

Special issues or book chapters on motivation and technology in international print media

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1 Summary

The goal of our dissemination plan is to raise awareness of the “state of the science” on cognitive robotics applied to rehabilitation and to enhance the development of future devices that fill the needs of consumers and healthcare professionals. This task aims at the creation of scientific awareness on project achievements. The dissemination is both a collective activity managed by the entire consortium and an individual set of actions handled by each single partner on a local level. In addition to the scientific community, healthcare professionals and healthcare financing organizations are particularly important for later commercial exploitation: they must be convinced of the added value of the MIMICS rehabilitation systems via scientific publications.

The MIMICS consortium has published a total of 41 journal publications and book chapters, 39 invited talks until Dec. 1st, 2010. High-lights are the special issues in IEEE Transactions in Neural Systems and Rehabilitation Engineering and Presence. 11 general media and television broadcasts mentioned MIMICS results and collaborators.

2 Scientific dissemination of MIMICS research and results

2.1 Special issue 1: IEEE Transactions on Neural Systems and Rehabilitation Engineering, Rehabilitation via bio-cooperative control

A special issue of IEEE Transactions on Neural Systems and Rehabilitation Engineering (<http://ieeexplore.ieee.org/xpl/tocresult.jsp?isnumber=5545713>) was published in August 2010 (volume 18, issue 4) with the topic “Rehabilitation via bio-cooperative control” (<http://ieeexplore.ieee.org/xpl/tocresult.jsp?isnumber=5545713>). Robert Riener and Marko Munih were guest editors. Seven papers were published in the special issue:

- Individual Muscle Control Using an Exoskeleton Robot for Muscle Function Testing by *J. Ueda, D. Ming, V. Krishnamoorthy, M. Shinohara, and T. Ogasawara*
- Psychophysiological Responses to Robotic Rehabilitation Tasks in Stroke by *D. Novak, J. Zihel, A. Olenšek, M. Milavec, J. Podobnik, M. Mihelj, and M. Munih*
- Human Behavior Integration Improves Classification Rates in Real-Time BCI by *B. Grychtol, H. Lakany, G. Valsan, and B. A. Conway*
- Multimodal Physical Activity Recognition by Fusing Temporal and Cepstral Information by *M. Li, V. Rozgić, G. Thatte, S. Lee, A. Emken, M. Annavaram, U. Mitra, D. Spruijt-Metz, and S. Narayanan*
- Learning From EEG Error-Related Potentials in Noninvasive Brain-Computer by *R. Chavarriaga and J. d. R. Millán*
- A Methodology to Quantify Alterations in Human Upper Limb Movement During Co-Manipulation With an Exoskeleton by *N. Jarrassé, M. Tagliabue, J. V. G. Robertson, A. Maiza, V. Crocher, A. Roby-Brami, and G. Morel*
- Biometrically Modulated Collaborative Control for an Assistive Wheelchair by *C. Urdiales, B. Fernandez-Espejo, R. Annicchiarico, F. Sandoval, and C. Caltagirone*

An image from research conducted by MIMICS partners was featured on the cover of the special issue. The cover is shown in Figure 1.

IEEE TRANSACTIONS ON NEURAL SYSTEMS AND REHABILITATION ENGINEERING

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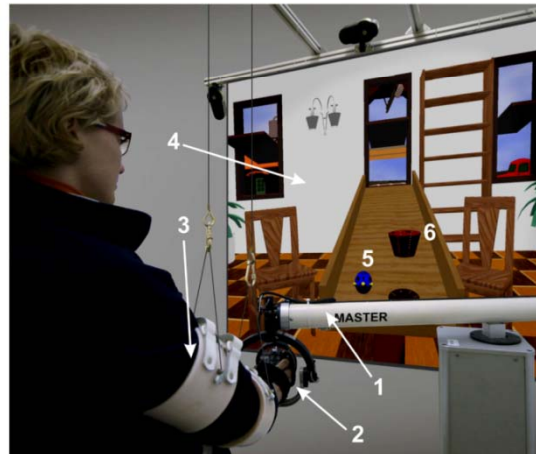
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A subject performing the virtual rehabilitation task, as described in the paper "Psychophysiological Responses to Robotic Rehabilitation Tasks in Stroke" by D. Novak, J. Žiherl, A. Olenšek, M. Milavec, J. Podobnik, M. Mihelj, and M. Munič on p. 351.



Figure 1: Front cover of the special issue in IEEE Transactions on Neural Systems and Rehabilitation Engineering.

2.2 Special issue 2: Presence, Special Theme Issue of the MIT Press Journal Presence: Teleoperators and Virtual Environments: "The Use of Virtual Reality in Neurological Rehabilitation"

A special theme issue of Presence: Teleoperators and Virtual Environments (<http://www.mitpressjournals.org/loi/pres>) was organized by Mel Slater, co-editor-in-chief of this journal and will be Guest Edited by Marko Munič and Robert Riener. The topic "The Use of Virtual Reality in Neurological Rehabilitation" reflects the MIMICS theme.

Scope: There are an increasing number of applications using visual, acoustic or tactile haptic cues for bio-feedback with the purpose of challenging or motivating patients during physical therapy exercises. In VR technologies, the measures of patient activity, such as particular limb, leg, arm or whole body movement patterns are displayed by graphics or audiovisual animation providing a realistic impression to the patients.

People in virtual reality tend to respond realistically to the stimuli that they encounter there. The goal is, thus, to exploit this natural behavior or presence in a virtual environment to construct therapies that are more efficient. Providing motivation to train longer and more often can lead to motor improvement, simultaneously applying tasks of increasing difficulty in combination with physical and verbal guidance of the person's movements or actions.

Areas of interest:

- Using Virtual Reality techniques in rehabilitation
- Virtual Reality systems in rehabilitation
- Virtual Reality serious games applied to therapy
- Measuring responses to VR cues, offline and realtime, psychophysiological recordings
- Bio-cooperative Virtual Reality closed loop designs
- Adaptive Virtual Reality environments
- Studies including control and rehabilitation population

The call for papers is currently distributed. The completion is planned for end. 2011.

