Report on the Distinguished and Life Members Affinity Group Lecture given by Pierre-Yves Oudeyer to the French CIS chapter

Form of the presentation: Because of the pandemic, Pierre-Yves Oudeyer's distinguished lecture to the French CIS chapter was held online.

Date of Presentation: 2 March 2021, 5:00PM-6:30PM (Paris time).

Organisers of Presentation: Adrien Revault d'Allonnes (IEEE France Section CIS Chapter chair), Bernadette Bouchon-Meunier (IEEE France Section CIS Chapter vice-chair)

Title of Presentation: Developmental Machine Learning, Curiosity and Deep reinforcement Learning

Abstract of Presentation: Current approaches to AI and machine learning are still fundamentally limited in comparison with autonomous learning capabilities of children. What is remarkable is not that some children become world champions in certain games or specialties: it is rather their autonomy, flexibility and efficiency at learning many everyday skills under strongly limited resources of time, computation and energy. And they do not need the intervention of an engineer for each new task (e.g. they do not need someone to provide a new task specific reward function).
I will present a research program (Kaplan and Oudeyer, 2004; Oudeyer et al., 2007; Gottlieb and Oudeyer, 2019) that has focused on computational modeling of child development and learning mechanisms in the last decade. I will discuss several developmental forces that guide exploration in large real world spaces, starting from the perspective of how algorithmic models can help us understand better how they work in humans, and in return how this opens new approaches to autonomous machine learning.
In particular, I will discuss models of curiosity-driven autonomous learning, enabling machines to sample and explore their own goals and their own learning strategies, self-organizing a learning curriculum without any external reward or supervision. I will introduce the Intrinsically Motivated Goal Exploration Processes (IMGEPs-) algorithmic framework, and present two families of IMGEPs: population-based IMGEPs (Baranes and Oudeyer, 2013; Forestie et al.,2017) with learned goal spaces (Pere et al., 2018), which have allowed sample efficient learning, learning of skill repertoires in real robots, and goal-conditioned Deep RL-based IMGEPs, which enable strong generalization properties when they are modular (Colas et al., 2019), in particular when leveraging the compositionality of language to imagine goals in curiosity-driven exploration (Colas et al., 2020).

References:
Baranes, A., Oudeyer, P-Y. (2013) Active Learning of Inverse Models with Intrinsically Motivated Goal Exploration in Robots, Robotics and Autonomous Systems, 61(1), pp. 49-73. http://www.pyoudeyer.com/ActiveGoalExploration-RAS-2013.pdf
Colas, C., Sigaud, O., Oudeyer, P-Y. (2019) CURIOUS : Intrinsically Motivated Modular, Multi- Goal Reinforcement Learning, Proceedings of International Conference on Machine Learning (ICML 2019). https://arxiv.org/abs/1810.06284

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Forestier S, Oudeyer P-Y. (2017) Intrinsically Motivated Goal Exploration Processes with Automatic Curriculum Learning. https://arxiv.org/abs/1708.02190
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Oudeyer P-Y, Kaplan , F. and Hafner, V. (2007) Intrinsic Motivation Systems for Autonomous Mental Development, IEEE Transactions on Evolutionary Computation, 11(2), pp. 265--286. http://www.pyoudeyer.com/ims.pdf
Péré, A., Forestier, S., Sigaud, O., & Oudeyer, P. Y. (2018). Unsupervised learning of goal spaces for intrinsically motivated goal exploration, ICLR 2018, https://arxiv.org/abs/1803.00781

Description of the Event: The talk was widely publicized on the France Section website and the LIP6 website, as well as through various emails and eNotices to the CIS France Section Chapter, to LIP6 members and to national AI networks.
A total of 68 participants attended the very well received lecture, giving rise to several questions from participants, with detailed answers by Pierre-Yves Oudeyer.
Some screenshots of the event are included below.

