Valeria Gazzola

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Personal Data:

Date of Birth: 19 January 1977
Nationality: Italian
Languages: Mother tong: Italian. Working language: English. Elements of Dutch and Spanish.
Gender: Female
Family Status: Married with 2 children (Born June 2010 and March 2013)

Education:

2004-07 **PhD** *cum laude* in Social Neuroscience (8/10/2007); Department of Neuroscience, University Medical Center of Groningen (UMCG) and University of Groningen (RuG), Groningen, NL

Hearing rhythmic steps and music coming from above we might feel that the neighbors are having a dance party. Frequently, such guesses will be right. What are the neural bases of such spontaneous understanding? Using functional magnetic resonance imaging, we found that when seeing or hearing someone else's actions participants activate the same regions involved in executing similar acts (premotor, parietal and temporal). The action's goal is a key aspect translated by the system: while observing someone else grasping a glass with the hand, individuals born without arms recruit regions involved in their own way of grasping the glass - their foot – while observers that do have hands also activate areas specifically controlling the hand. We show that the sight of an industrial robot also activates the same circuit suggesting why robots in Star Wars are so engaging. Sharing goals provides a tool for interpreting the behavior of organisms even if their bodies differ from ours. Although every participant shared observed acts, more empathic individuals activated this system more strongly. A similar system seems to exist also for sensation and emotion.

10/11/2003 **Master** in Biology (Neuroscience) with a grade of 110/110 cum laude (maximum possible grade) and an experimental thesis entitled: "The role of the somatosensory cortices during the observation of the tactile stimulation of others" which contributed to a publication in Neuron. University of Parma, Italy

1996-1997 E.U. financed course of programming ('Programmatore ad indirizzo applicativo') that led to the degree of programmer in July 1997.

Positions:

From 2015 **Group leader (tenured)**, Social Brain Laboratory, Netherlands Institute for Neuroscience (NIN), Amsterdam, NL.

The main topic of my group is the investigation of the causal relationship between the areas involved in our perception of the actions and sensations of others, and behaviour, by using combination of fMRI, EEG, TMS/tDCS and animal work.

From 2015 **Associate Professor (tenured)**, Dep. of Psychology, University of Amsterdam (UvA)

2014 - 2015 **Assistant professor (tenured)**, Dep. of Neurosci., UMCG-RuG and UvA

2010 - 2015 **Senior researcher**, Social Brain Laboratory, Netherlands Institute for Neuroscience (NIN), Amsterdam, NL.

2007-10 **Post-Doc** in Social Neuroscience; UMCG-RuG,NL

Humans are social animals. While it is of cardinal importance for us to understanding what other people do and feel, we still lack an understanding of how our brain achieves this function. Research on social perception has focused so far on cognitive processes. I investigate an alternative account: 'shared circuits'. Shared circuits are brain areas involved when we ourselves do an action, feel an emotion or sense a sensation AND when we observe or listen to someone else perform the same actions, express the same emotions and experience the same sensations. Such shared circuits reflect an automatic transformation of what other people do and feel into the neural representation of our own actions, emotions and sensations. Using fMRI we investigate the role of brain regions involved in the execution of actions during the perception of the

actions of others; the role of the somatosensory cortices during the perception of other people being touched; and the role of emotional structures (e.g. amygdala and insula) during the observation of the emotional stimuli. The emphasis of the work was to investigate the idea that a single mechanism – shared circuits – could give valuable insights into all three domains.

2005-06 **Visiting associate** @ the Caltech, Pasadena, CA, USA

Career breaks:

May-June 2010 and February-May 2013 for maternity leave.

Additional Past Research Experience:

2001-2002 **Independent Research Project in Psychobiology, University of Parma**

Research project on the physiological consequences of stress in rats under the supervision of Prof. A. Sgoifo (biology department).

