

2016 Joint IEEE International Conference on Development and Learning and Epigenetic Robotics (ICDL-EpiRob 2016)

**Cergy-Pontoise, France
19 – 22 September 2016**



**IEEE Catalog Number: CFP16294-POD
ISBN: 978-1-5090-5070-3**

**Copyright © 2016 by the Institute of Electrical and Electronics Engineers, Inc
All Rights Reserved**

Copyright and Reprint Permissions: Abstracting is permitted with credit to the source. Libraries are permitted to photocopy beyond the limit of U.S. copyright law for private use of patrons those articles in this volume that carry a code at the bottom of the first page, provided the per-copy fee indicated in the code is paid through Copyright Clearance Center, 222 Rosewood Drive, Danvers, MA 01923.

For other copying, reprint or republication permission, write to IEEE Copyrights Manager, IEEE Service Center, 445 Hoes Lane, Piscataway, NJ 08854. All rights reserved.

****** This is a print representation of what appears in the IEEE Digital Library. Some format issues inherent in the e-media version may also appear in this print version.***

IEEE Catalog Number:	CFP16294-POD
ISBN (Print-On-Demand):	978-1-5090-5070-3
ISBN (Online):	978-1-5090-5069-7
ISSN:	2161-9484

Additional Copies of This Publication Are Available From:

Curran Associates, Inc
57 Morehouse Lane
Red Hook, NY 12571 USA
Phone: (845) 758-0400
Fax: (845) 758-2633
E-mail: curran@proceedings.com
Web: www.proceedings.com

CURRAN ASSOCIATES INC.
proceedings
.com

TABLE OF CONTENTS

MULTISENSORY OBJECT DISCOVERY VIA SELF-DETECTION AND ARTIFICIAL ATTENTION	1
<i>Pablo Lanillos ; Emmanuel Dean-Leon ; Gordon Cheng</i>	
USING AN FPGA TO EMULATE GRID CELL SPATIAL COGNITION IN A MOBILE ROBOT	7
<i>Peter J. Zeno</i>	
NEURALLY PLAUSIBLE MOTOR BABBLING IN ROBOT REACHING	9
<i>Zahra Mahoor ; Bruce J. MacLennan ; Allen C. McBride</i>	
GAZE CONTINGENT JOINT ATTENTION WITH AN AVATAR IN CHILDREN WITH AND WITHOUT ASD	15
<i>G. E. Little ; L. Bonnar ; S. W. Kelly ; K. S. Lohan ; G. Rajendran</i>	
LEARNING ABOUT ACTIONS IN INFANCY WITHOUT A RATIONALITY PRINCIPLE	21
<i>Robert J. Powers ; David H. Rakison ; David C. Plaut</i>	
DIRECT WORD DISCOVERY FROM SPEECH SIGNALS BASED ON HIERARCHICAL DIRICHLET PROCESS-HIDDEN LANGUAGE MODEL AND DEEP SPARSE AUTOENCODER	23
