Ivan Sysoev

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RESEARCH INTERESTS

- Self-driven, playful, creative learning
- AI-driven scaffolding
- Technologies for supporting play and self-expression

EDUCATION

Massachusetts Institute of Technology — Cambridge, MA
PhD in Media Arts and Sciences, GPA: 5.0 / 5 — 2014 – 2020
Dissertation title:
Digital Expressive Media for Supporting Early Literacy through Child-Driven, Scaffolded Play
Advisor: Deb Roy

Georgia Institute of Technology — Atlanta, GA
Master of Science in Computer Science, GPA: 4.0 / 4 — 2012 – 2014
Master's project: *Viewpoints AI (*co-creative art installation)
Advisor: Brian Magerko

Novosibirsk State University — Novosibirsk, Russia
Master of Science in Computer Science, GPA: 4.86 / 5 — 2009 – 2011
Thesis title: *Applying a Variational Constraint Solver to 3D Geometry Editing*
Advisor: Dmitry Ushakov

Novosibirsk State University — Novosibirsk, Russia
Bachelor of Science in Computer Science, GPA: 5.0 / 5 — 2005 – 2009
Thesis title: *Applying Lazy Evaluation to Semantic Text Analysis*
Advisor: Elena Sidorova

RESEARCH EXPERIENCE

MIT Media Lab — Cambridge, MA
Postdoctoral Associate — 2020 – present

- Designing and implementing robotic companions to support development of early literacy and creativity in children via open-ended play.
- Designing and implementing an interactive storybook to introduce preschoolers to computational thinking and artificial intelligence.

MIT Media Lab — Cambridge, MA
Research Assistant — 2014 – 2020

- Proposed a child-driven, machine-guided approach to early literacy learning, grounded in findings from learning theory and literacy learning research.
- Designed and developed two open-ended literacy apps to evaluate this approach.
- Refined the proposed designs via iterative playtesting.
- Conducted mixed-method studies utilizing the design-based research methodology to

evaluate the approach.
- Closely collaborated with colleagues and schools to conduct the studies.
- Participated in development of a novel model for stance detection on Twitter.

Georgia Institute of Technology Atlanta, GA
Master's Student 2012 – 2014
- Participated in development of co-creative systems for drawing and dance.
- Developed a novel model for semantic parsing of natural language sentences.

Novosibirsk State University Novosibirsk, Russia
Master's Student 2009 – 2011
- In collaboration with Ledas Ltd., researched automatic generation of constraints for intuitive editing of 3D geometry in CAD software.
- Worked on novel methods of knowledge representation in AI systems.

Novosibirsk State University Novosibirsk, Russia
Bachelor's Student 2005 – 2009
- Researched a novel method for semantic parsing of natural language sentences.

RESEARCH PROJECTS HIGHLIGHT

A constructionist approach to early literacy MIT Media Lab, 2015-2018
- Based on the literature on constructionism, Montessori education and emergent literacy, designed and implemented an early literacy app *SpeechBlocks*.
- Led a preschool-based pilot study with *SpeechBlocks* and participated in two home-based studies with the app led by my colleagues.
- Key findings:
    - The approach facilitates children's engagement, agency and self-efficacy;
    - Social interactions around literacy activities emerged between children;
    - There is a need for automatic scaffolding (guidance) for the approach to be scalable.
- Related publications: C3, C1, P2

Child-driven, machine-guided learning MIT Media Lab, 2017-present
- Based on results of the previous project, proposed a child-driven, machine-guided approach and implemented an app *SpeechBlocks II* to evaluate it.
- Implemented a novel information-theoretic method to align phonemes and graphemes in English words, to support the work of the scaffolding system.
- Led a school-based study with 4-5 years old participants to evaluate the approach.
- Key findings:
    - Most children were eventually able to use the system nearly autonomously, which supported their expressive play and peer learning;
    - Children with lower self-regulation and literacy skills were more likely to engage in distracted behaviors, which reduced the effectiveness of the system for them.
- Related publication: J2

Input mechanisms for child-driven literacy learning MIT Media Lab, 2018-2019
- Implemented input mechanisms for children to communicate their intent to *SpeechBlocks II*, to support child-driven literacy learning activities: word bank, speech recognition, text recognition, invented spelling interpretation, semantic association network (the last four were innovative).
- Evaluated the design in the *SpeechBlocks II* school-based study with 4-5 year olds.
- Key findings:

    - Word bank, speech recognition, text recognition and the association network were actively used;
    - Three roles of different input mechanisms emerged: (1) helping the child implement specific ideas, (2) helping the child to browse for ideas, and (3) being a fall-back option;
    - Invented spelling interpretation was difficult to use, and text recognition led to frequent distractions.

