

Phil Lopes, Ph.D.

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SHORT VITA

Phil Lopes (Louis-Philippe Lopes) is currently a Post-Doctoral Researcher at the Immersive Interaction Group of the EPFL in Lausanne. Before this he was a post-doc at the Computer Vision and Multimedia Lab of the University of Geneva, where his research focused on emotion recognition using physiological signals and the orchestration of content in the field of digital games.

He completed his PhD at the Institute of Digital Games of the University of Malta (2017). During his PhD his research focused on developing new tools and methodologies for procedurally generating content between the domains of audio, level design and visuals within the horror digital game genre; while also exploring new ways of automating and adapting sound to 3D virtual environments. The system developed was the Sonancia generator, a multi-faceted generator for horror. He completed his M.Sc. in Computer Science (2011) at the University of Lisbon, Portugal. During his master thesis, he developed a mixed-initiative musical tool called the Traveling Percussionist. Additionally, at the GAIPS INESC-ID laboratory at the Instituto Superior Técnico he developed the Geometry Friends competition framework. Currently he is investigating the application of affective computing techniques for the adaptation of procedurally generated content in games.

EDUCATION

Artificial Intelligence in Digital Games Ph.D. Degree: December 2013 – September 2017

Institute of Digital Games – University of Malta, Malta (**Supervised by Georgios N. Yannakakis**)

Computer Science M.Sc. Degree: September 2009 – September 2011

Faculty of Science - University of Lisbon, Portugal

Computer Science Degree: September 2005 – July 2009

Faculty of Science - University of Lisbon, Portugal

RESEARCH INTERESTS

- Computational Creativity in Games (Autonomous Game Design, Game Facet Blending)
- Computational Intelligence in Games (Player Experience Modeling, Mixed-Initiative Systems, Procedural Content Generation)
- Evolutionary Computation
- Machine Learning (Preference Learning, Supervised Learning and Unsupervised Learning)
- Affective Computing (Affect Modeling in Audio, Music Emotion Recognition)
- Audio Signal Processing (Audio Feature Extraction, Audio Analysis)
- Multi-Agent Systems (Swarm Systems, Multi-Agent Cooperation, Multi-Agent Competition)

APPLIED RESEARCH EXPERIENCE

Recognizing Emotion during Virtual Reality Experiences through fMRI imagery.

Immersive Interaction Group (<https://iig.epfl.ch/>), Ecole Polytechnic Federale de Lausanne (EPFL), Lausanne, Switzerland.

From: January 1st, 2019 until present.

Emotions play a big part in digital game playing; thus, it has been widely used in the field of psychology and neuroscience as a stimulus for the study of several brain phenomena. This project

consists of developing different applications capable of functioning under the rigorous and constraint heavy conditions of fMRI recording, allowing us to collect MRI data during a VR gameplaying experience. All conditions will be developed under Unity, and an initial pilot will be conducted to study the effects of motion sickness and player posture.

Accomplishments:

- Development of experimental protocols and VR experiences capable of functioning during an fMRI data collection process (i.e. limited hardware and fixed posture condition).
- Case study on the concept of motion sickness and how to solve it under such conditions.

Technologies Used: C#, Unity 3D, Python

Detecting emotions of professional players in competitive e-sport gaming.

Computer Vision and Multimedia Lab (<http://cvml.unige.ch/>), University of Geneva, Geneva, Switzerland.

From: June 1st, 2018 until December 31st, 2018.

Mental fortitude and concentration are big factors in any type of competitive sports, including competitive digital games. Thus, the ability to recognize players' emotions which arise from specific game-playing events can be a crucial ability for professional players. By pin-pointing the exact situations that trigger specific emotional reactions, affective feedback could be used to build new training strategies allowing players to better cope with emotional events. Given the recent rise of interest in e-sports worldwide the importance of such systems can be beneficial to the teams and the players of these institutions and underlines the importance of competitive digital games as another medium of entertainment.