Teaching activities:

2016 Lecturer in the "Neuroscience of Emotions Advanced Course", Lisbon, Portugal

From 2016 Organizer of the Project management course for the graduate school

From 2015 Lecturer and co-organizer of the Cognitive Neuroscience and Introductory courses of the graduate school for neuroscience, @UvA

From 2015 Lecturer in the Introduction to Neurophysiology & Imaging Techniques master course,@UvA From 2013 Lecture in the Behavioural Neuroscience 2013 master, University of Amsterdam

2013 "Empathy in the brain" introductory lecture, Roosevelt Academy students, NL.

2008-09 Organizer of the BCN graduate school orientation course, UMCG-RuG, NL

Supervision of master, graduate students and postdoctoral fellows:

The field below include the years of supervision, the last name of the student, the title of the PhD-thesis or the project, and the current position of the lab member. PhDs and postdocs for whom I was the primary daily supervisor are marked with *. The supervision of the other members was shared at 50% with C. Keysers, co-leader of the Social Brain Lab, or other collaborators.

2015-2019 Bhandari*, fMRI Multi-band optimization, Postdoc @NIN

2015-2017 Bozzacchi, Contextual information in action, Postdoc @NIN

2014-2016 de Sanctis*, Action observation information flow, Postdoc @NIN

2012-2014 Migliorati, SI and PM functional connectivity, Postdoc @NIN

2015-2018 Bruls, Rodent models of empathy, PhD student @NIN, and UvA

2014-2017 Gallo*, Do shared circuits really help?, PhD student @NIN, and UvA

2014-2017 Borja*, Neural correlates of empathy regulation, PhD student @NIN, and UvA

2014-2017 Abdelgabar*, Role of cerebellum in action perception, PhD student @NIN, and UvA

2012-2016 Suttrup, Neural correlate of action perception, PhD student @NIN, and UvA

2015-2016 Paracampo, Shared emotional circuits & behaviour, PhD student @ Univ. of Bologna, IT

2013-2017 Müller-Pinzler*, The social emotion of embarrassment, Postdoc @NIN

2011-2014 Borgomaneri*, Your emotions move my motor system, Postdoc at @ Univ. of Bologna, IT

2008-2014 Valchev*, Primary somatosensory cortex and its role during action observation, Postdoc @ Yale university, US

2010-2013 Cui*, Distinguishing and Connecting Self and Others, Assistant prof. @ Shenzhen Univ., China

2006-2012 Meffert, Empathy under arrest?, Director of the Social Cognition Research Program, Boys Town National Research Hospital, Center for Neurobehavioral Research, US

2007-2011	Schippers, Brains in interaction, product developer for Gino Software, Groningen, NL
2007-2011	Atsak, Stress and Cognition, postdoc @ Radboud University, Nijmegen, NL
2007-2011	Kokal, When we move together: the neural correlates of joint action, Managing Director at Bonn Cologne Graduate School of Physics and Astronomy

In addition I supervised a research assistant, and at least 12 master students (@ least 6 months period), 6 @ the UMCG-Rug, 6 @ the NIN, all continued in academia.

Institutional responsibilities

From 2016	Member of the Data Management Committee @ NIN
From 2013	ONWAR (neurosciences graduate school) teaching committee member, requiring about 30h/y, and involving planning the training program, Erasmus Rotterdam and UvA, NL
From 2004	Journal club coordinator @ UMCG-RuG and NIN, NL
From 2004	Hiring committee for the Marie Curie Excellence and ERC grants, UMCG-RuG and NIN

Commission of trust

2007-now	Reviewer for: Reviewer for: Journal of Neuroscience, Cerebral cortex, Neuroimage, PlosOne, Brain Structure and Function, Biological Psychiatry, JOCN, HBM, SCAN, Cortex, Social Neurosci, and Frontiers.
2014	External reviewer for the FWO, ERC and GIF funding organizations
2014	PhD thesis external reviewer for Deakin University, Australia
2013	PhD thesis external reviewer for The University of Queensland, Australia

