



Open and Interdisciplinary
Journal of Technology,
Culture and Education

Special issue
Learning and assessment
in natural
and artificial systems

Edited by
Davide Marocco
Elena Dell'Aquila
& *Onofrio Gigliotta*

Editor

M. Beatrice Ligorio (University of Bari "Aldo Moro")

Coeditors

Stefano Cacciamani (University of Valle d'Aosta)

Donatella Cesareni (University of Rome "Sapienza")

Valentina Grion (University of Padua)

Associate Editors

Carl Bereiter (University of Toronto)

Bruno Bonu (University of Montpellier 3)

Michael Cole (University of San Diego)

Roger Salijo (University of Gothenburg)

Marlene Scardamalia (University of Toronto)

Scientific Committee

Sanne Akkerman (University of Utrecht)

Ottavia Albanese (University of Milan – Bicocca)

Susanna Annese (University of Bari "Aldo Moro")

Alessandro Antonietti (University of Milan – Cattolica)

Pietro Boscolo (University of Padua)

Lorenzo Cantoni (University of Lugano)

Felice Carugati (University of Bologna – Alma Mater)

Cristiano Castelfranchi (ISTC-CNR)

Alberto Cattaneo (SFIVET, Lugano)

Carol Chan (University of Hong Kong)

Cesare Cornoldi (University of Padua)

Crina Damsa (University of Oslo)

Frank De Jong (Aeres Wageningen Applied University, The Netherlands)

Ola Erstad (University of Oslo)

Paolo Ferrari (University of Milan – Bicocca)

Alberto Fornasari (University of Bari "Aldo Moro")

Carlo Galimberti (University of Milan – Cattolica)

Begona Gros (University of Barcelona)

Kai Hakkarainen (University of Helsinki)

Vincent Hevern (Le Moyne College)

Jim Hewitt (University of Toronto)

Antonio Iannaccone (University of Neuchâtel)

Liisa Ilomaki (University of Helsinki)

Sanna Jarvela (University of Oulu)

Richard Joiner (University of Bath)

Kristina Kumpulainen (University of Helsinki)

Minna Lakkala (University of Helsinki)

Mary Lamon (University of Toronto)

Leila Lax (University of Toronto)

Marcia Linn (University of Berkeley)

Kristine Lund (CNRS)

Giuseppe Mantovani (University of Padua)

Anne-Nelly Perret-Clermont (University of Neuchâtel)

Donatella Persico (ITD-CNR, Genoa)

Clotilde Pontecorvo (University of Rome "Sapienza")

Peter Renshaw (University of Queensland)

Vittorio Scarano (University of Salerno)

Roger Schank (Socratic Art)

Neil Schwartz (California State University of Chico)

Pirita Seitamaa-Hakkarainen (University of Joensuu)

Patrizia Selleri (University of Bologna)

Robert-Jan Simons (IVLOS, NL)

Andrea Smorti (University of Florence)

Jean Underwood (Nottingham Trent University)

Jaan Valsiner (University of Aalborg)

Jan van Aalst (University of Hong Kong)

Rupert Wegerif (University of Exeter)

Allan Yuen (University of Hong Kong)

Cristina Zuccheromaglio (University of Rome "Sapienza")

Editorial Staff

Nadia Sansone – head of staff

Luca Tateo – deputy head of staff

Francesca Amenduni, Sarah Buglass,

Lorella Glannandrea, Hanna Järvenoja,

Mariella Luciani, F. Feldia Loperfido,

Katherine Frances McLay,

Audrey Mazur Palandre, Giuseppe Ritella

Web Responsabile

Nadia Sansone



Publisher

Progedit, via De Cesare, 15

70122, Bari (Italy)

