

# André Biedenkapp

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## Personal Information

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**Date of birth:** 13.07.1992

**Nationality:** German

## Work experience

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Position held.....

**Machine Learning Lab**  
*Scientific Researcher*

**Albert-Ludwigs-University Freiburg**  
*Since 10.2017*

Past positions.....

**Machine Learning Lab**  
*Student Assistant*

**Albert-Ludwigs-University Freiburg**  
*10.2015 – 09.2017*

Assisting in the implementation of research projects

**Chair of Computer Architecture**  
*Student Assistant*

**Albert-Ludwigs-University Freiburg**  
*04.2014 – 09.2014*

Maintenance of the mobile robots for the Hardware-Labcourse

## Research Interests

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- Dynamic Algorithm Configuration
- Learning to Learn
- Deep Reinforcement Learning
- Automated Machine Learning and Reinforcement Learning

## Education

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**PhD. Candidate (Computer Science)**  
*Machine Learning Lab*

**Albert-Ludwigs-University Freiburg**  
*Since 02.2018*

Thesis Working Title: Dynamic Algorithm Configuration by Reinforcement Learning

**Summer School**

**Reinforcement Learning Summer SCHOOL (RLSS'19)**

*In: Lille, France*

*July 2019*

Topics: *Reinforcement Learning and Bandits*

**Computer Science**

**Albert-Ludwigs-University Freiburg**

*Master of Science (M.Sc.), Final Grade: 1.2*

*2014 – 2017*

Thesis: Per Instance Algorithm Configuration (Grade 1.0)

Supervisor: Prof. Dr. Frank Hutter

**Computer Science**

**Albert-Ludwigs-University Freiburg**

*Bachelor of Science (B.Sc.)*

*2011 – 2014*

Thesis: Data Analysis for the Selection of Recording Channels on Multielectrode-Arrays (Grade 1.7)

Supervisor: Prof. Dr. Wolfram Burgard

## Teaching Experience

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**Automated Machine Learning**

**Massive Open Online Course (MOOC)**

*Graduate course*

*Published 04.2021*

Creation of coding exercises. Involved in setting up MOOC

## Teaching Assistant.....

<b>Automated Machine Learning</b> <i>Graduate course</i> Creation and grading of exercises & final project.	<b>(Flipped Classroom)</b> 04.2022 – 09.2022
<b>Automated Machine Learning</b> <i>Graduate course, Virtual</i> Creation and grading of exercises & final project. Setting up online teaching through Zoom and GitHub classroom.	<b>(Flipped Classroom)</b> 04.2021 – 09.2021
<b>Automated Machine Learning</b> <i>Graduate course, Virtual</i> Creation and grading of exercises & final project. Setting up online teaching through Zoom and GitHub classroom.	<b>(Flipped Classroom)</b> 04.2020 – 09.2020
<b>Automated Machine Learning</b> <i>Graduate course</i> Creation and grading of exercises & final project	04.2019 – 09.2019
<b>Machine Learning for Automated Algorithm Design</b> <i>Graduate course</i> Creation and grading of exercises & final project	10.2018 – 03.2019
<b>Machine Learning for Automated Algorithm Design</b> <i>Graduate course</i> Creation and grading of exercises & final project	10.2017 – 03.2018
<b>Hardware-Labcourse</b> <i>Undergraduate course</i> Assisting students with practical exercises	04.2014 – 09.2014

## Student Supervision.....

<b>MSc Thesis</b> <i>Baohe Zhang, Joint supervision with R. Rajan, Published at AISTATS'21</i> On the Importance of Hyperparameter Optimization in Model-based Reinforcement Learning	04.2020 – 10.2020
<b>MSc Project &amp; Thesis</b> <i>Gresa Shala, Published at PPSN'20</i> Learning to Optimize CMA-ES	04.2019 – 05.2020
<b>MSc Thesis</b> <i>Furkan Bozkurt</i> RL-DCBO: Reinforcement Learning Guided Dynamic Control for Bayesian Optimization	03.2019 – 11.2019
<b>MSc Thesis</b> <i>Theresa Eimer, Follow up work published at ICML'21</i> Improved Meta-Learning for Algorithm Control through Self-Paced Learning	12.2018 – 09.2019
<b>MSc Thesis</b> <i>Kevin Hättig</i> Model-Based Population Based Training	12.2018 – 09.2019
<b>MSc Thesis</b> <i>Oliver Brunner, Joint supervision with D. Speck at GKI-Freiburg</i> Learning Domain-Independent Heuristics with Deep Neural Networks	11.2018 – 04.2019
<b>MSc Project</b> <i>Theresa Eimer &amp; Kevin Hättig</i> Algorithm State Description for Algorithm Control	04.2018 – 12.2018

