PROJECT 29329

PLAYGROUND

Animated Playgrounds for Learning

1. Project summary

PLAYGROUND will design a computational playground where children aged 4-8 can play and create their own games using **tools and metaphors of animation** as a means to express the rules — an entrée for children into abstract worlds closed to them until now. Children will engage in quasi-formal thinking, gaining access to formal systems, without having first to learn their symbols and conventions. Prototypes will progressively integrate tactile interaction, speech, intelligent 'pals' (personal assistants for learning), and gesture in virtual reality. The functionality of the playground will be evaluated throughout all phases of its design by **comparison with a second playground** developed in a new, state-of-the-art system, *OpenLogo*, with a non-textual interface but without animated code. Playground design will take place concurrently with **studies of children learning and social interactions** with peers and adults, across a sample of European schools and clubs. Evaluation of the children's games, game creation and learning outcomes will identify cultural, conceptual and developmental variation.

Objective 1: to design and build a playground.
>   Result : A playground, based on an animation-based kernel, ToonTalk, (TT) where children (aged 4-8 years) design and play their own games.

Objective 2: to evaluate the new paradigm through comparison.
>   Result: An analysis of the power and functionality of the new concepts and metaphors, by comparison at every stage of the design process with a second playground built on a newly-developed evolution of Logo, OpenLogo, (OL).

Objective 3: to enhance the ToonTalk and OpenLogo kernels.
>   Result: Extensions of the ToonTalk and OpenLogo kernels with new generic capabilities for tactile, oral and physical means of expressing the rules underlying games, and with organic enhancements emerging from a rolling programme of analysis of children's activities.

Objective 4: to evaluate games and game creation.
>   Result: Evaluation reports of the games and game creation of children from different European cultures and of different ages, working in the two playgrounds.

Objective 5: to evaluate learning about rules
>   Result: Case studies of how children learn to express and manipulate rules, and comparative analyses of how they learn by interacting in each playground, with each other and with adults, and analyses of learning outcomes.

Objective 6: to develop principles for playground design
>   Result: A set of principles for playground design for use in future technical, commercial and policy developments.

Objective 7: to Disseminate results.
>   Result: Large-scale dissemination of the playgrounds, the analyses of children games and game creation, and the set of design principles.

The project consists of a consortium of partners from UK, Portugal, Sweden and Slovakia, both academic and commercial, with complementary expertise in computer science, educational research and development, and young children's learning. We will exploit the cross-cultural dimension of the project to make comparisons between the games, game creation and learning in different countries and contexts. The division of labour between *participants* is as follows:

	Development of TT-playgrounds	Development of OL-playgrounds	Enhancement of kernel systems	Research on activities within playgrounds
IoE	YES	YES		TT/OL
Logotron			TT	
CNOTINFOR	YES	YES		TT/OL
Uppsala	YES		TT	TT
Comenius		YES	OL	

The *impact* of the expected results will be through the playgrounds with their technical enhancements, the evaluation of the utility for learning of its metaphors and paradigm, and the set of design principles which will be disseminated to feed into the next generation of tools for commercial and policy development.

Results will be communicated through an extensive network of schools and clubs; workshops; presentations at academic and professional conferences; press releases to popular media; our web site and an international invited seminar for key academic, industrial, and professional figures.

1. Objectives and results

Early learning
Objective 1: Creative game construction

> *Method:* Children will design interesting and challenging games for themselves and for others. The games will be played and judged in two games workshops conducted simultaneously in different countries. Sites for the workshops will be connected over the Internet so judgements can be compared and discussed by adults and children. Analysis will draw out differences in games deriving from children using different tools, different ages and in different cultures Schools will be connected via the internet, and games played in native languages of the children. Appropriate translation into a common language (English) will be made by the project officers where necessary.

> *Expected Result 1:* Games and their evaluations (by adults and children), and comparisons and contrasts between playgrounds and between cultures.

