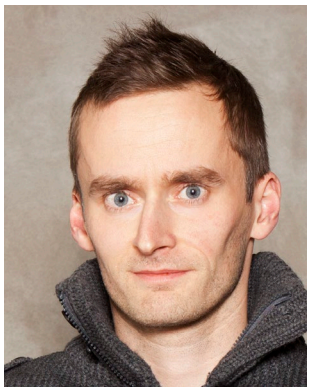


Prof. Perttu Hämäläinen
Aalto University, Finland
Contact: perttu.hamalainen@aalto.fi
Homepage: http://perttu.info
Google Scholar:
https://scholar.google.fi/citations?user=i90uqXUAAAAJ

Mission: To positively impact public health through *intelligent exergames and digitally augmented sports* that promote physical activity and movement skill learning.

Education and degrees awarded

Doctor of Science in Technology, 10 May 2007, Helsinki University of Technology. Major: Interactive Digital Media. Contact: kirjaamo@aalto.fi, +358 9 47001

Master of Arts in New Media, 13 Dec 2002, University of Art and Design Helsinki UIAH. Major: Interaction design.

Master of Science in Technology, 8 July 2001, Helsinki University of Technology. Major: Signal processing.

Other education and skills

I have a mixed design and science background, my skills ranging from optimization, computer vision, machine learning, and signal processing to game design, full-body interaction, and sound design. I programmed my first computer game when I was 9 years old. In addition to new media, I've been involved in various theatre and short film productions.

Related to my field of movement AI and exergames, I have *intimate knowledge of human movement* from practicing nearly 20 sports and movement arts, e.g., modern dance, capoeira, karate, taekwondo, hand balancing, ring gymnastics, rock climbing, and medieval swordmanship.

Linguistic skills

Finnish (mother tongue)
English (fluent)

Current positions

Tenure Track Assistant Professor in computer games, Aalto University, since 1.4.2012. Advancing to Tenured Associate Professor on 1 Oct 2020. I lead a game research group and the Game Design and Production major.

Scientific advisor, Valo Motion Ltd. (a spin-off from my group), since 1.9.2016.

Previous work experience

2006-2012	R&D Director/CTO, Virtual Air Guitar Company. I led a team of researchers and engineers working on real-time computer vision technology and related game innovations.
2004-2012	Co-founder, R&D Director, Animaatiokone Industries Co-op.

2002-2006 Doctoral candidate, Helsinki University of Technology, Telecommunications Software and Multimedia Laboratory.

2000-2002 Specialist, Oy Elmorex Ltd. My duties included electronics and software design, game design and design and implementation of signal processing algorithms.

1999-2000 Audio programmer, Audioriders Ltd. Further development of my M.Sc. thesis project.

1998-1999 Research assistant, Helsinki University of Technology, Signal Processing Laboratory. I produced teaching material for a basic course in digital electronics and computer technology, and worked on my M.Sc. thesis project.

1997-1998 Chief technician, OUBS Ota-tv. OUBS Ota-tv was the campus television at Helsinki University of Technology

1996-1997 Editor, OUBS Ota-tv. My main responsibility was sound design of the weekly 30-minute program. In addition to that, I did cinematography, lighting and stage design, scriptwriting and video editing.

Leadership and supervision experience

I have supervised three completed doctoral theses, and I'm currently supervising three full-time doctoral students and two post-docs. In 2006-2012 I led the R&D team (including 2 PhDs in addition to myself) at the experimental games startup Virtual Air Guitar Company. I've also supervised or co-supervised 20+ Master's theses.

Personal research funding and grants

2018 Predictive Control of Moving Machinery, Technology Industries of Finland Centennial Foundation. Total budget: 230000€ (split between two consortium partners). My role: co-PI.

2017 Automatic Game Testing and Balancing Using Intelligent Agents, Aalto University's internal competitive peer-reviewed funding (4 years for a PhD student)

2016 Virtual Coach Based on Multibody Dynamics (VIMU), Academy of Finland and Tekes (Finnish Funding Agency for Innovation), Total budget: 402 803€ (split between two consortium partners). My role: PI

2016 Interactive Movement Artificial Intelligence (IMAI), Academy of Finland. Total budget 754 214€. My role: PI

2015 Augmented Climbing Wall research commercialization funding, Tekes (Finnish Funding Agency for Innovation), 360000€. My role: supervising professor, writing the proposal with my post-doc who was the project lead and is now the CEO of the spinoff company

2013 Future Game Animation, Tekes (Finnish Funding Agency for Innovation), 360000€. My role: PI, leading a consortium of Aalto University and 7 game and animation companies.