tel. 080.5230627

fax 080.5237648

info@progedit.com

www.progedit.com

qwerty.ckbg@gmail.com

www.ckbg.org/qwerty

Registrazione del Tribunale di Bari

n. 29 del 18/7/2005

© 2019 by Progedit

ISSN 2240-2950

Index

<i>Editorial: Learning and assessment in natural and artificial systems</i> Davide Marocco, Elena Dell'Aquila, Onofrio Gigliotta	5
<i>Attain Cultural Integration through teachers' CONflict Resolution skills Development: The ACCORD Project</i> Davide Marocco, Elena Dell'Aquila, Maria Clelia Zurlo, Federica Vallone, Mario Barajas, Frédérique Frossard, Andrea di Ferdinando, Raffaele di Fuccio, Michiel Lippens, Lore Van Praag, Aristidis Protopsaltis, Christian Swertz, Pelin Yüksel Arslan, Annaleda Mazzucato	11
<i>Playing digital cards as an assessment tool for numerical abilities</i> Michela Ponticorvo, Massimiliano Schembri, Antonio Cerrato, Orazio Miglino	31
<i>Micro-movement as an objective measure to assess autism spectrum disorder</i> Roberta Simeoli, Angelo Rega, Davide Marocco	49
<i>Affect Recognition in Autism: A single case study on integrating a humanoid robot in a standard therapy</i> Daniela Conti, Grazia Trubia, Serafino Buono, Santo Di Nuovo, Alessandro Di Nuovo	66
GUEST ARTICLES	
<i>Young Girls and Careers in science: May a course on robotics change girls' aspirations about their future?</i> <i>The ROBOESTATE Project</i> Ornella Mich, Patrizia Ghislandi	88
Experience <i>User-Centered Design applicata ad un corso mobile: il format "USiena"</i> Antonio Giardi	110



Editorial Learning and assessment in natural and artificial systems

Davide Marocco, Elena Dell'Aquila*, Onofrio Gigliotta**

DOI: 10.30557/QW000014

This special issue contains a collection of articles derived from the exciting research presented during the 1st International Workshop on Learning and Assessment in Natural and Artificial Systems, which took place in Naples during September 2018.

The selected contributions present different perspectives on the exploration of the multifaceted interface that connects learning and assessment with the processes, practices, and models of natural and artificial cognition, as well as technologies. Indeed, the interactions of such domains are increasingly integrated in contemporary psychology, education, learning sciences and computer science/robotics, where the renewed worldwide interest in Artificial Intelligence (AI) and machine learning continues to challenge the boundaries between natural and computational intelligence.

Learning is a peculiar characteristic of many natural organisms, which can modify their behaviors during their lifetime, to address new and progressively more complex challenges. Dynamics of learning processes and cognitive requirements for supporting learning in natural organisms is a long-standing and fundamental trend of research in psychology and education. In the same vein, the research in cognitive science and AI has the ambition to replicate such processes, as well as to suggest novel and alternative cognitive models capable of learning from their experiences.

*Università Federico II di Napoli (IT).

On the other side, assessing those changes and the extent to which an agent possesses specific cognitive capabilities is a common problem that challenges both the study of natural and artificial domains. Altogether, the concept of intelligence is indeed an interesting example of the current challenges, as “intelligence” is regarded very differently in those two areas. AI systems have the ambition to be indistinguishable from humans (it is the assumption of the well-know Turing test), or even to outperform humans in specific domains. However, human intelligence is defined and assessed under entirely different premises. Specific psychometric tools and protocols are currently used worldwide to identify intelligence deficits and learning disabilities, which do not apply to AI systems. In this respect, it is possible to foresee two possible evolutions in the future: Either the work in AI and cognitive science will try to look at artificial systems under comparable assumptions and theoretical models such as those used by psychology and educational theories. Or, alternatively, AI will challenge the current concept of intelligence in psychology. Indeed, we believe that the significant advances in those areas should inform the research in psychology and learning sciences and suggest alternative models and assumptions under which natural systems might be investigated and, ultimately, assessed. In this view, technology assumes a transformative role that has the power to modify the models and methods by which humans and living creatures are studied and understood.