2.3 Other publications

The MIMICS consortium has published a total of 41 journal and conference publications and book chapters, 39 invited talks until Dec. 1st, 2010.

2.3.1 Journal Publications

1. R. Banz, M. Bolliger, S. Müller, C. Santelli, R. Riener, (2009) A method of estimating the degree of active participation during stepping in a driven gait orthosis based on actuator force profile matching. *IEEE Transactions on Neural Systems and Rehabilitation Engineering*, vol. 17, no. 1, pp. 15-22
2. A. Brogni, D. Caldwell, M. Slater, (2009), Touching Sharp Virtual Objects Produces a Haptic Illusion, submitted
3. A. Koenig, X. Omlin, L. Zimmerli, M. Sapa, C. Krewer, M. Bolliger, F. Müller and R. Riener, Psychological state estimation from physiological recordings in stroke patients during robot assisted gait rehabilitation, *JRRD*, accepted
4. J. Zihler, J. Podobnik, M. Šikic, M. Munih, (2009) Pick to place trajectories in human arm training environment. *Technology and Health Care*, 17(4), pp. 323-335
5. J. Kastanis, M. Slater, 2010, "Reinforcement Learning Utilizes Proxemics: An Avatar Learns to Manipulate the Position of People in Immersive Virtual Reality", submitted
6. C. Groenegrass, B. Spanlang, M. Slater. "The physiological mirror—a system for unconscious control of a virtual environment through physiological activity", *The Visual Computer*, Springer Berlin / Heidelberg, pp. 649-657, vol. 26, issue 6, 2010

7. D. Novak, J. Zihlerl, A. Olenšek, M. Milavec, J. Podobnik, M. Mihelj, M. Munih. Psychophysiological responses to robotic rehabilitation tasks in stroke. *IEEE Transactions on Neural Systems and Rehabilitation Engineering*, Aug. 2010, vol. 18, no. 4, pp. 351-361.
8. D. Novak, M. Mihelj, M. Munih. Psychophysiological responses to different levels of cognitive and physical workload in haptic interaction. *Robotica*, 2010, DOI: 10.1017/S0263574710000184.
9. D. Novak, M. Mihelj, M. Munih. Dual-task performance in multimodal human-computer interaction: A psychophysiological perspective. *Multimedia Tools and Applications*, 2010, DOI: 10.1007/s11042-010-0619-7.
10. J. Zihlerl, D. Novak, A. Olenšek, M. Mihelj, M. Munih. Evaluation of upper extremity robot-assistances in subacute and chronic stroke subjects. *Journal of Neuroengineering and Rehabilitation*, 7:52, 2010.
11. D. Novak, M. Mihelj, J. Zihlerl, A. Olenšek, M. Munih. Psychophysiological measurements in a biocooperative feedback loop for upper extremity rehabilitation. Submitted to *IEEE Transactions on Neural Systems and Rehabilitation Engineering*.
12. D. Novak, M. Mihelj, M. Milavec, M. Munih.. Psychophysiology and adaptive discriminant analysis for task difficulty adaptation. Submitted to *Applied Ergonomics*.
13. R. Riener, M. Munih. Guest editorial special section on rehabilitation via bio-cooperative control. *IEEE trans. neural syst. rehabil. eng.*, Aug. 2010, vol. 18, no. 4, pp. 337-338.
14. T. Koritnik, A. Koenig, T. Bajd, R. Riener, M. Munih. (2010) Comparison of visual and haptic feedback during training of lower extremities. *Gait & Posture*. in press
15. A. Duschau-Wicke, A. Caprez, R. Riener. (2010) Patient-cooperative control increases active participation of individuals with SCI during robot-aided gait training. *J. NeuroEngin and Rehab (JNER)* 7:43.
16. R. Riener, L. Lünenburger, I.C. Maier, G. Colombo, V. Dietz. (2010) Locomotor Training in Subjects with Sensori-Motor Deficits: An Overview of the Robotic Gait Orthosis Lokomat. *Journal of Healthcare Engineering* 1, pp. 197-216.
17. A. Duschau-Wicke, A. Morger, H. Vallery, R. Riener. (2010) Adaptive Patientenunterstützung für die Rehabilitationsroboter. *Automatisierungstechnik* at, 58, pp. 260-268.
18. K. Brüttsch, T. Schuler, A. Koenig, L. Zimmerli, S. Merillat, L. Lünenburger, R. Riener, L. Jäncke, A. Meyer-Heim. (2010) Influence of virtual reality soccer game on walking performance in robotic assisted gait training. *J. NeuroEngin and Rehab (JNER)* 7.
19. A. Koenig, D. Novak, M. Pulfer, X. Omlin, E. Perreault, L. Zimmerli, M. Mihelij, R. Riener. "Real-time control of cognitive load in neurological patients during robot-assisted gait training", *Transactions on Neural Systems and Rehabilitation Engineering*, submitted
20. A. Koenig, X. Omlin, J. Bergmann, L. Zimmerli, M. Bolliger, F. Müller, R. Riener. "Controlling Patient Participation during robot-assisted Gait Training", *Journal of NeuroEngineering and Rehabilitation*, submitted

2.3.2 Conference Proceedings:

1. T. Koritnik, T. Bajd, M. Munih. Lower-extremities training in virtual reality augmented by sound and sensory electrical stimulation. *Proceedings of the 7th Mediterranean Congress of Physical and Rehabilitation Medicine*, Portoroz, Slovenia, September 18-21, 2008, pp. 43-44.
2. T. Koritnik, T. Bajd, M. Munih. Virtual mirror for assessment and training of lower extremities. *Proceedings of the 5th Regional Central European Conference of the*

