

Piotr Majdak, Katharina Pollack, David Meijer

The 4th AMT Workshop

Introduction

Graz, 5.9.2026



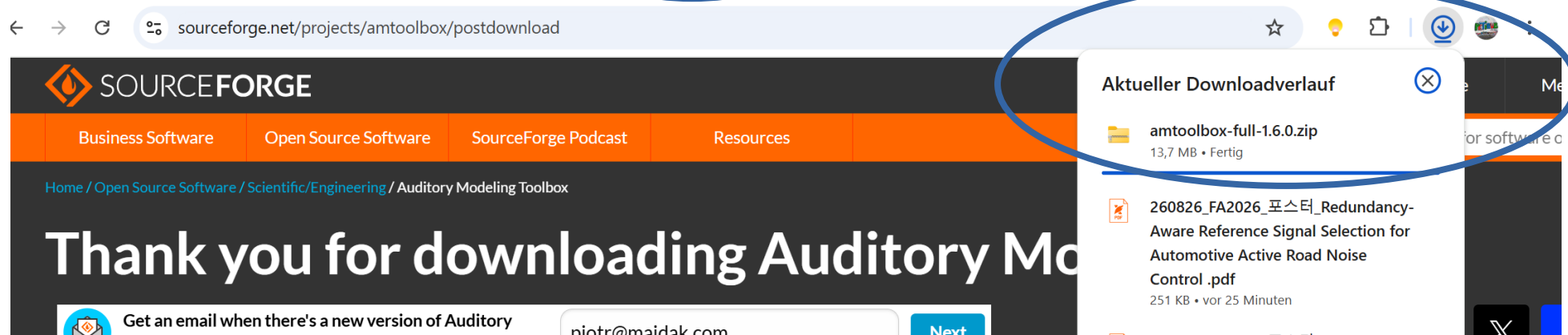
First step: Download the full package

- <http://amtoolbox.org>



Download

The easiest and recommended method is to download the



The AMT Workshop: Structure and Goals

- What is the AMT and how can it be useful for you?
 - General AMT structure
 - Using AMT models
 - Using AMT parameters and functions
- Goals:
 - Do you know what is the AMT and its components?
 - Do you have a basic idea of what you can do with the AMT?
 - Are you able to install the AMT?
 - Are you able to run its models by writing own simulation scripts?

The AMT

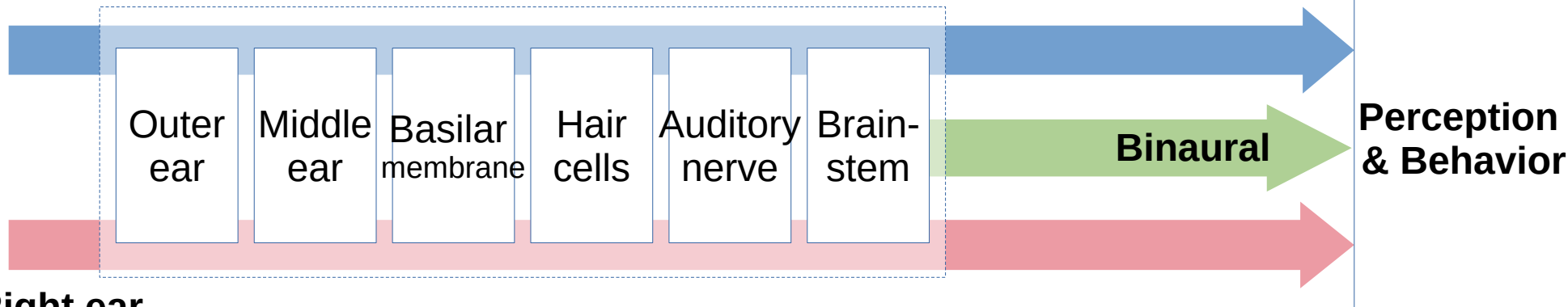
- An open-source and open-access toolbox for auditory modeling
 - A tool for reproducing scientific experiments with auditory models
 - A framework for developing new models
- Environment:
 - Core: Matlab/Octave
 - Models: (nearly) any programming language
- Software license:
 - Core: GPL version 3
 - Models: Multi licensing; (nearly) any GPL3-compatible license
- Link of a large amount of data and complex code
- Integration of other toolboxes useful in auditory research

The AMT

- 2009: Development initiated by Peter Sørensgaard
- 2012: Development moved to ÖAW
- 2021: AMT 1.0 released
- Now: Over 60 auditory models, 40 GB of auditory data
- Two releases per year, with a focus on sustainability
- Community work: Most of the models “donated” to the AMT
- Increase the authors’ visibility and add citations

