Audiometry Training with Virtual Patients

Autonomous Learning - Practice - Consolidation

Otis
the virtual patient
New Quality Standards in Audiometry

*Otis* - the virtual patient simulates a range of complex hearing defects so that correct audiometry can be administered without having to burden a patient at all. The software intelligently and realistically simulates the behaviour of the patient and detects possible user errors immediately. The program guides the learner through the exercises at several levels of difficulty and provides useful help.

*Otis* shortens the time needed for training, as all types of hearing impairment can be simulated for audiometry testing at any time. In this way, proficiency in procedures can be improved, and the skills acquired can be put into practice significantly faster.

Using the program, experienced practitioners also have the opportunity to acquire routine in working with complex hearing impairments, thus decisively increasing client safety. The integration of autonomous learning concepts allows learners to work simply and efficiently wherever they are, and thus make best use of their time.

*Otis* - the virtual patient was developed in close cooperation with consultants at the Aston University in Birmingham, the Academy for Hearing Aid Acoustics in Lübeck and the University Hospital in Zürich. *Otis* does not just set completely new quality standards, it has also been extremely well received by experts. Only two years after the product launch, the fundamental benefits of *Otis* compared with traditional methods have led to nearly all training institutions in the German-speaking world integrating it into their training and further education programmes.

Dr. Annette Limberger, Audiologist, acoustician and physician, based in Mainz

“Audiometry is a matter of practice. Correct results can only be achieved with a great deal of practice and a feeling for the activity - and so beginners need a lot of training. That is what *Otis* - the virtual patient provides and a book doesn’t.”
Otis Pro

The Edition Pro of Otis - the virtual patient has been specially developed for medical practices and private hearing aid dispensers.

Conducting complex hearing tests requires a high level of training and continuing professional development in the field of audiometry.

It is to meet this need that Otis Pro has been developed with its user-friendly interface and numerous features. The didactically designed software familiarizes learners with audiometry at a selectable level of difficulty and monitors each and every step. Accurate analysis of the measuring processes also allows the learning objectives to be continually monitored and adapted.

Otis Pro is therefore the instrument of choice for cost reduction whilst quality demands increase.

Quality enhancing features

- Increased reliability when measuring complex hearing impairments
- Prevention of measurement errors
- Increased reliability and comfort for the patient due to training without hearing test participant
- Completely objective feedback

Cost-saving features

- Intensive autonomous training
- Time-pressure off physicians and audiologists
- Less supervision during audiologist training
- More efficient measurements thanks to more routine
- Otis Pro can be used on any PC for training purposes

Herbert Jakits, chartered audiologist, chief executive of a private hearing aid dispensary in Zurich

"The obvious benefits are that we can now make use of slack time to practice with Otis, and that staff can manage their own training whenever it is convenient or an opportunity presents itself."
Otis Expert

The Edition Expert of Otis - the virtual patient was developed specially for course leaders and training managers; it provides numerous functions to allow the patient profiles and exercise data to be tailored to the particular needs of learners. With the additional assessment module, you can generate and evaluate student exams.

The Edition Expert for trainers and tutors in conjunction with the Edition Professional for learners provides a completely new training concept, combining the most up-to-date communication technologies with traditional didactic principles.

The Otis Training Concept

Otis - the virtual patient presents a completely new approach to running training courses for audiologists.

During the actual audiometry course, the instructors focus on teaching the theory and providing the participants with an introduction to using the program Otis. After the course, the participants have the opportunity to deepen the theoretical competence they have acquired autonomously either on a distance learning course or in a suitably equipped skills lab and apply them with Otis - the virtual patient.

At the same time, exercises and analysis data are exchanged over the Internet so that each learner may be individually supervised and supported by the course organisers.

These courses can finish with a test which the participants can take using a PC not tied to any particular location.

Otis Expert is therefore the instrument of choice for increasing the efficiency of continuing training.

Quality enhancing features

• Standardized training
• Better routine and certainty when masking
• Individual feedback from the software and from tutor via the internet
• Completely objective evaluation

Cost-saving features

• Training without actual test subjects
• Intensive and autonomous learning
• Reduced staff costs for running training courses
• Practice facility without having to rely on expensive audiometers

Nicole Bachmann, Otis course participant, Delémont

E-mail from Nicole to the course leader:

“It ‘grabbed’ me immediately, because I really wanted to go on and do more exercises and send them to you.”