Accomplishments:

- Development of a multimodal platform capable of synchronizing and collecting different physiological signals from a variety of modalities (ECG, EMG, EDA, Respiration, Body Movement, Face Camera) and devices (Webcam, BITalino, SenseMAT, Empatica E4). Available online: https://github.com/WorshipCookies/ApplicationLSL_Test.
- Modifying an established open-source game (i.e. Xonotic) capable of logging and synchronizing player actions with the different physiological modalities.
- Extensive piloting and initial data collection process testing the synchrony and quality of the different data types.

Technologies Used: C#, C, Python.

Exploring the interplay of different facet manipulation for emotional impact of players in digital games.

Computer Vision and Multimedia Lab (<http://cvml.unige.ch/>), University of Geneva, Geneva, Switzerland.

From: April 1st, 2017 until December 31st, 2018.

Exploring how the different interactions of facets within virtual spaces impact the emotional intensity of players. Studying both the affective component of audio, lighting and virtual space to guide the emotional progression of generated content.

Accomplishments:

- Development of experimental modules for the gathering of user affective annotations and physiology data.
- Development of games that serve as experimental platforms for the easy parametrization of different facets of games.
- Building models capable of dynamically alternating the parameters of levels in order to investigate how these interact and are reflected emotionally by players.

Technologies Used: C#, Unity 3D, Python, MatLab.

Measuring Affect of Dynamic Sonification of Horror Levels (Ph.D Thesis – Part Two)

Institute of Digital Games (<http://game.edu.mt>), University of Malta, Msida, Malta.

From: August 30th, 2014 until September 25th, 2017.

Validation of machine learned models of audio, through galvanic skin conductance measurements of participants. Studying both the affect of audio and virtual space and its influence on the participant emotions (specifically tension).

Accomplishments:

- Development of an experiment protocol and procedures for user participation.
- Development of an experimental platform from the Sonancia game, capable of logging skin conductance responses, player input logs and current game environments, while maintaining synchronicity.
- Creation of a novel annotation system, where participants are capable of annotating their affective state in real-time, by analyzing their own gameplay recordings.
- Thorough analysis of skin conductance signals by applying methods such as continuous decomposition analysis, signal to rank transformations and event based correlation analysis.
- Currently over 30 participant individual experiments with a dataset of over 90 different real-time annotations and skin conductance signals.

Technologies Used: C#, Unity 3D, Python, MatLab, Empatica Bracelet Device.

Generating Multi-Faceted Game Content from Level to Audio (Ph.D Thesis – Part One)

Institute of Digital Games (<http://game.edu.mt>), University of Malta, Msida, Malta.

From: August 30th, 2014 until September 25th, 2017.

Researching both the interplay between level design, visuals and audio for procedural content generation in digital games, and the perceived emotion of audio within the tension, arousal and valence dimensions of affect.

Accomplishments:

- Conception and Development of a Multi-Faceted Procedural Content Generator for Digital Horror Games.
- Creation of a crowdsourcing platform for annotating perception of emotion in the tension, arousal and valence dimension in audio.
- The Creation of an Emotion Recognition Model using Rank Support Vector Machines for Audio in Horror.

- A fully playable prototype developed in both the .NET C# framework and the Unity 3D Engine.
- The creation of an annotated audio library for the horror digital game genre.
- Publication of 5 Conference Papers and one Journal Paper (Pending Review)
- Creation of a fully playable Sonancia demonstration in Unity 3D.

Technologies Used: C#, Unity 3D, Python, MatLab.

C2Learn Project

Institute of Digital Games (<http://game.edu.mt>), University of Malta, Msida, Malta.

From: October 30th, 2013 until January 2015.

Research and creation of co-creative games, where both users and machines collaborate with each other, for the creation of novel and creative content.

Accomplishments:

- Development of a mixed-initiative creativity tool using the lateral thinking techniques.
- Design multiple games with the objective of fostering creativity in young students.
- Write detailed EU standard deliverables for both design and technological developments of the project.
- Develop and experiment with various creativity metrics and algorithms capable of generating new images from previously generated content.
- Creation of the C2Create tool.
- Development and experimentation of various metrics used within C2Create.
- Help design a “gameful” social system, allowing users to share and create game content.
- Design and help design multiple creative games.

Technologies Used: C#, Java, Unity 3D, Python, JavaScript, SOAP.

