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Psychology
Neuroscience
Machine Intelligence

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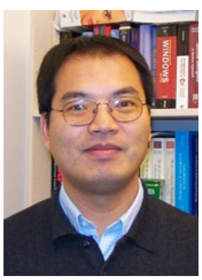
Editorial

This issue reflects the vivid dynamics of our community. As a result of its growth and development, Zhengyou Zhang announces the creation of a dedicated journal, the IEEE Transactions on Autonomous Mental Development, whose inaugural issue will appear early next year. I encourage all of you to submit papers for this issue. This is an essential step forward which will contribute to leverage our scientific contributions into a unified visible science of computational developmental processes. We also have two lively reports of IEEE ICDL 2008 and Epirob 2008 conferences, highlighting high selection standards as well as important research topics such as embryogenesis and the interaction between evolution and development. The dialogue column, orchestrated by Paul Fitzpatrick, challenges us around the question of finding killer-applications for developmental systems. Finally, Kerstin Dautenhahn's call for next issue's dialog questions the use of robots for investigating human developmental disorders such as autism, as well as potential tools for therapy. Answers shall be sent by the 15th February to k.dautenhahn@herts.ac.uk or pierre-yves.oudeyer@inria.fr.

-Pierre-Yves Oudeyer, INRIA, Editor

AMD TC Chairman's Message



I am extremely pleased to inform you that our journal proposal for the IEEE Transactions on Autonomous Mental Development (IEEE TAMD) was approved by all the related committees of IEEE with no negative votes. Prof. Jim Keller, the Vice President of Publications of CIS, did a superb job in presenting the proposal at the IEEE Periodicals Committee meeting on June 19, 2008. I want to thank Jim, David Fogel (CIS President), Vincenzo Piuri (Past CIS President) and Juyang Weng (Founding AMD TC Chair) for their immense support to this endeavor. I would also like to thank the AMD community for putting together a strong proposal and for your massive responses to my call for abstracts. Congratulations!

IEEE TAMD is supported by four IEEE Societies. It is co-sponsored by the IEEE Computational Intelligence Society and the IEEE Consumer Electronics Society. It is technically co-sponsored by the IEEE Computer Society and the IEEE Robotics and Automation Society.

IEEE TAMD is accepting submissions. The first issue is to be published in spring 2009. See Call For Papers in this issue of the Newsletter. Please send your paper by the 14th December to have your papers published in the inaugural issue of IEEE TAMD.

Finally, I want to thank Pierre-Yves Oudeyer for obtaining financial sponsoring from INRIA to distribute hardcopies of the AMD TC Newsletter in Europe. The AMD TC and community thank INRIA for this support.

- Zhengyou Zhang, Chair of the AMD TC

Committee news

- Zhengyou Zhang was appointed the founding editor-in-chief of the IEEE Transactions on Autonomous Mental Development by David Fogel, the CIS President and the Acting Chair of the IEEE TAMD Steering Committee, after voting on August 22, 2008.

- ICDL 2008, held in Monterrey, California, from August 9 to 12, 2008, was a success. See the Conference Report in this issue of the Newsletter.

- AMD TC and ICDL Governing Board held a business meeting at ICDL 2008. Among several items discussed is the establishment of ICDL Guidelines for organizing future ICDL conferences. The meeting appointed a subcommittee, consisting of Zhengyou Zhang (Chair), Jay McClelland, Brian Scassellati, and Juyang Weng, to write a formal document. The subcommittee has completed the task.

- ICDL 2009 will be held in Shanghai, China, June 5 - 7, 2009. See the call-for-papers in this issue of the Newsletter.

Dialog column

Which skills most need development?

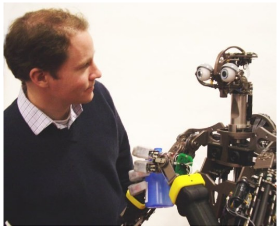
Paul Fitzpatrick, RobotCub humanoid project, University of Genoa, Italy.

We know that as adults, every skill we possess arose through an intricate developmental process of interlocking behaviors, innate and learned. Robot abilities are not generally constructed this way, although our community is doing its bit to change this. Are there skills for which the case for development in implementation (for robots) or description (for humans) is particularly strong? Without development, what skills can reasonably be implemented or described, and which skills will lie outside our reach?

As a roboticist, I speculate that the skills most in need of developmental implementation are those that retain a strong need for plasticity in their mature state, since a cheap and powerful way to implement such plasticity would be to retain parts of the developmental process used to create the skill in the first place. On the other hand, skills which don't retain this kind of plasticity in their mature form are candidates for abstraction and implementation without appeal to development.
Consider obstacle avoidance, one of the most frequently implemented abilities for any new robot, where the robot sidles its way around objects in the environment. To a first approximation, new objects or arrangements of objects don't call for much plasticity, since they can probably be evaded in much the same way as other objects. And in fact this ability has been implemented satisfactorily without developmental methods (although it is never quite as robust as one might like).