Jennifer Löbert, responsible for training, Education College, Dresden

“... I find it makes a lot of sense to use this package in training programmes; it really backs up the practical work. I am very happy with the operation and preparation of the program...”
Software functions

**Overview**

Otis firstly provides functions for audiometry training using virtual subjects. Here you have a selection of different exercises available.

In addition to this, Otis provides password-protected tutor functions, enabling tutors and course leaders to design their own exercises and exams for their students and to modify test subject data.

**Virtual Audiometer**

The virtual audiometer contains all the functions required for testing hearing thresholds and ULL. It is operated in the same way as equipment commonly available.

In addition, Otis gives you numerous facilities for interacting with the test subject - tuning fork tests, otoscopy, questions about subjective hearing ability, viewing case history etc.

The appearance of the virtual audiometer (e.g. number of diagrams per audiogram, symbol conventions) can be adapted in an optimum fashion to match the equipment used in your actual practice.

**Direct Feedback**

Otis not only allows learners to practice audiometry on virtual subjects, but also checks each step they take and gives them helpful feedback. Depending on the exercise settings, the program draws learners’ attention directly to mistakes they have made. The following are some of the points assessed:

- Correct selection of audiometer settings
- Correct sequence of steps in the procedure
- Efficient use of time
- Observing safety guidelines
- Accuracy of hearing thresholds
- Test subject’s comfort

This direct feedback demonstrably contributes to highly efficient learning.¹

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**Interpreting audiograms**

Using model answers, beginners gain practice in interpreting their test results. In higher-level exercises they are required to interpret the audiograms themselves.

As a further step, trainees can have to explain the test results to the subject in simple terms.

**Otoscopy / Tympanometry**

Beside pure-tone audiometry, otoscopy and tympanometry also have a part to play in the overall assessment of a hearing impairment. For this reason, Otis - the virtual patient also provides you with functions for conducting and evaluating otoscopy and tympanometry.

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**Detailed evaluation**

Each hearing test is analyzed and evaluated according to numerous criteria. A detailed report is produced, which firstly gives the learner a self-check so that they can improve their audiometry technique in a focused manner, and which secondly can be sent via the Internet or an intranet to the tutor or trainer, who can then make an objective assessment of the learner’s progress and offer assistance as required.

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Virtual test subjects

The database contains numerous profiles of test subjects with a variety of hearing impairments. Trainers have the facility to create new test subjects or to modify existing ones.

Experts consider patient reactions to be very realistic. The modelling takes account of phenolmena such as the cross-hearing of stimuli and masking noise, adaption, tone decay, conditioning and hysterisis. A special feature is that Otis contains various functions for simulating pathologies.

Thanks to its authentic simulation of test subject behaviour, Otis has already been successfully deployed for optimizing existing testing methods.

Exercises

Based on sound didactic criteria, a varied exercise model has been set up which includes the following types of exercise:

- Theory exercises with written exercise descriptions, to acquire new knowledge;
- Practice exercises, for reinforcing learning;
- Self-check exercises in which no error messages are displayed during audiometric testing;
- Exams, which can only be taken once, and in which no error messages are displayed. The encrypted evaluations can only be viewed by teachers and trainers (Edition Expert).
Thanks to the modular structure with varying degrees of difficulty (Mastery Principle\(^2\)), the Otis exercises are ideal both for beginners and for experienced audiometrists.

**Focused exercises**

Using the profiles of virtual test subjects, exercises can be created which are tailored to the learners’ level of training and their learning objectives.

This is achieved with the help of multiple program functions. For example, not-masked hearing thresholds can be displayed automatically, so that the learners can concentrate on the masking. The result is a major time-saving compared with working with real subjects, as it is not necessary first to determine the not-masked hearing thresholds.

Many of these exercises are provided with detailed instructions with clearly defined learning aims\(^3\) and learning tasks which can be accessed directly in the program.

### Integrated teaching materials

#### Theory manual

The Theory Manual teaches the most important knowledge needed for practical audiometry. Helpful explanations and illustrations make it particularly easy for newcomers to find their way into audiometry.

#### Audiometry methods

There are numerous recommended methods for conducting audiometric hearing tests, which differ from each other to a greater or lesser extent depending on the country and field of activity. The learning package contains detailed descriptions of those guidelines which are supported by the computer program (ASHA, BSA...).

#### User-defined Methods

Apart from the implemented standard methods, Otis also allows for the hearing test to be conducted using a procedure defined by the user.

#### Customizing

**innoForce Est.**, the company producing Otis also offers educational and training institutions the option of an individualized configuration of the program. This customizing allows you to tailor Otis exactly to your particular teaching programmes.

