



Perseo™

PersonalLogic™ and Dual-Program automatic function

Abstract

Everyday life is filled with a very wide range of hearing situations. Automatic multi-program hearing systems are ideal for assisting people with hearing difficulties in any environment. Hearing needs and preferences can be very individual, with marked differences from one person to the next in the same hearing situation. So, in addition to compensating for measured hearing loss, an advanced hearing system also must cater to specific personal requirements, and simply and effectively be customizable to individual client needs.

The Perseo hearing system, with its PersonalLogic and dual-program automatic function, is the first to meet the challenge. Perseo can be "tailored" to the client's needs as part of the fitting process. After all, a hearing instrument not only needs to win spontaneous acceptance, it also must prove itself in everyday use – and that means catering to individual personal requirements. This aspect is crucial to improving long-term satisfaction, and to ultimate fitting success.

PHONAK

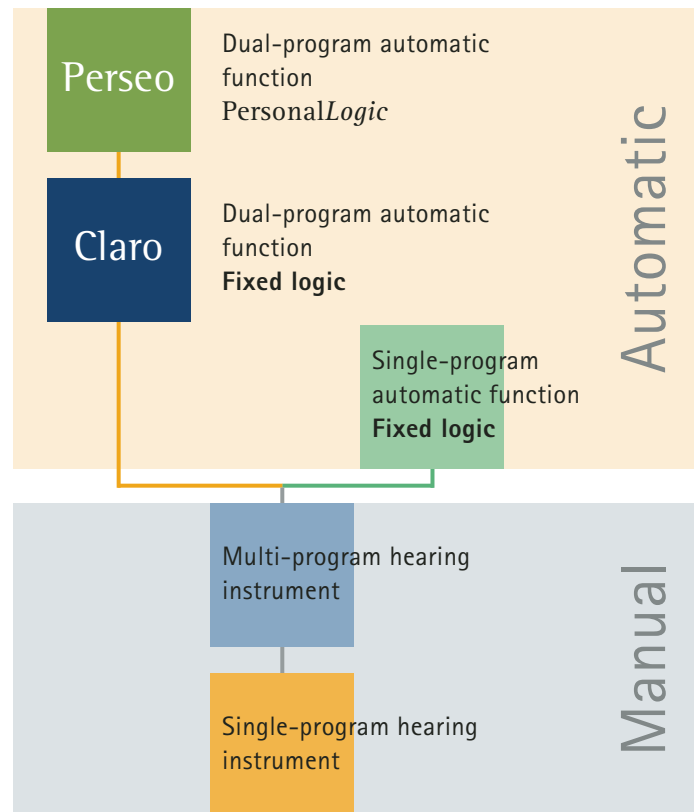
hearing systems

Background

We encounter a very wide range of hearing situations every day. We move between relatively quiet and extremely noisy environments. We talk with people at home, in public transport, or at a busy café. While people with normal hearing are unchallenged generally by any of these situations, people with hearing difficulties need backup from their hearing instruments. These provide maximum benefit if they can process sounds in the most effective way for the current situation. In high ambient noise levels, for example, directional microphones and noise suppression improve speech intelligibility and hearing comfort (e.g. Ricketts and Henry, 2002; Gabriel, 2001; Alcantara et al., 2002). By contrast, people prefer omnidirectional microphones in quiet situations. A series of studies determined that trial subjects preferred different response curves, depending on the current acoustic environment (Fabry and Stypulkowski, 1992; Keidser, 1996; Keidser, 1998). This is where single-program hearing instruments reach their limits, because sound processing cannot adapt to the needs of the moment.

Multi-program hearing instruments incorporate several hearing programs, each with different sound processing. The user can select the preferred program manually, either via a remote control unit or directly on the instrument. A hearing instrument satisfaction survey (Kochkin, 1996) revealed that the multi-program option was a major contributor to increased client satisfaction. To benefit from the multi-program option, a hearing instrument user needs to assess the current acoustic environment personally and then manually switch to the optimal hearing program.