In contrast, consider grasping and manipulation. These "hands-on" skills depend heavily on the details of the objects being manipulated, and have so far been satisfactorily implemented only in scenarios in industry, entertainment, etc. where the robot interacts with a theatrical version of the world, with everything laid out just so by a team of human servants. I suspect that grasping and manipulation are skills whereby an attempt to implement the mature skill with sufficient robustness in unstructured environments, through fall-back grasping strategies and active probing, would be of the same order of complexity as a developmental implementation.
My questions: what skills do people see as most in need of a developmental implementation (for robots) or description (for humans), and why? Are there skills which are "killer applications" for developmental robotics, that we just can't imagine implementing in any other way?

Dialog column



Practical Challenges for Developmental Robotics

Charlie Kemp, Wallace H. Coulter Department of Biomedical Engineering at Georgia Tech and Emory University

Dr. Paul Fitzpatrick asks a very interesting and important question. With respect to robotics, what skills would most benefit from a developmental implementation? In some sense this asks, what is development good for? Will development enable robots to do something new or do something better? As an engineer, one would like to understand when developmental methods are likely to be a good solution. As a publically funded researcher, one would like to connect research to matters of societal importance.

Humans often serve as a model for roboticists. Clearly, if we were to create robots that develop and learn as humans do, it would be a monumental achievement with profound theoretical and practical consequences. The harder question is to figure out how a developmental approach to robotics might be advantageous in the nearer term as it competes with more mature approaches to robotics. I see this as a formidable challenge for the developmental robotics community.
At the start of this dialog, Dr. Fitzpatrick suggested that autonomous robot manipulation may be a “killer application” for developmental approaches, and I am sympathetic to this view.

But rather than speculate on how this may be true, I instead wish to outline some of the practical challenges that I believe developmental approaches face. The points I will make closely follow my talk at ICDL 2007 titled, “How much can robots do for us without learning or developing?”

First and foremost, I believe it is easy to underestimate what can be achieved through careful design and engineering. Prior to the personal computer revolution, few would have guessed that computers would be so generally useful and abundant in both homes and the workplace. Contrary to expectations, this success and generality has not relied on learning, development, nor AI in a conventional sense. Rather, this success has been a tribute to humanity's ability to create magnificent tools that are modular and extensible. Robotics might follow a similar progression with the creation of standard interfaces and specialized applications carefully programmed by experts.
Of course, one could argue that the personal computer revolution is a poor model for robotics. Even if a personal robotics revolution comes to fruition, perhaps robots will require learning and development in order to robustly perform useful tasks in unstructured environments. Yet Roomba, which is one of the most successful home robots to date, does not rely on learning nor development and is in over 2 million homes. Likewise, research at several labs has begun to result in robots that manipulate novel objects in predefined ways without making use of developmental methods. Will robots with more general and robust capabilities benefit from development? Time will tell.

For biological systems, one of mental development's roles may be to adapt to phenotypic variation due to the nature of biological reproduction, which involves recombination, mutation, and gradual growth. In contrast, robots can be manufactured such that they are nearly identical to one another and vary little over time. As such, robots have distinct characteristics and may not accrue the same benefits from mental development as humans.

Another challenge for learning and development is the effort involved in training or raising a robot. For many service roles, people wish to hire an experienced employee who does not require training. Raising children or even puppies requires a large investment by caregivers. I expect that for many situations people would prefer to work with a fully mature robot. If commercial robots develop, they may need to do so at a factory prior to being shipped, or rely on copying the brain of a single robot that has developed.
There may also be risks associated with development. If a robot's development is truly open ended, a robot could potentially become a blessing or a curse. How can one make assurances about the performance and dependability of a developing robot? Will the robot be modular and serviceable? Will it be safe? Will the trajectory of development be predictable? Robots that develop will make mistakes as they explore the world. How can one ensure that the costs of these mistakes are low, especially if the robot has an “adult” body?

Dialog column

Although in this response I have focused on outlining challenges that may impede or constrain the practical application of developmental robotics, I remain optimistic that this field of research will make contributions to the pursuit of deployable robots that meet real human needs. What will these contributions be? Time will tell.

Developmental intelligence is history-driven intelligence

Hideki Kozima, Miyagi University, Japan

As Fitzpatrick noted, our skills emerge out of "an intricate developmental process", which is truly the major research interest of AMD community. I, and probably many of you, believe that the developmental process starts from a genetic subsystem, onto which it builds up higher skills through the course of adaption to ever-changing environment. I also believe that the skills are formed into not just a collection, but a system with a topological and yet tangled structure that reflects the chronological order of acquisition and the degrees of difficulty of the skills. From this perspective on human/robot development, I would like to point out two aspects of development, which might direct us to an answer to Fitzpatrick's question.