Fellowships, awards and honors:

2016	Member of the Young Academy of Europe
2015 - 2020	VIDI + ASPASIA grant by NWO 900k€
2014 - 2016	NARSAD young investigation award ~60k€
2012	NWO open access publication grant 3.500€
2011	Best presentation award (ABIM BTOP award) at the Alpine Brain Imaging Meeting, Switzerland; 300€
2010 - 2014	VENI grant by the NWO; 250k€
2008	van Swinderen Prize of the Koninklijk Natuurkundig Genootschap' (KNG) for my PhD thesis; 2250€. This prize is awarded in recognition of the best thesis summary in terms of effectiveness to communicate science to the general public.
2008	University Medical Center Groningen, BCN, Best PhD Thesis Award.
2008	Cum Laude for both my Master and PhD thesis
2008	Travel award, Organization for Human Brain Mapping Conference; 1000 AUD
2007	Dutch Top Science publication (Dutch Endo-Neuro-Psycho meeting)
2006	Travel award, Organization for Human Brain Mapping Conference; 750 USD
2004	Students Present Award, Cognitive Neuroscience Society Conference; 500 USD
2003	DAAD PhD scholarship (~36.000€ for 3 years) to conduct my PhD at the MaxPlanck Institute of Nikos Logothetis in Tuebingen, Germany. Declined when Christian Keysers and I were given the opportunity to build up a neuroimaging lab in Groningen.

Oral communications at national and international conferences:

2016	Brain and Behaviour conference, Haifa, Israel
2015	Symposium of the Italian Society of Psychophysiology.

2015	Joint improvisation meeting, Paris
2014	Conference “Aspects of Neuroscience”, Warsaw, Poland
2014	Summer School on “Shared experiences: the boundaries of the social brain”, Aegina, Greece
2014	OHBM satellite “Perspectived in Social Neuroscience” workshop, Marburg, Germany
2012	Australasian Cognitive Neuroscience Conference Brisbane, Australia.
2012	Kinaesthesia, Empathy and Aisthesis in Music and Dance Symposium. Delmenhorst, Germany.
2012	Science and Dharma workshop "Perceiving Others: What does it involve?" MUDA - The Israeli Center for Science, Mindfulness and Society, Unit of Applied Neuroscience, the School of Psychology, IDC Herzliya, Israel
2011	Beyond the Brain IX, The Science of Empathy and the Spirit of Compassion, Winchester, UK
2008	Re-interpreting others' actions through the lens of our experience. *Endo-Neuro-Psycho Meeting*, Doorwerth, The Netherlands
2007	Empathy and the somatotopic auditory mirror system in humans. *Endo-Neuro-Psycho Meeting*, Doorwerth, The Netherlands
2003	A touching sight: what does your leg do in my SII? *Human Brain Mapping Conference,* New York, NY.

National and International ongoing Collaborators:

The fields below indicate: year when collaboration started, name of the collaborator(s), collaborator’s expertise, collaborator institution and ongoing project(s)’ description (P). Publication list above shows past successful collaborations.

From 2016	Wynn Legon, University of Minnesota, MN, US P: Investigating the causal relationship between vicarious activity and prosocial behavior by means of focal ultrasound neurostimulation
From 2016	Yoshiyuki Onuki, University of Tokyo, Japan P: Human electrophysiological recording to investigate the direction of information flow between areas vicariously responding to other’s actions.
From 2015	Caruana F, Avanzini P, University of Parma P: Human electrophysiological recording to investigate the direction of information flow between areas vicariously responding to other’s actions.
From 2015	Baaijen, JC, VUmC, Amsterdam P: Human electrophysiological recording in the anterior insula to investigate the physiological bases of emotion perception.
From 2015	Bolognini N, University of Milano, Italy. P: role of somatosensory activity in borderline personality disorders.
From 2014	Yatawatta S, Optimization & FEM, ASTRON, Dwingloo, NL P: Developing a procedure to optimize electro configuration to reach the anterior insula using tDCS
From 2013	Viding E, CU youths, UCL, UK P: Investigate differences between children with Callous-Unemotional (CU) vs. Emotionally Reactive (ER) in (1) neural reactivity to affective, empathy-inducing stimuli, and in (2) brain anatomy.
From 2013	Sack A, TMS-fMRI, University of Maastricht, NL P: Causal role of onnline TMS in the mirror system
From 2012	Krach S, Autism, Philipps-University Marburg, DE