<i>Tadahiro Taniguchi ; Ryo Nakashima ; Shogo Nagasaka</i>	
DIRECTIONALITY IN FIGURATIVE LANGUAGE INTERPRETATION: PRIOR ACTIVATION DETERMINES DETAILS OF FEATURE ATTRIBUTION IN METAPHOR PROCESSING	25
<i>Daniel C. Strack</i>	
SENSORIMOTOR LEARNING IN A BAYESIAN COMPUTATIONAL MODEL OF SPEECH COMMUNICATION	27
<i>Marie-Lou Barnaud ; Jean-Luc Schwartz ; Julien Diard ; Pierre Bessière</i>	
DEVELOPING OBJECT UNDERSTANDING THROUGH SCHEMA GENERALISATION	33
<i>Suresh Kumar ; Patricia Shaw ; Daniel Lewkowicz ; Alexandros Giagkos ; Qiang Shen ; Mark Lee</i>	
CAUSAL LEARNING IN THE CRIB: A PREDICTIVE PROCESSING FORMALIZATION AND BABYBOT SIMULATION	39
<i>Maria Otworowska ; Lorijn Zaadnoordijk ; Erwin de Wolff ; Johan Kwisthout ; Iris van Rooij</i>	
THE MOBILE-PARADIGM AS MEASURE OF INFANTS' SENSE OF AGENCY? INSIGHTS FROM BABYBOT SIMULATIONS	41
<i>Lorijn Zaadnoordijk ; Maria Otworowska ; Johan Kwisthout ; Sabine Hunnius ; Iris van Rooij</i>	
PROGRESSIVE LEARNING OF SENSORY-MOTOR MAPS THROUGH SPATIOTEMPORAL PREDICTORS	43
<i>Erhard Wieser ; Gordon Cheng</i>	
DYNAMICAL SELF-CONSISTENCY LEADS TO BEHAVIORAL DEVELOPMENT AND EMERGENT SOCIAL INTERACTIONS IN ROBOTS	49
<i>Ralf Der ; Georg Martius</i>	
EMERGENCE OF COMMUNICATION AMONG REINFORCEMENT LEARNING AGENTS UNDER COORDINATION ENVIRONMENT	57
<i>Qiong Huang ; Eiji Uchibe ; Kenji Doya</i>	
A DEEP LEARNING APPROACH FOR SEAMLESS INTEGRATION OF COGNITIVE SKILLS FOR HUMANOID ROBOTS	59
<i>Jungsik Hwang ; Minju Jung ; Jinhyung Kim ; Jun Tani</i>	
THE COMPLEXITY OF BIOLOGICAL MOTION - A TEMPORAL MULTI-RESOLUTION MOTION DESCRIPTOR FOR HUMAN DETECTION IN VIDEOS	66
<i>A. Vignolo ; N. Noceti ; A. Sciutti ; F. Rea ; F. Odone ; G. Sandini</i>	
GOAL BABBLING OF ACOUSTIC-ARTICULATORY MODELS WITH ADAPTIVE EXPLORATION NOISE	72
<i>Anja Kristina Philippsen ; René Felix Reinhart ; Britta Wrede</i>	
GROUNDING SPEECH UTTERANCES IN ROBOTICS AFFORDANCES: AN EMBODIED STATISTICAL LANGUAGE MODEL	79
<i>Francesca Stramandinoli ; Vadim Tikhanoff ; Ugo Pattacini ; Francesco Nori</i>	
ROBOT LEARNS THE CONCEPT OF DIRECTION THROUGH MOTION ACTIVITY	87
<i>Dingsheng Luo ; Fan Hu ; Wentao Liu ; Xihong Wu</i>	
REFERENTIAL UNCERTAINTY AND WORD LEARNING IN HIGH-DIMENSIONAL, CONTINUOUS MEANING SPACES	95
<i>Michael Spranger ; Katrien Beuls</i>	