First, the topological structure of skills is built by a series of layering of new skills made up by combining and/or modifying the existing skills. In other words, the structure represents its history of acquiring new skills on older, which reflects the incremental sophistication of intelligence. This enables "fall-back" to an older (coarser) skill when no newer (finer) skills work out, which is one of the core ideas of Brooks' Subsumption Architecture. I think the "killer applications" should take advantage of this ontogenetic history in the layers of skills.
Second, as Kaplan, Oudeyer, and many other researchers have stated, human development is an open-ended process, in which many goals are not predetermined: the developmental process would be driven outward by some intrinsic motivations such as the search for novelty or for learning progress, achieving artificial curiosity. This idea goes well with the layering process of new skills on older. It is imaginable that any intelligence is designed (or destined) to perform continuously this open-ended layering in the course of adaptation to environment. I think such open-ended accumulation of the topological history should be employed by the "killer applications".

Having considered these two points, which are both sides of the nature of historical ontogeny, I still cannot come up with specific candidates for the "killer applications" unfortunately. An exploratory rover in unpredictable environment could be one of the candidates; a rescue robot that crawls across earthquake debris and searches for victims may also sound good. In any case, "killer applications" should always acquire and perform skills at various levels of granularity in order to widen and deepen the gamut of behavior. This is certainly the core of human/robot intelligence; however, it is hard to pick a handy task in the current robotics research.

Which skills most need development?

Matthew Schlesinger, Psychology Department,
Brain and Cognitive Sciences, Southern Illinois University Carbondale

Before answering the question, “Which skills most need development?” I think it’s crucial that we first consider another, more basic question: “What are we trying to do?”. If we are roboticists-as-engineers, then (presumably) we are looking for a “killer app”. But if instead we are roboticists-as-researchers, then we are looking for a killer app *while also trying to understand* the phenomenon we are studying.

In highlighting this second perspective, there are three points I would like to make. First, recall that Piaget helped inspire the

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field of **genetic epistemology** [1]. Note that in its original use, "genetic" meant "developmental" or "unfolding", or perhaps in more modern terms, "emergent". "Epistemology", meanwhile, means the study of knowledge. In this sense, developmental robotics is closely related to Piaget's genetic epistemology, insofar as it allows us to design the system we hope to understand one step at a time. As Braitenberg suggests with his "Law of Uphill Analysis and Downhill Invention", this is often a more effective strategy than research by "reverse engineering" [2].

By this view, I would argue that the skills "which most need development" are those we most want to understand (i.e., especially developmental psychologists!). In that sense, the very things we are working on—motor skill development, object recognition, language, just to name a few— are the perfect skills to study. Second, in the process of investigating *how something develops*, a related question that arises is "*Why* does it develop?" For biological organisms, development makes sense when wiring a solution into the genes is too expensive (e.g., in terms of task complexity, neural structure, metabolic cost, etc.). A related constraint that favors development is a noisy or non-stationary environment, in which the optimal or most effective behavior may shift over time. This is not to suggest, however, that evolution plays a negligible role. Indeed, there is plenty of room for nature to shape the developmental process by influencing neural growth and developmental timing (i.e., what Elman and colleagues call *architectural* and *chronotopic* nativism [3]).
Perhaps not surprisingly, the same skills I listed above (and many others) are good candidates for development. In particular, language acquisition is an especially attractive topic, as it seems to offer a unique opportunity to study both the roles of innate neural structure and developmental experience.

Finally, as Vygotsky and other contextual psychologists have argued, understanding *how something develops* also requires us to identify the organism's developmental context.

Unfortunately, developmental robotics has often overlooked this step. Nevertheless, new insights or advances in robotics may occur by placing developmental change in an evolutionary (i.e., genetic, multi-generational, etc.) perspective, in which we view the individual as representing a single instance of a longer-term process. Similarly, it is important to remember that no skill emerges in isolation--either in terms of the physical and social environment, or more importantly, in terms of other skills and abilities.
Thus, as we ponder the question, "Which skills most need development?" it is important to consider the holistic approach, which views the organism not as collection of particular skills but instead as a coherent entity situated in and interacting with its environment.