Typical stages of auditory models

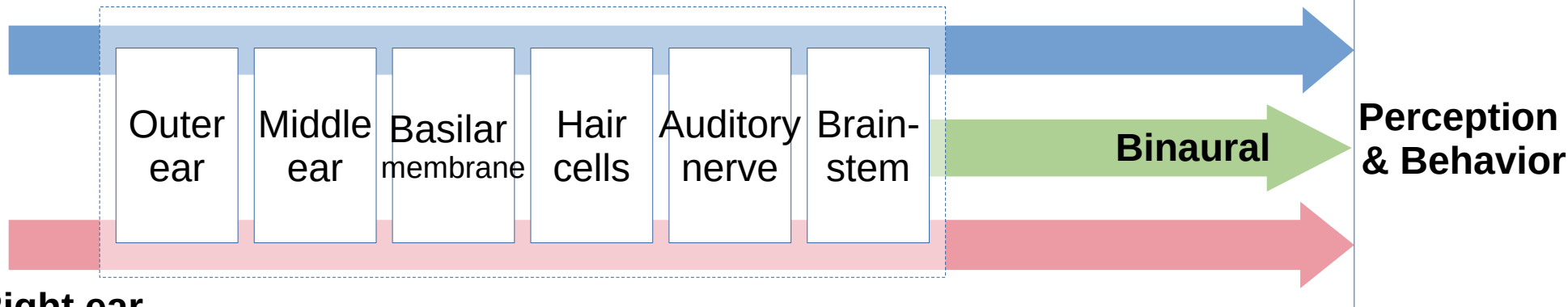
Left ear



Right ear

Typical stages of auditory models

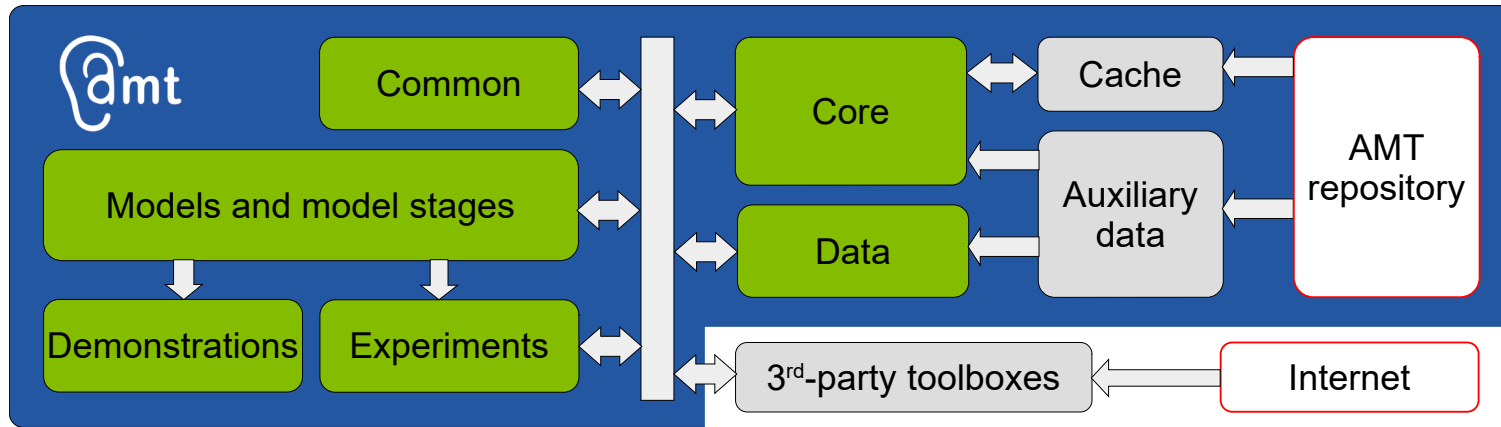
Left ear



Right ear

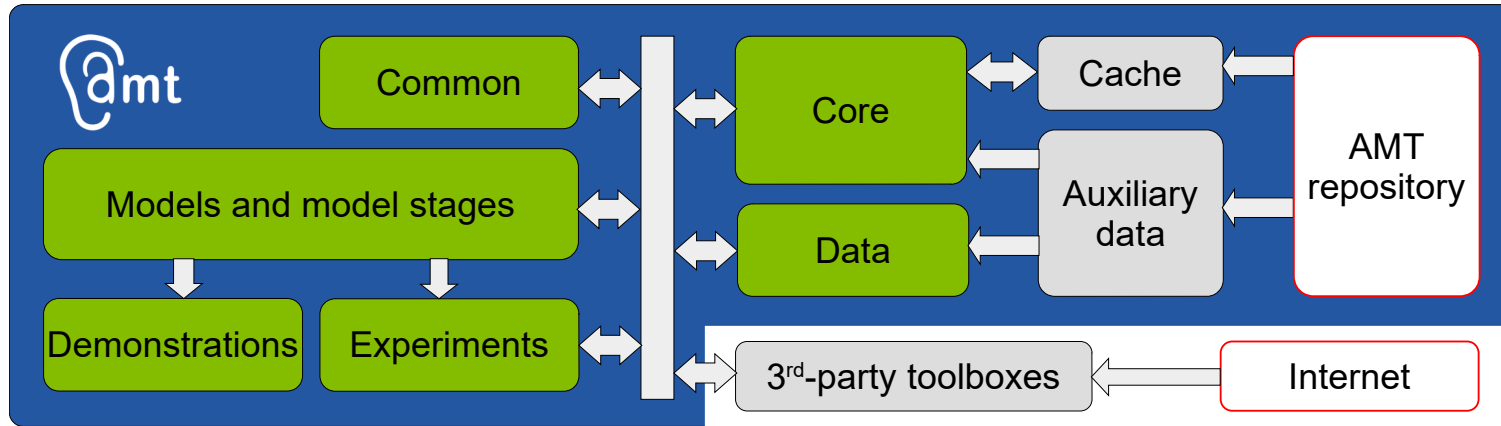
- Model $\neq$ Model implementation
- Models need data
- Model implementations often rely on toolboxes
- Some models use common functionality, some are stand-alone concepts

The Auditory Modeling Toolbox (AMT)



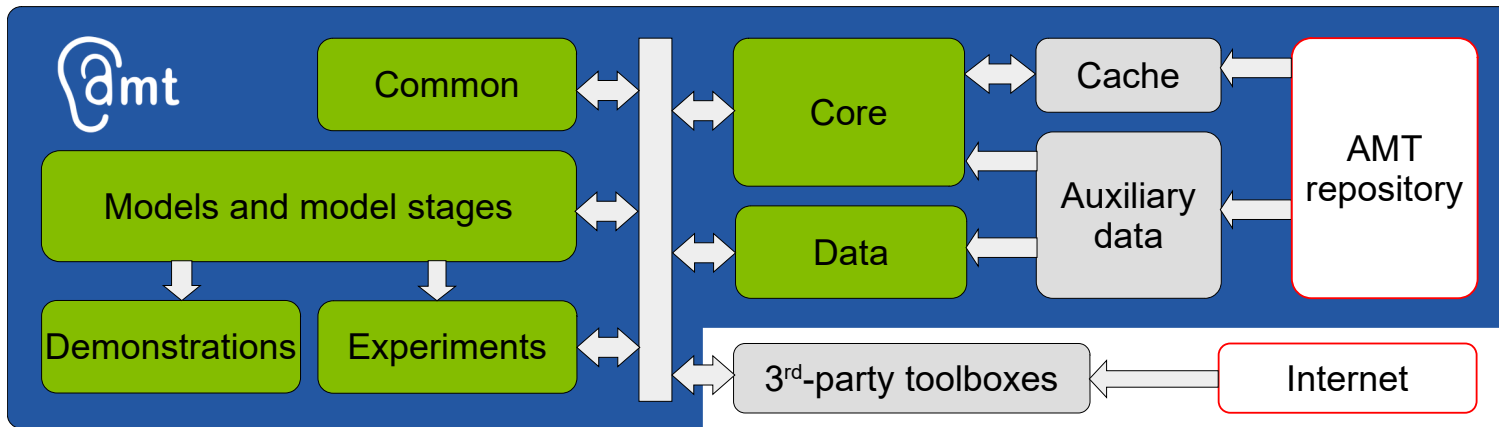
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The Auditory Modeling Toolbox (AMT)



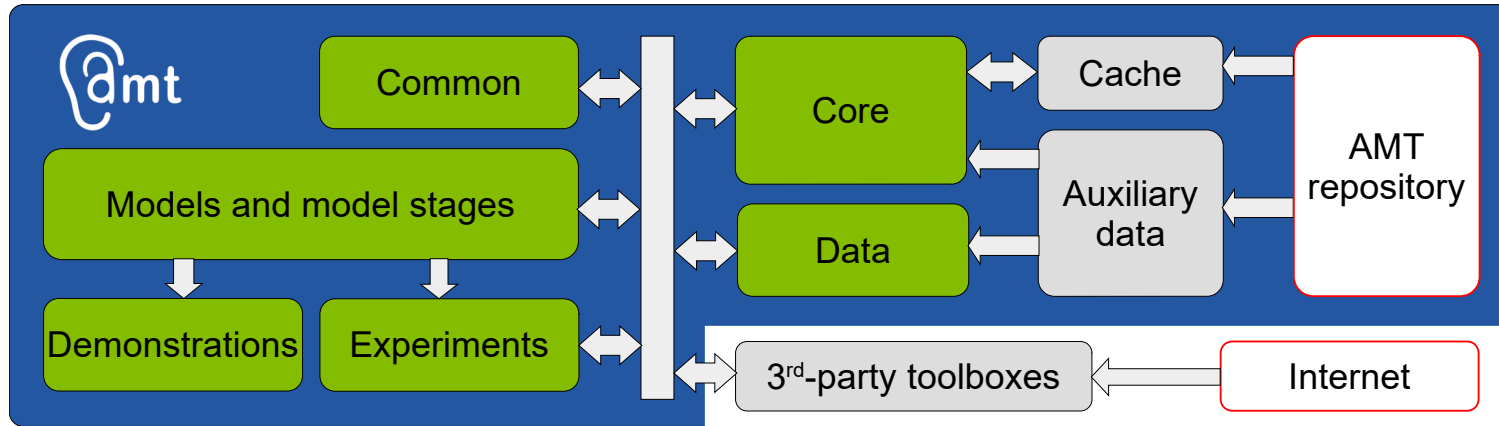
- Model $\neq$ Model implementation: Baumgartner et al. (2014) $\rightarrow$ baumgartner2014

