in the descriptive analysis.

Question 3 originated from two questions in the survey; "I find that sudden sounds in the listening environment are uncomfortably loud" and "I get bothered by sudden loud sounds". As both questions yielded a significant distribution between respondents and the questions also correlated with each other, they were combined into one of the final questions. This question gives information about sensitivity to loud sounds.

Question 4 adds a preference for help system activation. Of the respondents 2% commented that Question 4 could be difficult to answer without hearing instrument experience and some indicated that they would like both, but in different situations. Since this only applies to a small group of users, this is seen as a problem that could be solved by dialogue between the user and professional in a fitting situation.

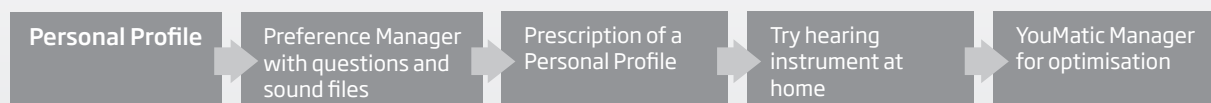


Figure 3. The Personalisation Process fitting flow.

Alta VAC

FEATURE	Normal	LIVELY	EXACT	BALANCED	GENTLE	STEADY
		Opti Omni	Opti Omni	Opti Omni	Speech Omni	Speech Omni
Omni type	Normal	Opti Omni	Opti Omni	Opti Omni	Speech Omni	Speech Omni
	Power	Opti Omni	Opti Omni	Opti Omni	Opti Omni	Opti Omni
Directional Automatics	Normal	Tri-mode	Tri-mode	Tri-mode	Tri-mode	Tri-mode
	Power	Tri-mode	Tri-mode	Tri-mode	Tri-mode	Tri-mode
Directional with Low Frequency Compensation	Normal	Off	Off	Off	Off	Off
	Power	On	On	On	On	On
Noise Management						
Maximum reduction - Noise only		12 dB	12 dB	12 dB	12 dB	12 dB
Maximum reduction - Speech in noise		4.5 dB	6.75 dB	9.75 dB	11.25 dB	11.25 dB
Transient Noise Management		Off	Off	On / Situation Dependent	On / Situation Dependent	On / Situation Dependent
Gain adjustment (for VAC, above 2 kHz)						
		~ +3.0 dB	~ +2.5 dB	~ +1.5 dB	None	None
Speech Guard E						
Time constant setting		Fast	Medium	Medium	Medium	Slow
Floating linear window		12 dB	12 dB	12 dB	12 dB	12 dB
Spatial Noise Management						
Maximum reduction		6 dB	6 dB	6 dB	6 dB	6 dB
SNR difference to activate		-10 dB	-7.5 dB	-5 dB	-2.5 dB	-2.5 dB

Table 1. YouMatic options for Alta with VAC. The bigger colored boxes illustrate five Personal Profiles. The smaller colored boxes illustrate sub-steps, giving a total of 15 profile steps on a scale. Settings below the boxes give information about parameters that are prescribed for each Personal Profile. The sub-steps prescribe settings with values in between the ones for the Personal Profiles.

Info box 1: A deeper look into the Personal Profiles

Surveys of hearing instrument satisfaction have shown that the number one complaint of hearing impaired people and hearing instrument users is their inability to clearly understand speech in challenging acoustic environments (Kochkin, 2010). In order to accommodate for individual differences in speech understanding in difficult environments, both perceptual and cognitive differences need to be taken into account. One example of a parameter affecting differences in speech understanding in noise is working memory capacity.

Personal Profiles are constructed with different groups of signal processing parameters. The user is prescribed a profile depending on how much support from help systems the user requires. These requirements are based on answers to questions in the Preference Manager. The questions in the Preference Manager prescribe an "Exact", "Balanced" or "Gentle" Personal Profile. The Personal Profile sub-steps, "Lively" and "Steady" are not automatically prescribed but can be chosen in the YouMatic Manager when optimising the fitting.

Generally, users who want more details from their surroundings, presumably someone with higher working memory capacity, gets a profile closer to

"Lively". A user with less desire for details, presumably someone with lower working memory capacity, gets a profile closer to "Steady". An example of this is displayed in Table 1 where "Steady" is prescribed with more noise management - less environmental details - for speech in noise than "Lively".

Spatial Noise reduction is activated at different signal-to-noise ratios (SNRs) depending on the Personal Profile. A user with a "Lively" setting has the Spatial Noise reduction activated at a lower SNR (less frequently) than a user with a "Steady" setting. In this way a user with a "Lively" setting gets a more natural and challenging sound experience and a user with a "Steady" setting gets more help in complex listening environments.

Individuals with higher cognitive ability (i.e. working memory capacity) have been found to benefit from faster compression speed (e.g. Cox and Xu, 2010; Moore, 2008) than individuals with lower working memory capacity. How this has been taken into account in the Personal Profiles can also be seen in Table 1 where "Steady" is prescribed with a slower time constant setting of Speech Guard E and "Lively" with a faster setting.

Dedicated sound files

Dedicated sound files have been created for all four new questions. These are available to guide the user to the most appropriate answer to the questions. The sound files were created with several parameters in mind: 1) they should roughly illustrate how the hearing instrument will sound depending on the user's answer to the question 2) the sound sample should focus on the most important element of the question.

Sound files to Questions 1, 2 and 4 were created on an A-B-A-B model, where one first hears the sound sample for the first answer to the question (A) and then the sound sample for the second answer to the question (B) and then (A) and (B) again. They are played four times so that the user has the opportunity to separate the two answers and to get strong validity. For Question 1, two different noisy surroundings or a music sample can be chosen (same setup as for experienced users), for Question 2 and 4 there is also an option to play A and B separately if the user does not hear the difference in the A-B-A-B default sound sample. Sound files to Question 3 are examples of sudden sounds and not created on an A-B-A-B model.

Conclusion

One of the reasons for choosing Oticon instruments is an ability to personalise the fitting from a professional and user standpoint. Oticon does not only focus on amplification in the hearing instrument, but on the entire concept of better hearing. In that concept lies the opportunity to involve the user in the fitting for best fitting outcomes.

Another reason for choosing Oticon instruments is the advanced way signal processing parameters are prescribed. The user requests and expects better listening opportunities and speech understanding also in complex listening environments. In order to meet the user's preferences, demands and needs multiple known peripheral and cognitive variations (e.g. working memory capacity) needs to be taken into account in the prescription.

With the new questions and dedicated sound files for first time users, the Personalisation Process has been extended to also include individuals who are new to amplification. With these tools hearing care professionals are better equipped to communicate that they offer the best possible hearing health care and that they can meet the user's demands and needs with high competence, appropriate tools and great understanding.

New questions	Purpose:
I prefer the sound to be: Sharp and distinct/Soft and round	Helps determine if the user prefer a modest (3-4 dB) gain increase in higher frequencies or more support from help systems such as noise reduction and directionality.
I can hear well at a lower volume. I prefer to listen at: That volume/A volume slightly higher	Gives information about the loudness preference which is valuable since soft gain is prescribed somewhat differently in the different Personal Profiles.
I find that sudden sounds in the listening environment are unpleasantly loud: Yes/No	Determines if the user requires more noise control and transient noise management or if the user does not want to miss out on any details in sound.
When in noisy surroundings, I would like the hearing instruments to: Help me focus/Keep the natural sound picture complete	Gives information about how much help from automatic systems such as noise reduction and directionality is needed.

Table 2. New questions for first time users and the purpose of the questions.

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