Phoneme-based blocks for early literacy apps MIT Media Lab, 2018-2019

- Suggested using phoneme blocks to avoid the issue of orthographic complexity, which is known to interfere with early literacy learning.
- Determined optimal block design via iterative playtesting. Designed and implemented onomatopoeic characters to represent phonemes.
- Evaluated the design in the *SpeechBlocks II* school-based study with 4-5 year olds.
- Key findings:
    - Children generally found the characters engaging and understood their functioning;
    - There were differences in effectiveness of onomatopoeic mnemonics for different children, possibly determined by their preexisting letter-sound knowledge.
- Related publication: J3

PUBLICATIONS

Journal Articles

(J1) (under review) Nazare, J., Hershman, A., **Sysoev, I.**, Ballinger, S., Saveski, M., Walker, M. & Roy, D. (2022). Technology-Assisted Coaching: A System for Children's Literacy Learning. Submitted to *Computers & Education.*

(J2) **Sysoev, I.**, Gray, J. H., Fine, S., Makini, S.P. & Roy, D. (2022). Child-driven, machine-guided: Automatic scaffolding of constructionist-inspired early literacy play. *Computers & Education.*

(J3) **Sysoev, I.**, Gray, J. H., Fine, S., & Roy, D. (2021). Designing building blocks for open-ended early literacy software. *International Journal of Child-Computer Interaction.*

(J4) **Sysoev I.** (2012) A Stereotype-Based Model of Reasoning. *Program Engineering*, 9/2012, ISSN 2220-3397, New Technologies, Moscow. Russia. (in Russian)

Conference Proceedings

(C1) Hershman, A., Nazare, J., **Sysoev, I.**, Fratamico, L., Buitrago, J., Soltangheis, M., … Roy, D. (2018). Family Learning Coach: Engaging Families in Children's Early Literacy Learning with Computer-Supported Tools. *Proceedings of International Conference on Computers and Education* 2018. **Nominated for best paper award.**

(C2) Nazare, J., Hershman, A., **Sysoev, I.**, & Roy, D. (2017). Bilingual SpeechBlocks: Investigating How Bilingual Children Tinker with Words in English and Spanish. *Proceedings of the Annual Symposium on Computer-Human Interaction in Play*

(C3) **Sysoev, I.**, Hershman, A., Fine, S., Traweek, C., & Roy, D. (2017). SpeechBlocks: A Constructionist Early Literacy App. *Proceedings of the 2017 Conference on Interaction Design and Children*

(C4) Vijayaraghavan, P., **Sysoev, I.**, Vosoughi, S., & Roy, D. (2016). DeepStance at SemEval-2016 Task 6: Detecting Stance in Tweets Using Character and Word-Level CNNs. *Proceeding of SemEval (2016)*

(C5) Davis, N. M., Popova, Y., **Sysoev, I.**, Hsiao, C.-P., Zhang, D., & Magerko, B. (2014). Building Artistic Computer Colleagues with an Enactive Model of Creativity. *Proceedings of International Conference on Computational Creativity 2014*, 38–45.

(C6) Jacob, M., Coisne, G., Gupta, A., **Sysoev, I.**, Verma, G. G., & Magerko, B. (2013). Viewpoints AI. *Proceedings of Ninth Artificial Intelligence and Interactive Digital Entertainment Conference.*

Theses

(T1) **Sysoev, I.** (2020). *Digital Expressive Media for Supporting Early Literacy through Child-Driven, Scaffolded Play.* Doctoral dissertation, MIT Media Lab.

(T2) **Sysoev I.** (2011) *Applying a Variational Constraint Solver to 3D Geometry Editing.* Master's thesis, Novosibirsk State University. (in Russian)

(T3) **Sysoev I.** (2009) *Applying Lazy Evaluation to Semantic Text Analysis.* Bachelor's thesis, Novosibirsk State University. (in Russian)

Presentations and Posters

(P1) Nazare, J., Hershman, A., **Sysoev, I.**, Fratamico, L., Buitrago, J., Soltangheis, M., … Roy, D. (2018). Child-coach-parent network for early literacy learning. *International Society of the Learning Sciences*

(P2) **Sysoev, I.**, Hershman, A., Fine, S., Roy, D., Soltangheis, M., & Fitzpatrick, B. (2016). Exploring SpeechBlocks: Piloting a Constructionist Literacy App with Preschool Children. Talk at *2016 Convention of American Speech and Hearing Association*

(P3) **Sysoev, I.**, Chitloor, R. D., Rajaram, A., Summerlin, R. S., Davis, N., & Walker, B. N. (2013). Middie mercury: an ambient music generator for relaxation. Poster in *Proceedings of the 8th Audio Mostly Conference, 20. ACM.*

(P4) **Sysoev I.** (2011). Applying a variational constraints solver to 3D geometry editing. *XLIX International Scientific Students Conference, Novosibirsk, Russia.* (in Russian) **1st award.**

(P4) **Sysoev I.** (2009). Applying lazy evaluation to semantic text analysis. *XLVII International Scientific Students Conference, Novosibirsk, Russia.* (in Russian) **2nd award.**

INVITED TALKS

Fall 2019, Spring 2020, Fall 2020, Spring 2022
Guest lecture at *Language Literacy* class (Northeastern University)

TEACHING EXPERIENCE

Designing Learning Technologies for Children (MAS.S65) Spring 2022
Co-Instructor

- Led the development of the course
- Leading 8 out of 15 theoretical sessions
- Supporting students with individual projects, academic and administrative questions

Learning in the Flow of Everyday Life (MAS.S70) Spring 2018
Teaching Assistant
- Collaborated with instructors on designing the class, including considerations on format, evaluation, set of topics and invited speakers.
- Lectured one of the sessions and facilitated both in-classroom and online discussions.
- Processed students' homework and answered academic and administrative questions.
- Overall Rating: 6.5/7.