Objective 2: Learning through game design, about rules, the different ways they can be expressed, how they can be changed and the implications of modifications

> *Method:* Analysis will identify the ways in which children's expression and modification of rules throw light on existing developmental sequences in game playing, and the extent to which these are mediated by tools and cultures. Case studies in core sites in Sweden, Portugal and UK, will include interviews with teachers and adult helpers on attitudes to game design, and the appropriateness of the new metaphors and tools; task-based interviews with children around their games to probe their understandings of rules and the functionality of the new paradigm; ethnographic and participant observation; children's reflections on videotapes of their and others' play. Orally-administered closed questionnaires and selected interviews with children of different ages in outer sites in Sweden, Portugal and UK.

> *Expected Result 2:* Description of what is learned about rules and rule creation, analyses of different trajectories in learning, comparisons and contrasts between playgrounds and cultures.

Objective 3: Learning to interact and learning by interacting. Children will learn to negotiate with others (a computerised personal assistant, peers and adults) about the games they create and play, and by so doing, learn to reflect on their learning.

> *Method:* The interactions between children and children, and children and adults (teachers, parents, older siblings) around playground activity will be documented in case studies and analysed. Structured tasks will be designed to test whether or not well-defined learning goals have been achieved. Children working in each playground will serve as comparison groups, one for the other. Work will include a small number of more fine-grained experimental studies to test what learning is taking place, and how it might be improved

> *Expected Result 3:* Analysis of interactions between children and children and adults and how these are mediated by the metaphors and tools available in the playgrounds and by the different cultural contexts of the European partners. Analyses of learning outcomes from structured tasks and experimental studies

New tools
Objective 1: To build a playground based on the animation-based tools and metaphors of ToonTalk

Objective 2: To exploit comparisons between the design processes of playgrounds in ToonTalk and in OpenLogo to generate new concepts and principles for the design of playgrounds to support learning about rules.

Objective 3: To integrate into the playgrounds through kernel enhancements (physical, oral and tactile interfaces and collaborative tools), to enhance their potential for creative game construction and for promoting the appreciation of rules.

Objective 4: To improve the playgrounds in terms of their potential for learning and creative design on the basis of feedback from studies of children interacting in the playgrounds.

Method: The raw material on which we will base the iterative design and construction of the playground is ToonTalk. The key question is to design playground tools which enable the metaphors of ToonTalk and its connections with children's culture to be exploited to offer apertures for children into the world of quasi-formal, abstract thought. We will evaluate how to exploit ToonTalk's natural way of expressing concurrency and the simple metaphors for program writing and message passing, in order for children to create their own games and rules without encountering the unnecessary obstacles of interacting with text, typing and fixing syntax errors.

OpenLogo will integrate direct manipulation tools into a graphical formal language, with Internet and multimedia support, and animation. Although these features will begin to tackle the issue of accessibility to serious programming which has always been problematic in Logo, the OpenLogo playground will not be based on the new, animation paradigm of the ToonTalk playground. It is this fundamental difference which we will investigate — aiming to evaluate the new paradigm against the yardstick of a tried and tested Logo paradigm and all that has been found about learning within it.

The two kernels, ToonTalk and OpenLogo will be enhanced in two ways: a first set of enhancements, which we call *generic,* to add to the ways users can interact with the system and to help them to interact more effectively for learning. Generic enhancements will include 'force-joystick' control; speech; multi-user capabilities, real and virtual; a personal assistant for learning (called a *pal)* growing and adapting to a child's needs, and helping establish learning goals; and, in mock up at least, virtual reality — so that children will be able to *gesture* in front of the screen — and artificial life environments. These enhancements will be integrated into the playgrounds as part of a working system which will add genuine functionality to the playing and designing of the games by children. The second set of enhancements which we call *'organic'* enhancements will also be put in place as a result of continual interplay with needs identified in playground prototyping and testing with children. The TT kernel has been prototyped in the US, independently of EC funding. Two members of the IoE team will make annual visits to the US developers, in order to feed into the PLAYGROUND project ongoing developments on the kernel and to shape it in ways which support the project.

A log of evolving design decisions and choices will be set up at the first project meeting. This will be revisited and extended through discussions between partners where new information from prototype testing and the studies of children and their games will be fed in and discussed from cross-country and cross-playground perspectives.

Expected Results: TT and OL playgrounds based on enhanced versions of the kernels. A set of design principles for future initiatives and exploitation.

