



Professor Andre van Schaik

RESEARCH PROFESSOR, BIOELECTRONICS & NEUROSCIENCE,
MARCS Institute for Brain, Behaviour & Development

Biography

André van Schaik received the M.Sc. degree in electrical engineering from the University of Twente, Enschede, The Netherlands, in 1990 and the Ph.D. degree in electrical engineering from the Swiss Federal Institute of Technology (EPFL), Lausanne, Switzerland, in 1998. In 1998 he was a postdoctoral research fellow in the Department of Physiology at the University of Sydney, funded by fellowship from the Garnett Passe and Rodney Williams memorial foundation. In 1999 he became a Senior Lecturer in the School of Electrical and Information Engineering at the University of Sydney and promoted to Reader in 2004. In 2011 André became a research professor at UWS. His research focuses on three main areas: neuromorphic engineering, bioelectronics, and neuroscience. He was identified as a world leader in neuromorphic engineering research in May 2006 by an independent article in IEEE Spectrum, the IEEE largest circulation magazine. He has authored more than 100 papers and is an inventor of more than 30 patents. He is a founder of three start-up companies: VAST Audio, Personal Audio, and Heard Systems.

This information has been contributed by Professor van Schaik.

Professional Memberships

- Fellow IEEE (2014)

Awards

- ARC Australian Research Fellow 2003-01-01
- ARC QEII Fellow 2008-01-01

Interests

- Computational Neuroscience
- Electronic Circuit Design
- Integrated Circuit Design
- Neuromorphic Engineering
- Neurophysiology
- Neuroscience

Organisational Unit (School / Division)

- MARCS Institute for Brain, Behaviour & Development

Committees

- MARCS Institute

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Publications

Chapters in Books

- van Schaik, A. and Hamilton, T. (2015), 'Silicon cochlea building blocks', *Event-Based Neuromorphic Systems*, Wiley & Sons 9781118927601.
- van Schaik, A., Hamilton, T. and Liu, S. (2015), 'Silicon cochleas', *Event-Based Neuromorphic Systems*, Wiley & Sons 9781118927601.
- Kan, A., Jin, C. and Van Schaik, A. (2011), 'Psychoacoustic evaluation of different methods for creating individualized, headphone-presented virtual auditory space from B-format room impulse responses', *Principles and Applications of Spatial Hearing*, World Scientific 9789814313872.
- Gargiulo, G., Bifulco, P., Calvo, R., Romano, M., Ruffo, M., Shephard, R., Cesarelli, M., Jin, C., McEwan, A. and Van Schaik, A. (2011), 'Giga-Ohm High-Impedance FET Input Amplifiers for Dry Electrode Biosensor Circuits and Systems', *Integrated Microsystems: Electronics, Photonics, and Biotechnology*, Taylor & Francis Inc 9781439836200.
- Ruffo, M., Cesarelli, M., Jin, C., Gargiulo, G., McEwan, A., Sullivan, C., Bifulco, P., Romano, M., Shephard, R. and Van Schaik, A. (2011), 'Non-invasive foetal monitoring with a combined ECG - PCG system', *Biomedical Engineering, Trends in Electronics, Communications and Software*, Intech 9789533074757.
- Gargiulo, G., Bifulco, P., Calvo, R., Cesarelli, M., Jin, C., McEwan, A. and Van Schaik, A. (2010), 'Non-invasive electronic biosensor circuits and systems', *Intelligent and biosensors*, InTech 9789537619589.
- Van Schaik, A., Hamilton, T. and Jin, C. (2010), 'Silicon models of the auditory pathway', *Springer handbook of auditory research: computational models of the auditory system*, Springer 9781441913708.