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Adjusting perception to action, and vice versa

Claus Von Hofsten, Uppsala University, Sweden

Solving action problems is never a simple question of making the appropriate motor movements. On the contrary, it is a question of developing relationships between perception and action. In order to perform a specific action, like grasping an object, the robot needs to have information available about its form, size, orientation, direction and distance. If the object is moving, it must also have information about the velocity and direction of the motion. In order to approach the object in a smooth and purposeful way, adjustments of the limb must be made at the onset of the action that anticipates the outcome of it. Finally, as the reach is implemented, adjustments must be made that improve the precision and correctness of the pre-adjusted parameters, but time is too short to allow for fall-back grasping strategies, active probing, or other elaborate feedback control.

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However, the most essential part of a reaching action is to perceive the object to be approached.
Visual motion is the most reliable means to segregate objects from the background and it is used by all biological organisms. Contrast and contours are also useful but can easily be deceptive. Animals use these parameters to camouflage themselves. Motion, however, cannot be escaped. Animals develop ways to be totally stationary by freezing, but if the predator moves, the relative visual motion created between the prey and its background will reveal it. Once the object to be approached is detected, the other necessary information needed can be specified. The more complex ones require combinations of visual input, like the way size is derived from distance and visual angle, and may therefore involve developmental processes, but research on human infants shows that object perception develops early in life.
The necessity of experience is much more apparent in the adjustments of perception to action. However, nothing starts from scratch. Newborn infants reach out in the direction of a salient object and move their hands into the visual field. Infants, who begin to grasp objects successfully around 4 months of age, adjust the orientation of the hand to the orientation of the object and begin to close the hand around the object ahead of time. However, these adjustments are rather crude and experience is needed to turn them into skilful actions. If these rules are followed in developmental robotics, there are no skills which are impossible to implement.

"Killer" Applications for Developmental Robotics and Humans: Muddy Tasks

Juyang Weng,
Department of Computer Science and Engineering,
Michigan State University East Lansing, USA

Paul Fitzpatrick raised an important question that has been in the mind of many developmental roboticists. However, the term "skills" raised by Paul is somewhat narrow. Thus, the term misled, as he stated "skills which don't retain this kind of plasticity in their mature form are candidates for (hand) abstraction and (hand) implementation without appeal to development."

I know that Paul is for development. However, the necessity of autonomous development does not lie only in the need for retaining plasticity, but also in a broader concept --- task. We argued that autonomous development is necessary for muddy tasks [1-3]. There are five categories of muddiness measures for each task [1,3] (also briefly outlined in [2], page 17): (1) the environment of the task, (2) agent input, (3) agent internal representation, (4) agent output, and (5) the goals of the task. Each of the five categories contains more detailed muddiness factors. For example, along the axis of controlledness factor, a controlled task environment is clean, but an uncontrolled task environment is muddy. I assume that an unstructured environment cannot be controlled, otherwise the control is a type of regulation. We argued that only developmental robots --- robots that are regulated by a task-nonspecific developmental program that simulates the functions of the genome --- can successfully perform one or multiple muddy tasks.

A robot programmer can pretty much forget about autonomous development for a grasping and manipulation skill (e.g., Paul's industrial scenario example), if he can fully and precisely specify and control the task environment before he programs. However, Paul's unstructured environment example does not belong to this simple class. "Unstructured environment" is a common concept in robotics. The answers.com site defines: Not regulated or regimented: an unstructured environment. There has been no robot yet that can grasp and manipulate objects in truly unstructured environments for a highly valued task. Developmental robotics is the only feasible approach toward such tasks. This is because at least vision for truly unstructured environments requires autonomous development. By unstructured environments, I mean truly non-regulated environments that humans deal with daily. As Paul mentioned the need of active probing, he does include environmental sensing as a part of the skill.

Let us consider a task example: A robot must hand over a required object (a drink, a bottle of milk, etc.) after it opens any refrigerator in a mid-size city (which may contain all possible kinds of stacked-up food items and packages). For this task, the robot must be able to deal with a challenging chicken-and-egg problem: Attention selection (i.e., where to look, which

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requires object recognition to be effective) and object recognition (which requires the success of attention selection) before it can reach. It must recognize different items and packages to find what it is looking for, figure out which part of the object is suitable for handling, and how to grasp to avoid damaging this item and other nearby items. This task example shows that any mental skill needs to be evaluated in the context of tasks. Otherwise, it is misleading. Of course, my discussion of the example above is limited in scope as it only focused on one category of the task muddiness factors, the environment of the task.

In summary, it appears that autonomous development is necessary for any intelligent agent (natural or artificial) to perform muddy tasks. By autonomous development, I mean that the agent (human or robot) is regulated by a task non-specific program (genome or its artificial functional counterpart) through extensive task-specific, interactive developmental experience. For a developmental robot, tasks to be learned are not given during the program time, but are conveyed through the context of robot-environment interactions. It is important to note that the mode in which a task is conveyed to the robot is related to the task muddiness (e.g., through a press on the corresponding task button vs verbal communication), a muddiness factor that belongs to the category of task goal [2,3]. All muddy tasks are killer applications of autonomous development.
Since handling muddy tasks is probably the most impressive hallmark of intelligence, understanding brain's mechanisms of autonomous development is also necessary for us to understand how the brain works and how the mind emerges.