2. Project Workplan and Deliverables
The workplan is divided into 9 workpackages and tasks as follows:

1 TT kernel enhancement

2 OL kernel enhancement

3 TT Playgrounds

4 OL Playgrounds

5 TT Case studies and evaluation of games

6 OL Case studies and evaluation of games

7 Studies of learning and structured tasks

8 Dissemination

9 Management.

The project is divided into three yearly phases, at the end of which there will be *Milestone meetings* (A, B, C) to receive the deliverables of the relevant Workpackages (WPs), from which a report will be drawn up and submitted to the commission, together with the specified deliverables. The project starts with an initial design workshop.

Crucial to achieving our objectives is close interaction between schools and teachers, and developers of the playgrounds. To this end, we have already secured the agreement in principle of a number of schools to join the project. All these schools are known to the University partners in UK, Sweden and Portugal, and good working relationships are already established. In UK, we have secured the agerement of a Local Education Authority to support the project in terms of school access, staff availability and general IT support. One person (not funded by ESPRIT) has been allocated to support the project. The following schools (See Table 1) have agreed to participate: final choices will be made in terms of core and outer sites for our research, after contracts have been signed.

CAMBRIDGE	UPPSALA	COIMBRA
St. Phillips Primary	Lidingö Resursskola Högstadiet	Private schools:
Morley Memorial		Colégio Valsassina - Lisboa (1500 pupils)
Romsey Junior	Broskolan, Bro	Colégio Nossa Senhora do Rosário - Porto (1100 pupils)
Histon and Impington Junior		
Queen Edith Primary	Lilljöskolan, Kungsängen	Official shools:
St. Matthews Primary		Escola EB 1 nº 2 da Lousã - Coimbra (+ / - 150 pupils)
Park St Primary	Råbyskolan, Bro	
Kings Hedges		Escola EB 1 nº 16 de Coimbra - Coimbra (+ / - 150 pupils)
LONDON		Non formal schools:
		ABC da Tartaruga - Coimbra
Netley School		Sábados Diferentes - CIAP - ESE de Paula Frassinetti - Porto

Table 1: Preliminary list of schools agreeing to participate in research and evaluation

We intend to start work with children aged approximately 8 years, in the second year we will work with 5-8 year-old children, and in the third year, 4-8.

WP 1: TT kernel enhancement

Objective: To implement generic and organic enhancements of the ToonTalk kernel.
Lead partner: Logotron. **Others:** None.

Approaches: The approach to kernel development will be iterative, involving constant prototyping and fast testing within sites, and across sites. We will not wait to try out prototypes with children until they are technically tested, but will instead try small-scale explorations with children whenever we have a technical development. This will ensure that educational priorities are not preempted by technical decisions, and help to control technical enthusiasm which does not genuinely serve educational interests.

Activities: The technical enhancement of the TT kernel will involve 4 tasks: 1. the development of force joystick & speech; 2. multi-user & PAL and 3. VR/a-life mock-up; 4. Preparation of software package and documentation. In addition, organic developments arising from WPs 3, 5 and 7 will be incorporated into each prototype. Each significant development will be accompanied by provisional versions of documentation, and will be distributed across collaborating sites and schools.

Dissemination: We intend to disseminate widely and continuously through our schools network, research sites, and other collaborating groups as well as other i[3]-ese projects. The web will be used for making available downloadable versions of the systems, and for allowing the broader professional and research community to access Java-based simulations of working prototypes.

Task	Type of deliverable	Description	Avai	Partner resp.	Milestone	Mnth
1.1	TT Generic prototype i.	Force Joystick/Speech & organic enhancements	R	Logotron	Mtg. A	12
1.2	TT Generic prototype ii.	Multi-user / PAL & organic enhancements	R	Logotron	Mtg. B	24
1.3	TT Generic prototype iii	VR/a-life mock-up & organic	R	Logotron	Mtg. C	36
1.4	TT Package	Software & documentation	C	Logotron	Mtg. C	36

WP 2: OL kernel enhancement

Objective: To implement generic and organic enhancements of the OL kernel.
Lead partner: Comenius. **Others:** Logotron.

Approaches: The approach to kernel development will be iterative, involving constant prototyping and fast testing within sites, and across sites. The primary rationale for WP 2 is to provide a comparative framework against which technical developments in WP1 can be gauged, and to allow the researchers to tap into the existing research evidence on Logo-based systems. OL will allow very fast prototyping, and the school sites will involve children and teachers who already have a working knowledge of Logo systems.