By introducing automatic program selection, Phonak has advanced the state-of-the-art in multi-program hearing instruments greatly. The Perseo features a dual-program automatic function with *PersonalLogic*. It continually analyzes the acoustic environment, accounts for the user's personal needs and preferences, and dynamically selects whichever hearing program is most appropriate to current conditions.



Perseo dual-program automatic function

To provide optimal assistance for people with hearing difficulties in all acoustic environments, the hearing instrument must adjust automatically to the current situation. Automatic hearing systems fall into two categories: single-program and dual-program. Single-program instruments always use the same basic hearing program, with additional directional microphones or other aids being activated to counteract noise interference. Should fine-tuning be necessary, for example if the client desires a gain modification for situations with interfering noise, that adjustment inevitably applies to quiet conversational situations as well – probably quite the opposite of what the

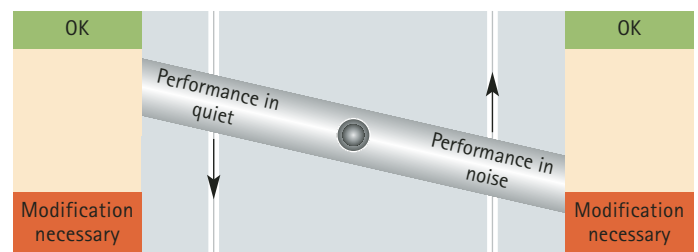


Figure 1 "See-saw" effect with a single-program automatic function: enhancing one situation impairs the other.

Glossary

Automatic function: Hearing instrument parameters and functions modify themselves in response to acoustic situations, without user intervention.

Single-program automatic function: Automatically effects changes within the basic hearing program (e.g. activates directional microphones). Fine-tuning the basic program affects all hearing situations.

client wants. This "see-saw" effect (Figure 1) means that an improvement in one hearing situation causes deterioration in another. Despite increased fitting effort, the client is no better off in the end.

That is why Perseo uses a dual-program automatic function, incorporating two separate hearing programs optimized for hearing in quiet and noisy situations respectively. Each program is adjustable independently (Figure 2). The client's personal needs can be met for any environment, a vital factor towards long-term satisfaction with the hearing system.

Same acoustic situation – differing needs

Automatic program selection requirements can vary widely between individuals, such that hearing instrument users in the same environment may prefer different programs. Out on the street, for example, certain users like to use a second hearing program with directional microphones and attenuated gain, to reduce auditory overload and increase comfort. Others in the same situation prefer the first hearing program with omnidirectional microphones, in order to receive as much auditory input as possible and avoid a sensation of being cut-off from their environment.

A successful hearing instrument fitting must address the individual needs of the person with hearing difficulties. A series of studies has shown that satisfaction with the hearing instrument depends not only on measurable audiological factors, but also on how well the instrument supports personal preferences and listening habits (Noble, 1999; Gatehouse, 2002).

Dual-program automatic function: Automatic switching between two separate hearing programs, each designed for a different hearing situation. Fine-tuning can be made specific to a given hearing situation.

Fixed logic: The automatic system responds according to fixed preset criteria that do not account for individual user needs and preferences.

PersonalLogic: The automatic system accommodates individual preferences, behaving in accordance with the user's wishes in different hearing situations.

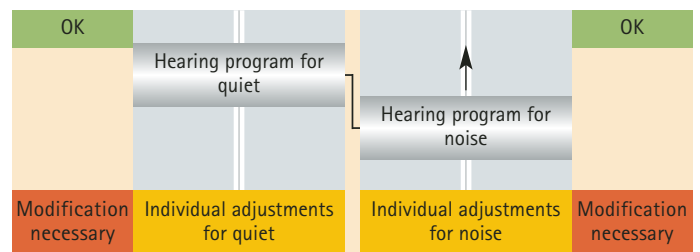


Figure 2 Dual-program automatic function: independent optimization for quiet and noisy situations.