References:

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[2] J. Weng and W. Hwang, "From Neural Networks to the Brain: Autonomous Mental Development," *IEEE Computational Intelligence Magazine*, vol. 1, no. 3, pp. 15-31, 2006.
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Development within the "complete creature" paradigm

Lola Cañamero, University of Hertfordshire, Feelix Growing project coordinator

Having formed as a roboticist within the "complete creatures" paradigm, I look at development as a global or holistic process of a system in interaction with its (multiple) environment(s). Considering the development of a particular "skill" in isolation from the rest would overlook important interactions among subsystems. Development also involves different interwoven factors (genetic, epigenetic, social, cultural) that, when singled out, only provide partial (and biased) views of a complex process. Ideally, thus, we would like to see a collaborative effort involving scientists from multiple disciplines to understand development through both analysis and synthesis of biological and robotic systems.

This ideal is however difficult to implement at present given, on the one hand, the big gaps that still exist in our knowledge of how the different factors, "levels" and "subsystems" interact in the development of even simple biological systems, and on the other hand to the dynamics and practices of scientific communities. The methodological principle of "divide and conquer" must thus often be adopted for pragmatic reasons.

In this context, the hypothesis put forward by Paul Fitzpatrick raises very interesting questions for robot developers. I would however like to consider his claim as consisting of two separate parts, namely: (a) that the skills that retain high plasticity in their mature state benefit most from a "developmental" implementation; and (b) that more "rigid" or less open-ended ones are candidates for abstraction and non-developmental types of implementation. The first part is somehow similar to the viewpoint we have adopted in the EU-funded project Feelix Growing (www.feelix-growing.org) for the study of social-emotional development, which involves highly flexible "skills". While this project takes a "global" perspective that focuses on the interactions among emotional development, the development of skills for social interaction, and of various forms of

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expression, for pragmatic reasons it cannot also investigate the interactions of these with the development of more “rigid” skills and behaviors or with other “flexible” cognitive and sensorimotor capabilities.
As argued elsewhere, a developmental approach is fundamental to produce robots that can appropriately interact with us in our own world in a “human-oriented” way that is natural, meaningful, and acceptable for us. Using development presents many advantages over “mature” forms of learning, not only because it gives rise to more flexible and adaptable robots, better suited to interact with the humans they grow up with, but also since it opens up the door to creating affective bonds that can provide the basis for longer-term relations between humans and robots. I am however less willing to agree with the second part of Fitzpatrick’s claim, particularly as the a priori characterization of a particular skill as “rigid” might be erroneous. Grasping, mentioned by Fitzpatrick as a type of “flexible” skill that requires a developmental approach, is a case in point. While grasping has been rather successfully modeled as a “rigid” skill in areas like industrial robotics, recent neuroscience research related e.g. to the role of canonic and mirror neurons in goal-oriented action has shown the adaptive, goal-oriented and flexible nature of grasping, making it a very interesting subject for developmental modeling. We should thus be careful when “dividing” the development and functioning of a system into “skills”, and bear in mind that considering particular skills in interaction with others and/or under a developmental perspective might totally change our initial given or preconceived ideas about them.

Reply and Summary: which skills most need development

Paul Fitzpatrick

My thanks to everyone for their thoughtful responses. There are far too many good ideas to summarize, so apologies for what I have to omit here. My question was: is there a "killer application" for development -- something we can't imagine doing (in robots) or describing (for humans) any other way. Kemp spells out why development can be a tough sell in robotics. Careful design and engineering can achieve a lot (just look at computers). Robot "brains" can be copied, and so may need less adaption after manufacture than biological organisms need after being born. And development is risky and costly.

Schlesinger notes that in biology development is important when wiring a solution into the genes is too expensive. For robotics, as Kemp points out, copying solutions is basically without cost. So it does seem a good bet that individual robots in the future will not need an infantile period, but could rather be manufactured with a copied "mature" state. Nevertheless: should we expect that parts of the copied robot "brains" require development in their original creation? And that some parts would need to develop outside the factory?

Returning to Schlesinger, he notes another case where development is important in biology: when the environment is noisy or non-stationary. Weng expands on the properties of different environments, goals, methods of perception and action that lead to a need for development. He believes that unlike highly ordered "clean" tasks that robots have long been applied to, messy, unclear, "muddy" tasks can only be solved with autonomous mental development.