The contributions included in this issue present different interpretations of the various intersections between psychology and technology, with human learning and comprehension at its core. Articles range from the application of psychology and learning theories in games (both PC based and physical) to foster the acquisition of transversal skills, through to the uses of new technological methods in the training and assessment of autism, one of the most widespread and socially relevant, yet poorly understood learning disabilities.

The article by Marocco and colleagues discusses the result of the European Project ACCORD, where the features, theoretical grounding, and applications of a new scenario-based, virtual role-playing game, are presented. The ACCORD game is designed to develop an e-learning system to promote intercultural skills in terms of cross-cul-

tural literacy, inclusive education and conflict management skills, and to prepare secondary school teachers to take an active stand against intercultural conflicts within the school context. The article by Ponticorvo and colleagues, on the other hand, exploits traditional card games, both described as physical games and translated in a software game animated by a virtual character, to foster numerical cognition and related emotional dimensions. The article reports on the use of games to train and assess players of different ages and intellectual abilities, by highlighting the scientific theories of numerical cognition and emotion at the basis of its design.

From a different perspective, the article by Simeoli and colleagues looks at modern technological means to assess learning impairment by proposing an integrated cognitive and sensorimotor perspective on the assessment of learning disabilities. The authors consider the physical interaction patterns of children with and without a diagnosis of autism, while undertaking a non-verbal test of intelligence on a tablet. In contrast, Conti and colleagues, explore the role of humanoid robots in the training of children with autism and intellectual disabilities, reporting on the experience of having a humanoid robot NAO integrated within the usual training practice of an autistic child.

Editorial

La collection d'articles qui composent ce numéro spécial de *QWERTY* est le résultat de recherches intéressantes présentées lors du 1er atelier international sur l'apprentissage et l'évaluation des systèmes naturels et artificiels, tenu à Naples en septembre 2018. Les contributions sélectionnées présentent différents points de vue sur la relation complexe qui relie l'apprentissage et l'évaluation psychologique à des processus, pratiques et modèles de cognition et à des technologies naturelles et artificielles. Les interactions impliquant ces éléments font de plus en plus intégrés de nos jours et il est souvent difficile de séparer la contribution des approches concernant l'apprentissage et des approches concernant l'évaluation dans la psychologie moderne, dans éducation, dans les sciences de l'apprentissage et dans informa-

tique/ robotique. Cela est d'autant vrai qu'à la lumière du regain d'intérêt pour l'intelligence artificielle, où les frontières entre intelligence naturelle et intelligence de calcul sont de plus en plus floues.

L'apprentissage est une caractéristique particulière de nombreux organismes naturels, qui peuvent modifier leur comportement au cours de la vie pour faire face à des défis nouveaux et de plus en plus complexes. La dynamique des processus d'apprentissage et les exigences cognitives pour soutenir l'apprentissage dans des organismes naturels constituent un domaine de recherche fondamental en psychologie et en éducation. Parallèlement, la recherche en sciences cognitives et en intelligence artificielle, domaine de la technologie moderne, ambitionne de reproduire ces processus et de proposer des modèles cognitifs nouveaux et alternatifs capables de tirer profit de leurs expériences.

D'autre part, évaluer dans quelle mesure un agent possède certaines capacités cognitives et d'apprentissage est un problème commun à la recherche dans le domaine naturel et dans le domaine artificiel. Le concept même d'intelligence est un exemple intéressant des défis actuels, dans la mesure où «l'intelligence» est considérée de manière très différente dans les deux domaines: les systèmes d'intelligence artificielle ont l'ambition de ne pas être distingués des êtres humains, mais l'intelligence humaine est définie et évaluée sur la base d'hypothèses complètement différentes.