Perseo with *PersonalLogic* takes due account of the user's individual preferences. Unlike fixed logic hearing systems, Perseo can be "tailored" to the client's needs as part of the fitting process. After all, a hearing instrument not only needs to win spontaneous acceptance, it also must prove itself in everyday use – and that means catering to individual personal requirements. This aspect is crucial to improving long-term satisfaction, and to ultimate fitting success.

Comfort vs. audibility

In non-speech hearing situations, hearing instrument users may be classified into two basic groups. There are those who prefer maximum audibility, in order to take in as much as possible of the environment. Then there are others who find the audibility of the background rather irritating and prefer to tune it out for greater comfort.

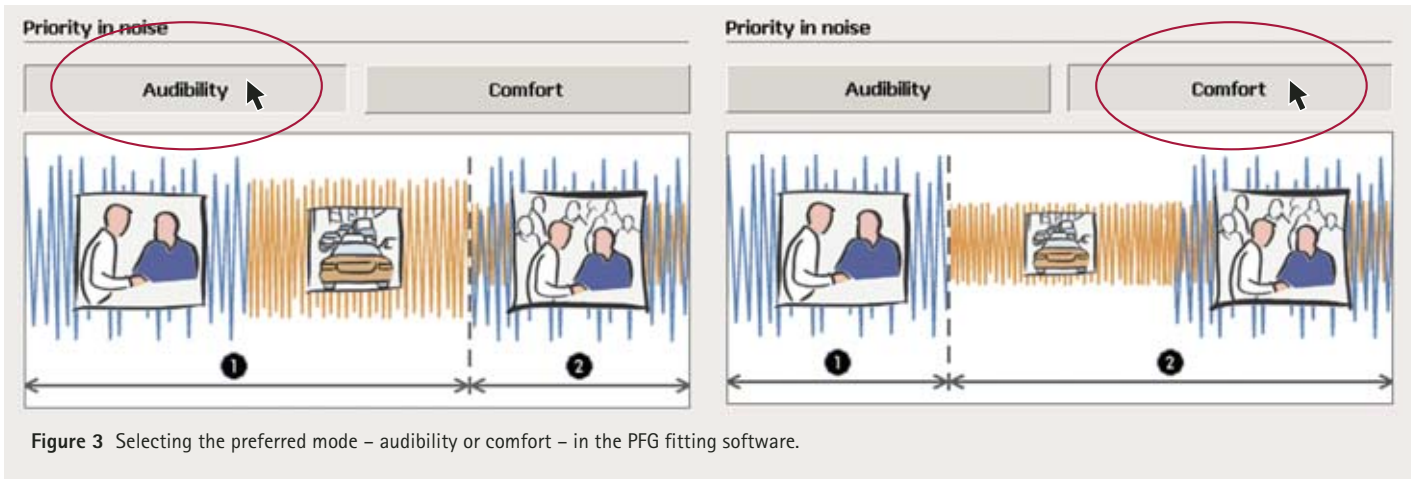


Figure 3 Selecting the preferred mode – audibility or comfort – in the PFG fitting software.