Kozima describes a developing robot as containing "a system with a topological and yet tangled structure that reflects the chronological order of acquisition and the degrees of difficulty of the skills", and I couldn't agree more. But Canamero notes the conundrum that many of us have faced, where despite our belief in the importance of a global or holistic approach to development (she and Schlesinger motivate this well), where many factors are interwoven, we are faced in practice with the need to divide things up for pragmatic reasons.

We have to be very careful about what we omit, if development is to succeed where other approaches fail. Kozima makes the point that in principle the structure of skills created by development is inherently incremental and robust, with "older (coarse) skills to fall back on when no newer (finer) skills work out". I would go further: not only does the robot have primitive skills to fall back on, but it also has the tools needed to recreate the finer skills in whatever new form is necessary.
But these advantages are only going to be clear in a quite complicated system. So where do we start? It was this search for a good starting point, complex but not all-embracing, that led me to suggest grasping as a "killer application". Stepping back

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from abstractions, Von Hofsten looks very concretely at the possible role of development in reaching and grasping in humans. He sees experience as useful in turning crude orientation and reaching behaviors in early life into skilful actions. He emphasizes the importance of perception: "the most essential part of a reaching action is to perceive the object to be approached" (this resonates with Weng's emphasis on the difficulty of vision). But Von Hofsten reminds us that mature reaching and grasping is highly polished, with no time for "fall-back grasping strategies, active probing, or other elaborate feedback control". I agree, but I speculate that stressors such as using thick gloves, grasping beneath water, use of a mirror, manipulation of a very unfamiliar object, etc. would trigger strategies with some developmental character to them to adapt the mature grasping skill for a new situation. I also suspect that quite ordinary situations (to us) could be very challenging for any kind of robot we can hope to build soon, requiring some fumbling and re-adaptation at first. In any case, as a roboticist, I am excited to try to build a system modeled after the kind of blueprint Von Hofsten has sketched.

Other suggestions for "killer applications" were many and varied. Possibilities mentioned were: an exploratory or rescue robot in a hostile/unpredictable environment (Kozima), motor skill development, object recognition, and language (Schlesinger), getting objects from a fridge, autonomous urban driving, and all muddy tasks (Weng). Like Kemp, I am hopeful that we can contribute to "the pursuit of deployable robots that meet real human needs."

Dialog Initiation

Are robots beneficial to children with autism?

Kerstin Dautenhahn
Adaptive Systems Research Group, University of Hertfordshire, UK

Increasingly various types of robotic systems are being used in care or therapeutic contexts, involving elderly people in care homes or children with developmental disabilities. Over the past 12 years I have been involved specifically in research investigating the potential use of robots as therapeutic toys for children with autism, and we have used various mobile (e.g. Aibo, Labo-1) and humanoid robots (Kaspar, Robota) in this research. Autism is a spectrum disorder and life-long developmental disability that affects communication, social interaction and imagination and fantasy.

There are many potential roles that robots may play in therapy or education for children with autism: robots as interaction partners for children (with the purpose to teach about interaction and communication skills, e.g. imitation); robots as research tools e.g. for psychologists in order to investigate certain hypotheses regarding the nature of autism; robots as a diagnostic tool that may be used in the assessment of children with autism; robots as an educational 'tool' that may be used e.g. to teach about colours, shapes etc. similar to other interactive toys that are already being used in teaching; and robots as mediators where the robot mediates between the child and other children or adults.

While I am very enthusiastic about this topic from the point of view of a human-robot interaction researcher, a number of issues have emerged over the years, and I invite other researchers to comment on this:
(1) Design space of robots: Given the variety of different robots used in the field, how can we arrive at a common understanding of the impact of robot behavior and appearance on the children's reactions?
(2) Can robots (mechanical entities) really help children to better cope with the social world (beyond being an engaging toy)? Can they isolate children even more from the social environment rather than helping them to cope with it better?
(3) How important is the autonomy of the robot's behaviour?
(4) To what extent can robots help scientists understand better the developmental disorder of autistic children? How far can the use of robots as "research tools" be compatible with the use of robots as "educational tools"?
(5) Ethical issues: How can we ensure that this type of work is benefiting the children?

Answers shall be sent by the 15th February to k.dautenhahn@herts.ac.uk or pierre-yves.oudeyer@inria.fr.