The Auditory Modeling Toolbox (AMT)



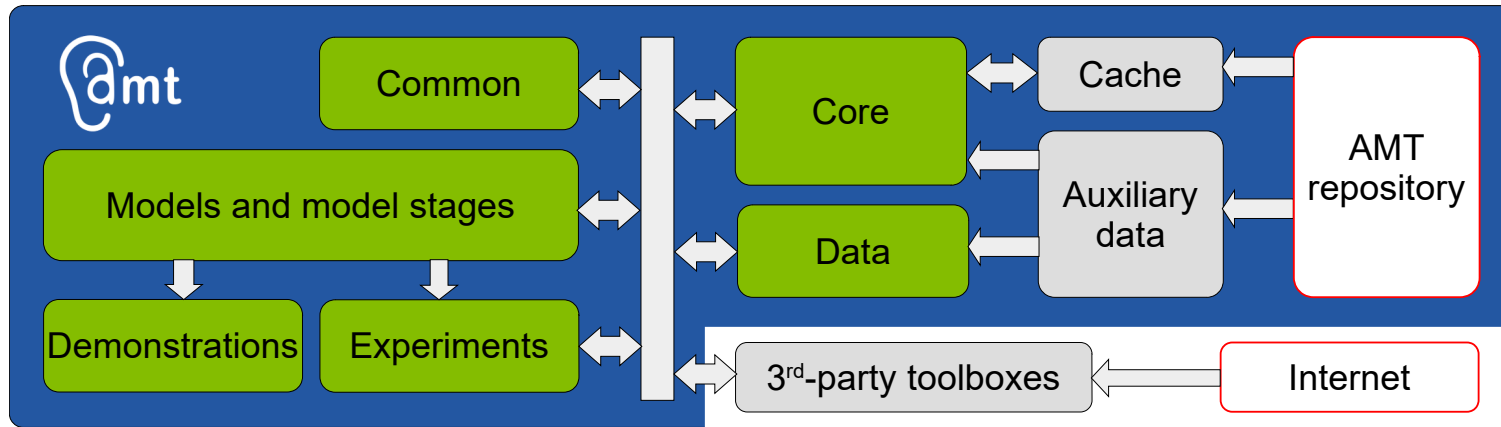
- Model $\neq$ Model implementation: Baumgartner et al. (2014) $\rightarrow$ `baumgartner2014`
- Models need data: Auxiliary data
 - Dedicated function: $\rightarrow$ `data_baumgartner2014`
 - Direct: $\rightarrow$ `amt_load('baumgartner2014', ...)`

The Auditory Modeling Toolbox (AMT)



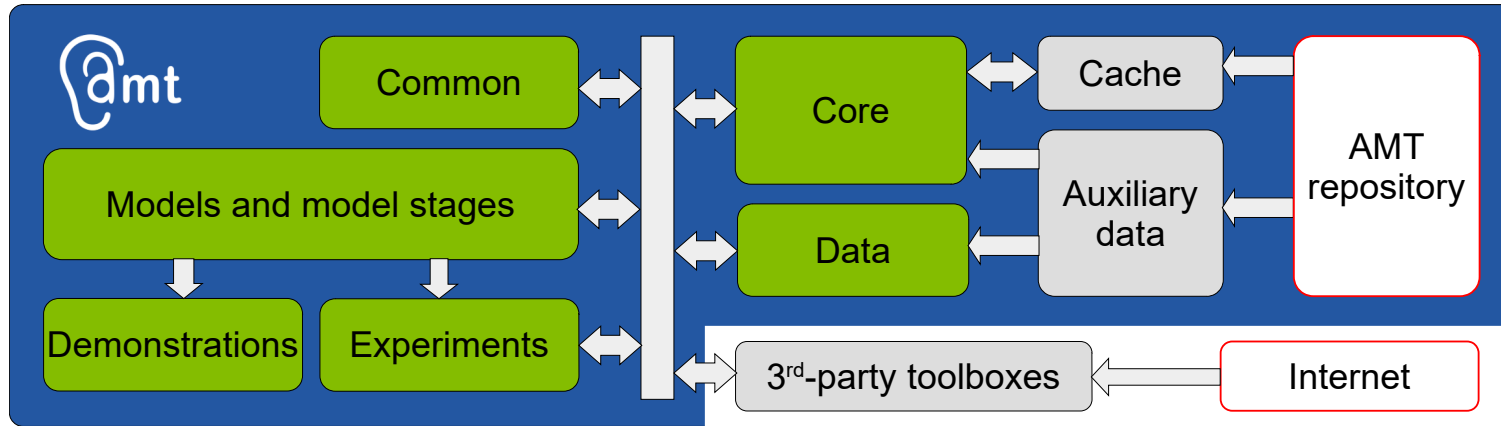
- Model implementations often rely on toolboxes: Third-party toolboxes
 - Large Time Frequency Analysis Toolbox (LTFAT)
 - *Optional:* Spatially Oriented Format for Acoustics (SOFA) Toolbox, Sound Field Synthesis (SFS) Toolbox, Circular Statistics (CircStat) Toolbox, Binaural Spherical Harmonics (BinSH) Toolbox

The Auditory Modeling Toolbox (AMT)



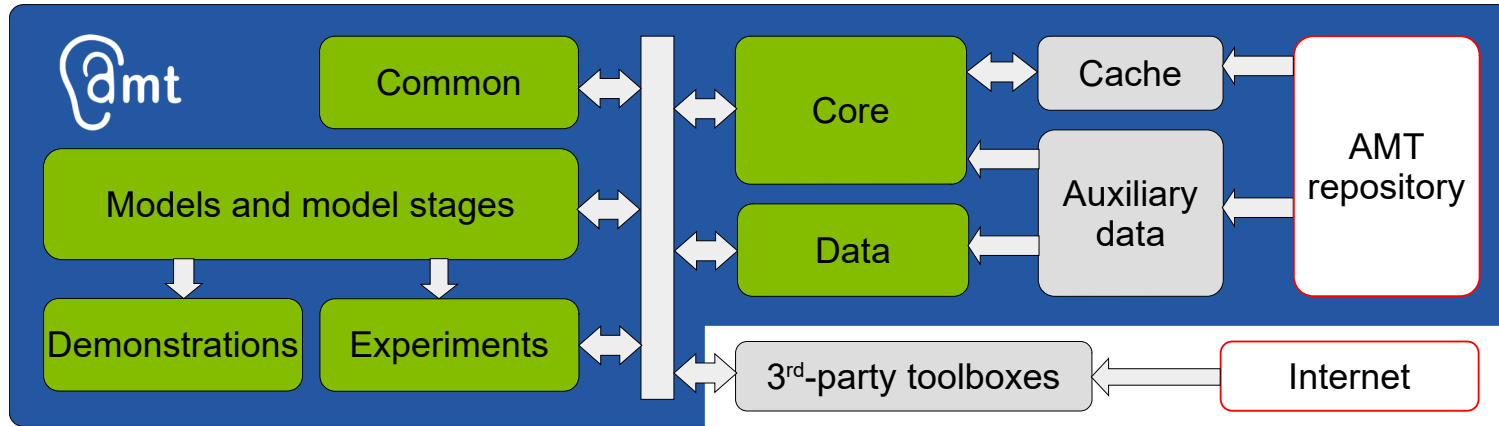
- Core functions: the main power of the AMT
 - Storing pre-calculated data: Cache → `amt_cache`
 - Data handling: Auxiliary data → `amt_load`
 - Simulation of experiments: → `amt_emuexp`