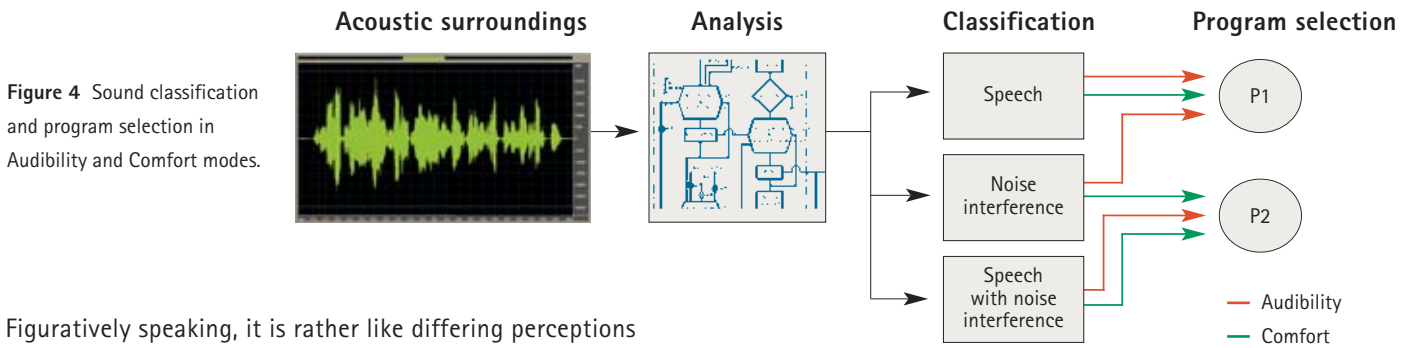


Figure 4 Sound classification and program selection in Audibility and Comfort modes.

Figuratively speaking, it is rather like differing perceptions of a full-throated Harley-Davidson roar: music to the ears of the bike's owner, but a deafening impertinence to his neighbor, who would rather see the machine fitted with a decent muffler.

PersonalLogic satisfies the needs of both basic groups of hearing instrument users, by allowing them to select Audibility or Comfort mode according to preference (Figure 3).

In Audibility mode, PersonalLogic selects the first hearing program with omnidirectional microphones for non-speech situations, to deliver as complete an auditory impression as possible. In Comfort mode, the same situation selects the second hearing program with directional microphones and a modified response curve, to provide the desired attenuation of ambient sounds. The sound classification and program selection principle used in both modes is shown in Figure 4.

In Audibility mode, switching to another hearing program requires the situation classification to remain stable for 10 seconds; Comfort mode switches to the second hearing program after just 4 seconds, so the desired attenuation of incoming sounds cuts-in as early as possible (e.g. to mute the sound of a truck driving past).

Sensitivity

Not only does the preferred program for a given situation vary between individuals, so does the preferred sensitivity of the automatic program selection algorithm (Büchler, 2001). Figure 5 shows the wide range of individual appraisals of the frequency with which the system switches algorithms (which reflects individual sensitivity to noise). Many trial subjects were satisfied basically with the default setting. Others expressed a wish for considerably more or less frequent program switching.

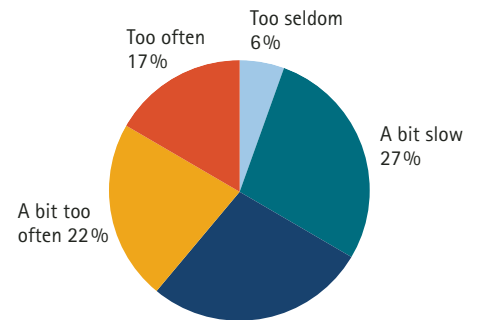


Figure 5 Survey results: "How do you rate the AutoSelect switching frequency?" (Büchler 2001).



PersonalLogic allows automatic program selection to match the client's personal taste and sensitivity (Figure 6).

Variable switching sensitivity is achieved by incorporating an offset in the classification criterion (Figure 7). A high and hence "stricter" classification criterion is less conducive to switching, making the system correspondingly less responsive. Conversely, lowering the criterion leads to more frequent switching, so the system becomes more responsive.

Contrast

There are also considerable person-to-person differences in the preferred contrast between hearing programs. While some clients like to hear a significant difference between the two settings (and want to sense clearly that "something has happened"), others prefer a more restrained contrast. PersonalLogic caters to this individual preference, too. Modifying the contrast causes the amplification parameters for the second program to approach or diverge from the first program. Changing the contrast does not affect the settings for the first program (Figure 8).

Figure 6 Adjusting the automatic program selection sensitivity in the PFG fitting software.