Conference reports

8th International Conference on Epigenetic Robotics (Epirob 2008)

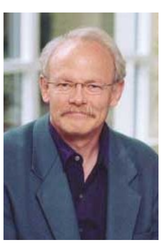

Matthew Schlesinger and Luc Berthouze

The 8th annual Epigenetic Robotics conference was held at the University of Sussex, Brighton, UK, on the 30th and 31st of July, 2008. Thanks to support from the Centre for Computational Neuroscience and Robotics at the University of Sussex, as well as the euCognition European Network for the Advancement of Artificial Cognitive Systems, the meeting provided an informative and stimulating environment for researchers in computer science and robotics, psychology, biology, and philosophy to meet and discuss their work. A special feature of EpiRob08 was a focus on the theme of evolution and development as interrelated processes of change. Thus, in addition to a broad array of research reports that cut across the fields (and subdisciplines) of developmental science, robotics, and neuroscience, there were also several papers that integrated the evolutionary and developmental perspectives. A variety of presentation formats —including not only oral papers and posters, but also two poster highlight sessions—created numerous opportunities for interaction among the conference participants.

As part of the conference theme, four distinguished speakers were invited to provide their unique view on evo-devo interaction. On the first day of the meeting, Domenico Parisi (Italian National Research Council) offered a systematic discussion of learning and development from the Artificial Life perspective, with an emphasis on integrating both the evolutionary and cultural levels of influence. Next, Claudio Stern (University College London) carefully elucidated the concept of epigenesis and highlighted its application in developmental biology to the process of gastrulation. On the second day, Eva Jablonka (Tel Aviv University) described the provocative phenomenon of epigenetic inheritance, in which acquired changes in phenotype are passed to offspring without modifications in the transmitted DNA sequence. Finally, Susan Oyama (John Jay College and CUNY Graduate School) presented a comprehensive overview of developmental systems theory that focused on the dynamic interplay of development and evolution as complementary constructive processes.

If you were unable to attend the meeting, please note that the electronic version of the conference proceeding is forthcoming, and will be available for download at http://www.lucs.lu.se/LUCS. We look forward to seeing you at EpiRob09!

7th IEEE International Conference on Development and Learning (ICDL-2008)




Asilomar ICDL: A Conference at a Historical Site

Jay McClelland, Juyang Weng, Gedeon Deák and Brian Scassellati

The 7th IEEE International Conference on Development and Learning (ICDL-2008) took place at the Asilomar Conference Grounds in Monterrey, California, from August 9 to 12, 2008. The Asilomar Conference Ground has been a place for some well-known conferences in the US history, with its natural, beech surroundings scattered by rustic, wood buildings having spacious rooms and decks. This year's conference had support from the IEEE Computational Intelligence Society and the Cognitive Science Society. Like our previous meetings, ICDL '08 was a truly interdisciplinary conference, with papers and posters ranging from computer science and engineering, machine learning, robotics, to developmental, cognitive and social psychology, with additional content in the fields of anthropology and linguistics, and the biological and neurosciences. The common theme was multidisciplinary efforts to understand complex dynamics of emergent cognitive and behavioral systems, in biological or artificial agents/systems.

The review process for ICDL was rigorous and explicitly interdisciplinary. Each submission was assigned to two program committee members, one from the "natural intelligence side," such as neuroscience and psychology, and the "artificial intel-

Conference reports

ligence side," such as machine intelligence and robotics. The program committee members ensured that each submission received at least three reviews, including at least one from a reviewer on each side. ICDL 2008 accepted not only a regular 6 -page paper submission track but also a short "late-breaking" 1-page abstract submission track. This was the first year that the "late-breaking" submission track was offered, and we received very positive feedback on providing the opportunity for many to present preliminary or very recent work and to take part in the ICDL meeting.From the more than 120 different submissions, we selected 24 full papers for oral presentation, 27 full papers for poster presentation, 2 special sessions with a total of 8 presentations, and 21 late-breaking abstracts for poster presentation. The quality of the submissions was universally very high, providing a difficult (and often hotly debated!) choice for our program committee. Our review process enlisted the help of 38 program committee members who coordinated reviews from 127 reviewers.

Attendees enjoyed cutting-edge talks from three outstanding invited speakers. Professor Dick Aslin of Rochester University discussed evidence and models of unsupervised learning by human infants and adults. Professor Terry Jernigan of UC-San Diego described recent breakthroughs in structural imaging of developing brains, and resulting insights into emergent changes in cognition. Professor Andrew Ng of Stanford described neurally inspired learning algorithms by which systems can discover complex structures. These talks were complemented by competitive talks and two reviewed special sessions on Bayesian and connectionist approaches to learning, and on visual attention and recognition. The program (http://www.icdl08.org/schedule.htm) nicely illustrates the diverse but coherent and cutting-edge breadth of the ICDL.

ICDL 2008 was organized by Jay McClelland and Juyang Weng (General Chairs), Gedeon Deák and Brian Scassellati (Program Chairs), Odest Chadwicke Jenkins (Publication Chair) and Charlie Kemp (Publicity Chair). It was announced at the conference that the next meeting will take place at Shanghai, China, June 5 - 7, 2009, organized by Juyang Weng (General Chair), Profs. Tiande Shou and Xiangyang Xue, (General Co-Chairs), Drs. Jochen Triesch and Zhengyou Zhang (Program Chairs), Prof. Alexander Stoychev (publicity chair), Dr. Yilu Zhang (publication chair) and Prof.l Hong Lu (local arrangement chair).