Journal Articles

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- Cohen, G., Orchard, G., Leng, S., Tapson, J., Benosman, R. and van Schaik, A. (2016), 'Skimming digits : neuromorphic classification of spike-encoded images', *Frontiers in Neuroscience*, vol 10 .
- Cameron, M., Kekesi, O., Morley, J., Tapson, J., Breen, P., van Schaik, A. and Buskila, Y. (2016), 'Calcium imaging of AM dyes following prolonged incubation in acute neuronal tissue', *PLOS One*, vol 11, no 5 , pp 1 - 13.
- Kasi, P., Wright, J., Khamis, H., Birnie, I. and van Schaik, A. (2016), 'The Bayesian decoding of force stimuli from slowly adapting type I fibers in humans', *PLoS One*, vol 11, no 4 .
- Wright, J., Macefield, V., van Schaik, A. and Tapson, J. (2016), 'A review of control strategies in closed-loop neuroprosthetic systems', *Frontiers in Neuroscience*, vol 10 , pp 312 - .
- Wang, R., Hamilton, T., Tapson, J. and van Schaik, A. (2015), 'A neuromorphic implementation of multiple spike-timing synaptic plasticity rules for large-scale neural networks', *Frontiers in Neuroscience*, vol 9 .
- Tapson, J., Cohen, G. and van Schaik, A. (2015), 'ELM solutions for event-based systems', *Neurocomputing*, vol 149, no pt. A , pp 435 - 442.
- van Schaik, A. and Tapson, J. (2015), 'Online and adaptive pseudoinverse solutions for ELM weights', *Neurocomputing*, vol 149, no pt. A , pp 233 - 238.
- Afshar, S., George, L., Thakur, C., Tapson, J., van Schaik, A., De Chazal, P. and Hamilton, T. (2015), 'Turn down that noise : synaptic encoding of afferent SNR in a single spiking neuron', *IEEE Transactions on Biomedical Circuits and Systems*, vol 9, no 2 , pp 188 - 196.
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- Hamilton, T., Afshar, S., Van Schaik, A. and Tapson, J. (2014), 'Stochastic electronics : a neuro-inspired design paradigm for integrated circuits', *Proceedings of the Institute of Electrical and Electronics Engineers*, vol 102, no 5 , pp 843 - 859.
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- Wang, R., Cohen, G., Stiefel, K., Hamilton, T., Tapson, J. and Van Schaik, A. (2013), 'An FPGA implementation of a polychronous spiking neural network with delay adaptation', *Frontiers in Neuroscience*, , no FEB .
- Stiefel, K., Tapson, J. and Van Schaik, A. (2013), 'Temporal order detection and coding in nervous systems', *Neural Computation*, vol 25, no 2 , pp 510 - 531.
- Tapson, J. and Van Schaik, A. (2013), 'Learning the pseudoinverse solution to network weights', *Neural Networks*, vol 45 , pp 94 - 100.
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- Reeve, R., Van Schaik, A., Jin, C., Hamilton, T., Torben-Nielsen, B. and Webb, B. (2007), 'Directional hearing in a silicon cricket', *Bio Systems*, vol 87, no 40604 , pp 307 - 313.
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Conference Papers

- Wang, R., Thakur, C., Hamilton, T., Tapson, J. and van Schaik, F. (2016), 'A stochastic approach to STDP', *IEEE International Symposium on Circuits and Systems*, Montreal, Canada.
- De Chazal, P., Tapson, J. and van Schaik, A. (2015), 'Learning ELM network weights using linear discriminant analysis', *International Conference on Extreme Learning Machines*, Singapore.
- Tapson, J., De Chazal, P. and van Schaik, A. (2015), 'Explicit computation of input weights in extreme learning machines', *International Conference on Extreme Learning Machines*, Singapore.
- Kasi, P., Birznies, I. and van Schaik, A. (2015), 'A point process approach to encode tactile afferents', *IEEE/EMBS International Conference on Neural Engineering*, Montpellier, France.
- De Chazal, P., Tapson, J. and van Schaik, A. (2015), 'A comparison of extreme learning machines and back-propagation trained feed-forward networks processing the MNIST database', *ICASSP (Conference)*, Brisbane, Qld.
- Wright, J., Macefield, V., van Schaik, A. and Tapson, J. (2015), 'Decoding force from multiunit recordings from the median nerve', *IEEE International Conference on Rehabilitation Robotics*, Singapore.