- International Society for Prosthetics and Orthotics, Portoroz, Slovenia, September 2008, pp. 19-21.
3. A. König, K. Brüttsch, L. Zimmerli, M. Guidali, A. Duschau-Wicke, M. Wellner, A. Meyer-Heim, L. Lünenburger, S. Köneke, L. Jäncke, R. Riener. Virtual environments increase participation of children with cerebral palsy in robot-aided treadmill training. Proceedings of "Virtual Rehabilitation 2008", Vancouver, British Columbia, Canada, pp. 121-126 (2008)
 4. A. König, M. Bolliger, M. Wieser, R. Riener. Controlling physiology during robot automated treadmill training. Submitted to Technically Assisted Rehabilitation (TAR) Berlin 2009
 5. M. Mihelj, J. Podobnik, M. Munih. HEnRiE -- Haptic environment for reaching and grasping exercise. Proceedings of the 2nd Biennial IEEE/RAS-EMBS International Conference on Biomedical Robotics and Biomechatronics Scottsdale, AZ, USA, October 19-22, 2008
 6. M. Mihelj, J. Podobnik, M. Munih. Virtual physiotherapist based on a haptic system for training of reaching and grasping. Book of Abstracts, 7th Mediterranean Congress of Physical and Rehabilitation Medicine, Portoroz, Slovenia, September 18-21, 2008.
 7. L. Jensterle, M. Mihelj, M. Munih. Vodenje haptičnega vmesnika zasnovano v okolju Matlab xPC Target (Control of haptic interface in Matlab xPC Target). ERK 2008, Seventeenth International Electrotechnical and Computer Science Conference, Portoroz, Slovenia, September 29 - October 1, 2008.
 8. J. Podobnik, M. Marko, J. Činkelj. HARMiS - hand and arm rehabilitation system. SHARKEY, Paul (ed.). The 7th International Conference on Disability, Virtual Reality and Associated Technologies with Artabilitation, 8-11 September 2008, Maia, Portugal. Proceedings. Reading: University of Reading, School of Systems Engineering, 2008, pp. 237-244.
 9. I. Kastanis, M. Slater. Guiding users in virtual reality rehabilitation environments using a machine learning decision system, *INRS 2009*
 10. A. Koenig, L. Somaini, M. Pulfer, T. Holenstein, X. Omlin, M. Wieser, R. Riener. Model-Based Heart Rate Prediction during Lokomat Walking, *IEEE EMBC 2009, Minneapolis, USA, September 2009*
 11. A. Koenig, C. Binder, J. v. Zitzewitz, X. Omlin, M. Bolliger, R. Riener, Voluntary gait speed adaptation for robot-assisted treadmill training, *IEEE ICORR 2009, Kyoto, Japan, June 2009*
 12. T. Koritnik, A. Koenig, T. Bajd, R. Riener, M. Munih, Haptic training of lower extremities enhanced by visual modality. *ICORR 2009, IEEE ICORR 2009, Kyoto, Japan, June 2009, pp. 431-435*
 13. M. Mihelj, D. Novak, M. Munih, Emotion-aware system for upper extremity rehabilitation. *Virtual rehabilitation 2009: International conference, Haifa, Israel, June 29 - July 2, 2009. [New York]: IEEE, cop. 2009, pp. 160-165*
 14. M. Munih, R. Riener, G. Colombo, L. Lünenburger, F. Müller, M. Slater, M. Mihelj, MIMICS : multimodal immersive motion rehabilitation of upper and lower extremities by exploiting biocooperation principles. *ICORR 2009, IEEE ICORR 2009, Kyoto, Japan, June 2009, pp. 127-132.*
 15. M. Munih, D. Novak, T. Bajd, M. Mihelj, Biocooperation in rehabilitation robotics of upper extremities. . *ICORR 2009, IEEE ICORR 2009, Kyoto, Japan, June 2009, pp. 425-430.*
 16. D. Novak, M. Mihelj, M. Munih, Using psychophysiological measurements in physically demanding virtual environments. *Lecture Notes on Computer Science, part 1, pp. 490-*

493 (INTERACT 2009, 12th IFIP TC13 Conference on Human-Computer Interaction, August 24-28, 2009, Uppsala, Sweden)

17. D. Novak, J. Zihlerl, A. Olensek, J. Podobnik, M. Mihelj, M. Munih. Robotska rehabilitacija z navidezno resničnostjo in psihofiziološkimi meritvami (Robotic rehabilitation using virtual reality and psychophysiological measurements). *Proceedings of the 12th International multiconference INFORMATION SOCIETY 2009, 12 - 16 October 2009, Ljubljana, Slovenia. Ljubljana: Jožef Stefan Institute, 2009, part A, pp. 423-426*
18. J. Podobnik, M. Mihelj, M. Munih. Upper limb and grasp rehabilitation and evaluation of stroke patients using HenRIE device. *Virtual rehabilitation 2009: International conference, Haifa, Israel, June 29 - July 2, 2009. [New York]: IEEE, cop. 2009, pp. 173-178*
19. J. Podobnik, M. Munih. Robotic system for rehabilitation of upper extremities. *Proceedings of the Eighteenth International Electrotechnical and Computer Science Conference - ERK 2009, 21-23 September, 2009, Portorož, Slovenija. Ljubljana: IEEE Region 8, Slovenian Section of the IEEE, 2009, part B, pp. 213-216*
20. M. Sapa. Symposium "Hirn – Mensch – Maschine", *St. Mauritius Therapieklinik, 30-31/10/2009*
21. M. Sapa. „Herzratenvarianz bei neurologischen Rehapatienten in Abhängigkeit von Medikation und Begleiterkrankungen“ *Gemeinsame Jahrestagung der Deutschen Gesellschaft für Neuro-traumatologie und Klinische Neurorehabilitation e.V. und der Deutsche Gesellschaft für Neurorehabilitation e.V. (DGNKN & DGNR), 3.-5.12.2009*
22. J. Zihlerl, M. Munih. Pick to place trajectories in human arm training environment. *World Congress on Medical Physics and Biomedical Engineering, 7-12 September, 2009, Munich, Germany, (IFMBE proceedings, vol. 25). Heidelberg: Springer, 2009, pp. 440-443*
23. A. Pomés, M. Slater. 2010, "A Virtual Umbilical Chord", *Body Representation in Physical and Virtual Reality with Application to Rehabilitation. Frontiers in Neuroscience*
24. M. Gonzalez-Franco, D. Perez-Marcos, B. Spanlang, M. Slater. "The contribution of real-time mirror reflections of motor actions on virtual body ownership in an immersive virtual environment", *Virtual Reality Conference (VR), 2010 IEEE, pp.111-114, 20-24 March 2010*
25. M. Munih, D. Novak, J. Zihlerl, A. Olenšek, J. Podobnik, T. Bajd, M. Mihelj. Robotic rehabilitation tasks and measurements of psychophysiological responses. In: *Proceedings of ICRA 2010, pp. 4360-4365.*
26. D. Novak, M. Mihelj, J. Zihlerl, A. Olenšek, M. Munih. Measuring motor actions and psychophysiology for task difficulty estimation in human-robot interaction. In: *Proceedings of Measuring Behavior 2010, pp. 269-272.*
27. D. Novak, M. Mihelj, J. Zihlerl, A. Olenšek, M. Munih. Adaptivna senzorna integracija na osnovi biomehanskih in fizioloških meritev v rehabilitacijski robotiki (Adaptive sensory integration of biomechanical and physiological measurements in rehabilitation robotics). In: *Proceedings of Information Society 2010, pp. 357-360.*
28. D. Novak, J. Zihlerl, A. Olenšek, M. Mihelj, M. Munih. Patient state assessment in virtual rehabilitation using adaptive discriminant analysis. Presented at *Body Representation in Physical and Virtual Reality with Application to Rehabilitation, abstract publication pending.*
29. J. Zihlerl, D. Novak, A. Olenšek, M. Munih. Haptic assistance in virtual environments for motor rehabilitation. In: *Proceedings of Eurohaptics 2010 (Lecture notes on computer science), pp. 117-122.*