INVITE & Geometry Friends Projects

GAIPS INESC-ID (<http://gaips.inesc-id.pt/>), Instituto Superior Técnico, Lisbon, Portugal.

From: October 1st, 2012 until October 20th, 2013.

Development of an AI framework where two cooperative AI agents work in conjunction to solve seen and unseen puzzles. Geometry Friends is an official competition of the Computational Intelligence in Games Conference (as of 2013 to present).

Accomplishments:

- Creation of cognitive algorithms using the social identity theory for the INVITE project.
- Integration of Artificial Intelligence Agent into a human player only multiplayer game.
- Creation of an Artificial Intelligence framework and AI infrastructure for the game Geometry Friends.
- Development of the website and the competition infrastructure for the Geometry Friends Competition (<http://gaips.inesc-id.pt/geometryfriends/>)
- Implement specific algorithms (Clustering, Social Identity Model, Social Influence Model) found in literature.
- Test and interpret results obtained from experimentation.
- Develop a robust framework.
- Develop a competition infrastructure for competition participants.

Technologies Used: C#, XNA, Farseer Physics, PHP, HTML, MonoDevelop, VisualStudio 10.

PREVER - Development of Route Optimization Algorithms

Laboratório de Modelação de Agentes (LabMAG - <http://labmag.ul.pt/>), University of Lisbon, Lisbon, Portugal.

From: January 1st 2012, until October 1st, 2012.

Development of different evolutionary algorithms to solve the traveling salesman problem. This work was developed in collaboration with the Portuguese electric company (EDP).

Accomplishments:

- Implement and statistically evaluate Traveling Salesman, Vehicle Routing Problem algorithms.
- Interpret and value results.
- Conceptually design and create genetic parameter methods capable of minimizing the total distance at a decent amount of processing time.
- Program a system which is capable of easily using various Solomon Benchmarks (VRPTW test instances).
- Obtained valuable data through experimentation allowing the project to obtain further funding.

Technologies Used: Java, ECJ, Netbeans, Ubuntu Linux.

The Traveling Percussionist Project (M.Sc. Thesis)

Laboratório de Modelação de Agentes (LabMAG – <http://labmag.ul.pt/>), University of Lisbon, Lisbon, Portugal.

From: September 15th, 2010, until June 30th, 2011

M.Sc. thesis project consisting of generating percussion music through evolutionary algorithms and path-finding algorithms.

Accomplishments:

- Application and research on all forms of Artificial Life applications, these include Swarm, Genetic Algorithms and Cellular Automata techniques.
- Development of a graph creation application capable of using user created graphs and music and generating a percussion song.
- Development of a Genetic Drum Machine prototyped using NetLogo, which was later translated into a Java Framework Application.
- Development of an Image Sonification prototype also using NetLogo, which used user drawings to create percussion rhythms or beats.

Technologies Used: Java, NetLogo, JGAP, JUNG, NetBeans, Ubuntu Linux,

PUBLICATIONS

Wang, Chen, Phil Lopes, Thierry Pun and Guillaume Chanel, “Towards a Better Gold Standard: Denoising and Modelling Continuous Emotion Annotations Based on Feature Agglomeration and Outlier Regularisation.”. Proceedings of the 2018 Audio/Visual Emotion Challenge and Workshop (2018)

Lopes, Phil, Georgios N. Yannakakis, and Antonios Liapis. “RankTrace: Relative and Unbounded Affect Annotation.”. Proceedings of the Affective Computing and Intelligent Interaction Conference (2017).

Lopes, Phil, Antonios Liapis, and Georgios N. Yannakakis. "Modelling Affect for Horror Soundscapes." *IEEE Transactions on Affective Computing* (2017).

Liapis, Antonios, Georgios N. Yannakakis, Constantine Alexopoulos and Phil Lopes: "Can Computers Foster Human Users' Creativity? Theory and Praxis of Mixed-Initiative Co-Creativity," - Journal Paper. *Digital Culture & Education (DCE)*, 8 (2). 2016.

Lopes, Phil, Antonios Liapis, and Georgios N. Yannakakis. "Sonancia: A Multi-Faceted Generator for Horror." — Demo Paper. *Proceedings of the IEEE Computational Intelligence in Games Conference*. 2016.