Activities: The technical enhancement of the OL kernel will involve 4 tasks, or similar enhancements depending on available system support: 1. the development of force joystick & speech; 2. multi-user & PAL and 3. VR mock-up; 4. Preparation of software package and documentation. In addition, organic developments arising from WPs 4, 6 and 7 will be incorporated into each prototype. Each significant development will be accompanied by provisional versions of documentation, and will be distributed across collaborating sites and schools.

Dissemination: We intend to disseminate widely and continuously through our schools network, research sites, and other collaborating groups as well as other i[3]-ese projects. The web will be used for making available downloadable versions of the systems, and for sharing children's early and for headlining new functionalities of the system as they emerge.

Task	Type of deliverable	Description	Avai	Partner resp.	Milestone	Mnth
2.1	OL Generic prototype i.	Force Joystick /Speech & organic enhancements	R	Comenius	Mtg. A	12
2.2	OL Generic prototype ii.	Multi-user / PAL & organic enhancements	R	Comenius	Mtg. B	24
2.3	OL Generic prototype iii	VR/a-life mock-up & organic enhancements	R	Comenius	Mtg. C	36
2.4	OL Package	Software & documentation	C	Comenius	Mtg. C	36

WP 3: TT Playground

Objective: Design and build TT Playground
Lead partner: Uppsala. **Others:** CNOTINFOR/IoE

Approaches: A key aspect of the iterative development of the TT Playground which will centrally include technical developments, will be that these proceed alongside the technical development of WP 1. WP 3 is divided into 4 tasks: the first building a playground on the basic kernel, and subsequent iterations using the new functionalities specified in WP 1. Thus we expect new functionalities to be developed which support new kinds of games within the Playground, and, simultaneously, for our knowledge of game-design to inform WP 1 as it develops.

The main thrust of playground development from the software point of view, will involve constructing new objects, new functionalities, and new kinds of interactions in TT, and at a level below TT (but probably not involving much base-level programming of the TT kernel).

Activities: TT playground I specification follows first workshop and is implemented as prototype i Subsequent specifications and prototypes build on outcomes of WP 5 and 7, and new kerne enhancements, at milestone meetings A, B and C. Games will be developed, trialled and tested with children. Working prototypes of games and game-design activities will be tried out continually. We expect our knowledge of game design in the new environment to embark on a steep learning curve, with many iterations contributing to a single qualitative evolution of the system. Annual visits to US TT developers.

Dissemination: A key activity, given the approach outlined above. We will make extensive use of the web, and of electronic communication between schools and sites. As interesting games emerge, we will outline these on the web site, and we expect to enter into dialogue with children, teachers, parents, as well as researchers and other interested professionals. We expect to disseminate policy and commercial data as it becomes available.

Task	Type of deliverable	Description	Avai	Partner resp.	Milestone	Mnth
3.1	TT playground prototype i	Playground on basic kernel	R	Uppsala	Mtg. A	12
3.2	TT playground prototype ii	Playground + enhancements i	R	Uppsala	Mtg. B	24
3.3	TT playground prototype iii	Playground + enhancements ii	R	Uppsala	Mtg. C	36
3.4	TT playground package	Software and documentation	C	Uppsala	Mtg. C	36

WP 4: OL Playground

Objective: Design and build the OL Playground
Lead partner: Comenius. **Others:** CNOTINFOR/IoE

Approaches: as for WP 3,with one major difference. We anticipate that the balance of design activity between teacher/developer and child will need to shift, perhaps heavily, in favour of teacher/developer, as even the new Logo will still be largely dependent on text-based interaction, and we do not anticipate many children being able to interact at the design level. However, OL will allow fast prototyping of games by the designers and researchers, and we will make these available with a fast turn-around time between design and trialling.

Activities: OL playground I specification follows first workshop and is implemented as prototype i Subsequent specifications and prototypes build on outcomes of WP 6 and 7, and new kerne enhancements, at milestone meetings A, B and C. Games will be developed, trialled and tested with children. Working prototypes of games and game-design activities will be tried out continually. We expect our knowledge of game design in the new environment to embark on a steep learning curve, with many iterations contributing to a single qualitative evolution of the system.