2009 Nordic game funding (100k€) for the innovative Kung-Fu Live PlayStation 3 exergame by Virtual Air Guitar Company. My role: technology lead, writing the proposal.

2006 One year artist grant from Suomen Kulttuurirahasto

2002-2005 Funding from HeCSE graduate school for my doctoral research

2004 Finnish foundation for Technology Promotion scholarship (5000€) for doctoral research

2004 Nokia Foundation scholarship (5000€) for doctoral research

2003 Nokia Foundation scholarship (5000€) for doctoral research
2002 Finnish foundation for Technology Promotion scholarship (5000€) for doctoral research
2002 Jenny and Antti Wihuri's foundation scholarship (5000€) for doctoral research

Patents, inventions, awards, and honours

2019 Computer implemented method for providing augmented reality (AR) function regarding music track, US Patent 10,482,862
2019 Best paper award (top 1%) at ACM CHI 2019, with Maximus Kaos, Nick Graham, and Ryan Rhodes
2017 Finnish Applied Game of the Year ("vuoden hyötypeli") at Finnish Game Awards 2017 for Augmented Climbing Wall (my role: computer vision and parts of the design of the first version, supervising professor in commercialization phase)
2016 Finnish Game Jam award for the jam game Come as you are. My role: game mechanics design, programming, procedural audio.
2016 Augmented Climbing Wall shortlisted for Unity Awards 2016
2016 Best paper honorary mention (top 5%) at ACM CHI 2016. In collaboration with Raine Kajastila and Leo Holsti.
2015 Best paper honorary mention (top 5%) at CHI PLAY 2015. In collaboration with Raine Kajastila, Joe Marshall, Rich Byrne, Floyd Mueller.
2013 Best Low-Cost, Minimally-Intrusive Solution award in 3DUI contest, Orlando, U.S. In collaboration with Tuukka Takala and Meeri Mäkäräinen.
2011 Kung-Fu High Impact (Virtual Air Guitar Company) won the "Control Design, 2D or Limited 3D" category in the 11th annual National Academy of Video Game Testers and Reviewers awards. My role: leading the game tech team, designing and implementing most of the controls/embodied interaction.
2006 Object Tracking in Computer Vision. Finnish patent 20060926.
2004 Kick Ass Kung-Fu won the Games Platforms category in Europrix Top Talent multimedia innovation competition in Vienna, Austria. In collaboration with Ari Nykänen & Mikko Lindholm.
2004 Mindtrek Grand Prix (20000€) for Kick Ass Kung-Fu, Tampere, Finland
2004 Korjaamo Young Design Award for Animaatiokone, Helsinki, Finland. With Mikko Lindholm & Ari Nykänen.
2003 Animaatiokone won the Pikku Kakkonen (best multimedia for children) and non-commercial categories at Mindtrek competition, Tampere, Finland. With Mikko Lindholm & Ari Nykänen.
2003 Prix Spécial du Jury for Animaatiokone in the international Prix Möbius multimedia competition in Athens, Greece. With Mikko Lindholm & Ari Nykänen.
2001 Kukakumma Muumaassa won the Pikku Kakkonen category in Mindtrek competition (best multimedia for children), Tampere, Finland. With Johanna Höysniemi, Laura Turkki, Teppo Rouvi.

Other academic merits and positions of trust

I regularly serve on the technical paper committees of the leading conferences of my field, as listed below. Notably, I was invited to chair the paper committees of ACM CHI PLAY 2017 & 2018, and I'm now also a member of the CHI PLAY steering committee.