30. R. Riener. Motor and Cognitive Restoration in Virtual Worlds, Body Representation in Physical and Virtual Reality with Application to Rehabilitation, 2010. Frontiers in Neuroscience
31. A. Koenig, A. Caruso, M. Bolliger, L. Somaini, X. Omlin, M. Morari, R. Riener. "Model-Based Heart Rate Control during Robot-Assisted Gait Training", ICRA conference 2011, Shanghai, China, submitted
32. A. Koenig, X. Omlin, L. Zimmerli, R. Riener. „Virtual Environments in Neurological Gait Rehabilitation for Automated Control of Physical Activity”, Technically Assisted Rehabilitation conference (TAR) 2011, Berlin, submitted
33. A. Koenig, M. Pulfer, X. Omlin, E. Perreault, L. Zimmerli, R. Riener. "Automatic estimation of cognitive load during robot-assisted gait training", Automed Conference 2010, Zurich, Switzerland, accepted
34. A. Koenig, X. Omlin, D. Novak, L. Zimmerli, J. Bergmann, M. Bolliger, F. Müller, R. Riener. "Virtual Environments in Neurological Gait Rehabilitation for Automated Control of Physical Activity and Cognitive Load", Body Representation in Physical and Virtual Reality with Application to Rehabilitation conference 2010, Ascona, Switzerland, accepted
35. T. Schauer, H. Schmidt, R. Riener. Methods of Automation in Medicine, Automatisierungstechnik, 58, pp. 239-240, 2010
36. A. Duschau-Wicke, J. von Zitzewitz, A. Caprez, L. Lünenburger, R. Riener. Path Control, IEEE transactions on neural systems and rehabilitation engineering, 18 (1) Pages 38-48, 2010
37. F. Müller, M. Sapa, C. Krewer, A. König, R. Riener, L. Luenenburger, L. Zimmerli, M. Bolliger. Modelling a Virtual Reality Environment for Gait Training on a Robotic Gait Trainer. Abstracts of the 2010 World Congress of Neurorehabilitation, Vienna. Published in Neurorehabil Neural Repair, OnlineFirst, published on March 12, 2010 doi:10.1177/1545968310365984
38. J. Bergmann, M. Sapa, C. Krewer, L. Zimmerli, A. König, R. Riener, F. Müller. Intrinsische Motivation beim Gangtraining in virtueller Umgebung mit dem Gangroboter Lokomat. Neurologie & Rehabilitation 2010;6:P4-05.
39. D. Dorsic, C. Krewer, J. Bergmann, A. König, L. Zimmerli, R. Riener, F. Müller. Ein Vergleich der Aktivität des paretischen und nicht-paretischen Beins von Schlaganfall-Patienten während eines Lokomat-Trainings mit virtueller Realität. Neurologie & Rehabilitation 2010;6:P1-05.

2.3.3 Book chapters

1. A. Koenig, R. Riener. "The Human in the Loop". In: Neurorehabilitation Technology Editors: V. Dietz, Z. Rymer, T. Nef, Springer publishing group 2010 (in press)
2. R. Riener. "Technology of the robotic gait orthosis Lokomat". In: Neurorehabilitation Technology. Editors: V. Dietz, Z. Rymer, T. Nef, Springer publishing group 2010 (in press)

2.3.4 Invited talks:

1. M. Munih, T. Bajd. Robotics in rehabilitation. Proceedings of the 7th Mediterranean Congress of Physical and Rehabilitation Medicine 2008, Portoroz, Slovenia, pp. 3-5.
2. J. Kastanis. Reinforcement Learning as a Paradigm for Interaction in Virtual Environments, Opening of the EVENT lab, Barcelona, December 2008
3. R. Riener. Machines for Rehabilitation of Lower Extremities. 3rd International EURON UMH Robotics Winter School on Rehabilitation Robotics, 2008 Elche, ESP:

4. R. Riener. The Future of Rehabilitation Robotics. Euroacademia Multidisciplinaria Neurotraumatologica (EMN) 2008, Heidelberg
5. R. Riener. Patient-Interactive Robots for Rehabilitation. 5th International Conference on Electrical and Power Engineering, EPE 2008, Iasi, Romania:
6. R. Riener. Roboterunterstützte Bewegungstherapie. Forum Neuroradiologicum 2008, Ludwigshafen
7. R. Riener. Kooperative Roboter effektivieren die Bewegungstherapie. Jahrestagung 2008 „Neurorehabilitation, Wien
8. A. Kloenig. “MIMICS -Multimodal Immersive Motion Rehabilitation with Interactive Cognitive Systems”, IEEE Cogsys, Karlsruhe 2008,
9. M. Mihelj. Emotion-aware system for upper extremity rehabilitation. Workshop on Affective *Brain-Computer Interfaces 2009, Amsterdam, Netherlands*
10. M. Munih. Upper extremity rehabilitation using robotics and VR, *International Neurorehabilitation Symposium 2009, Zürich, Switzerland, February 12-14, 2009*
11. M. Munih, T. Bajd, M. Mihelj. Bio-kooperativna vloga rehabilitacijske robotike (Biocooperative role of rehabilitation robotics). *MARINČEK, Črt (Ed.), BURGER, Helena (Ed.). 20. jubilejni dnevi rehabilitacijske medicine, Ljubljana, 3. in 4. april 2009. Rehabilitacija v prihodnosti : zbornik predavanj : proceedings, (Rehabilitacija, letn. 8, supl. 1). Ljubljana: Inštitut Republike Slovenije za rehabilitacijo: Académie Européenne de Médecine de Réadaptation, 2009, pp. 27-33*
12. M. Munih, T. Bajd, M. Mihelj. Rehabilitacija s pomočjo robotov. *ZUPANC, Aleksander (Ed.). 13. kongres fizioterapevtov Slovenije, Ljubljana, 15. in 16. maj 2009. Zbornik predavanj, (Fizioterapija, Letn. 17, suppl. 4). Ljubljana: Društvo fizioterapevtov Slovenije - strokovno združenje, 2009, pp. 15-24*
13. M. Munih. Automatisation in neurorehabilitation, *14th Euroacademia Multidisciplinaria Neurotraumatologica Congress, Kaunas, Lithuania, June 4-6, 2009*
14. M. Munih. Robot pomaga človeku (Robot helps to human), *8. Dnevi elektrotehnike, Technical Museum of Slovenia, Bistra pri Vrhniki, May 10, 2009*
15. M. Munih, M. Mihelj. Robot pomaga pri rehabilitaciji (Robot helps in rehabilitation), *Faculty of Medicine, University of Ljubljana, Ljubljana, June 1, 2009*
16. M. Munih, M. Mihelj. Robot pomaga pri rehabilitaciji (Robot helps in rehabilitation), *Neurological Clinic, University Medical Centre, Ljubljana, June 2009*
17. M. Munih. How to write a successful proposal – a Slovenian view. FP7 – ICT Information Day, *Ministry of Education and Sport, Ljubljana, December 1, 2009*
18. M. Munih. Robotska rehabilitacija z interaktivnimi sistemi (Robotic rehabilitation using interactive systems). *90th Anniversary of the Faculty of Electrical Engineering, Ljubljana, December 3, 2009*
19. R. Riener. The European Research Project MIMICS, *Euroacademia Multidisciplinaria Neurotraumatologica 2009, Kaunas, Litauen: June 6, 2009*
20. R. Riener. Neurorehabilitation robotics: from the scientific idea to clinical application and commercial use, *International Conference on Rehabilitation Robotics (ICORR), Workshop “Standardization of robot/Machine-aided stroke rehabilitation”, Kyoto, Japan: June 23, 2009*
21. R. Riener. Innovationen in der computerunterstützten Rehabilitation, *Annual Conference, Humaine Klinik Zihlschlacht, CH: August 28, 2009*

22. R. Riener. Automation in rehabilitation: how to include the human into the loop, *World Congress on Medical Physics & Biomedical Engineering 2009, Munich, (AUTOMED Session): Sept. 7-12, 2009*
23. R. Riener. Roboter in der Pflege, *DGNER/DGNKN Jahreskongress, Berlin: December 3, 2009*
24. R. Riener. Bio-Cooperative Robotics: Controlling Biomechanical, Physiological and Mental Patient States, *Annual Conference of the Swiss Society for Biomed. Eng., Berne: August 27, 2009*
25. R. Riener. The Patient is the Master: How to Control Rehabilitation Robots, *International Neurorehabilitation Symposium, Zurich: February 12, 2009*
26. F. Müller. Apparative Möglichkeiten in der Neurorehabilitation. Klinik Kipfenberg, 23.11.2009
27. D. Novak. Control of patient motivation during rehabilitation. Body Representation in Physical and Virtual Reality with Application to Rehabilitation, 26th September to 1st October 2010, Monte Verità, Switzerland.
28. A. Koenig. "Detecting the undetectable – bio-cooperative robotics in gait rehabilitation" Bio-Inspired Robotics Network Zurich (Bironz), by Prof. Dr. Fumyia Iida, ETH Zurich, 2010
29. A. Koenig. „Frontiers in Control of Gait-Rehabilitation Robots“Carnegie Mellon University, Institut for robotics, Guest lecture 2010
30. A. Koenig. "Bio-cooperative Robotics for Diagnostics and Rehabilitation of Stroke", Georgia Institute of Technology, Laboratory for Neuroscience, Neuroseminar 2010
31. A. Koenig. "Bio-Cooperative Robotics for Gait Rehabilitation", at the University Hospital Zurich, Stroke Response Unit, University of Zurich, 2010
32. J. Kastanis, M. Slater. 2010 "Virtual Reality, Motivation and Rehabilitation", Body Representation in Physical and Virtual Reality with Application to Rehabilitation. *Frontiers in Neuroscience*
33. F. Müller. Virtual Reality in der Neurorehabilitation. DGN Jahreskongress, Mannheim: 24.9.2010
34. F. Müller. Geräteunterstützte Physio- und Ergotherapie in der neurologischen Rehabilitation. Innovationstag "Robotik- und Softwarelösungen in der Rehabilitation" Würzburg, 27. 10. 2010
35. R. Riener. „Biokooperative Therapieroboter: Herausforderungen und Chancen“, 3. Dresdner Medizintechnik Symposium, Dresden, Germany, 07.12.2010.
36. R. Riener. „Robot Control of Motor Control“, Plenary lecture at the Motor Control Conference, Varna, Bulgaria, 25.09.2010.
37. R. Riener. „Robotergestützte Bewegungstherapie“, Neurowoche Mannheim, Deutsche Gesell. f. Neurologie, Mannheim, Germany, 24.09.2010.
38. R. Riener. „Trainieren und Motivieren in Virtuellen Welten“, Deutsche Vereinigung für Sportwissenschaft (DVS) Symposium, Hamburg, Germany, 04.09.2010.
39. R. Riener. "New Technologies for Upper Limb Rehabilitation", ESMAC, Venedig, Italy, 26.05.2010