## Publications

 Google Scholar

 DBLP

 0000-0002-8703-8559

## Journal & Conference Publications.....

- [1] **A. Biedenkapp\***, N. Dang\*, M. S. Krejca\*, F. Hutter, and C. Doerr. "Theory-inspired Parameter Control Benchmarks for Dynamic Algorithm Configuration". In: *Proceedings of the Genetic and Evolution-*

ary Computation Conference (GECCO'22). **Joint first authorship**, Conference Rating: A, Nominated for Best Paper. ACM, July 2022.

- [2] J. Parker-Holder, R. Rajan, X. Song, **A. Biedenkapp**, Y. Miao, T. Eimer, B. Zhang, V. Nguyen, R. Calandra, A. Faust, F. Hutter, and M. Lindauer. "Automated Reinforcement Learning (AutoRL): A Survey and Open Problems". In: *Journal of Artificial Intelligence Research (JAIR)* 74 (2022), pp. 517–568.
- [3] M. Lindauer, K. Eggenberger, M. Feurer, **A. Biedenkapp**, D. Deng, C. Benjamins, R. Sass, and F. Hutter. "SMAC3: A Versatile Bayesian Optimization Package for Hyperparameter Optimization". In: *Journal of Machine Learning Research (JMLR) – MLOSS* 23.54 (2022), pp. 1–9.
- [4] **A. Biedenkapp**, R. Rajan, F. Hutter, and M. Lindauer. "TempoRL: Learning When to Act". In: *Proceedings of the Thirty-eighth International Conference on Machine Learning*. Acceptance rate: 21.5%, Conference Rating: A\*. July 2021, pp. 914–924.
- [5] T. Eimer, **A. Biedenkapp**, F. Hutter, and M. Lindauer. "Self-Paced Context Evaluation for Contextual Reinforcement Learning". In: *Proceedings of the Thirty-eighth International Conference on Machine Learning*. Acceptance rate: 21.5%, Conference Rating: A\*. July 2021, pp. 2948–2958.
- [6] T. Eimer, **A. Biedenkapp**, M. Reimer, S. Adriaensen, F. Hutter, and M. Lindauer. "DACBench: A Benchmark Library for Dynamic Algorithm Configuration". In: *Proceedings of the Thirtieth International Joint Conference on Artificial Intelligence (IJCAI'21)*. Acceptance rate: 19.3%, Conference Rating: A\*. ijcai.org, Aug. 2021, pp. 1668–1674.
- [7] D. Speck\*, **A. Biedenkapp\***, F. Hutter, R. Mattmüller, and M. Lindauer. "Learning Heuristic Selection with Dynamic Algorithm Configuration". In: *Proceedings of the Thirty-First International Conference on Automated Planning and Scheduling (ICAPS'21)*. **Joint first authorship**, Acceptance rate: ~30%, Conference Rating: A\*. Aug. 2021, pp. 597–605.
- [8] B. Zhang, R. Rajan, L. Pineda, N. Lambert, **A. Biedenkapp**, K. Chua, F. Hutter, and R. Calandra. "On the Importance of Hyperparameter Optimization for Model-based Reinforcement Learning". In: *Proceedings of the International Conference on Artificial Intelligence and Statistics (AISTATS'21)*. Acceptance rate: 29.8%, Conference Rating: A. Apr. 2021.
- [9] J. KH Franke, G. Köhler, **A. Biedenkapp**, and F. Hutter. "Sample-Efficient Automated Deep Reinforcement Learning". In: *Proceedings of the International Conference on Learning Representations (ICLR'21)*. Published online: iclr.cc, Acceptance rate: 28.7%, Conference Rating: A\*. May 2021.
- [10] G. Shala\*, **A. Biedenkapp\***, N. Awad, S. Adriaensen, F. Hutter, and M. Lindauer. "Learning Step-Size Adaptation in CMA-ES". In: *Proceedings of the Sixteenth International Conference on Parallel Problem Solving from Nature (PPSN'20)*. **Joint first authorship**, Conference Rating: A. Sept. 2020, pp. 691–706.
- [11] **A. Biedenkapp**, H. F. Bozkurt, T. Eimer, F. Hutter, and M. Lindauer. "Dynamic Algorithm Configuration: Foundation of a New Meta-Algorithmic Framework". In: *Proceedings of the European Conference on Artificial Intelligence (ECAI)*. Acceptance rate: 26.8%, Conference Rating: A. June 2020, pp. 427–434.
- [12] **A. Biedenkapp**, J. Marben, M. Lindauer, and F. Hutter. "CAVE: Configuration Assessment, Visualization and Evaluation". In: *Proceedings of the International Conference on Learning and Intelligent Optimization (LION'18)*. June 2018.
- [13] **A. Biedenkapp**, M. Lindauer, K. Eggenberger, C. Fawcett, H. Hoos, and F. Hutter. "Efficient Parameter Importance Analysis via Ablation with Surrogates". In: *Proceedings of the AAAI conference*. Acceptance rate: 24.6%, Conference Rating: A\*. Feb. 2017, pp. 773–779.