DEVELOPMENT OF PHYSICAL PROBLEM-SOLVING COMPETENCES IN HUMAN INFANTS AND CORVIDS	101
<i>Lauriane Rat-Fischer ; Alex Kacelnik ; Kim Plunkett ; Auguste von Bayern</i>	
SELF-CALIBRATING ACTIVE DEPTH PERCEPTION VIA MOTION PARALLAX.....	103
<i>Tanapol Prucksakorn ; Sungmoon Jeong ; Jochen Triesch ; Hosun Lee ; Nak Young Chong</i>	
ACTION CO-REPRESENTATION DURING TASK SHARING AND SENSORIMOTOR EXPERIENCE: A COMPARISON STUDY BETWEEN HUMAN-HUMAN AND HUMAN-ROBOT INTERACTION.....	109
<i>Frédérique Bunlon ; Jean-Pierre Gazeau ; Floren Colloud ; Cédric Bouquet</i>	
AUTONOMOUS AFFORDANCE CONSTRUCTION WITHOUT PLANNING FOR ENVIRONMENT-AGNOSTIC AGENTS.....	111
<i>Simon L. Gay ; Alain Mille ; Amélie Cordier</i>	
A DEVELOPMENTAL BAYESIAN MODEL OF TRUST IN ARTIFICIAL COGNITIVE SYSTEMS	117
<i>Massimiliano Patacchiola ; Angelo Cangelosi</i>	
THE EMERGENCE OF WHAT WHERE COORDINATION IN HUMAN INFANTS.....	124
<i>Adam Sheya</i>	
HOW EVERYDAY VISUAL EXPERIENCE PREPARES THE WAY FOR LEARNING OBJECT NAMES.....	126
<i>Elizabeth M. Clerkin ; Elizabeth Hart ; James M. Rehg ; Chen Yu ; Linda B. Smith</i>	
OBJECTS IN THE CENTER: HOW THE INFANT'S BODY CONSTRAINS INFANT SCENES.....	132
<i>Sven Bambach ; Linda B. Smith ; David J. Crandall ; Chen Yu</i>	
13-YEAR-OLDS APPROACH HUMAN-ROBOT INTERACTION LIKE ADULTS	138
<i>Francesco Rea ; Paola Muratore ; Alessandra Sciutti</i>	
AUTONOMOUS GROUNDING OF VISUAL FIELD EXPERIENCE THROUGH SENSORIMOTOR PREDICTION	144
<i>Alban Laflaquière</i>	
RECURRENT NEURAL NETWORK FOR SYNTAX LEARNING WITH FLEXIBLE PREDICATES FOR ROBOTIC ARCHITECTURES	150
<i>Xavier Hinaut ; Johannes Twiefel ; Stefan Wermter</i>	
EXPLORATION OF UNKNOWN DYNAMIC ENVIRONMENTS: A VISUAL SALIENCY-BASED BABBLING APPROACH.....	152
<i>Leni K. Le Goff ; Pierre-Henri Le Fur ; Stephane Doncieux</i>	
IMPROVING EXTRINSICALLY MOTIVATED DEVELOPMENTAL ROBOTS THROUGH INTRINSIC MOTIVATIONS	154
<i>Rodrigo Salgado ; Abraham Prieto ; Francisco Bellas ; Richard J. Duro</i>	
ACQUISITION OF ADAPTIVE BEHAVIOR OF ROBOT THROUGH BOW-TIE STRUCTURE	156
<i>Shotaro Okajima ; Shingo Shimoda ; Yasuhisa Hasegawa</i>	
ON THE USE OF INTRINSIC MOTIVATION FOR VISUAL SALIENCY LEARNING	158
<i>Céline Craye ; David Filliat ; Jean-François Goudou</i>	
ON THE SENSE OF AGENCY AND OF OBJECT PERMANENCE IN ROBOTS.....	166
<i>Sarah Bechtel ; Guido Schillaci ; Verena V. Hafner</i>	
USING PROPRIOCEPTIVE INFORMATION FOR THE DEVELOPMENT OF ROBOT BODY REPRESENTATIONS	172
<i>Idai Guertel ; Guido Schillaci ; Verena V. Hafner</i>	
MODELING THE SENSORY ROLES OF NORADRENALINE IN ACTION SELECTION	174
<i>Maxime Carrere ; Frédéric Alexandre</i>	
BEYOND GRASPING - PERCEIVING AFFORDANCES ACROSS VARIOUS STAGES OF COGNITIVE DEVELOPMENT.....	180
<i>Vasanth Sarathy ; Matthias Scheutz</i>	
AN ITERATIVE ALGORITHM FOR FORWARD-PARAMETERIZED SKILL DISCOVERY	186
<i>Adrien Matricon ; David Filliat ; Pierre-Yves Oudeyer</i>	
POSTURE RECOGNITION ANALYSIS DURING HUMAN-ROBOT IMITATION LEARNING.....	193
<i>Hakim Guedjou ; Sofiane Boucenna ; Mohamed Chetouani</i>	
THE "LANGUAGE FILTER" HYPOTHESIS: A FEASIBILITY STUDY OF LANGUAGE SEPARATION IN INFANCY USING UNSUPERVISED CLUSTERING OF I-VECTORS.....	195
<i>M. Julia Carbajal ; Ahmad Dawud ; Roland Thiollière ; Emmanuel Dupoux</i>	
INFANTS' USE OF MULTISENSORY INFORMATION FOR POSTURAL CONTROL	202
<i>Janny C. Stapel ; Kerstin Rosander ; Claes von Hofsten</i>	
STRATEGIC AND INTERACTIVE LEARNING OF A HIERARCHICAL SET OF TASKS BY THE POPPY HUMANOID ROBOT.....	204
<i>Nicolas Duminy ; Sao Mai Nguyen ; Dominique Duhaut</i>	