Dans cette relation dialectique entre les sciences humaines et la technologie, nous pensons que celle-ci peut, à différents niveaux, assumer un rôle transformateur qui a le pouvoir de modifier les modèles et les méthodes avec lesquels les êtres humains, et les créatures intelligentes en général, sont compris et étudiés. Dans cette perspective, les contributions incluses dans ce numéro présentent différentes interprétations des diverses intersections entre la psychologie et la technologie, et se focalisent sur l'apprentissage humain et sa compréhension. Elles vont de l'application de la psychologie et des théories de l'apprentissage aux jeux, tant basés sur l'ordinateur que physiques, en vue de favoriser l'acquisition de compétences transversales fondamentales, les compétences dites *soft skills*, jusqu'à l'application de nouvelles méthodes technologiques en réadaptation et en éducation, dans

l'évaluation de l'autisme. Ce dernier est l'un des troubles d'apprentissage les plus répandus et les plus pertinents sur le plan social, même si il n'est pas encore totalement compris.

Editoriale

La raccolta di articoli che costituiscono questo numero speciale di *QWERTY* è il risultato di alcune interessanti ricerche presentate nel corso del 1° International Workshop on Learning and Assessment in Natural and Artificial Systems, che si è svolto a Napoli a settembre 2018.

I contributi selezionati presentano punti di vista differenti sulla complessa relazione che lega l'apprendimento e la valutazione psicologica con i processi, le pratiche e i modelli di cognizione e tecnologie naturali e artificiali, le cui interazioni sono sempre più pregnanti nella ricerca moderna e dove risulta spesso difficile separare il contributo dei due approcci nella psicologia moderna, nell'educazione, nelle scienze dell'apprendimento e in informatica / robotica. Particolarmente, alla luce del rinnovato interesse per l'intelligenza artificiale, in cui i confini tra intelligenza naturale e computazionale sono sempre più sfumati.

L'apprendimento è una caratteristica peculiare di molti organismi naturali, che possono modificare i loro comportamenti durante la vita, per affrontare sfide nuove e progressivamente più complesse. La dinamica dei processi di apprendimento e i requisiti cognitivi per supportare l'apprendimento negli organismi naturali è un'area di ricerca fondamentale sia in psicologia che in ambito educativo. Allo stesso tempo, la ricerca nelle scienze cognitive e nell'intelligenza artificiale, dominio della moderna tecnologia, ha l'ambizione di replicare tali processi, nonché di suggerire modelli cognitivi nuovi e alternativi in grado di apprendere dalle loro esperienze. D'altro canto, valutare la misura in cui un agente possiede determinate capacità cognitive e di apprendimento è un problema che accomuna tanto la ricerca nel dominio naturale che in quello artificiale. Lo stesso concetto di intelligenza è un esempio interessante delle attuali sfide, poiché "l'intelli-

genza” stessa è considerata in modo molto diverso nei due ambiti: i sistemi di intelligenza artificiale hanno l’ambizione di essere indistinguibili dagli umani, tuttavia, l’intelligenza umana viene definita e valutata in base a presupposti completamente diversi.

All’interno di questo rapporto dialettico tra scienze umane e tecnologia crediamo che quest’ultima, a vari livelli, possa assumere un ruolo trasformativo che ha il potere di modificare i modelli e i metodi con cui gli esseri umani, e le creature intelligenti in generale, vengono compresi e studiati.

Con questa prospettiva, i contributi inclusi in questo numero presentano diverse interpretazioni delle varie intersezioni tra psicologia e tecnologia, mettendo al centro l’apprendimento umano e la sua comprensione. Essi vanno dall’applicazione della psicologia e delle teorie dell’apprendimento ai giochi, sia basati su PC che fisici, per favorire l’acquisizione di abilità trasversali fondamentali, le cosiddette *soft skills*, fino all’applicazione di nuovi metodi tecnologici nella riabilitazione e nella valutazione dell’autismo, che è una delle disabilità concernenti l’apprendimento più diffuse e socialmente rilevanti, ma ancora non del tutto compresa.