2019	ACM SIGGRAPH, ACM CHI PLAY
2018	ACM CHI PLAY (papers chair, with Jo Iacovides)
2017	ACM CHI, ACM CHI PLAY (papers chair, with Vero Vanden Abeele)
2016	ACM CHI, ACM CHI PLAY
2015	ACM CHI PLAY
2014	ACM CHI PLAY

I have also served as an associate editor of IEEE Transactions on Games, and reviewed for several other journals and conferences (e.g., IJHCS, ToDigra, FGJ, Simulation & Gaming).

I'm in the steering group of the Helsinki ICT doctoral education network, and I've been the opponent for two doctoral defenses outside Finland (Aarhus University, Denmark; Queens University, Canada), and one Finnish one (Tampere University of Technology)

Scientific excellence and societal impact

I publish at the leading venues in human-computer interaction, games, and computer animation, e.g., at **ACM SIGGRAPH, ACM CHI, ACM CHI PLAY, IEEE TVCG.** My H-index is 21, http://scholar.google.fi/citations?user=i90uqXUAAAAJ&hl=fi. Note that there is a publication gap due to my game industry years 2006-2012, when I could not publish except for patent applications (one patent granted). *I have started publishing again in 2013 with excellent success, including first-author papers in ACM SIGGRAPH, and award-winning papers at ACM CHI and ACM CHI PLAY.*

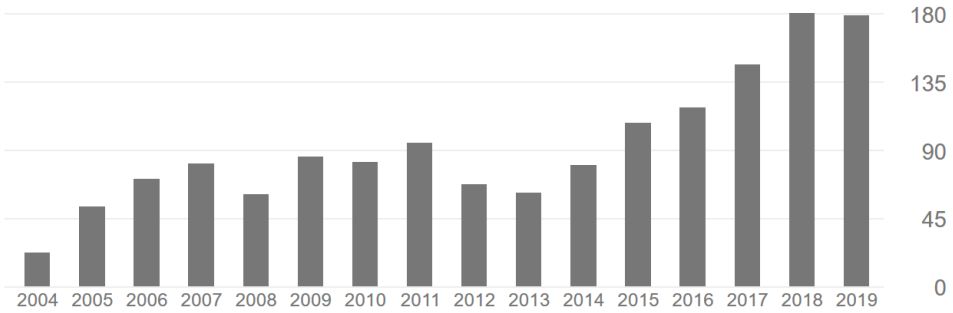


Figure 1. My citations according to Google Scholar. The publication gap due to my game industry years (2006-2012) caused a plateau, but I'm now back in the game.

I have an exceptional track record of research commercialization and media visibility:

- **Commercialization of my doctoral research** (Kick Ass Kung-Fu, CHI 2005)**,** as the CTO/R&D Director of Virtual Air Guitar Company in 2006-2012. I exchanged the rights to my patent FI20060926 for a 20% share of the company. Virtual Air Guitar Company attracted an **international investment of 1.2M€** and published two innovative exergames, Kung-Fu Live[1] and Kung-Fu High Impact[2]. Both games have sold over **100000 copies** and received enthusiastic reviews[3].
- **Commercialization of Augmented Climbing Wall,** a novel AR sports platform which started as a research project in my group. My post-doc Raine Kajastila and I built the first version that

[1] https://www.youtube.com/watch?v=MzDBOQD-woc
[2] https://www.youtube.com/watch?v=65TwePlA_BE, https://www.youtube.com/watch?v=ASB-ZXDPPUw
[3] For example, http://www.xboxfitness.org/review-of-kung-fu-high-impact-for-kinect/, https://www.amazon.com/Kung-Fu-High-Impact-Xbox-360/product-reviews/B0055NBPYM

was piloted highly successfully in a climbing center; this led to a CHI 2016 publication with an honorary mention, several videos with millions of views on social media (the best performing video with an estimated **100+ million views** on various channels[4], **Finnish Applied Game of the Year award**, and the successful spin-off start-up ValoMotion that has already sold the system to **over 40 countries**, now called ValoClimb[5]. ValoMotion was founded late 2016, and the second year revenue was already nearly **3M€**, with over 100% annual growth.