Dissemination: as WP3, but we do not anticipate working games on the web at present.

Task	Type of deliverable	Description	Avai	Partner resp.	Milestone	Mnth
4.1	OL playground prototype i	Playground on basic kernel	R	Comenius	Mtg. A	12
4.2	OL playground prototype ii	Playground + enhancements i	R	Comenius	Mtg. B	24
4.3	OL playground prototype iii	Playground + enhancements ii	R	Comenius	Mtg. C	36
4.4	OL playground package	Software and documentation	C	Comenius	Mtg. C	36

WP 5: TT Case studies and evaluation of games

Objective: To analyse and evaluate the games created by the children, the ways they are played and how children exploit the new metaphors for rule-making
Lead partner: IoE. **Others:** CNOTIFNOR/Uppsala

Approaches: Core study sites established in UK, Portugal and Sweden will be used for detailed ethnographic study of children's interactions with developing prototypes of the systems. Initially, the observation will be relatively unstructured, but will become progressively focussed around particular rule-strategies. At this point, observation schedules will be devised as guides to the ongoing work. At this point too, audio and/or video will be used to capture the interactions around particular uses of playground tools. Children will be encouraged to devise their own web sites and exchange information in an ongoing way (Java scripts of projects will be easily produced by within playgrounds). The games workshops will be the cumulative endpoints of these ongoing interactions. All this work will be undertaken with teachers, either as part of their day-to-day activity in schools, or in already-established out-of-school activities. It will be developed and supported by the project teams (and, in UK, by LEA personnel — see above).

We anticipate that observations will take place at least once a week in all core sites. Initially these will be open-ended, but after consultation with teachers and ongoing comparisons across sites, we will progressively focus on children playing and devising particular types of games with specific tools.

Interviews will be conducted with teachers and other adult helpers, as well as with children during or after their game playing. These interviews will be initially open, and then progressively refined to probe particular aspects of the game design and the role of the tools.

Outer sites will be identified and equipped where less detailed evaluation will take place. Questionnaires will be devised on the basis of the ongoing results in core sites, to be given to teachers with selected children. We anticipate that 80 children will be involved in the UK, and 40 in each of Portugal and Sweden. We are aiming for a time allocation pf approximately 30-40 hours per year per child, although we anticipate that some children will be able to devote considerably more time than this.

The observers will be project personnel, and observations will be augmented by comments produced by teachers and the children themselves. In both these latter cases, participants will be asked to keep a diary of their ongoing work: some or all of these diaries will form part of emerging evaluation available with restricted access to the project participants.

Comparative analyses will include responses of teachers in the various countries to the sets of tools and questions; and responses of children to particular aspects of game design and specific aspects of games.

Activities: Core and outer sites established and equipped; case studies in core sites; orally-administered questionnaires, selected interviews (teachers, parents, children); documentation of design process of games, and design decisions log. Research reports, case studies for playgrounds i ii & iii. Games workshops (X, Y) where children from different countries evaluate each others' games.

Dissemination: Extensive use will be made of the web, and interactions with other i^3-ese projects will be important in establishing a wider network through which results can be disseminated. Conferences, reports, papers, seminars etc. will be employed. We intend to interest teachers, policy makers, educational publishers, and education professionals in partner countries and elsewhere.

Task	Type of deliverable	Description	Avai	Partner resp.	Milestone	Mnth
5.1	Design documentation	Description of types of games	R	IoE	A, B, C	12,24 36
5.2	Case study reports	Analysis: activities/interviews	R	IoE	A,B,C	12,24 36
5.3	Evaluation of games	Games + Analysis + kids' commentaries	R	IoE	B,C	24,36

WP 6: OL Case studies and evaluation of games

Objective: To provide a comparative baseline for the evaluation of the games created by the children
Lead partner: IoE. **Others:** CNOTINFOR

Approaches: As WP 5, but starting at month 9. Then iterative with outcomes at milestone meetings.

Activities: Core and outer sites established and equipped; case studies in core sites; orally-administered questionnaires, selected interviews (teachers, parents, children); documentation of design process of games, and design decisions log. Research reports, case studies for playgrounds i ii & iii. Games workshops (X, Y) where children from different countries evaluate each others' games.