Adrien Revault d'Allonnes,
Bernadette Bouchon-Meunier
March 30, 2021

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Developmental Machine Learning, Curiosity and Deep Reinforcement Learning

IEEE France Section's Life Members Affinity Group and French Chapter on Computational Intelligence IEEE is happy to invite you to join the lecture by Pierre-Yves Oudeyer.
Date and time: 2 March at 5:00PM
Venue: https://zoom.us/j/91578786916?pwd=NGxONkt0NUw5WWxRT2dBMFpxbXRhUT09

Abstract: Current approaches to AI and machine learning are still fundamentally limited in comparison with autonomous learning capabilities of children. What is remarkable is not that some children become world champions in certains games or specialties: it is rather their autonomy, flexibility and efficiency at learning many everyday skills under strongly limited resources of time, computation and energy. And they do not need the intervention of an engineer for each new task (e.g. they do not need someone to provide a new task specific reward function).
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Bio: Dr. Pierre-Yves Oudeyer is Research Director (DR1) at Inria and head of the Inria and Ensta-ParisTech FLOWERS team (France). Before, he has been a permanent researcher in Sony Computer Science Laboratory for 8 years (1999-2007). He studied theoretical computer science at Ecole Normale Supérieure in Lyon, and received his Ph.D. degree in artificial intelligence from the University Paris VI, France. He has been studying lifelong autonomous learning, and the self-organization of behavioural, cognitive and cultural structures, at the frontiers of artificial intelligence, machine learning, cognitive sciences and educational technologies. He has been developing models of intrinsically motivated learning, pioneering curiosity-driven learning algorithms working in real world robots, and developed theoretical frameworks to understand better human curiosity and autonomous learning. He also studied mechanisms enabling machines and humans to discover, invent, learn and evolve communication systems. He has published two books, more than 100 papers in international journals and conferences, holds 8 patents, gave several invited keynote lectures in international conferences, and received several prizes for his work in developmental robotics and on the origins of language. In particular, he is laureate of the Inria-National Academy of Science young researcher prize in computer sciences, and of an ERC Starting Grant EXPLORERS. He is also editor of IEEE CIS Newsletter on Cognitive and Developmental Systems where he organizes interdisciplinary dialogs in cognitive science, AI and robotics, as well as associate editor of IEEE Transactions on Cognitive and Developmental Systems and Frontiers in Neurorobotics. He has been chair of IEEE CIS Technical Committee on Cognitive and Developmental Systems.

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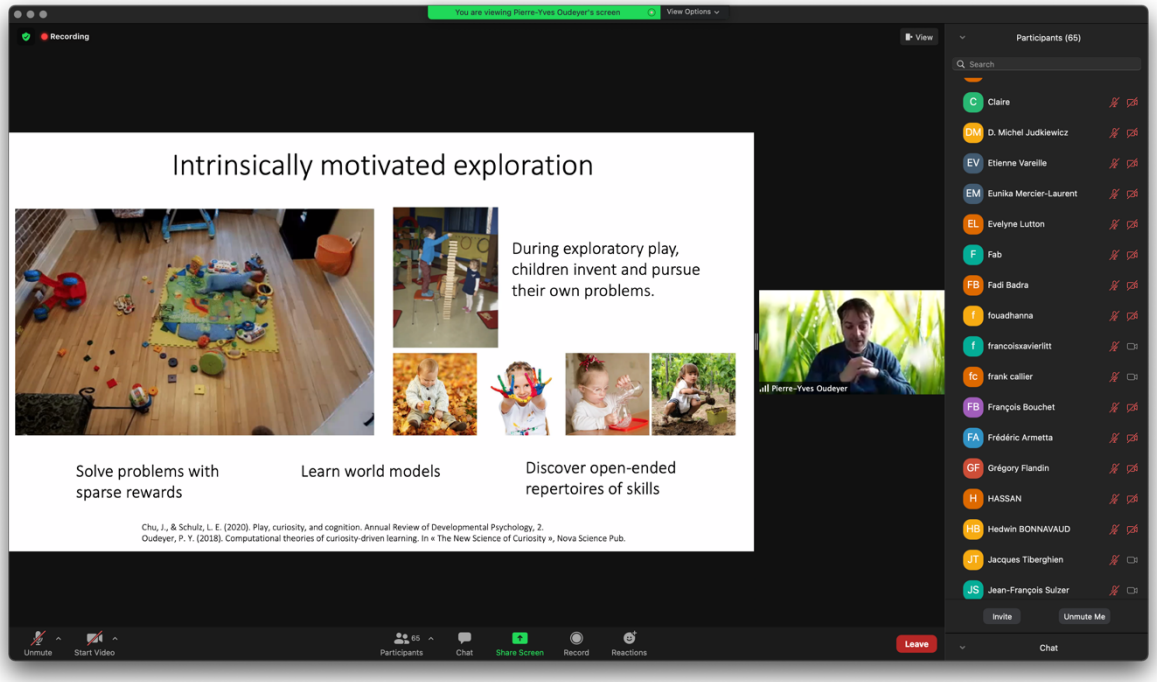