The Auditory Modeling Toolbox (AMT)



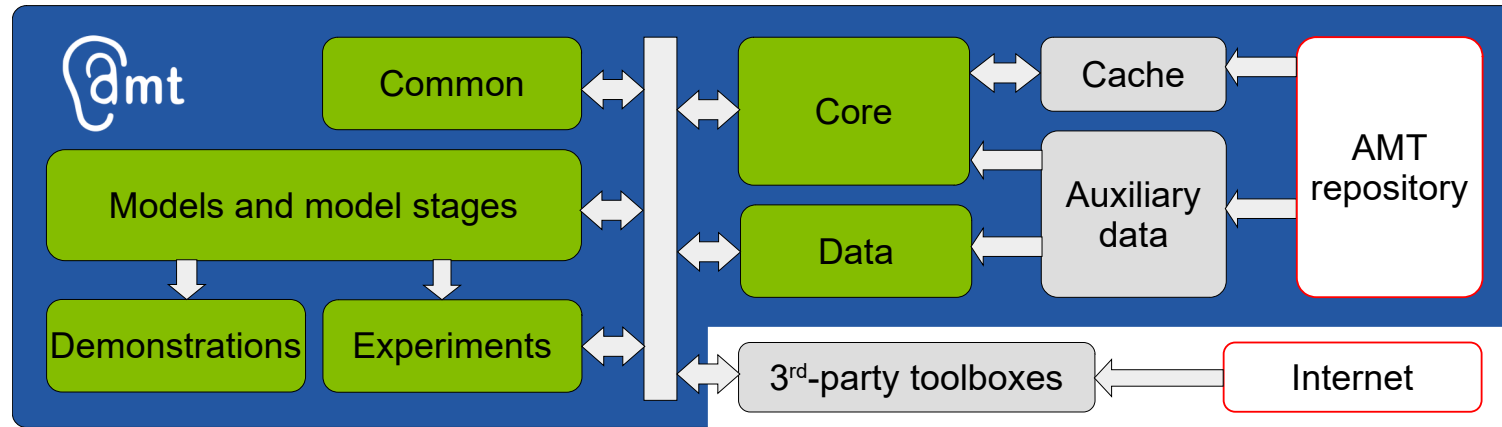
- **Models**
 - breebaart2011
- **Model stages:**
 - breebaart2011_outmiddlefilter
 - breebaart2011_eicell
 - breebaart2011_centralproc

The Auditory Modeling Toolbox (AMT)



- Common functions:
 - scaletodbspl
 - erb2fc
 - middleearfilter
 - gammatone
 - itdestimator
 - adaptloop

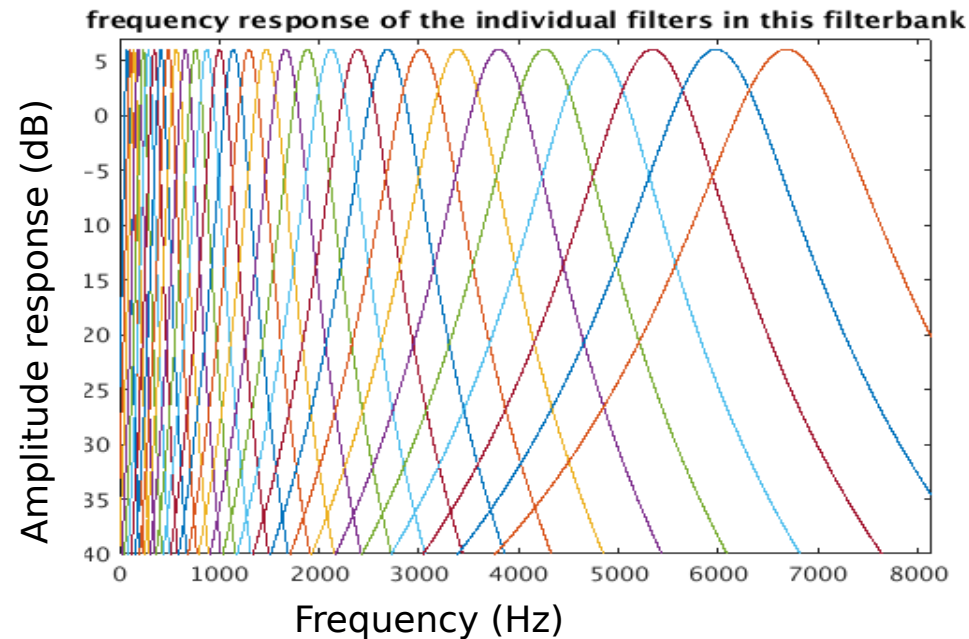
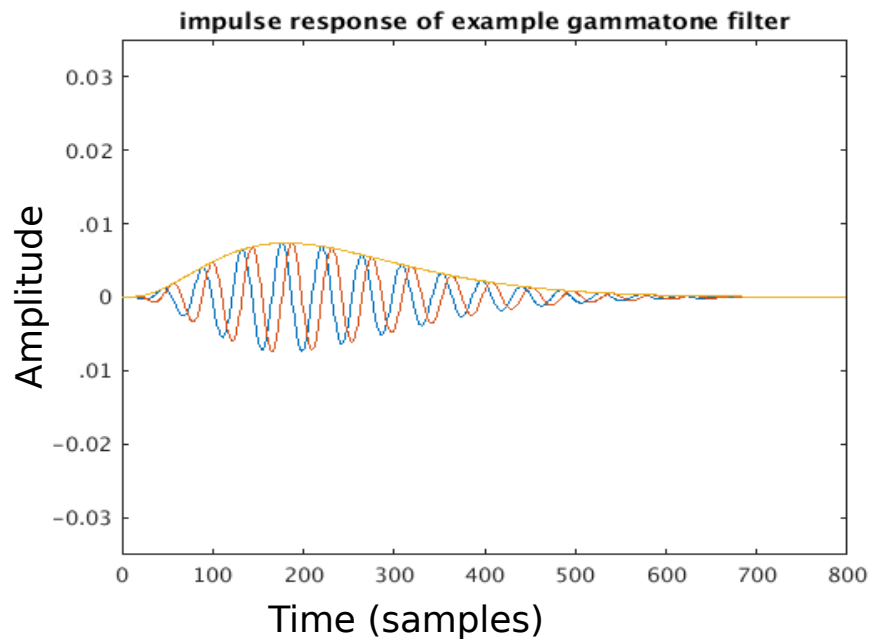
The Auditory Modeling Toolbox (AMT)



- Demonstrations: Simple scripts demonstrating the functionality
→ `demo_baumgartner2014`