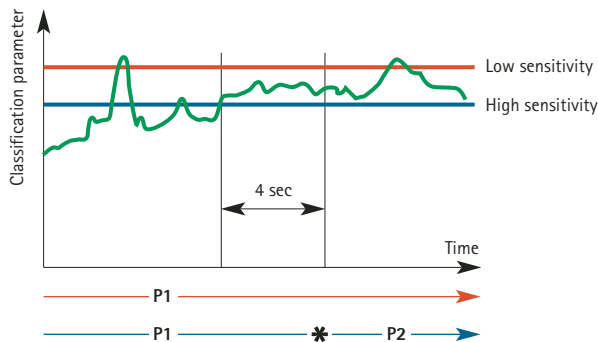
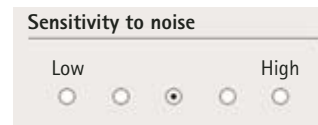


Figure 7 Continuous situation analysis generates a classification parameter that characterizes the present acoustic situation. The hearing instrument switches from the first to the second hearing program if a certain threshold criterion is continuously exceeded for longer than 4 seconds (10 seconds in Audibility mode). In this example, the condition is met only by selecting a low threshold criterion (high sensitivity). The hearing instrument remains in its first program. Low sensitivity effectively reduces the frequency with which the hearing instrument switches back and forth.

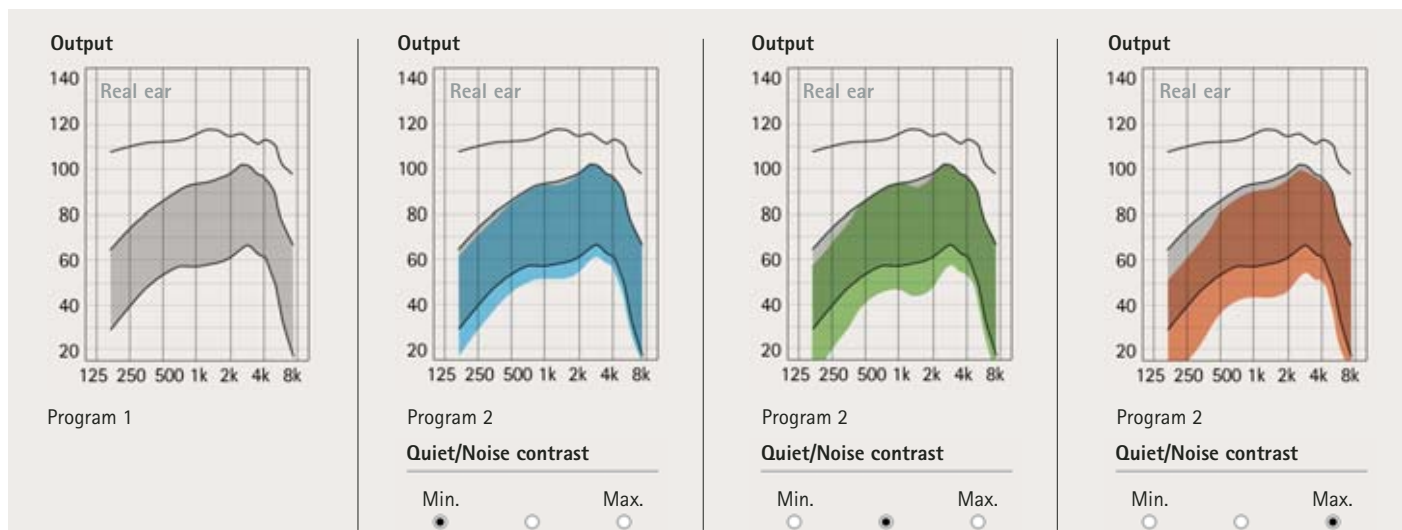


Figure 8 Output level range for amplified speech: changing the contrast affects the second program's parameter settings.



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