- Thakur, C., Hamilton, T., Wang, R., Tapson, J. and van Schaik, A. (2015), 'A neuromorphic hardware framework based on population coding', *International Joint Conference on Neural Networks*, Killarney, Ireland.
- Sadr Lahijany, H., De Chazal, P., van Schaik, A. and Breen, P. (2015), 'Sleep apnoea episodes recognition by a committee of ELM classifiers from ECG signal', *IEEE Engineering in Medicine and Biology Society. Annual Conference*, Milan, Italy.
- Wang, R., Thakur, C., Hamilton, T., Tapson, J. and van Schaik, A. (2015), 'A compact aVLSI conductance-based silicon neuron', *Biomedical Circuits and Systems Conference*, Atlanta, Ga..
- Xu, Y., Thakur, C., Hamilton, T., Tapson, J., Wang, R. and van Schaik, A. (2015), 'A reconfigurable mixed-signal implementation of a neuromorphic ADC', *Biomedical Circuits and Systems Conference*, Atlanta, Ga..
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- Nicholson, A., Jenkins, J., van Schaik, A., Hamilton, T. and Lehmann, T. (2014), 'A digital to transconductance converter for Nauta structure op-amps in 65nm CMOS', *Midwest Symposium on Circuits and Systems*, College Station, Tex..
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- Wang, R., Hamilton, T., Tapson, J. and van Schaik, A. (2014), 'A generalised conductance-based silicon neuron for large-scale spiking neural networks', *IEEE International Symposium on Circuits and Systems*, Melbourne, Vic..
- Thakur, C., Wright, J., Hamilton, T., Tapson, J. and van Schaik, A. (2014), 'Live demonstration : FPGA implementation of the CAR model of the cochlea', *IEEE International Symposium on Circuits and Systems*, Melbourne, Vic..
- Wang, R., Hamilton, T., Tapson, J. and van Schaik, A. (2014), 'A compact reconfigurable mixed-signal implementation of synaptic plasticity in spiking neurons', *IEEE International Symposium on Circuits and Systems*, Melbourne, Vic..
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- Afshar, S., Kavehei, O., van Schaik, A., Tapson, J., Skafidas, S. and Hamilton, T. (2012), 'Emergence of competitive control in a memristor-based neuromorphic circuit', *International Joint Conference on Neural Networks*, Brisbane, Qld..
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- Wabnitz, A., Epain, N., Van Schaik, A. and Jin, C. (2011), 'Time Domain Reconstruction of Spatial Sound Fields Using Compressed Sensing', *International Conference on Acoustics, Speech and Signal processing*, Prague, Czech Republ.
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- Gmel, G., Hamilton, T., Leblebici, Y. and Van Schaik, A. (2011), 'A Silicon Model of the Inner Hair Cell', *Conference on Intelligent Sensors, Sensor Networks and Information Processing*, Adelaide.
- Hamilton, T. and Van Schaik, A. (2011), 'Silicon implementation of the generalized integrate-and-fire neuron model', *2011 Seventh International Conference on Intelligent Sensors, Sensor Networks and Information Processing*, Adelaide, Australia.
- Ang, C., Jin, C., Leong, P. and Van Schaik, A. (2011), 'Spiking neural network-based auto-associative memory using FPGA interconnect delays', *2011 International Conference on Field-Programmable Technology*, New Delhi, India.
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- Tapson, J., Hamilton, T. and Van Schaik, A. (2010), 'Live Demonstration : The Self-Tuned Regenerative Electromechanical Parametric Amplifier', *IEEE Asia Pacific Conference on Circuits and Systems*, Paris, France.
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- Wu, P., Jin, C., Kan, A. and Van Schaik, A. (2010), 'A Multi-Microphone Speech Enhancement Algorithm Tested Using Acoustic Vector Sensors', *International Workshop on Acoustic Echo and Noise Control*, Tel Aviv, Israel.
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Research

Reverse engineering the brain

The brain creates a coherent interpretation of the external world based on input fr om its senses. Yet data from the senses are unreliable and confused. How does the brain determine what is out there in the world around it? BENS will conduct neurophysiological and psychophysical investigations combined with theoretical, computational and electronic modelling studies to discover how the brain achieves this. The outcomes of this research will then be applied t o create electronics sensors with built in brains.