P1: Krach, Kamp-Becker, Einhäuser, Müller-Pinzler, Sommer, Jansen, Gazzola, Paulus (in prep.) Reduced embodied social pain in autism spectrum disorder is compensated by hippocampal activity.
P2: Müller-Pinzler; Gazzola; Keysers; Sommer; Jansen; Frässle; Einhäuser; Paulus (under revision in NeuroImage) Neural Pathways of Embarrassment.

From 2012 De Zeeuw C, Cerebellar-cortical control, Erasmus MC, Rotterdam, NL
P: Cerebellar Contribution to Action Perception. This collaboration brought to this year submission of a Research talent grant (N.W.O.)

From 2012 Noy L, Weizmann Institute Of Science, Israel.
P: Studying togetherness in the brain.

From 2010 Turner B, 7T MRI, Max-Planck Institute, Leipzig, DE & UvA, NL
P1: Classifying action's goals and means at 7T
P2: High resolution FEM
P3: TDS current imaging

From 2009 Avenanti A, TMS, University of Bologna, Italy.
P1: Does S1 play a causal role in cortical networks while perceiving the actions of others?
P2: Borgomaneri, Gazzola, Avenanti (under review @ Brain Structure and Function) "Perception of emotional bodies triggers fast motor reactions and motor resonance"

From 2008 Spezio M, Emathy & morality, Scripps College, Claremont, CA, USA
P: Developing the economical games that measure moral behavior.

Output:

44 publications, h=22, 2721 citations (Cit.), average impact factor (IF)=8.3, Median IF=6.1 (according to WoS; median IF of relevant research fields: Neuroscience 2.9, Neuroimaging 2.4, Psychology 2.0, Behavioral sciences 2.7).