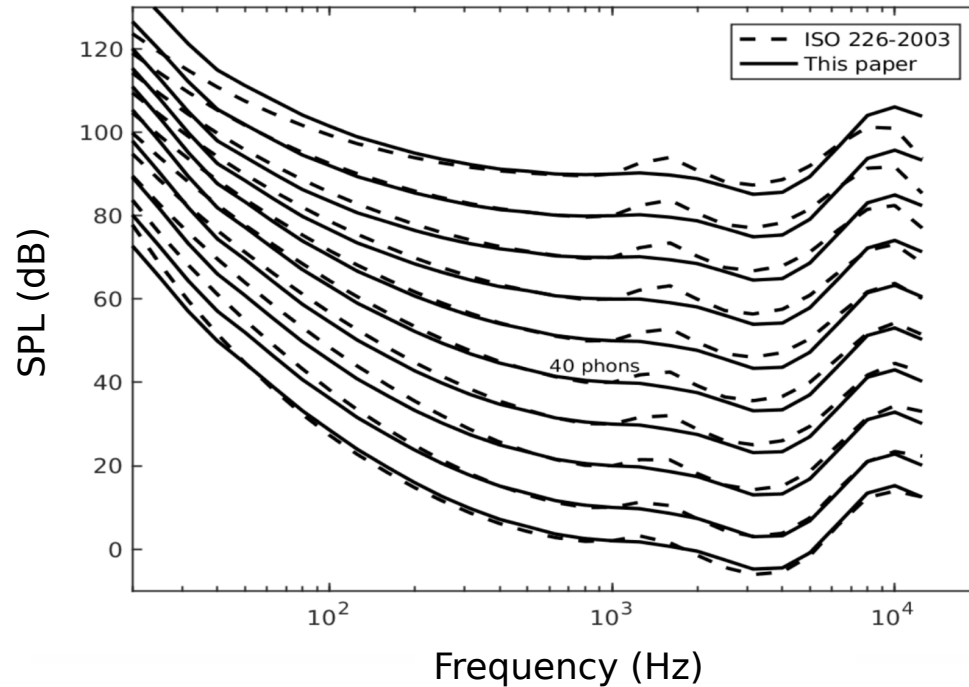
Demonstrations

demo_hohmann2002;



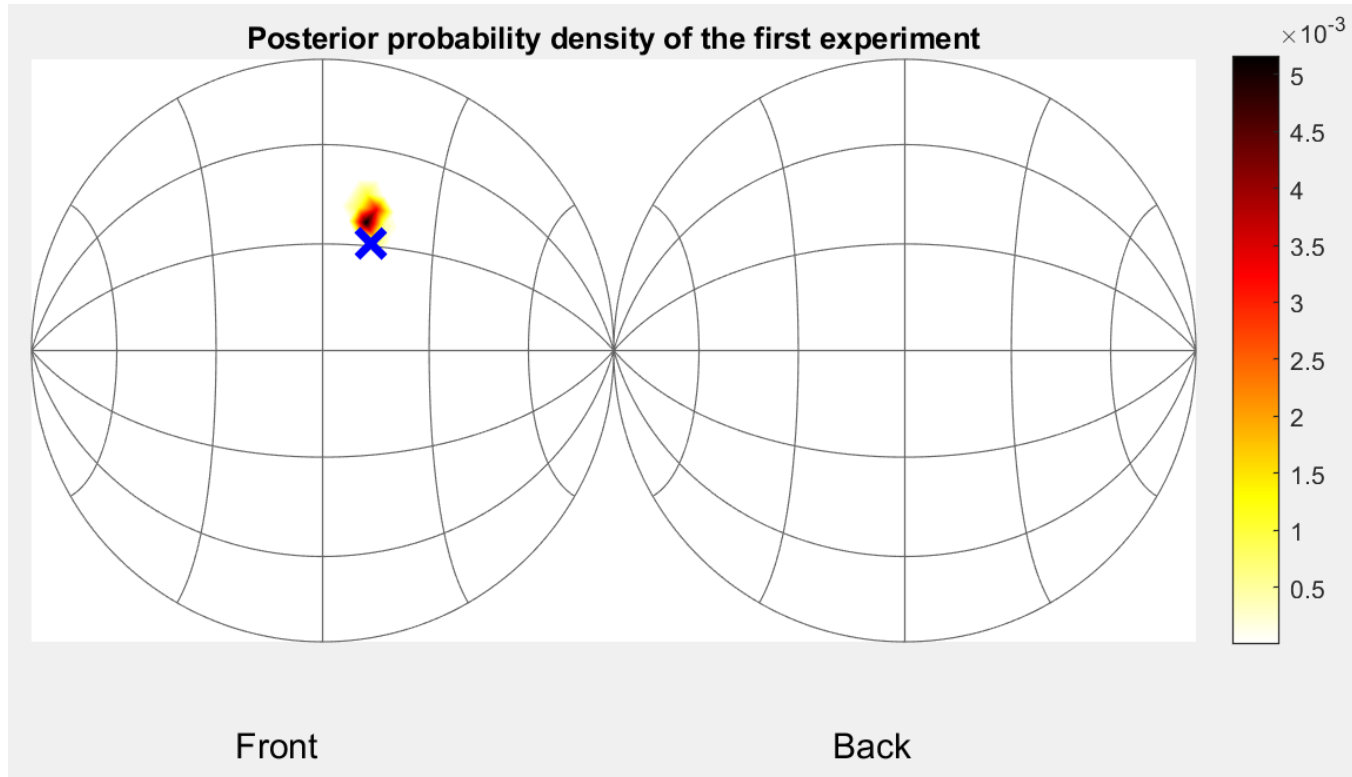
Demonstrations

demo_chen2011;

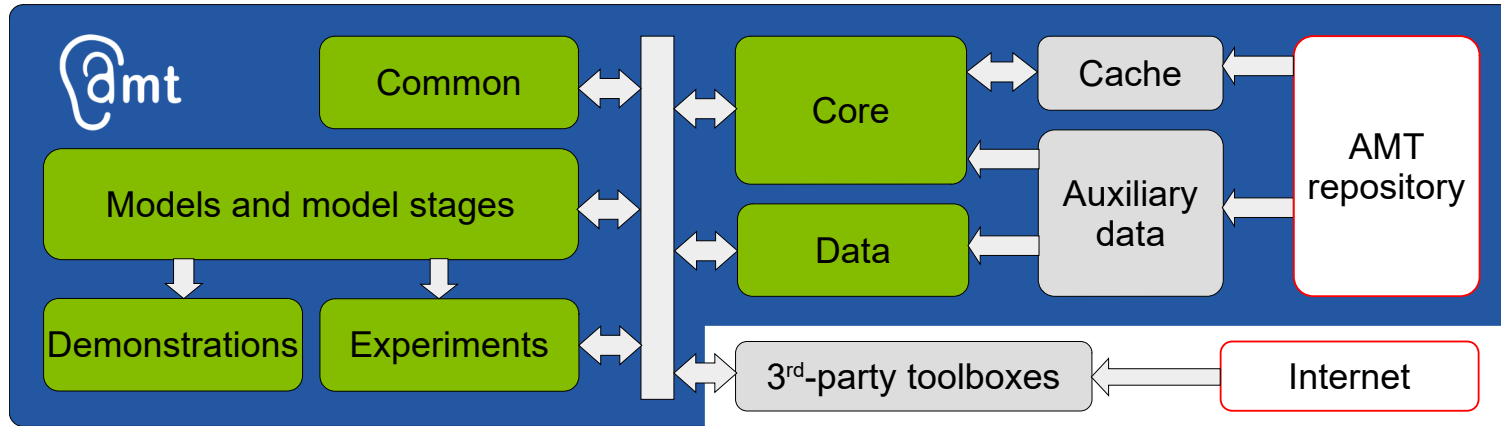


Demonstrations

demo_reijniers2014;