PRESCHOOLERS' ENGAGEMENT IN SOCIAL INTERACTION WITH AN AUTONOMOUS ROBOTIC SYSTEM	210
<i>Phillip Lücking ; Katharina Rohlfing ; Britta Wrede ; Malte Schilling</i>	
AN EXPERIMENTAL COMPARISON BETWEEN NMF AND LDA FOR ACTIVE CROSS-SITUATIONAL OBJECT-WORD LEARNING	217
<i>Yuxin Chen ; Jean-Baptiste Bordes ; David Filliat</i>	
MOTOR DEVELOPMENT FACILITATES THE PREDICTION OF OTHERS' ACTIONS THROUGH SENSORIMOTOR PREDICTIVE LEARNING.....	223
<i>Jorge Luis Copete ; Yukie Nagai ; Minoru Asada</i>	
TONIC DOPAMINE EFFECTS IN A BIO-INSPIRED ROBOT CONTROLLER ENHANCE EXPECTED LIFETIME.....	230
<i>Cristobal J. Nettle ; Maria-Jose Escobar ; Arthur Leblois</i>	
OVERLAPPING WAVES IN TOOL USE DEVELOPMENT: A CURIOSITY-DRIVEN COMPUTATIONAL MODEL	238
<i>Sébastien Forestier ; Pierre-Yves Oudeyer</i>	
HOW DO I SOUND LIKE? FORWARD MODELS FOR ROBOT EGO-NOISE PREDICTION.....	246
<i>Antonio Pico ; Guido Schillaci ; Verena V. Hafner ; Bruno Lara</i>	
SHOULD I DO THAT? USING RELATIONAL REINFORCEMENT LEARNING AND DECLARATIVE PROGRAMMING TO DISCOVER DOMAIN AXIOMS	252
<i>Mohan Sridharan ; Ben Meadows</i>	
INTRINSICALLY MOTIVATED MULTIMODAL STRUCTURE LEARNING	260
<i>Jay Ming Wong ; Roderic A. Grupen</i>	
GLOBAL AND LOCAL STATISTICAL REGULARITIES CONTROL VISUAL ATTENTION TO OBJECT SEQUENCES	262
<i>Alexa Romberg ; Yayun Zhang ; Benjamin Newman ; Jochen Triesch ; Chen Yu</i>	
USING NATURAL LANGUAGE PROCESSING (NLP) FOR DESIGNING SOCIALLY INTELLIGENT ROBOTS.....	268
<i>Ibrahim A. Hameed</i>	
LEARNING TO BE ATTRACTIVE: PROBABILISTIC COMPUTATION WITH DYNAMIC ATTRACTOR NETWORKS	270
<i>Alexander Gepperth ; Mathieu Lefort</i>	
TOWARDS LEARNING STRATEGIES AND EXPLORATION PATTERNS FOR FEATURE PERCEPTION.....	278
<i>Daniel Lewkowicz ; Alexandros Giagkos ; Patricia Shaw ; Suresh Kumar ; Mark Lee ; Qiang Shen</i>	
LOOK AND LEARN: A MODEL OF GAZE-CONTINGENT LEARNING	284
<i>Max Murakami ; Jantina Bolhuis ; Thorsten Kolling ; Monika Knopf ; Jochen Triesch</i>	
DYNAMIC SENSORIMOTOR MODEL FOR OPEN-ENDED ACQUISITION OF TOOL-USE.....	286
<i>Raphael Braud ; Alexandre Pitti ; Philippe Gaussier</i>	
VOCAL INTERACTIONS AT THE DAWN OF COMMUNICATION: THE EMERGENCE OF MUTUALITY AND COMPLEMENTARITY IN MOTHER-INFANT INTERACTION.....	288
<i>Giuseppe Leonardi ; Iris Nomikou ; Katharina J. Rohlfing ; Joanna Rączaszek-Leonardi</i>	
CONTEXT DISCOVERY FOR MODEL LEARNING IN PARTIALLY OBSERVABLE ENVIRONMENTS	294
<i>Nikolas J. Hemion</i>	
A LANGUAGE ACQUISITION METHOD BASED ON STATISTICAL MACHINE TRANSLATION FOR APPLICATION TO ROBOTS.....	300
<i>Kenta Takabuchi ; Naoto Iwahashi ; Takeo Kunishima</i>	
EMERGENCE OF INTERACTIVE BEHAVIORS BETWEEN TWO ROBOTS BY PREDICTION ERROR MINIMIZATION MECHANISM.....	302
<i>Yiwen Chen ; Shingo Murata ; Hiroaki Arie ; Tetsuya Ogata ; Jun Tani ; Shigeaki Sugano</i>	
DEVELOPMENTAL ROBOT WITH OSTENSIVE CUE SENSITIVE LEARNING FOR REAL-WORLD INTERACTION BASED ON LOCAL CONTINGENCY EVALUATION	308
<i>Hamed Mahzoon ; Yuichiro Yoshikawa ; Hiroshi Ishiguro</i>	
AN INFANT-INSPIRED MODEL FOR ROBOT DEVELOPING ITS REACHING ABILITY	310
<i>Dingsheng Luo ; Fan Hu ; Yian Deng ; Wentao Liu ; Xihong Wu</i>	
A NEURAL PROCESS MODEL OF LEARNING TO SEQUENTIALLY ORGANIZE AND ACTIVATE PRE-REACHES.....	318
<i>Jan Tekülve ; Stephan K. U. Zibner ; Gregor Schöner</i>	
Author Index	