2.3.5 Public Magazines:

1. Der mechanische Thüringer. *Deutsches Ärzteblatt 2009; 106(9): [8] Supplement: PRAXiS, Hillienhof Arne, Roboter im Gesundheitswesen*

2. youtube: Towards Immersive Journalism: The IPSRESS Experience, *July 10, 2009*
3. Presos de un Guantánamo virtual. *El País, Barcelona, July 14, 2009*
4. MUNIH, Marko. Robotika v rehabilitaciji rok in nog (Rehabilitation robotics for the upper and lower extremities). *Inženir*, 2010, vol. 3, no. 1, pp. 48-55
5. Virtuell ein Spiegelei braten. Südwest Presse, 06.03.2010.
6. Mit dem Roboter ein Spiegelei braten. Mangfall-Bote, 15.03.2010.
7. Roboterarm hilft Schlaganfallpatienten: Neue Steuerethode soll therapeutischen Nutzen steigern, Presstext Nachrichtenagentur, 18.3.2010

2.3.6 Television:

1. "Einstein", Schweizer Fernsehen SF 1, 25.09.2008. Roboter als Therapeuten - Roboter als Pfleger, <http://www.sf.tv/sf1/einstein/sendung.php?docid=20080925>
2. „Gesundheit Sprechstunde“, Schweizer Fernsehen SF1, 02.01.2010. Wenn Gelähmte wieder gehen können, <http://www.gesundheitsprechstunde.ch/TVSendung/57c7dcbc-bbff-4ca4-b262-5b9d6955f095>
3. Roboter: Auf der Suche nach der künstlichen Intelligenz, Treffpunkt, DRS 1, 31. Mai 2010
4. Doktor Roboter, NZZ Format, SF1, 14. October 2010

2.3.7 Papers in Preparation:

1. 1. Kastanis, J. & Slater, M. (2011) 'Reinforcement Learning in Maximising the Variance in Effort in a Walking Task in Virtual Reality - With Applications to Rehabilitation' (in progress)
- 2.
3. 2. Sivecas, P., Kastanis, J. and Slater M. (2011) 'The Utility of Collision Based Haptic Feedback in a Walking Task in Virtual Reality' (in progress)
- 4.
5. 3. Pomés, A., Giannopoulos, E., Spanlang, B. and Slater, M. (2011) 'Body Ownership in Immersive Virtual Reality Through a Virtual Umbilical Cord' (in progress).

3 Appendix

List of peer-reviewed scientific publications accepted for publication in 2008

Author(s) and affiliation(s)	Title of the article / publication	Details / Reference (Journal / book / conference details, as applicable)	Date of publication/acceptance	Dissemination principle	Accessible from (open access repository used and/or link to the openly accessible publication on the internet)
T. Koritnik, T. Bajd, M. Munih	Lower-extremities training in virtual reality augmented by sound and sensory electrical stimulation.	Proceedings of the 7th Mediterranean Congress of Physical and Rehabilitation Medicine, Portorož, Slovenia, September 18-21, 2008. Turin: Minerva Medica, 2008, str. 43-44	Sept 2008	www	http://robo.fe.uni-lj.si/ref-08.html
M. Munih, T. Bajd	Robotics in rehabilitation	Proceedings of the 7th Mediterranean Congress of Physical and Rehabilitation Medicine, Portorož, Slovenia, September 18-21, 2008. Turin: Minerva Medica, 2008, str. 4-6	Sept 2008	www	http://robo.fe.uni-lj.si/ref-08.html
T. Koritnik, T. Bajd, M. Munih.	Virtual mirror for assessment and training of lower extremities.	Proceedings of the 5th Regional Central European Conference of the International Society for Prosthetics and Orthotics, Portoroz, Slovenia, September 2008, pp. 19-21.	Sept 2008	www	http://robo.fe.uni-lj.si/ref-08.html
M. Mihelj, J. Podobnik, M. Munih.	HEnRiE -- Haptic environment for reaching and grasping exercise	Proceedings of the 2nd Biennial IEEE/RAS-EMBS International Conference on Biomedical Robotics and Biomechatronics Scottsdale, AZ, USA, October 19-22, 2008	Sept 2008	www	http://robo.fe.uni-lj.si/ref-08.html
M. Mihelj, J. Podobnik, M. Munih.	Virtual physiotherapist based on a haptic system for training of reaching and grasping.	Book of Abstracts, 7th Mediterranean Congress of Physical and Rehabilitation Medicine, Portoroz, Slovenia, September 18-21, 2008.	Sept 2008	www	http://robo.fe.uni-lj.si/ref-08.html

L. Jensterle, M. Mihelj, M. Munih	Vodenje haptičnega vmesnika zasnovano v okolju Matlab xPC Target (Control of haptic interface in Matlab xPC Target).	ERK 2008, Seventeenth International Electrotechnical and Computer Science Conference, Portoroz, Slovenia, September 29 - October 1, 2008.	Sept 2008	www	http://robo.fe.uni-lj.si/ref-08.html
J. Podobnik, M. Marko, J. Činkelj.	<i>HARMIS - hand and arm rehabilitation system.</i>	The 7th International Conference on Disability, Virtual Reality and Associated Technologies with Artabilitation, 8-11 September 2008, Maia, Portugal. Proceedings. Reading: University of Reading, School of Systems Engineering, 2008, pp. 237-244.	Sept 2008	www	http://robo.fe.uni-lj.si/ref-08.html
A. König ^{1,2} , K. Brütsch ³ , L. Zimmerli ^{1,5} , M. Guidali, A. Duschau-Wicke ^{1,5} , M. Wellner ¹ , A. Meyer-Heim ⁴ , L. Lünenburger ⁵ , S. Köneke ³ , L. Jäncke ³ , R. Riener ^{1,2} ¹ Sensory-Motor-Systems Laboratory, ETH Zurich, Switzerland ² Spinal Cord Injury Center, Balgrist University Hospital, Zurich, Switzerland ³ University of Zurich, Switzerland ⁴ Rehabilitation Center Affoltern a.A, Switzerland ⁵ Hocoma AG, Volketswil, Switzerland	Virtual environments increase participation of children with cerebral palsy in robot-aided treadmill training.	Proceedings of Virtual Rehabilitation 2008, Vancouver, British Columbia, Canada, pp. 121-126 (2008)	2008	open	https://www.zora.uzh.ch/7019/ DOI 10.1109/ICVR.2008.4625147