Call for papers

CFP: 8th IEEE International Conference on Development and Learning (ICDL 2009)

Shanghai,
June 5 - 7, 2009

Important dates:
Sunday, Jan. 25, 2009: Special session proposals and tutorial proposals due
Sunday, Feb. 8, 2009: Full papers due
Friday, March 27, 2009: Authors' optional rebuttal to review comments due
Sunday, April 19, 2009: Notification of acceptance
Sunday, April 26, 2009: Poster abstracts due
Sunday, May 10, 2009: Final camera-ready papers due

INNS–NNN Symposia (New directions in Neural Networks)

"Modelling the Brain and Nervous Systems"
General Chair: Juyang Weng (weng@cse.msu.edu)
Program Chair: Nikola Kasabov (nkasabov@aut.ac.nz)
Publicity Chair: Ming Xie (mmxie@ntu.edu.sg)
Local Organising Chair: Joyce D'Mello (jdmello@aut.ac.nz)
Technical support Chair: Peter Hwang (phwang@aut.ac.nz)

Auckland, NZ
24-25 November 2008
associated with ICONIP 2008
(25-28 November 2008)
http://www.aut.ac.nz/nnn08/index.htm
Submission deadline: Oct. 20, 2008

The symposia will provide a forum for researchers to exchange latest new ideas and present new research advances in the general areas related to computational modelling of the brain and nervous systems, including development and learning in animals and artificial systems/robots, computational neurogenetic modelling, and applications of related techniques.

Call for papers

IEEE Transactions On Autonomous Mental Development

The IEEE TRANSACTIONS ON AUTONOMOUS MENTAL DEVELOPMENT (TAMD, http://ieee-cis.org/pubs/tamd/), published four times a year, includes:

- Computational modeling of mental development, including mental architecture, theories, algorithms, properties and experiments;
- Experimental investigations relevant to the goal of achieving a computational understanding of developmental processes in humans and animals, especially those focusing on the role of experience and on the active exploration of the environment;
- Engineering applications of autonomous mental development such as mechanisms enabling highly complex capabilities by robots and other artificial systems.

Authors are encouraged to submit papers that disclose significant conceptual, computational, or empirical discovery, technical and practical knowledge, exploratory developments, and applications to both artificial and biological mentally developing systems. The Journal encourage papers submitted from all areas related to mental development, including, but not limited to, computer science, engineering, neuroscience, psychology, biology, medicine, and philosophy. Due to the existence of many empirically oriented journals in the field of human developmental psychology, the Journal will emphasize computational approaches to mental development and experimental studies that make contact with computational approaches.

Timely Publications. Every effort is made to ensure minimum delay from submission to publication. When the final version of a manuscript is accepted, it is immediately published electronically on IEEE Xplore and given a Digital Object Identifier (DOI), at which time it enters the queue for publication in the paper version. In line with the IEEE's policy on scholarly publishing, authors are also free to archive the PDF of the published paper on their own web-site or institutional repository. TAMD aims to publish a paper in less than 12 months from the date of its original submission, and to post it online in IEEE Xplore in less than 6 months from the date of its original submission. For manuscripts that are accepted without revision it is entirely feasible that they could be posted online within 3 months of its original submission.

Manuscript Types. TAMD manuscript types and submission length guidelines are as follows:
- Regular paper – up to 15 double column pages / 38 single column pages
- Correspondence paper – up to 8 double column pages / 20 single column pages
- Survey paper – up to 25 double column pages / 55 single column pages

A correspondence paper is manuscript that publishes an original research contribution in a shorter form, as well as a “perspective” that includes insights into issues of wider scope than a regular paper related to computational mental development but without being highly computational in style.
A survey paper is well-focused manuscript that puts recent progress into a broader perspective and accurately assesses the limits of existing theories.

Submissions. The Journal is now accepting submissions, with the first issue to be published in spring 2009.
As we are still setting up the online submission tool, we are accepting submissions through email. Please send your submissions by the **14th December** to ieee_tamd@live.com.
TAMD follows the format standards of the IEEE. The IEEE Transactions, Journals, and Letters Information for Authors, including LaTeX and Word templates, is available at http://www.ieee.org/web/publications/authors/transjnl/index.html

Sponsors. The journal is co-sponsored by the IEEE Computational Intelligence Society, and the IEEE Consumer Electronics Society. It is technically co-sponsored by the IEEE Computer Society, and the IEEE Robotics and Automation Society.

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