Depolarization by Design (MAS.S62) Fall 2017
Teaching Assistant
- Took notes and summarized the content of each session for students' usage. Not rated.

Introduction to Social Machines (MAS.S65) Spring 2015
Teaching Assistant
- Advised students without NLP background on basics of NLP for usage in their projects. Not rated.

MENTORSHIP

MIT Undergraduate Research Opportunities Program 2020-present, 2018, 2016
- Advised 7 MIT undergraduate students who worked on projects related to applying AI techniques to support child-driven learning.

SpeechBlocks Spring 2019
- Supervised a group of 6 Northeastern University students who took observation notes.

FELLOWSHIPS & AWARDS

- Fulbright Visiting Graduate Student Scholarship 2012 – 2014
- Donald Jackson Fellowship 2013
  Awarded to 3 Georgia Tech College of Computing MS students yearly
- Baker Atlas Fellowship 2009
  Awarded to students and alumni of Novosibirsk State University

ACADEMIC SERVICE

Journal Article Referee
IJITDM (International Journal of Information Technology and Decision Making)

Conference Paper Referee
SemEval; CHI; ACM Creativity and Cognition

INDUSTRY EXPERIENCE

Ledas Ltd. / Bricsys Technologies Russia Novosibirsk, Russia
Software Developer 2009 – 2012

- Developed CAD software on C++
- Participated in development of a novel approach to modeling in CAD systems
- Participated in designing the architecture of the system

COMMUNITY INVOLVEMENT

MIT Graduate Dorms Cambridge, MA
Recycling and Gardening Chair at Tang Hall 2017 – 2019

- Facilitated reduction in contamination of recycling streams by setting up information materials and events.
- Maintained implementation of Trash2Treasure reuse program at the dorm.
- Distinguished as an outstanding chair by Heads of House.

MIT Graduate Student Council Cambridge, MA
Sustainability Subcommittee Member 2016 – 2019

- Participated in the creation of an online course on sustainable practices for MIT students. Co-designed a survey (taken by about 490 students) to assess students' knowledge of sustainable practices.

SKILLS

- Designing learning technologies for children
- Qualitative and quantitative research
- Programming languages: C++, C#, Java, JavaScript, Python, Lisp, Haskell, MATLAB
- Object-oriented design and functional programming
- Game development in Unity
- Android development
- Machine learning, AI and NLP
- Robotics: Jibo platform
- Oral and written proficiency in Russian.
- Drawing and painting using traditional and digital media; digital animation

SELECT COURSEWORK

Massachusetts Institute of Technology
Computational Cognitive Science; Statistical Learning Theory; Designing for Learning by Creating; Creative Learning Technologies

Georgia Institute of Technology
Advanced Game AI; Artificial Intelligence; Cognitive Science - Special Topics; Computational Creativity; Interactive Fiction; Knowledge-Based AI; Machine Learning; Natural Language Processing

Novosibirsk State University
Algebra, Analytic Geometry and Numbers Theory; Analysis of Algorithms; Calculus; Decision Theory; Mathematical Logics; Mathematical Optimization; Methods of Discrete Mathematics; Neurocomputers; Systems and Methods of Artificial Intelligence; Theory of Probability and Mathematical Statistics

REFERENCES

Deb Roy: PhD advisor, instructor of the classes TA-ed by Ivan. *Research and teaching reference.*
Professor of Media Arts and Sciences, MIT Media Lab.
dkroy@media.mit.edu

James Gray: research collaborator, instructor of MAS.S70, TA-ed by Ivan. *Research and teaching reference.*
Research scientist at MIT Media Lab. Previously, VP of Learning Design at Sesame Workshop and Director of Learning at LeapFrog Enterprises.
jhgray@media.mit.edu

Mitchel Resnick: PhD thesis committee member. *Research reference.*
Lego Papert Professor of Learning Research, MIT Media Lab.
mres@media.mit.edu

Catherine Snow: PhD thesis committee member. *Research reference.*
Patricia Albjerg Graham Professor of Education, Harvard Graduate School of Education
catherine_snow@gse.harvard.edu

Susan Fine: research collaborator. *Research reference.*
Assistant Clinical Instructor, Language and Literacy Program at Northeastern University
s.fine@northeastern.edu