List of peer-reviewed scientific publications accepted for publication in 2009

Author(s) and affiliation(s)	Title of the article / publication	Details / Reference (Journal / book / conference details, as applicable)	Date of publication/acceptance	Dissemination principle	Accessible from (open access repository used and/or link to the openly accessible publication on the internet)
J. Zherl, J. Podobnik, M. Šikic, M. Munih,	Pick to place trajectories in human arm training environment.	Technology and Health Care, 17(4), pp. 323-335	2009	www	http://robo.fe.uni-lj.si/ref-09.html
T. Koritnik, A. Koenig, T. Bajd, R. Riener, M. Munih,.	Haptic training of lower extremities enhanced by visual modality	IEEE ICORR 2009, Kyoto, Japan, June 2009, pp. 431-435	Jun 2009	www	http://robo.fe.uni-lj.si/ref-09.html
M. Munih, R. Riener, G. Colombo, L. Lünenburger, F. Müller, M. Slater, M. Mihelj,	MIMICS multimodal immersive motion rehabilitation of upper and lower extremities by exploiting biocooperation principles.	IEEE ICORR 2009, Kyoto, Japan, June 2009, pp. 127-132.	Jun 2009	www	http://robo.fe.uni-lj.si/ref-09.html
M. Munih, D. Novak, T. Bajd, M. Mihelj	Biocooperation in rehabilitation robotics of upper extremities	IEEE ICORR 2009, Kyoto, Japan, June 2009, pp. 425-430	Jun 2009	www	http://robo.fe.uni-lj.si/ref-09.html
M. Mihelj, D. Novak, M. Munih,	Emotion-aware system for upper extremity rehabilitation.	Virtual rehabilitation 2009: International conference, Haifa, Israel, June 29 - July 2, 2009. [New York]: IEEE, cop. 2009, pp. 160-165	Jun 2009	www	http://robo.fe.uni-lj.si/ref-09.html
J. Podobnik, M. Mihelj, M. Munih	Upper limb and grasp rehabilitation and evaluation of stroke patients using HenRIE	Virtual rehabilitation 2009: International conference, Haifa, Israel, June 29 - July 2,		www	http://robo.fe.uni-lj.si/ref-09.html

	device.	2009. [New York]: IEEE, cop. 2009, pp. 173-178			
D. Novak, M. Mihelj, M. Munih,	Using psychophysiological measurements in physically demanding virtual environments.	Lecture Notes on Computer Science, part 1, pp. 490-493 (INTERACT 2009, 12th IFIP TC13 Conference on Human-Computer Interaction, August 24-28, 2009, Uppsala, Sweden)	Aug 2009	www	http://robo.fe.uni-lj.si/ref-09.html
D. Novak, J. Zihel, A. Olensek, J. Podobnik, M. Mihelj, M. Munih,	Robotic rehabilitation using virtual reality and psychophysiological measurements.	Proceedings of the 12th International multiconference INFORMATION SOCIETY 2009, 12 - 16 October 2009, Ljubljana, Slovenia. Ljubljana: Jožef Stefan Institute, 2009, part A, pp. 423-426	Oct 2009	www	http://robo.fe.uni-lj.si/ref-09.html
J. Podobnik, M. Munih	Robotic system for rehabilitation of upper extremities.	Proceedings of the Eighteenth International Electrotechnical and Computer Science Conference - ERK 2009, 21-23 September, 2009, Portorož, Slovenija. Ljubljana: IEEE Region 8, Slovenian Section of the IEEE, 2009, part B, pp. 213-216	Sept 2009	www	http://robo.fe.uni-lj.si/ref-09.html
J. Zihel, M. Munih	Pick to place trajectories in human arm training environment.	World Congress on Medical Physics and Biomedical Engineering, 7-12	Sept 2009	www	http://robo.fe.uni-lj.si/ref-09.html

		September, 2009, Munich, Germany, (IFMBE proceedings, vol. 25). Heidelberg: Springer, 2009, pp. 440-443			
R. Banz ¹ , M. Bolliger ^{1,2} , S. Müller ³ , C. Santelli ³ , R. Riener ^{1,2}	A method of estimating the degree of active participation during stepping in a driven gait orthosis based on actuator force profile matching.	IEEE Transactions on Neural Systems and Rehabilitation Engineering, vol. 17, no. 1, pp. 15-22	Feb 2009	open	http://e-citations.ethbib.ethz.ch/view/pub:30016 DOI 10.1109/TNSRE.2008.2008281
¹ Spinal Cord Injury Center, Balgrist University Hospital, Zurich, Switzerland, ² Sensory-Motor-Systems Laboratory, ETH Zurich, Switzerland ³ Signal and Information Processing Laboratory, ETH Zurich, Switzerland					
A. Koenig ¹ , L. Somaini ¹ , M. Pulfer ¹ , T. Holenstein ¹ , X. Omlin, M. Wieser ¹ , R. Riener ^{1,2} .	Model-Based Heart Rate Prediction during Lokomat Walking.	IEEE EMBC 2009, Minneapolis, USA, September 2009	Sept 2009	open	Are submitted to ETH e-citations
¹ Sensory-Motor-Systems Laboratory, ETH Zurich, Switzerland ² Spinal Cord Injury Center, Balgrist University Hospital, Zurich, Switzerland					
A. Koenig ¹ , C. Binder ¹ , J. v. Zitzewitz ¹ , X. Omlin ¹ , M. Bolliger ^{1,2} , R. Riener ^{1,2} ,	Voluntary gait speed adaptation for robot-assisted treadmill training,	IEEE ICORR 2009, Kyoto, Japan, June 2009	2009	Open	Are submitted to ETH e-citations
¹ Sensory-Motor-Systems Laboratory, ETH Zurich, Switzerland ² Spinal Cord Injury Center, Balgrist University Hospital, Zurich, Switzerland,					
A. Koenig ¹ , M. Bolliger ^{1,2} , X. Omlin ¹ , M. Wieser ¹ , R. Riener ^{1,2} ,	Controlling physiology during robot	TAR 2009, Berlin, Germany, March 2009	March 2009	open	http://e-citations.ethbib.ethz.ch/view/pub:30009?lang=de