Year	Output description		
	Peer-reviewed Publications – authors, title, journal, volume, pages	**Cit.**	**IF**
2016	Zaki, Wager, Singer, Keysers, **Gazzola**. The Anatomy of Suffering: Understanding the Relationship between Nociceptive and Empathic Pain. TICS 20(4): 249-259	1	17.8
2016	Etzel, Valchev, **Gazzola**, Keysers. Is brain activity during action observation modulated by the perceived fairness of the actor? PlosOne 11(1): e0145350		3.1
2015	Paulus, Müller-Pinzler, Jansen, **Gazzola**, Krach. Mentalizing and the role of the posterior superior temporal sulcus in sharing others' embarrassment. *Cerebral Cortex*. 25(8): 2065-2075	4	8.3
2015	Krach, Kamp-Becker, Einhauser, Sommer, Frassle, Jansen, Rademacher, Muller-Pinzler, **Gazzola**, Paulus. Evidence from pupillometry and fMRI indicates reduced neural response during vicarious social pain but not physical pain in autism. Human brain mapping 36(11): 4730-44	2	8.1
2015	Cui, Abdelgabara, Keysers, **Gazzola.** Responsibility Modulates Pain-matrix Activation Elicited by the Expressions of Others in Pain. *Neuroimage* 114, 371-8	3	6.1
2015	Müller-Pinzler, **Gazzola**, Keysers, Sommer, Jansen, Frässle, Einhäuser, Paulus, Krach. Neural Pathways of Embarrassment and their Modulation by Social Anxiety. *Neuroimage* 119, 252-61	2	6.1
2015	Valchev, Curčić-Blake, Renken, Avenanti, Keysers, **Gazzola**, Maurits NM. cTBS delivered to the left somatosensory cortex changes its functional connectivity during rest. *Neuroimage* 114, 386-97	2	6.1
2015	Borgomaneri, Vitale, **Gazzola**, Avenanti. Seeing fearful body language rapidly freezes the observer's motor cortex. *Cortex* 65, 232-45	6	6.0
2015	Borgomaneri, Gazzola, Avenanti. Transcranial magnetic stimulation reveals two functionally distinct stages of motor cortex involvement… Brain Struct Funct. 220(5):2765-2781	6	4.6
2015	Carrillo, Migliorati, Bruls, Han, Heinemans, Pruis, **Gazzola***, Keysers*****. Repeated witnessing of conspecifics in pain: effects on emotional contagion. *PlosOne*		3.5
2015	Valchev, Zijdewind, Keysers, **Gazzola**, Avenanti, Maurits. Weight dependent modulation of motor resonance… *Neuropsychologia* 66, 237-245		3.5
2014	Keysers,**Gazzola**. Dissociating the ability and propensity for empathy.**TiCS** 18(4),163-166	14	**21.1**
2014	Keysers, Perrett, **Gazzola.** Hebbian Learning is about contingency not contiguity and explains the emergence of predictive mirror neurons. ***Behav Brain Sciences*** 37, 205-206		**15.0**
2014	Keysers, Meffert, **Gazzola**. Reply: Spontaneous versus deliberate vicarious representations: different routes to empathy in psychopathy and autism. ***Brain*** 137, e273	6	**10.2**
2014	Keysers, **Gazzola**. Hebbian learning and Predictive Mirror Neurons for Actions, Sensations and Emotions. *Philosophical Transactions B* 369, 20130175	12	6.3
2014	Borgomaneri, **Gazzola**, Avenanti. Temporal dynamics of motor cortex excitability during perception of	21	5.8