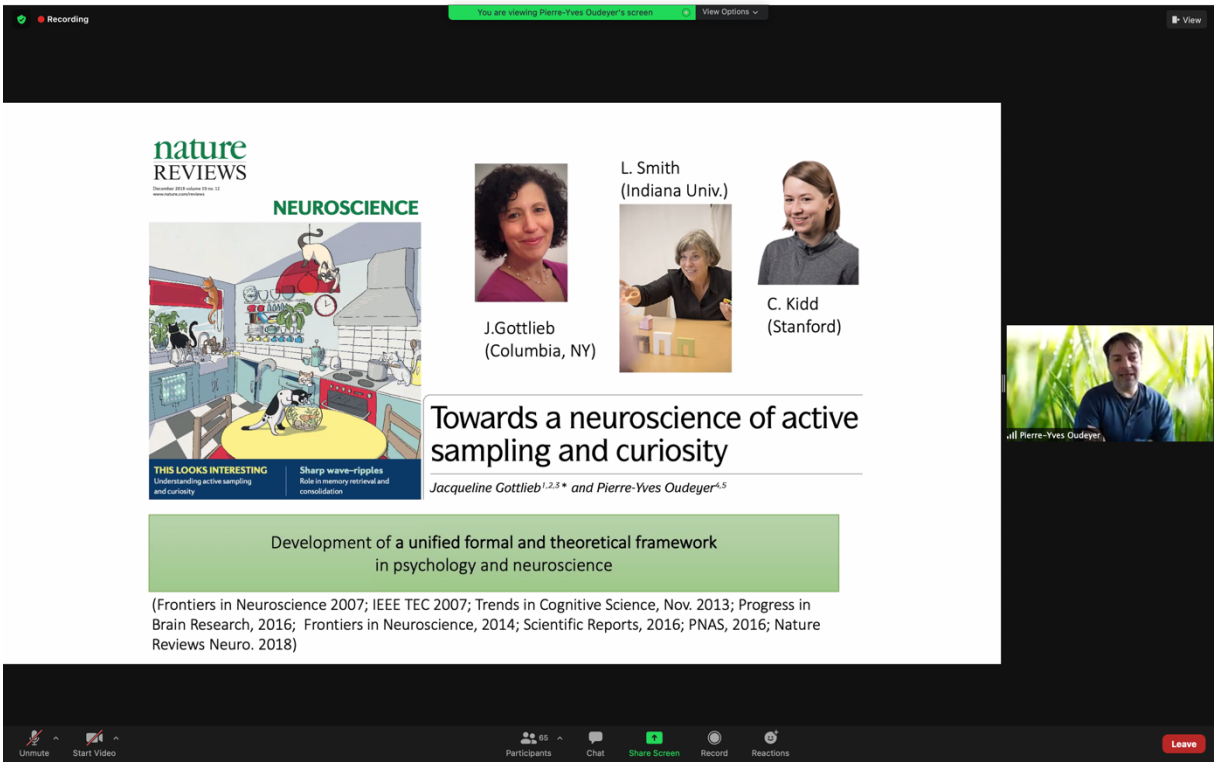
Recording
You are viewing Pierre-Yves Oudeyer's screen
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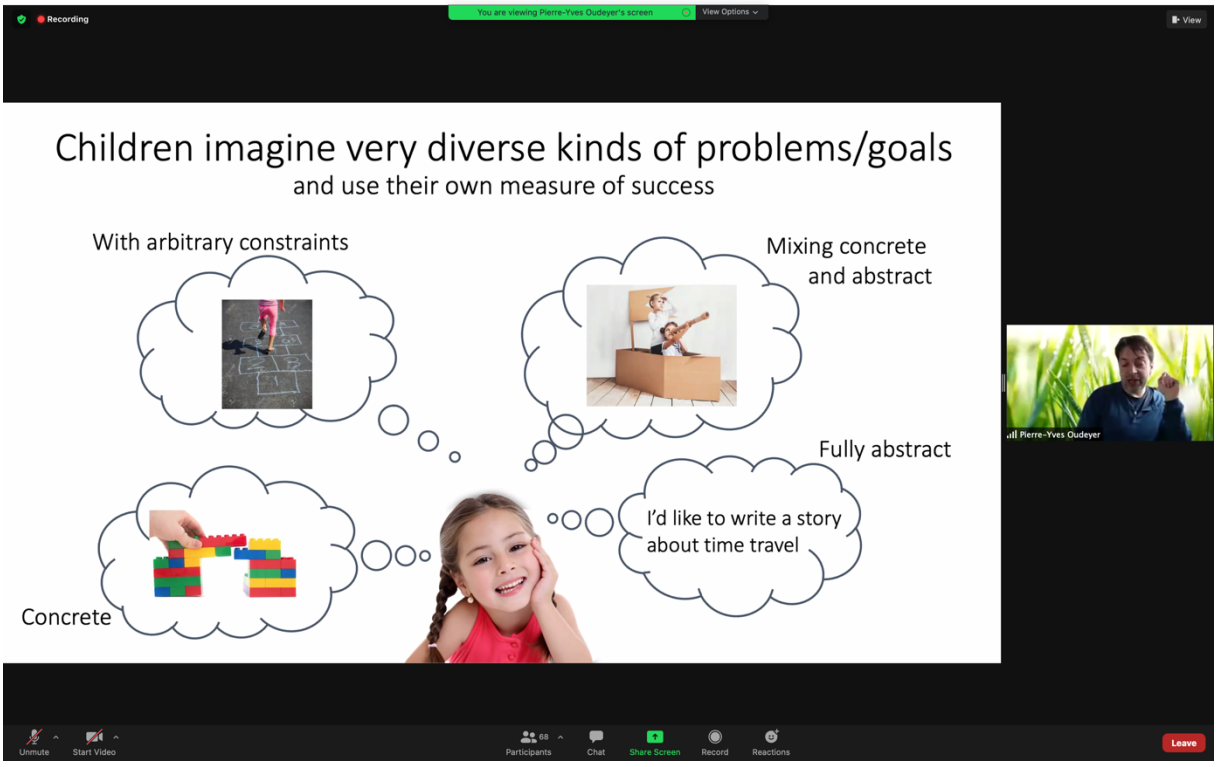
nature
REVIEWS
NEUROSCIENCE
THIS LOOKS INTERESTING
Understanding active sampling and curiosity
Sharp wave-ripples
Role in memory retrieval and consolidation
J.Gottlieb
(Columbia, NY)
L. Smith
(Indiana Univ.)
C. Kidd
(Stanford)
Towards a neuroscience of active sampling and curiosity
Jacqueline Gottlieb[1,2,3]* and Pierre-Yves Oudeyer[4,5]
Development of a unified formal and theoretical framework in psychology and neuroscience
(Frontiers in Neuroscience 2007; IEEE TEC 2007; Trends in Cognitive Science, Nov. 2013; Progress in Brain Research, 2016; Frontiers in Neuroscience, 2014; Scientific Reports, 2016; PNAS, 2016; Nature Reviews Neuro. 2018)
Pierre-Yves Oudeyer
Unmute
Start Video
Participants
Chat
Share Screen
Record
Reactions
Leave