#### Workshop Publications & Preprints.....

- [14] R. Sass, E. Bergman, **A. Biedenkapp**, F. Hutter, and M. Lindauer. "DeepCAVE: An Interactive Analysis Tool for Automated Machine Learning". In: *Workshop on Adaptive Experimental Design and Active Learning in the Real World (ReALML@ICML'22)*. 2022.

- [15] **A. Biedenkapp**, D. Speck, S. Sievers, F. Hutter, M. Lindauer, and J. Seipp. “Learning Domain-Independent Policies for Open List Selection”. In: *Workshop on Bridging the Gap Between AI Planning and Reinforcement Learning (PRL@ICAPS’22)*. 2022.
- [16] C. Benjamins, T. Eimer, F. Schubert, **A. Biedenkapp**, B. Rosenhan, F. Hutter, and M. Lindauer. “CARL: A Benchmark for Contextual and Adaptive Reinforcement Learning”. In: *Workshop on Ecological Theory of Reinforcement Learning (EcoRL@NeurIPS’21)*. Sept. 2021.
- [17] S. Izquierdo, J. Guerrero-Viu, S. Hauns, G. Miotto, S. Schrod, **A. Biedenkapp**, T. Elsken, D. Deng, M. Lindauer, and F. Hutter. “Bag of Baselines for Multi-objective Joint Neural Architecture Search and Hyperparameter Optimization”. In: *Workshop on Automated Machine Learning (AutoML@ICML’21)*. May 2021.
- [18] S. Müller, **A. Biedenkapp**, and F. Hutter. “In-Loop Meta-Learning with Gradient-Alignment Reward”. In: *AAAI workshop on Meta-Learning Challenges (MetaLearning@AAAI’21)*. Feb. 2021.
- [19] N. Awad, G. Shala, D. Deng, N. Mallik, M. Feurer, K. Eggensperger, **A. Biedenkapp**, D. Vermetten, H. Wang, C. Doerr, M. Lindauer, and F. Hutter. “Squirrel: A Switching Hyperparameter Optimizer Description of the entry by AutoML.org & IOHprofiler to the NeurIPS 2020 BBO challenge”. In: *arXiv:2012.08180* (Dec. 2020). **Winning entry of the BBO Competition@NeurIPS’20 on a meta-learnable search space.**
- [20] **A. Biedenkapp**, R. Rajan, F. Hutter, and M. Lindauer. “Towards TempoRL: Learning When to Act”. In: *Workshop on Inductive Biases, Invariances and Generalization in RL (BIG@ICML’20)*. July 2020.
- [21] T. Eimer, **A. Biedenkapp**, F. Hutter, and M. Lindauer. “Towards Self-Paced Context Evaluation for Contextual Reinforcement Learning”. In: *Workshop on Inductive Biases, Invariances and Generalization in RL (BIG@ICML’20)*. July 2020.
- [22] S. Adriaensen, **A. Biedenkapp**, G. Shala, N. Awad, T. Eimer, M. Lindauer, and F. Hutter. “Automated Dynamic Algorithm Configuration”. In: *arXiv:2205.13881 [cs.AI]* (2022). Under Review.
- [23] Carolin Benjamins, Theresa Eimer, Frederik Schubert, Aditya Mohan, André Biedenkapp, Bodo Rosenhan, Frank Hutter, and Marius Lindauer. “Contextualize Me – The Case for Context in Reinforcement Learning”. In: *arXiv:2202.04500 [cs.LG]* (2022).