Dissemination: As WP 5. We will also take the case studies for dissemination within the Logo community publish on the Logo websites and discussion groups, in order to maximise the feedback we obtain for the comparative aspects of the research.

Task	Type of deliverable	Description	Avai	Partner resp.	Milestone	Mnth
6.1	Design documentation	Description of types of games	R	IoE	B,C	24,36
6.2	Case study reports	Analysis: activities/interviews	R	IoE	B,C	24,36
6.3	Evaluation of games	Games + Analysis + kids' commentaries	R	IoE	B,C	24,36

WP 7: Studies of learning and structured tasks

Objective: To analyse how children of different ages devise, express and modify rules in the process of game design.

Lead partner: IoE. **Others:** CNOTINFOR/Uppsala

Approaches: Focused studies which will be based on carefully-designed tasks, designed to probe what children are understanding, and how the different playgrounds afford them the opportunity to express themselves in new ways. These will be structured around simple games, in which children will be asked to predict outcomes, vary parameters, interpret and modify given rules, in order that we will be able to undertake some quantitative as well as qualitative evaluation of children's performance.

Activities: Piloting in all sites; detailed investigation of learning through task-based interviews questionnaires (children/teachers); small-scale longitudinal studies of selected children in selected core sites in UK, Sweden, Portugal.

Dissemination: The partners already have an extensive network of collaborators and colleagues with whom they will disseminate in the normal way (reports, papers etc.). In addition, our commercial partners will be tapping into commercial networks with a view to disseminating our findings widely. Publishers teachers, parents will be targeted.

Task	Type of deliverable	Description	Avai	Partner resp.	Milestone	Mnth
7.1	Task schedules	Task description & implementation	R	IoE	B	24
7.2	Learning outcomes	Response analysis	P	IoE	C	36

WP 8: Dissemination

Objective: To inform the education world of the background, philosophy, progress and results of the project and to make project materials available to other workers, publishers, researchers and stakeholders in the wider educational community.

Lead partner: IoE. **Others:** All.

Approaches: Our overriding approach will be to disseminate our findings across a wide range of commercial and research communities and commercial concerns, including demos of playgrounds to media in Europe and elsewhere. Careful documentation of dissemination of all partners to ensure adequate coverage of project outcomes to different audiences, and these will be submitted to milestone meetings B and C.

Activities: Continual updating of web site; schools network; demonstration workshops; papers, reports, working prototypes at all stages. Broadening existing links with games/home publishing (Comenius) and out-of-school sites. Press releases, out-of-school workshops.

One international seminar to disseminate project outcomes will be hosted by CNOTINFOR in month 27.

Task	Type of deliverable	Description	Avai	Partner resp.	Milestone	Mnth
8.1	Website	Design and pub. of website	P	IoE	A	12
8.2	Schedule of demos, papers, workshops	Documentation of diss activities of all partners	P	IoE	A,B,C	24,36
8.3	International Seminar	Invited seminar	P	CNOTINFOR	C	36
8.4	Schools network	Children's commentaries	P	IoE	B,C	24,36

WP 9: Management

Objective: Effective and efficient project control and management
Lead partner: IoE. **Others:** All

Approaches: Each of the 5 project partners is involved in several tasks within the workpackages, and each will attend project meetings. These are circumstances which assist communication and the establishment of the shared understandings necessary for the iterative design processes. However, as the iterative processes and the cross-dependencies of tasks and workpackages increase so does the need for intensive monitoring and evaluation.

The main risk we foresee is the delay of technical development due to bottlenecks in availability of software components; we intend to control this risk by early prototyping of existing versions, and we will maintain flexibility in the order of evolution of the technical development, while ensuring deliverables are produced on schedule.

Activities: Financial management; contract management; global planning; quality control and progress of deliverables as specified.

Task	Type of deliverable	Description	Avai	Partner resp.	Milestone	Mnth
9.1	Annual financial reports	Expenditure of partners against targets	C	IoE	A,B,C	12,24 36
9.2	Annual progress reports	WP+deliverables reporting	R	IoE	A,B,C	12,24 36
9.3	Quality control reports	S/ware, evals, documentation	R	IoE	A,B,C	12,24 36