Recording
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View
Children imagine very diverse kinds of problems/goals
and use their own measure of success
With arbitrary constraints
Mixing concrete and abstract
Fully abstract
I'd like to write a story about time travel
Concrete
Pierre-Yves Oudeyer
Unmute
Start Video
Participants
Chat
Share Screen
Record
Reactions
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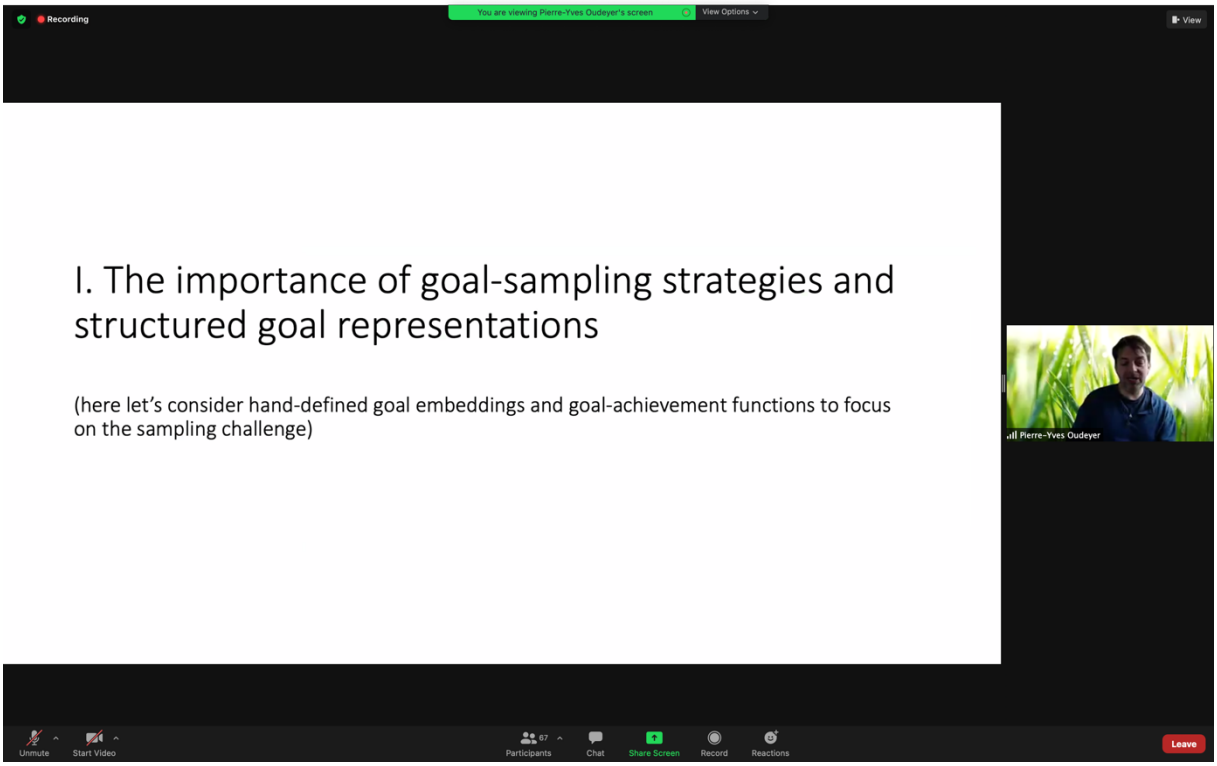
Recording
You are viewing Pierre-Yves Oudeyer's screen
View Options
View
I. The importance of goal-sampling strategies and structured goal representations
(here let's consider hand-defined goal embeddings and goal-achievement functions to focus on the sampling challenge)
Pierre-Yves Oudeyer
Unmute
Start Video
Participants
Chat
Share Screen
Record
Reactions
Leave