<p>¹Sensory-Motor-Systems Laboratory, ETH Zurich, Switzerland ²Spinal Cord Injury Center, Balgrist University Hospital, Zurich, Switzerland</p>	<p>automated treadmill training</p>				
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D. Novak, J. Zihel, A. Olensek, M. Milavec, J. Podobnik, M. Mihelj, M. Munih	Psychophysiological responses to robotic rehabilitation tasks in stroke	IEEE Transactions on Neural Systems and Rehabilitation Engineering, Aug. 2010, vol. 18, no. 4, pp. 351-361.	August 2010		http://robo.fe.uni-lj.si/ref-10.html
C. Groenegrass, B. Spanlang and M. Slater	The physiological mirror—a system for unconscious control of a virtual environment through physiological activity	Visual Computer, Vol. 26, Numbers 6-8, pp. 649-657	April 2010		DOI 10.1007/s00371-010-0471-9
D. Novak, M. Mihelj, M. Munih	Psychophysiological responses to different levels of cognitive and physical workload in haptic interaction	Robotica, 2010, DOI 10.1017/S0263574710000184	accepted April 2010, publication pending		http://journals.cambridge.org/article_S0263574710000184 or http://robo.fe.uni-lj.si/ref-10.html
D. Novak, M. Mihelj, M. Munih	Dual-task performance in multimodal human-computer interaction: A psychophysiological perspective.	Multimedia Tools and Applications, 2010, DOI 10.1007/s11042-010-0619-7	accepted October 2010, publication pending		http://www.springerlink.com/content/41635631k6931182 or http://robo.fe.uni-lj.si/ref-10.html
J. Zihel, D. Novak, A. Olensek, M. Mihelj, M. Munih	Evaluation of upper extremity robot-assistances in subacute and chronic stroke subjects.	Journal of Neuroengineering and Rehabilitation, 2010	October 2010		http://www.jneuroengrehab.com/content/7/1/52
D. Novak, M. Mihelj, J. Zihel, A. Olensek, M. Munih	Psychophysiological measurements in a biocooperative feedback loop for upper extremity rehabilitation	Submitted to IEEE Transactions on Neural Systems and Rehabilitation Engineering			

D. Novak, M. Mihelj, M. Milavec, M. Munih	Psychophysiology and adaptive discriminant analysis for task difficulty adaptation	Submitted to Applied Ergonomics			
R. Riener, M. Munih	Guest editorial special section on rehabilitation via bio-cooperative control	IEEE trans. neural syst. rehabil. eng., Aug. 2010, vol. 18, no. 4, pp. 337-338	August 2010		http://robo.fe.uni-lj.si/ref-10.html
T. Koritnik, A. Koenig, T. Bajd, R. Riener, M. Munih	Comparison of visual and haptic feedback during training of lower extremities	Gait & Posture, vol. 32, no. 4, pp. 540-546, October 2010.	October 2010		DOI: 10.1016/j.gaitpost.2010.07.017 or http://robo.fe.uni-lj.si/ref-10.html
A. Duschau-Wicke, A. Caprez, R. Riener	Patient-cooperative control increases active participation of individuals with SCI during robot-aided gait training	J. NeuroEngin and Rehab (JNER) 7:43.			
R. Riener, L. Lünenburger, I.C. Maier, G. Colombo, V. Dietz	Locomotor Training in Subjects with Sensori-Motor Deficits: An Overview of the Robotic Gait Orthosis Lokomat	Journal of Healthcare Engineering 1, pp. 197-216			
A. Duschau-Wicke, A. Morger, H. Vallery, R. Riener	Adaptive Patientenunterstützung für die Rehabilitationsroboter	Automatisierungstechnik at, 58, pp. 260-268			
K. Brütsch, T. Schuler, A. Koenig, L. Zimmerli, S. Merillat, L. Lünenburger, R. Riener, L. Jäncke, A. Meyer-Heim	Influence of virtual reality soccer game on walking performance in robotic assisted gait training	J. NeuroEngin and Rehab (JNER) 7			
M. Munih, D. Novak, J. Zherl, A. Olenšek, J.	Robotic rehabilitation tasks and measurements of	Proceedings of ICRA 2010, pp. 4360-4365.	May 2010		http://robo.fe.uni-lj.si/ref-10.html

Podobnik, T. Bajd, M. Mihelj	psychophysiological responses				
D. Novak, M. Mihelj, J. Zihel, A. Olenšek, M. Munih	Measuring motor actions and psychophysiology for task difficulty estimation in human-robot interaction	Proceedings of Measuring Behavior 2010, pp. 269-272	August 2010		http://robo.fe.uni-lj.si/ref-10.html
D. Novak, M. Mihelj, J. Zihel, A. Olenšek, M. Munih	Adaptivna senzorna integracija na osnovi biomehanskih in fizioloških meritev v rehabilitacijski robotiki (Adaptive sensory integration of biomechanical and physiological measurements in rehabilitation robotics)	Proceedings of Information Society 2010, pp. 357-360.	October 2010		http://robo.fe.uni-lj.si/ref-10.html
D. Novak, J. Zihel, A. Olenšek, M. Mihelj, M. Munih	Patient state assessment in virtual rehabilitation using adaptive discriminant analysis	Presented at Body Representation in Physical and Virtual Reality with Application to Rehabilitation, abstract publication pending	October 2010		http://robo.fe.uni-lj.si/ref-10.html
J. Zihel, D. Novak, A. Olenšek, M. Munih	Haptic assistance in virtual environments for motor rehabilitation	Proceedings of Eurohaptics 2010	July 2010		http://robo.fe.uni-lj.si/ref-10.html