- [24] R. Rajan, J. L. B. Diaz, S. Guttikonda, F. Ferreira, **A. Biedenkapp**, and Frank Hutter. “MDP Playground: Controlling Dimensions of Hardness in Reinforcement Learning”. In: *arXiv:1909.07750v3* (Oct. 2020).
- [25] **A. Biedenkapp**, H. F. Bozkurt, F. Hutter, and M. Lindauer. “Towards White-Box Benchmarks for Algorithm Control”. In: *IJCAI 2019 DSO Workshop*. Aug. 2019.
- [26] M. Lindauer, M. Feurer, K. Eggensperger, **A. Biedenkapp**, and F. Hutter. “Towards Assessing the Impact of Bayesian Optimization’s Own Hyperparameters”. In: *IJCAI 2019 DSO Workshop*. Aug. 2019.
- [27] M. Lindauer, K. Eggensperger, M. Feurer, **A. Biedenkapp**, J. Marben, P. Müller, and F. Hutter. “BOAH: A Tool Suite for Multi-Fidelity Bayesian Optimization & Analysis of Hyperparameters”. In: *arXiv:1908.06756* (Aug. 2019).

#### Blog Posts.....

- [28] **A. Biedenkapp**, R. Rajan, F. Hutter, and M. Lindauer. “TempoRL - Learning When to Act”. In: *Personal Blog* (May 2022). URL: <https://andrebieenkapp.github.io/blog/2022/temporl/>.
- [29] **A. Biedenkapp**, N. Dang, M. S. Krejca, F. Hutter, and C. Doerr. “Theory-Inspired Parameter Control Benchmarks for DAC”. In: *Personal Blog* (May 2022). URL: <https://andrebieenkapp.github.io/blog/2022/gecco/>.
- [30] N. Lambert, B. Zhang, R. Rajan, and **A. Biedenkapp**. “The Importance of Hyperparameter Optimization for Model-based Reinforcement Learning”. In: <https://bair.berkeley.edu/blog> (Apr. 2021). URL: <https://bair.berkeley.edu/blog/2021/04/19/mbrl/>.

- [31] R. Rajan, **A. Biedenkapp**, T. F. Runge, and J. Franke. “AutoRL: AutoML in the Realm of Deep Reinforcement Learning”. In: <https://www.automl.org/automl-blog> (Apr. 2021). URL: <https://www.automl.org/blog-autorl>.
- [32] **A. Biedenkapp**. “Learning Step-Size Adaptation in CMA-ES”. In: <https://www.automl.org/automl-blog> (Aug. 2020). URL: <https://www.automl.org/learning-step-size-adaptation-in-cma-es>.
- [33] **A. Biedenkapp**. “Dynamic Algorithm Configuration”. In: <https://www.automl.org/automl-blog> (Feb. 2020). URL: <https://www.automl.org/dynamic-algorithm-configuration>.
- [34] **A. Biedenkapp** and F. Hutter. “BOHB”. In: <https://www.automl.org/automl-blog> (Aug. 2018). URL: [https://www.automl.org/blog\\_bohb](https://www.automl.org/blog_bohb).
- [35] **A. Biedenkapp**, K. Eggensperger, M. Feurer, and F. Hutter. “2nd AutoML Challenge”. In: <https://www.automl.org/automl-blog> (Aug. 2018). URL: <https://www.automl.org/blog-2nd-automl-challenge>.