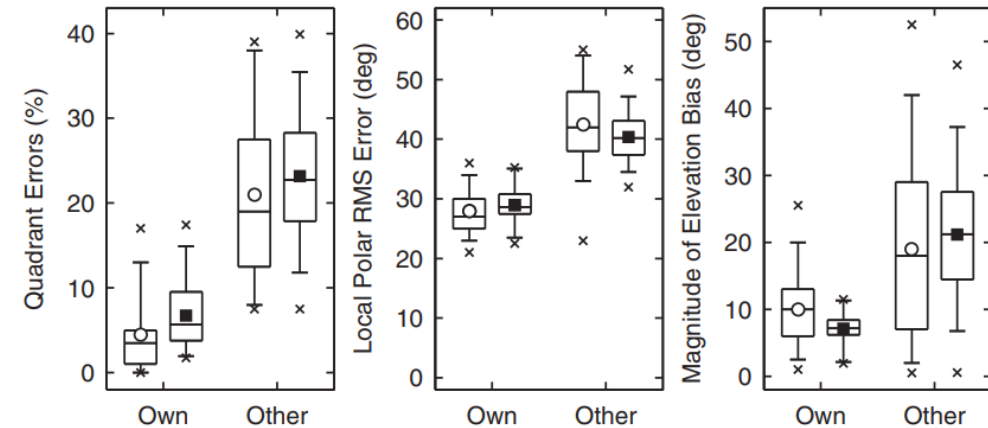
The Auditory Modeling Toolbox (AMT)



- **Demonstrations:** Simple scripts demonstrating the functionality
→ `demo_baumgartner2014`
- **Experiments:** Functions reproducing published results
→ `exp_baumgartner2014('fig9')`

Experiments

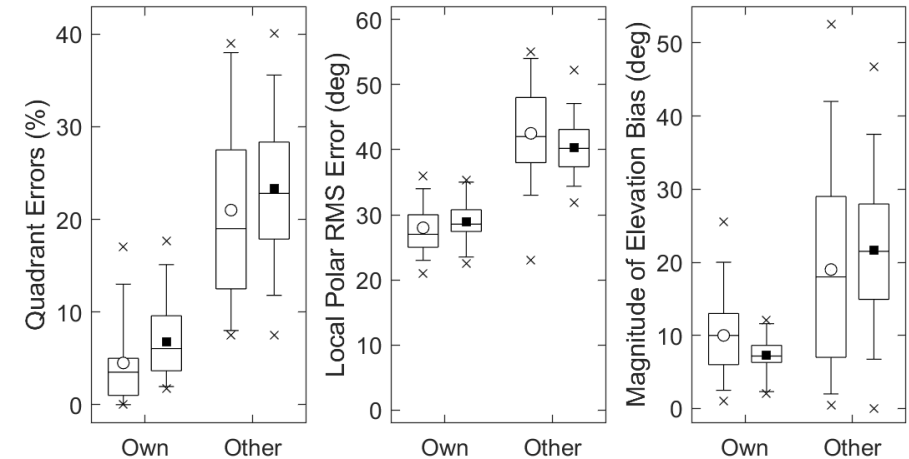
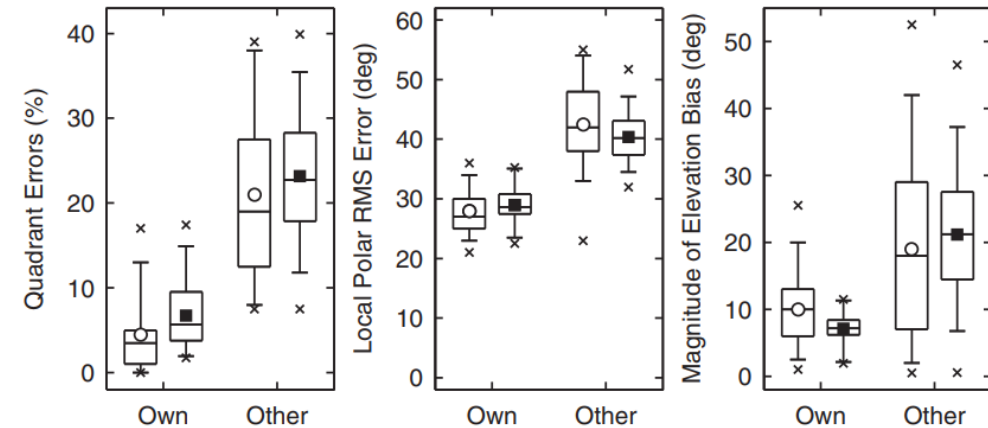
Screenshot from Figure 9
(Baumgartner et al., 2014):



Experiments

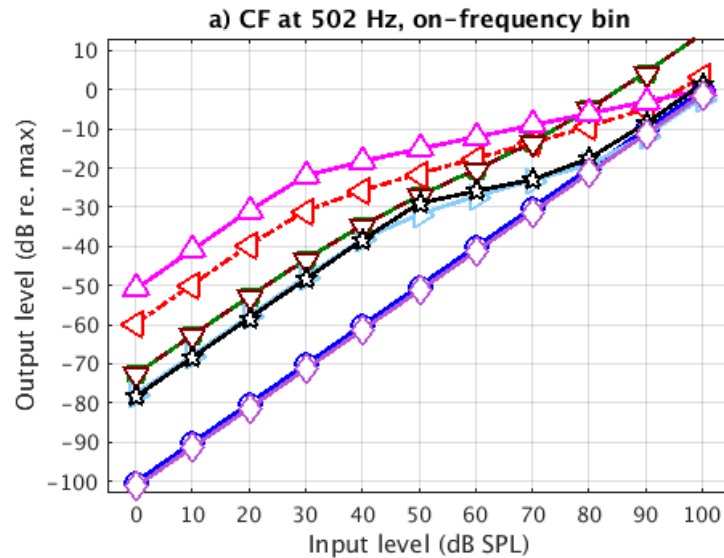
Screenshot from Figure 9
(Baumgartner et al., 2014):