Neuromorphic Engineering and Intelligent Sensors

Neuromorphic Engineering is a sub field of Electrical Engineering tha t aims to apply knowledge of how signals are processed in the brain to build electronic signal processing systems that vastly outperform current digital signal pr ocessing systems. Current 'smart' sensor s are generally sensor s with a built-in computer. What BENS aims to develop are smart sensor s with a built-in brain.

This information has been contribut ed by Professor van Schaik.

Current Projects

Title:	Hardware Acceleration for Neural Systems
Years:	2014-01-01 - 2016-12-31

ID:	P00021450
Western Researchers:	Andre Van Schaik
Funding:	<ul style="list-style-type: none">Australian Research Council (ACRG)
Title:	Designing a Bionic Voice Prosthesis to Restore Natural Voice for Laryngectomy Patients
Years:	2015-07-01 - 2019-06-03
ID:	P00022459
Western Researchers:	Farzaneh Ahmadi and Andre Van Schaik
Funding:	<ul style="list-style-type: none">The Garnett Passe and Rodney Williams Memorial Foundation
Title:	Neuromorphic Cognition for Micro-Aircraft Applications
Years:	2016-04-18 - 2017-10-16
ID:	P00023406
Western Researchers:	Andre Van Schaik and Jonathan Tapson
Funding:	<ul style="list-style-type: none">Departmen t of Defence
Title:	Event-based image sensors for optical space situational awareness
Years:	2016-04-27 - 2017-05-27
ID:	P00023405
Western Researchers:	Andre Van Schaik
Funding:	<ul style="list-style-type: none">Departmen t of Defence
Title:	Hardware implementation of spiking neural network architectures for sensory and learning systems
Years:	2016-05-05 - 2019-08-14
ID:	P00023408
Western Researchers:	Andre Van Schaik
Funding:	<ul style="list-style-type: none">Departmen t of Defence
Title:	Microelectronic 3D Imaging and Neuromorphic Recognition for Autonomous UAVs [via Milan Politechnic]
Years:	2016-04-04 - 2019-04-05
ID:	P00022195
Western Researchers:	Tara Hamilton and Andre Van Schaik
Funding:	<ul style="list-style-type: none">Departmen t of DefenceNorth Atlantic Treaty Organization (NATO)

Previous Projects

Title:	Novel circuits and design strategies for sub-65 nanometre complementary metal oxide semiconductor technologies [via UNSW - no funding to UWS]
Years:	2011-06-27 - 2014-06-26
ID:	P00020370
Western Researchers:	Andre Van Schaik
Funding:	<ul style="list-style-type: none">Australian Research Council (ACRG)
Title:	Astrocytic K⁺ regulation as a mechanism to modulate brain waves
Years:	2012-10-24 - 2014-03-31

ID:	P00021107
Western Researchers:	Yossi Buskila and Andre Van Schaik
Funding:	<ul style="list-style-type: none">University of Western Sydney
Title:	Feeling Color: Transforming Visual Color to Tactile Stimulation as a Pprothetic for the Blind
Years:	2011-11-09 - 2015-11-08
ID:	P00020464
Western Researchers:	Andre Van Schaik and Jonathan Tapson
Funding:	<ul style="list-style-type: none">University of Western Sydney
Title:	Electronic Auditory Pathway
Years:	2011-01-31 - 2014-06-30
ID:	P00020066
Western Researchers:	Andre Van Schaik
Funding:	<ul style="list-style-type: none">Australian Research Council (ACRG)

Supervision

Professor van Schaik is available to be a principal supervisor for doctoral projects

Current Supervision

Title:	Bayesian Inference with Spiking Neurons
Field of Research:	
Title:	Potential Biomedical Applications of Gas Array Sensor Technologies Using Dedicated VLSI Hardware Implementing Bayesian Inference for Pattern Recognition and Classification Tasks
Field of Research:	
Title:	Building Blocks for Electronic Neural Networks
Field of Research:	
Title:	Interfaces With the Somatosensory System
Field of Research:	
Title:	Bayesian Decoding of Tactile Afferents Responsible for Sensori Motor Control
Field of Research:	OTHER SOCIETY AND CULTURE