## Patents

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- [36] **Biedenkapp, A.**, G. Shala, S. Adriaensen, N. Awad, M. Lindauer, and F. Hutter. “Method and Device for Learning a Strategy and for Implementing the Strategy”. U.S. pat. req. 17/305,586. Robert Bosch GmbH. July 9, 2021. Filed.
- [37] S. Müller, **Biedenkapp, A.**, and F. Hutter. “Verbesserte Vorrichtung zum Anlernen von maschinellen Lernsysteme für Bildverarbeitung”. German pat. DE202021100225. Robert Bosch GmbH. Feb. 12, 2021. URL: <https://depatisnet.dpma.de/DepatisNet/depatisnet?action=bibdat&docid=DE202021100225U1>.
- [38] D. Speck, **Biedenkapp, A.**, R. Matmüller, F. Hutter, and M. Lindauer. “Device and Method for Planning and Operation of a Technical System”. U.S. pat. req. 17/242,790. Robert Bosch GmbH. Apr. 28, 2021. Filed.
- [39] D. Speck, **Biedenkapp, A.**, R. Matmüller, F. Hutter, and M. Lindauer. “Device and Method for Planning and Operation of a Technical System”. European pat. req. EP20178576.3 – 1203. Robert Bosch GmbH. *Also filed requests for US patent and CN patent*. June 1, 2020. URL: <http://v3.espacenet.com/textdoc?IDX=EP3920103>. Filed.
- [40] **Biedenkapp, A.**, H. F. Bozkurt, F. Hutter, and M. Lindauer. “Method, Device and Computer Program for Adjusting a Hyperparameter”. European pat. req. EP3748551. Robert Bosch GmbH. June 11, 2020. URL: <http://v3.espacenet.com/textdoc?IDX=EP3748551>. Filed.

## Presentations

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Invited Talks & Competitively-Selected Tutorials.....

<b>Dynamic Algorithm Configuration</b> <i>ELLIS Meetup Freiburg, Freiburg, Germany</i>	03.2022
<b>Advances of Dynamic Algorithm Configuration</b> <i>Bosch Center for Artificial Intelligence, Renningen, Germany</i>	06.2021
<b>Algorithm Configuration: Challenges, Methods and Perspectives</b> <i>IJCAI 2020 Tutorial</i> Jointly with Prof. Marius Lindauer	01.2021
<b>Algorithm Configuration: Challenges, Methods and Perspectives</b> <i>PPSN 2020 Tutorial</i> Jointly with Prof. Marius Lindauer	09.2020
<b>Challenges of Dynamic Algorithm Configuration</b> <i>Bosch Center for Artificial Intelligence, Renningen, Germany</i>	03.2020

## Dynamic Algorithm Configuration

*Institut für Informationsverarbeitung (TNT), University of Hannover*

01.2020

### Conference Presentations

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#### The Genetic and Evolutionary Computation Conference

Online

*GECCO (Joint video presentation with all authors)*

07.2022

Theory-inspired Parameter Control Benchmarks for Dynamic Algorithm Configuration

#### International Conference on Machine Learning

Online

*ICML (Poster)*

07.2021

TempoRL: Learning When to Act

#### International Conference on Parallel Problem Solving from Nature

Leiden

*PPSN (Poster), Netherlands*

08.2020

Learning Step-Size Adaptation in CMA-ES

#### European Conference on Artificial Intelligence

Santiago de Compostela

*ECAI (Oral), Spain*

08.2020

Dynamic Algorithm Configuration: Foundation of a New Meta-Algorithmic Framework

#### Learning and Intelligent Optimization Conference

Kalamata

*LION (Oral), Greece*

06.2018

CAVE: Configuration Assessment, Visualization and Evaluation

#### AAAI Conference on Artificial Intelligence

San Francisco

*AAAI (Poster), California, USA*

02.2017

Efficient Parameter Importance Analysis via Ablation with Surrogates

### Workshop Presentations

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#### Bridging the Gap Between AI Planning and Reinforcement Learning