	natural emotional scenes. *SCAN* 9(10), 1451-1457		
2014	Cui, Arnstein, Thomas, Maurits, Keysers, **Gazzola**. Functional magnetic resonance Imaging connectivity analyses reveal efference-copy to SI. *PLoS One*. 8;9(1):e84367	6	3.5
2013	Meffert, **Gazzola,** den Boer, Bartels, Keysers. Reduced spontaneous but relatively normal deliberate vicarious representations in psychopathy. ***Brain***. 136(Pt 8): 2550-62	39	**10.2**
2013	Monfardini, **Gazzola**, Boussaoud, Brovelli, Keysers, Wicker. Vicarious Neural Processing of Outcomes during Observational Learning. *PLoS One*. 8(9):e73879.	8	3.5
2012	**Gazzola,** Spezio, Etzel, Castelli, Adolphs, Keysers. Primary somatosensory cortex discriminates affective significance in social touch. ***Proc Natl Acad Sci U S A.*** 109(25):E1657-66.	49	**9.8**
2012	Cerliani, Thomas, Jbabdi, Siero, Nanetti, Crippa, **Gazzola,** D'Arceuil, Keysers. Probabilistic tractography recovers a rostrocaudal trajectory of connectivity variability in the human insular cortex. *Hum Brain Mapp*. 33(9):2005-34.	58	6.9
2012	Borgomaneri, **Gazzola**, Avenanti. Motor mapping of implied actions during perception of emotional body language. Brain Stimulation. *Brain Stimul*. 5(2):70-6.	24	5.4
2011	Arnstein, Cui, Keysers, Maurits, **Gazzola.** Mu-suppression during action observation and execution correlates with BOLD in dorsal premotor, inferior parietal, and SI cortices. *J Neurosci 31*, 14243-14249.	66	6.7
2011	Quadflieg, Etzel, **Gazzola**, Keysers, Schubert, Waiter, Macrae. Puddles, parties, and professors: linking word categorization to neural patterns of visuospatial coding. *J Cogn Neurosci 23*, 2636-2649.	15	4.7
2011	Atsak, Orre, Bakker, Cerliani, Roozendaal, **Gazzola***, Moita*, Keysers*. Experience modulates vicarious freezing in rats: a model for empathy. *PLoS One 6*, e21855. *co-last	23	3.5
2010	Keysers, Kaas, **Gazzola**. Somatosensation in social perception. ***Nat Rev Neurosci*** *11*, 417-428.	257	**31.4**
2010	Keysers, **Gazzola.** Social neuroscience: mirror neurons recorded in humans. ***Curr Biol*** *20*, R353-354.	34	**10.0**
2009	**Gazzola,** Keysers. The observation and execution of actions share motor and somatosensory voxels in all tested subjects: single-subject analyses of unsmoothed fMRI data. ***Cereb Cortex*** *19*, 1239-1255.	262	**8.4**
2009	Keysers, **Gazzola**. Expanding the mirror: vicarious activity for actions, emotions, and sensations. *Curr Opin Neurobiol 19*, 666-671.	127	6.8
2009	Nanetti, Cerliani, **Gazzola**, Renken, Keysers. Group analyses of connectivity-based cortical parcellation using repeated k-means clustering. *Neuroimage 47*, 1666-1677.	54	6.1
2009	Kokal, **Gazzola**, Keysers. Acting together in and beyond the mirror neuron system. *Neuroimage 47*, 2046-2056.	40	6.1
2009	Schippers, **Gazzola**, Goebel, Keysers. Playing charades in the fMRI: are mirror and/or mentalizing areas involved in gestural communication? *PLoS One 4*, e6801.	31	3.5
2009	Etzel, **Gazzola**, Keysers. An introduction to anatomical ROI-based fMRI classification analysis. *Brain Res 1282*, 114-125.	34	2.8
2008	Thioux, **Gazzola**, Keysers. Action understanding: how, what and why. ***Curr Biol*** *18*, R431-434.	36	**10.0**
2008	Etzel, **Gazzola**, Keysers. Testing simulation theory with cross-modal multivariate classification of fMRI data. *PLoS One 3*, e3690.	56	3.5
2007	Keysers, **Gazzola**. Integrating simulation and theory of mind: from self to social cognition. ***Trends Cogn Sci*** *11*, 194-196.	217	**21.1**
2007	**Gazzola**, van der Worp, Mulder, Wicker, Rizzolatti, Keysers. Aplasics born without hands mirror the goal of hand actions with their feet. ***Curr Biol*** *17*, 1235-1240.	88	**10.0**
2007	**Gazzola**, Rizzolatti, Wicker, Keysers. The anthropomorphic brain: the mirror neuron system responds to human and robotic actions. *Neuroimage 35*, 1674-1684.	277	6.1
2006	**Gazzola**, Aziz-Zadeh, Keysers. Empathy and the somatotopic auditory mirror system in humans. ***Curr Biol*** *16*, 1824-1829.	330	**10.0**
2006	Keysers, **Gazzola.** Towards a unifying neural theory of social cognition. *Prog Brain Res 156*, 379-401.	144	5.1
2004	Keysers, Wicker, **Gazzola**, Anton, Fogassi, Gallese. A touching sight: SII/PV activation during the observation and experience of touch. ***Neuron*** *42*, 335-346.	367	**16.0**

Book Chapters

2013	Keysers, **Gazzola**. The vicarious brain. In: Mechanisms of Social Connections. APA
2013	Keysers, Thious, **Gazzola**. Mirror neuron system and social cognition. In: Understanding other minds: Perspective from developmental social neuroscience. Oxford University Press, 14:233
2011	Keysers, Thious, **Gazzola.** Mirror neurons system and social cognition. In: The Oxford Handbook of Social Neuroscience, Oxford University Press
2008	Keysers, **Gazzola**. Towards a unifying neural theory of social cognition. In: *Vienna Series in Theoretical Biology*. MIT press.