Output of
`exp_baumgartner2014('fig9');`



Experiments

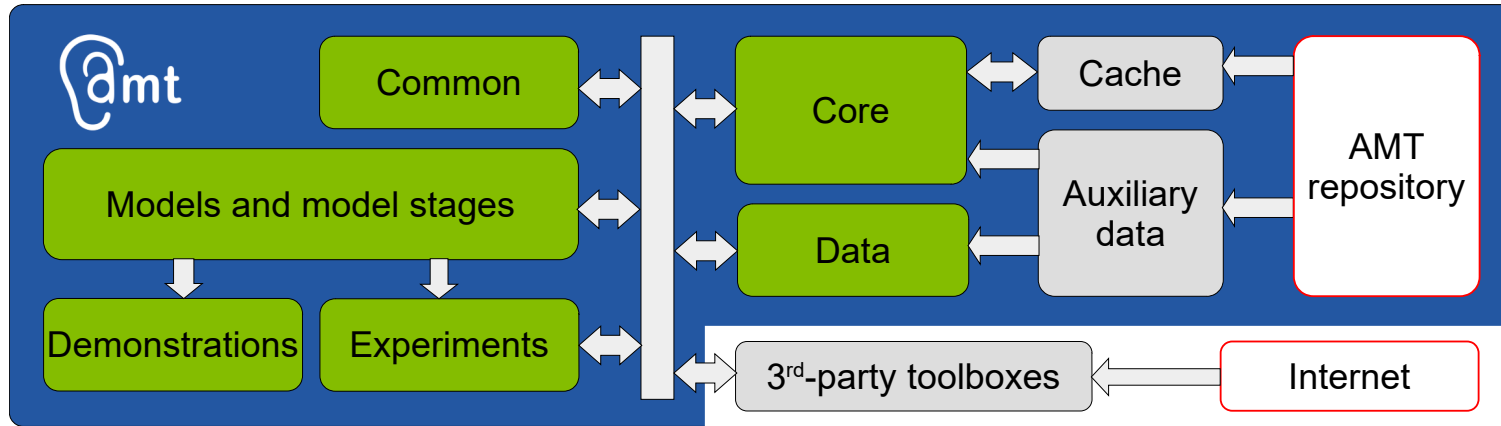
Output of
`exp_osses2022('fig5');`



- Blue: Dau et al. (1997)
- Orchid: Osses and Kohlrausch (2021)
- Green: Zilany et al. (2014)
- Maroon: Bruce et al. (2018)
- Red: Verhulst et al. (2015)
- Skyblue: Verhulst et al. (2018)
- Magenta: King et al. (2019)
- Black: Relano-Iborra et al. (2019)

Osses et al. (2022) „A comparative study of eight human auditory models of monaural processing“, Acta Acustica, 6: 17.

The Auditory Modeling Toolbox (AMT)



- Code: Files structured in directories
- Special directories:
 - auxdata
 - cache
 - defaults
 - mat2doc

Documentation

- Website: <http://amtoolbox.org>

THE AUDITORY MODELING TOOLBOX

HOME	DOWNLOAD	CONTRIBUTORS	CITE US	MODELS	DOCUMENTATION	DEVELOPMENT	RESOURCES
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Select the AMT version:

- **1.6.0** (September 2024). See [changes](#).
- **1.5.0** (July 2023). See [changes](#).
- **1.4.0** (May 2023). See [changes](#).
- **1.3.0** (March 2023). See [changes](#).
- **1.2.0** (May 2022). See [changes](#).
- **1.1.0** (Dec 2021). See [changes](#).
- **1.0.0** (May 2021). See [changes](#).
- **0.10.0** (May 2020). See [changes](#).
- **0.9.9** (September 2017). See [changes](#).
- **0.9.8** (June 2017). See [changes](#).
- **0.9.7** (June 2016)
- **0.9.6** (June 2014)
- **0.9.5** (March 2014)
- **0.9.2** (October 2013)

Bug or typo?

Documentation

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This documentation applies to the most recent AMT version (1.6.0).

Go to function

absolutethreshold



Categories
Main >
Core functions >
Common functions >
Data >
Demos >
Experiments >
Models >
Model stages >
Plot >

Online documentation

General

This is the most-complete and up-to-date description of the AMT. This documentation is directly included in the M-files and it is auto-generated for this website. Because of the automatic generation, the appearance on the website may suffer some details. Note that the current status of the models can be found in the section [Models](#) at this website.

New to the AMT?

Download the [AMT full package](#), which provides all third-party toolboxes, and install the AMT with `amt_start('install')`. This command also downloads the third-party toolboxes (if missing) and triggers compilation of the binaries.

To stop the session, use `amt_stop` which removes the temporary search paths and resets the configuration.

Documentation

- Website: <http://amttoolbox.org>

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Go to function

absolutethreshold



Categories

Main



Core functions



Common functions



Data



Demos



Experiments



Models



Model stages



Core functions

Installation and session management

- [amt_mex](#) - Compile binaries (Mex/Oct interfaces)
- [amt_stop](#) - Stop the AMT session and remove all AMT paths

General functions

- [amt_cache](#) - Cache variables for later or retrieves variables from cache
- [amt_disp](#) - AMT-specific overload of the function 'disp'
- [amt_emuexp](#) - Emulate psychoacoustic experiments
- [amt_flags](#) - Return the start-up flags of the AMT
- [amt_load](#) - Load auxiliary data of a model

Documentation

- Website: <http://amttoolbox.org>

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[View the code](#)
[Go to function](#)

amt_configuration



Categories

[Main](#)
[Core functions](#)
[Common functions](#)
[Data](#)
[Demos](#)
[Experiments](#)
[Models](#)
[Model stages](#)

AMT_CONFIGURATION

Get and set the configuration of the current AMT session

Usage:

```
[flags, kv] = amt_configuration;
[flags, kv] = amt_configuration('cacheURL', cU);
[flags, kv] = amt_configuration('silent');
[flags, kv] = amt_configuration('silent', 'normal');
```

Description:

Documentation

- Website: <http://amtoolbox.org>

THE AUDITORY MODELING TOOLBOX

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[View the help](#)

Go to function

amt_configuration



Categories

Main



Core functions



Common functions



Data



Demos



Experiments



Models



Model stages



AMT_CONFIGURATION

Get and set the configuration of the current AMT session

Program code:

```
function [flags,kv]=amt_configuration(varargin)
%AMT_CONFIGURATION Get and set the configuration of the current AMT session
%
% Usage:
% [flags, kv] = amt_configuration;
% [flags, kv] = amt_configuration('cacheURL', cU);
% [flags, kv] = amt_configuration('cacheURL', cU, 'cacheSize', sU);
```

Documentation

MATLAB R2018b

HOME PLOTS APPS

New Script New Live Script New Open Compare Import Data Save Workspace New Variable Open Variable Favorites Analyze Code Run and Time Clear Commands Layout Set Path Add-Ons Help Community Request Support Learn MATLAB

FILE VARIABLE CODE ENVIRONMENT RESOURCES

C:\ISF\AMT\workshop\code

Current Folder

Name	Git
.git	.
auxdata	.
cache	.
common	.
core	.
data	.
defaults	.
demos	.
environments	.
experiments	.
hrtf	.
legacy	.
licenses	.
mat2doc	.
mex	.
models	.
modelstages	.
oct	.
plot	.
signals	.
testing	.
thirdparty	.
.gitignore	.
amt_start.m	.