Online

*PRL@ICAPS'22*

06.2022

Learning Domain-Independent Policies for Open List Selection

#### Inductive Biases, Invariances and Generalization in Reinforcement Learning

Online

*BIG@ICML'20*

07.2020

Towards TempoRL: Learning When to Act

#### Data Science Meets Optimisation

Macau

*DSO@IJCAI'19, Macau (SAR), China*

08.2019

Towards White-box Benchmarks for Algorithm Control

## Scholarships, Honors and Awards

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### Best Paper Award Nomination

*GECCO'22, Theory-inspired Parameter Control Benchmarks for Dynamic Algorithm Configuration*

2022

### Best Reviewers (Top 10%)

*ICML'21*

2021

### Black-Box Optimization Competiton@NeurIPS'20

1st place

*Part of the AutoML & IOHprofiler Team, 1st place on a meta-learning friendly search space*

2020

Leaderboard: <https://bbochallenge.com/altleaderboard>

### Black-Box Optimization Competiton@NeurIPS'20

3rd place

*Part of the AutoML & IOHprofiler Team*

2020

Leaderboard: <https://bbochallenge.com/leaderboard>

### Travel Grant

*to visit the Thirty-First AAAI Conference on Artificial Intelligence (AAAI-17), \$400*

2017

## Professional Service

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### 2nd AutoML Fall School

*2022, Co-Organiser*

Journal Reviewing.....

## Computational Intelligence

2022

## Journal of the Association for Computing Machinery

2022, 2021

Program Committee Membership at Conferences.....

## AAAI Conference on Artificial Intelligence (AAAI)

2018

## AutoML Conference (AutoML-Conf)

2022

## European Conference on Artificial Intelligence (ECAI)

2020

## European Workshop on Reinforcement Learning (EWRL)

2022

## International Conference on Machine Learning (ICML)

2021, 2019

## Neural Information Processing Systems (NeurIPS)

2022, 2021

## NeurIPS Datasets and Benchmarks (NeurIPS DBT)

2021 (Track 1 & Track 2)

Program Committee Membership at Workshops.....

## ICLR Workshop on Agent Learning in Open-Endedness (ALOE)

2022

## ICML Workshop on Automated Machine Learning (AutoML@ICML)

2021, 2020, 2019, 2018

## NeurIPS Workshop on Meta-Learning (MetaLearn@NeurIPS)

2019

## Programming Skills

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**Excellent:** Python, Bash,  $\LaTeX$

**Good:** C, C#, C++

**Basic:** Matlab, Java

## Selected Open-Source Projects

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**GitHub Page:** <https://github.com/AndreBiedenkapp>

<https://github.com/automl/DAC>

*DAC*

Role: Developer

DAC is the first dynamic algorithm configurator which enables configuration not only to specific problem instances but also at each time-step. To gain insights into the strengths and weaknesses of this reinforcement learning based configurator DAC comes with example white-box benchmarks.

<https://github.com/automl/DACBench>

*DACBench*

Role: Contributor

DACBench is a benchmark library for Dynamic Algorithm Configuration. Its focus is on reproducibility and comparability of different DAC methods as well as easy analysis of the optimization process.

<https://github.com/automl/ParameterImportance>

*PyImp*

Role: Developer

PyImp is an easy to use tool that helps developers to identify the most important parameters of their algorithms. Given the data of a configuration run with SMAC3, PyImp allows for usage of various parameter importance methods to determine which parameters have the most influence on the algorithms behaviour.

<https://github.com/automl/SMAC3>

*SMAC3*

Former Role: Contributor

Python implementation of SMAC (sequential model-based algorithm configuration). SMAC is a tool for automated algorithm configuration.

## Languages

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**Native:** German

**Fluent:** English

**Basic:** French