- **Commercialization of Computer Vision Trampoline Games.** One of my major research streams is exergames that give players empowering superhero experiences, in order to motivate physical activity. When I started as a professor in 2012, I set out to combine a real trampoline with computer vision tracking to implement the empowerment in both the real and the virtual worlds. ValoMotion has now turned this research project into their highly successful second product ValoJump[6]. Currently, **ValoMotion's analytics data shows over 10k ValoClimb and ValoJump games played every day at over 200 locations around the world.** As the games require high physical exertion, I can confidently say that my work is starting to have **substantial societal impact** through motivating physical activity. Obviously, successful spin-offs like ValoMotion also contribute to the society through taxes and job creation.

In addition to publishing articles, speaking at various events, and actively commercializing my research, I have exhibited my works over 30 times in art and design exhibitions, and at various events, including **Ars Electronica, WIRED NextFest, and Karate World Championships.** My work has also appeared several times in national and international media, e.g., **New Scientist, WIRED, TechCrunch, Kotaku,** Yle, Nelonen news, Tilt! game show, and Helsingin Sanomat.

[4] For example, https://www.facebook.com/ValoMotion/videos/friday-fun-at-the-office-climball-battle-between-leo-and-joni/1081345311957279/
[5] https://valomotion.com/valoclimb/
[6] https://valomotion.com/valojump/, http://valomotion.com/valojump/games-applications/super-stomp/

Three most significant successes

The following summarizes what I consider my top 3 successes. I'm highlighting both research and commercialization; success in the latter makes me a better tutor for students with entrepreneurial ambition, and also strengthens the societal impact of my work.

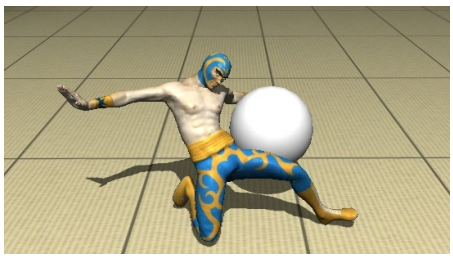
1. Augmented Climbing Wall: Outstanding success in research and design

Augmented Climbing Wall (a.k.a. ValoClimb) was the world's first AR climbing system with interactive projected graphics, with the goal of motivating physical exercise and pushing the boundaries of exercise diversity and intensity in exergames. The project resulted in CHI PLAY 2015 & CHI 2016 papers with honorary mentions (top 5% of submissions), Best Finnish Applied Game award 2016, successful spin-off startup Valo Motion with several million euros in global sales, over 10k games played every day, and highly viral videos with over 100M total views on various channels.

2. Movement Empowerment in Exergames: Sustaining and developing original research and design vision over a long time span

Insufficient physical exercise is a societal health problem. A key component of exercise motivation is perceived competence, i.e., how capable and skilled we feel when exercising. Thus, a viable goal for exergame design research is innovating ways to make exergame players feel empowered, with superhuman movement abilities. Kick Ass Kung-Fu (CHI 2005, an innovative martial arts exergame, part of my doctoral dissertation) made the player run faster and jump higher through a careful integration of computer vision and game physics. The game won awards and also inspired the commercial exergames Kung-Fu Live & Kung-Fu High Impact by Virtual Air Guitar Company, where I served as the CTO/R&D Director (2006-2012), taking the empowerment concept further with advanced computer vision and gesture detection. After I joined Aalto University, my group has developed the world's first "mixed reality empowerment" trampoline games (CHI 2013 WIP, IJCSS 2014), using both real devices (a trampoline) and game physics to empower the player's movement. Recently, we have also investigated the empowerment of flexibility (CHI PLAY 2018), and Valo Motion has launched a highly successful series of commercial trampoline games based on our research.

3. Movement AI for Simulated Characters: Scientific excellence



Creating 3D animation is slow and expensive. To mitigate this problem, my SIGGRAPH 2014 and 2015 papers proposed novel model-predictive control algorithms that allowed a physically simulated character to improvise complex, realistic movements like getting back up after being pushed over, in real-time, without animation data and without a time-consuming training phase. The papers opened a new research direction for me (I had not published on animation or intelligent control before), helped me win grants and fund students, and my group has published follow-up work at leading venues, e.g., SIGGRAPH 2017, and IEEE TVCG 2018. My PhD student Joose Rajamäki defended his dissertation "Random Search Algorithms for Optimal Control" in 2018, with distinction. Two related doctoral dissertations are well on their way.