Command Window

```
>> help amt_configuration
amt_configuration Get and set the configuration of the current AMT session

Usage:
[flags, kv] = amt_configuration;
[flags, kv] = amt_configuration('cacheURL', cU);
[flags, kv] = amt_configuration('silent');
[flags, kv] = amt_configuration('silent', 'normal');

`amt_configuration` accepts the following optional parameters:

'cacheURL',cU      Set the download URL of the cache

'auxdatapath',aP   Set the path where the auxdata is stored

'auxdataURL',aU    Set the download URL for the auxdata

`amt_configuration` accepts the following flags:

'cacheMode'       sets the global cache mode, supported options
                  - global
                  - normal
                  - cached
```

Workspace

Name
ans
modeloutput

Command History

```
name2doc('v')
['asdasdd' ...
- ['asdasdd' ...
['asdasdd' ...
```

Documentation

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 - Code version
- In-code documentation
 - Syntax: Similar to reStructuredText
 - Compiler: Based on mat2doc
 - Automatic creation of figures and results
 - Links to the publications

Categories
Main
Core functions
Models
Model stages
Demos
Experiments
Common functions
Plot
Signals
Data
Auxdata
Cache

See also
tabuchi2016

EXP_TABUCHI2016 - Results from Tabuchi et al. (2016)

Usage:

```
data = exp_tabuchi2016(flag)
```

Description:

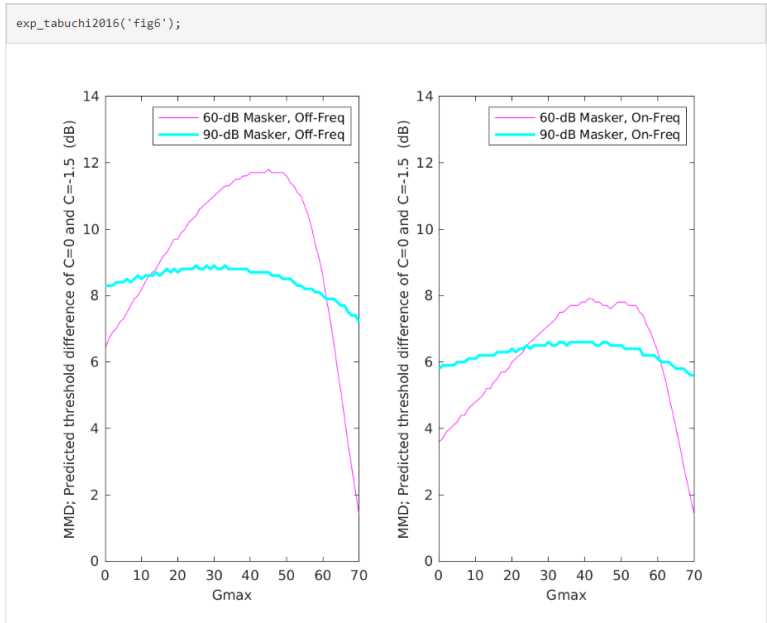
`exp_tabuchi2016(flag)` reproduces figures of the study from Tabuchi et al. (2016).

The following flags can be specified

'fig6' Reproduces the lower panel of Figure 6

Examples:

To display Fig.6 use :



References:

H. Tabuchi, B. Laback, T. Necciari, and P. Majdak. The role of compression in the simultaneous masker phase effect. *The Journal of the Acoustical Society of America*, 140(4), 2016. [DOI]

Categories
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Auxdata >
Cache >

See also
tabuchi2016

EXP_TABUCHI2016 - Results from Tabuchi et al. (2016)

Program code:

```
function varargout = exp_tabuchi2016(varargin)
%EXP_TABUCHI2016 Results from Tabuchi et al. (2016)
% Usage: data = exp_tabuchi2016(flag)
%
% EXP_TABUCHI2016(flag) reproduces figures of the study from
% Tabuchi et al. (2016).
%
% The following flags can be specified
%
% 'fig6' Reproduces the Lower panel of Figure 6
%
% Examples:
% -----
%
% To display Fig.6 use :
%
%     exp_tabuchi2016('fig6');
%
% See also: tabuchi2016
%
% References:
% H. Tabuchi, B. Laback, T. Necciari, and P. Majdak. The role of
% compression in the simultaneous masker phase effect. The Journal of the
% Acoustical Society of America, 140(4), 2016.
%
%
% Url: http://amttoolbox.org/amt-1.5.0/doc/experiments/exp_tabuchi2016.php

% #Author: Hisaaki Tabuchi (2022)
% #Author: Clara Hollomey (2023): adaptations for AMT
% #Author: Joonas Guevara (2023): implemented plotting

definput.import = {'amt_cache'};
definput.flags.type = {'missingflag','fig6'};

[flags,~] = ltfatarghelper({},definput,varargin);
```


Documentation

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 - Links to the publications
- Model list and ratings

Documentation

THE AUDITORY MODELING TOOLBOX

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Models included in the AMT (latest release, 1.5.0)

In order to describe the quality of the models available in the AMT, we rate the implementation of every model by considering its **source code** and **documentation**. We also rate the models in terms of their **verification**, i.e., we rate the results of the implementation versus the results shown in the corresponding publication. The comparison is done within the experiments implemented in the `exp_` functions. In the best case, the experiments produce the same results as in the publication - up to some minor layout issues in the graphical representations.

The following table provides an overview of the available models, their documentation, code, and verification status.

Peripheral models	Function	Doc	Code	Verification
Gammatone filterbank	gammatone	✓	✓	✓
Linear filtering for monaural masking (basic)	dau1996	○	✓	?
Linear filtering for monaural masking (improved)	dau1997	○	✓	?
Invertible Gammatone filterbank	hohmann2002	✓	✓	✓
Dual-resonance nonlinear filterbank (DRNL)	lopezpoveda2001	✓	✓	✓
Fast acting compression (CARFAC) model	Ivon2011	✓	✓	?

Documentation

- Website: <http://amtoolbox.org>
 - Compiled version: the website
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 - Links to the publications
- Model list and ratings
- Other resources

Getting started

- In you file explorer: Unzip amtoolbox-1.6.0.zip to a directory
- In Matlab/Octave:
 - Go to that directory/amtoolbox-1.6.0
 - Start the AMT: `amt_start;`

```
Starting packages and toolboxes:
* Signal Processing Toolbox: Found.
* Statistics and Machine Learning Toolbox: Found.
* Deep Learning Toolbox: Not found.
* Python Environment: Python 3.13.14.
* LTFAT: LTFAT version 2.6.0 (for AMT). Copyright 2005-
* SOFA: SOFA Toolbox for Matlab/Octave 2.2.0. Copyright
* SFS: Toolbox version 2.5.0 loaded
* CIRCSTAT: Circular statistics toolbox found.
* BINAURALSH: BinauralSH toolbox loaded.
* BADS: Bayesian Adaptive Direct Search toolbox found.
```

- Help: `doc amt_start`
- Stopping the AMT: `amt_stop;`

Folder structure

- models: The models! Just one file per model.
- modelstages: Larger models have more files: model stages.
- experiments: Code to compute model's results (e.g., in publications).
- demos: Scripts(!) show-casing the basic functionalities of a model.
- common: Useful functions for hearing related computations.
- data: Code providing published data (used in experiments, demos).
- defaults: Definition of parameters and flags an their default values.
- plot: Code to generate complex visualizations.
- signals: Code to generate generic or specific signals.
- auxdata: Local storage of auxiliary data.
- cache: Local storage of cached data.
- thirdparty: 3rd-party toolboxes like SOFA or LTFAT.

Current Folder

	Name ^
+	auxdata
+	cache
+	common
+	core
+	data
+	defaults
+	demos
+	environments
+	experiments
+	frambi
+	legacy
+	licenses
+	mex
+	models
+	modelstages
+	oct
+	plot
+	signals
+	testing
+	thirdparty
	amt_start.m

First tests

- Testing the environment:
 - Simple test: `demo_absolutethreshold`
 - SOFA/auxdata/internet test: `demo_baumgartner2014`
 - C-compiler test: `demo_zilany2014`
 - *(Python test: `demo_verhulst2012`)*
- Sneak into the code: `edit demo_baumgartner2014`