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\(^3\) Effect size up to 0.4; Walberg H.J.: Productive Teaching and Instruction: Assessing the Knowledge Base. 1988 (University of Illinois of Chicago, School of Education, paper 18 pp).


**Summary cards**

In addition, the learning package includes summary instructions with flowcharts and concise descriptions.

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**Audiometry information**

On the Otis website you will find a collection of useful information on various aspects of audiometry training. For example, there is a computer animation demonstrating the anatomy and functioning of human hearing.

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**The training package compromises:**

- software with profiles of different hearing defects and impairments
- didactically structured textbook “Audiometry - A Manual for the Practitioner” by Dr. med. Thomas Spillmann and Christoph Wille (3rd extended edition)
- user handbook
- summary cards with flow diagrams and abbreviated descriptions
- numerous exercise modules with detailed descriptions
- free-of-charge download of the newest exercises and descriptions
- description of the audiometry methods supported by Otis

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**System requirements**

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<thead>
<tr>
<th>Components</th>
<th>Minimum requirement</th>
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</thead>
<tbody>
<tr>
<td>Processor</td>
<td>Intel Pentium 4 or compatible</td>
</tr>
<tr>
<td></td>
<td>1 GHz or faster</td>
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<tr>
<td>RAM</td>
<td>128 MB</td>
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<td>Hard disk</td>
<td>50 MB free space before installation</td>
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<td>Monitor</td>
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<td>Operating system</td>
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<tr>
<td>Internet</td>
<td>Microsoft® Internet Explorer® 5.0 or higher</td>
</tr>
<tr>
<td>Acrobat Reader</td>
<td>Adobe Acrobat® Reader 5.0 or higher</td>
</tr>
</tbody>
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**More information / Trial Version**

You will find a free demonstration version and further information on:

www.audiometry.biz

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Otis - the virtual Patient-Experiences at Aston University, Birmingham, U.K.

In October 2003, we started a new BSc course in Audiology in the School of Life and Health Sciences at Aston University. An important part of the programme is to prepare students for their placements in collaborating teaching hospitals where they are guided by clinical supervisors and practice their clinical skills. Accordingly, we train our students at the university in our “skills lab”, where routine audiological assessments are taught. While searching for good educational software to support our student’s learning, a colleague recommended Otis - the virtual Patient as an excellent training tool.

Wahid Zaman, who is a clinical audiologist and teaches in our skills labs has used Otis - the virtual Patient across the different years of study, and is full of praise for the options it gives him to present students at different levels with tasks to practise their skills. He has devised a workbook for the students with Otis tasks, which is marked and contributes towards their grade for this module. The students can work through these tasks in small groups at their own pace during their weekly “drop-in” sessions, after they have been instructed in the larger group (about 15 students at the time) by Wahid. This makes the skills lab manageable for one clinical teacher, with very good learning outcomes for the students.

Previously, we had to find several audiologists to help on a part-time basis with the skills lab, and since we do not run a clinic at the university, we could only teach the basic practical skills on volunteers with normal hearing, i.e. the students tested each other, and had to rely on the clinical placements to provide practice with hearing impaired patients. With the time-pressure on clinical departments to clear their waiting lists, this was far from ideal, and put extra pressure on the clinical supervisors. We are confident that now, after extensive training with Otis - the virtual Patient, our students are much better prepared for their clinical placements, and can start to test patients more confidently. This will give both the students and their clinical supervisors more time to develop advanced clinical skills, and will help the students to pass their initial clinical assessments at an earlier time.

Our students commented how much they like to work with Otis, and appreciate in particular the instantaneous feedback. This follows best practice for learning by doing, and is of immense benefit. With so much to learn, it is nice that the program also has a good sense of humor: the snoring patient who had to wait too long for the next stimulus put in the occasional light relief, much to the amusement of the whole class! Although the workbook tasks are graded, students can train in small groups or on their own until they are competent to pass the workbook tasks. This has resulted in good student engagement and a much higher learning outcome with better grades for the skills lab modules both for our first and second year students. Otis - the virtual Patient has been so popular that several students have asked for a student licence to put the program on their personal computer, so that they could train at home - so far, copies are only installed on computers in the skills lab at the University. Some clinical supervisors are interested in obtaining a copy for their hospitals, to help further training of audiologists in practice, and commented on the fact that many audiologists would appreciate more practice on non-standard cases, and that they also like to see with an objective method that they get their audiograms right!

In summary, Otis - the virtual Patient has been a great success story for us, and we are grateful for all the hard work which went into the programme to make it such an excellent teaching and learning tool!