Previous Supervision

Title:	A Real-Time Implementation of the Primary Auditory Neuron Activities
Field of Research:	ENGINEERING AND RELATED TECHNOLOGIES
Thesis:	A Real-Time Implementation of the Primary Auditory Neuron Activities
Title:	Neuromorphic Implementations of Polychronous Spiking Neural Networks
Field of Research:	ARTIFICIAL INTELLIGENCE; ELECTRONIC ENGINEERING
Thesis:	Neuromorphic Implementations of Polychronous Spiking Neural Networks

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Citation indices

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electronics

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AER EAR: A matched silicon cochlea pair with address event representation interface	V Chan, SC Liu, A van Schaik Circuits and Systems I: Regular Papers, IEEE Transactions on 54 (1), 48-59	152	2007
Pointing device utilizing a photodetector array and controlled by a human finger contacting a prism	M Bidiville, E Raeber J Arreguit, H Buczek, FA van Schaik, F Bauduin, ... US Patent 5,578,817	116	1996
Pointing device utilizing a photodetector array	M Bidiville, E Raeber J Arreguit, H Buczek, FA van Schaik, D O'Keefe, ... US Patent 5,703,356	113	1997
Cursor pointing device utilizing a photodetector array with target ball having randomly distributed speckles	M Bidiville, J Arreguit, FA van Schaik, B Steenis, F Droz-Dit-Busset, ... US Patent 5,288,993	104	1994
Building blocks for electronic spiking neural networks	A van Schaik Neural Networks 14 (6-7), 617-628	101	2001
A new EEG recording system for passive dry electrodes	G Gargiulo, RA Calvo, P Bifulco, M Cesarelli, C Jin, A Mohamed, ... Clinical Neurophysiology 121 (5), 686-693	99	2010
A CMOS motion detector system for pointing devices	X Arreguit, FA van Schaik, FV Bauduin, M Bidiville, E Raeber Solid-State Circuits, IEEE Journal of 31 (12), 1916-1921	97	1996
Pointing device utilizing a photodetector array	J Arreguit, F Bauduin, M Bidiville, H Buczek, D O'Keefe, E Raeber, ... US Patent 6,124,587	94 *	2000
The role of high frequencies in speech localization	V Best, S Carlile, C Jin, A van Schaik J. Acoust. Soc. Am 118 (1), 353-363	82	2005
Improved silicon cochlea using compatible lateral bipolar transistors	A van Schaik, E Fragnière, E Mtoz Advances in Neural Information Processing Systems, 671-677	82	1996

Title	1–20	Cited by	Year
A mobile EEG system with dry electrodes	G Gargiulo, P Bifulco, RA Calvo, M Cesarelli, C Jin, A van Schaik 2008 IEEE Biomedical Circuits and Systems Conference, 273-276	66	2008
Bias current generators with wide dynamic range	T Delbrück, A van Schaik Analog Integrated Circuits and Signal Processing 43 (3), 247-268	61	2005
Contrasting monaural and interaural spectral cues for human sound localization	C Jin, A Corderoy S Carlile, A van Schaik The Journal of the Acoustical Society of America 115, 3124	58	2004
Event-based 64-channel binaural silicon cochlea with Q enhancement mechanisms	SC Liu, A van Schaik, BA Mincti, T Delbruck Proceedings of 2010 IEEE International Symposium on Circuits and Systems ...	53	2010
An active 2-D silicon cochlea	TJ Hamilton, C Jin, A van Schaik, J Tapson Biomedical Circuits and Systems, IEEE Transactions on 2 (1), 30-43	51	2008
Dual layer optical ball for pointing device	M Bidiville, E Raeber J Arreguit, H Buczek, FA van Schaik, F Bauduin, ... US Patent 6,218,659	51	2001
A neuromorphic sound localizer for a smart MEMS system	A van Schaik, S Shamma Analog Integrated Circuits and Signal Processing 39 (3), 267-273	44	2004
Limits to the fault-tolerance of a feedforward neural network with learning	J Nijhuis, B Hofflinger, A van Schaik, L Spaanenburg Fault-Tolerant Computing, 1990. FTCS-20. Digest of Papers., 20th ...	44	1990
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