Lopes, Phil, Antonios Liapis, and Georgios N. Yannakakis. "Framing Tension for Game Generation." *Proceedings of the International Conference on Computational Creativity*. 2016.

Lopes, Phil, Antonios Liapis, and Georgios N. Yannakakis. "Targeting Horror via Level and Soundscape Generation." *Eleventh Artificial Intelligence and Interactive Digital Entertainment Conference*. 2015.

Prada, R., Lopes, P., Catarino, J., Quitério, J., & Melo, F. S. (2015, August). The geometry friends game AI competition. In *2015 IEEE Conference on Computational Intelligence and Games (CIG)* (pp. 431-438). IEEE

Lopes, Phil, Antonios Liapis, and Georgios N. Yannakakis. "Sonancia: Sonification of procedurally generated game levels." *Proceedings of the 1st Computational Creativity and Games Workshop*. 2015.

Lopes, Phil, and Georgios N. Yannakakis. "Investigating collaborative creativity via machine-mediated game blending." *Proceedings of the Artificial Intelligence and Interactive Digital Entertainment conference*. 2014.

Eladhari, Mirjam P., Philip L. Lopes, and Georgios N. Yannakakis. "Interweaving Story Coherence and Player Creativity through Story-Making Games." *Interactive Storytelling*. Springer International Publishing, 2014. 73-80.

Lopes, Phil, Antonios Liapis, and Georgios N. Yannakakis. "The C2 create authoring tool: Fostering creativity via game asset creation." - Demo Paper. *Computational Intelligence and Games (CIG), 2014 IEEE Conference on*. IEEE, 2014.

Dimas, Joana, Phil Lopes, Gonçalo Pereira, Guida Preto, Pedro Santos, and Rui Prada. "Social identity bias in agents rational decision." In *Intelligent Virtual Agents*, p. 460. 2013.

Dimas, Joana, Phil Lopes, and Rui Prada. "One for all, all for one: Agents with social identities." *Proceedings of the CogSci*. Conference 2013.

Lopes, Phil, and Paulo Urbano. "The traveling percussionist." *Evolutionary and Biologically Inspired Music, Sound, Art and Design*. Springer Berlin Heidelberg, 2012. 165-175.

TEACHING EXPERIENCE

University of Geneva (2017 - 2018)

- Teaching Assistant: Image Processing (Imagerie Numerique)
- Teaching Assistant: Multimodal and Affective Interaction (Interaction Multimodale et Affective)

Institute of Digital Games, University of Malta (2014 - 2017)

- Teaching Assistant: Image Processing [B.Sc. Level]
- Teaching Assistant: Interactive and Multimedia Systems [M.Sc. level]

- Teaching Assistant and Lecturer: Game AI [5 ECTS course, M.Sc. level]
- Teaching Assistant and Lecturer: Game AI [5 ECTS course; M.Sc. level]
- Teaching Assistant and Lecturer: Game AI Revisited [5 ECTS course; M.Sc. level]
- Teaching Assistant and Lecturer: Affective Computing [5 ECTS course; M.Sc. level]
- Tutor: Data Mining and Game Analytics [5 ECTS course; M.Sc. Level]
- Tutor: Introduction of Statistical Analysis

REVIEWER

International Conferences (since 2015-2018):

- Computational Intelligence in Games (CIG), IEEE.
- International Conference on Computational Creativity (ICCC)
- Foundations of Digital Games (FDG)
- Artificial Intelligence and Interactive Digital Entertainment (AIIDE), AAAI
- Advances in Computer Entertainment Technology (ACE)
- Affective Computing and Intelligent Interaction (ACII)
- Computational Intelligence in Music, Sound, Art and Design (EvoMusArt), Springer
- The Genetic and Evolutionary Computation Conference (GECCO)

Journals (since 2016-2018):

- IEEE Transactions on Affective Computing (TAC)
- IEEE Transactions on Computational Intelligence and AI in Games (TCIAG)
- IEEE Transactions on Games (T-G)
- Elsevier International Journal of Human-Computer Studies (IJHCS)

OTHER SKILLS AND HOBBIES

Languages: Can work in English, Portuguese and French.