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Children's Participation Patterns in Online Communities: An Analysis of Israeli Learners in the Scratch Online Community

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Abstract

Online participation and content contribution are pillars of the Internet revolution and are core activities for younger generations online. This study investigated participation patterns, users' contributions and gratification mechanisms, as well as the gender differences of Israeli learners in the Scratch online community.

The findings showed that: (1) Participation patterns reveal two distinct participation types - "project creators" and "social participators", suggesting different users' needs. (2) Community members gratified "project creators" and "social participators" for their investment – using several forms of community feedback. Gratification at the user level was given both to "project creators" and "social participators" – community members added them as friends. The majority of the variance associated with community feedback was explained by seven predictors. However, gratification at the project level was different for the two participation types - active "project creators" received less feedback on their projects, while active "social participators" received more. Project feedback positively correlated with social participation investment, but negatively correlated with project creation investment. A possible explanation is that community members primarily left feedback to their friends. (3) No gender differences were found in participation patterns or in project complexity, suggesting that Scratch provides similar opportunities to both genders in programming, learning, and participation.

Keywords: content contribution, participation patterns, Scratch, remix, online learning, community feedback, gender differences.

Introduction

Scratch is a visual programming environment developed by the Lifelong Kindergarten Group at the MIT Media Lab that enables children to create interac-

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tive media (Scratch International site: http://scratch.mit.edu; Scratch Israeli site: http://www.scratch.org.il). Young people use Scratch to create animations, simulations, games, interactive art, and stories (Maloney et al., 2004). One of the goals of Scratch is to foster creative thinking (Resnick, 2007b) through the creation of personally meaningful digital artifacts, in the spirit of Papert's (1991) ideas of constructionist learning and the more general notion of constructivism (Bruner, 1990; Dewey, 1916; Piaget, 1972; Vygotsky, 1978). Using constructionist learning environments in a natural way, children can learn complex concepts - such as causal models of dynamic behavior (Zuckerman, Grotzer, & Leahy, 2006). Online learning environments can be designed using models that are based on constructivism learning theory (Koohang, Riley, Smith, & Schreurs, 2009).

Scratch resonates with the youth culture by making it easy for people to use graphics and music – key technological interests for young people (Kafai, Peppler, & Chiu, 2007). Scratch promotes creative thinking (Romeike, 2008b), which influences students' motivation, concentration, and achievement (Fasko, 2000). Unlike other social media sites such as YouTube or Flickr, Scratch lets people share programmable media (Monroy-Hernández, 2007), that is, digital artifacts that can interact and respond to behavior programmed by its creator. Projects can be deconstructed and rebuilt into new ones, a process that can help children learn practical programming (Millner, 2005). The intuitive programming offered by Scratch enables the acquisition of key programming concepts even in the absence of instructional interventions or highly experienced mentors (Maloney, Peppler, Kafai, Resnick, & Rusk, 2008).

The Scratch online community provides a social aspect to the Scratch environment. It promotes interactions between community members, the creation of original or remixed projects, and the sharing of outcomes on the community site (Rosenbaum, 2008). Each original or remixed project is associated with all of its previous creators - showing respect for authorship and fostering collaboration by familiarizing community members with each other's creations (Sylvan, 2007).

Participation patterns in content communities are usually associated with content contribution, community involvement, and silent participation, i.e., lurking (Rafaeli & Ariel, 2008). Monroy-Hernández and Resnick (2008), inspired by Lave and Wenger's legitimization of peripheral participation in situated learning (1991) and Jenkins's analysis on fan communities (2006), suggested four different roles or states of participation in user-generated-content communities: passive consumption, active consumption, passive production, and active production. In the Scratch community context, Monroy-Hernández and Resnick (2008) map the four states of participation as follows: passive consumption - viewing projects on the community website; active consumption - social participation in the community such as commenting, tagging, or rating others' projects; passive production - project creation or remixing, while keeping the project to themselves; active production - project creation or remixing and sharing the project with the online community.

The motivation for content contribution in an online community can be examined through an analysis of users' logs, as well as by exploring the relationship between participation and community feedback (Rafaeli & Ariel, 2008; Rafaeli, Raban, & Ravid, 2007). Rubin's users and a gratification model (1994) suggested five generic motivation clusters of needs that media could fulfill: cognitive, affective, personal integrative, social integrative, and diversion needs. Based on Rubin's approach, different participation patterns can fulfill different Scratch users' needs: users with salient social integrative needs may prefer social participation; users with salient cognitive needs for understanding or with affective needs for aesthetics, pleasure, and entertainment, may prefer project creation or remixing.

Programming is traditionally perceived as a male-dominated area. The low participation level of school-aged female students in computer science lessons is well documented (Romeike, 2008a).

However, no gender difference in participation was found in the study of the early Scratch international community (Sylvan, 2007).

This study investigated the participation patterns, users' contribution and gratification mechanisms, as well as the gender differences of Israeli learners in the Scratch online community. The study hypotheses were that (1) project creation and social participation measures would not correlate, (2) individual investment in the community would positively correlate with community feedback both at the user and project level, and (3) there would be no significant gender differences in participation patterns and project complexity.

Method

Participants

The participants were a group of Israeli Scratch community members: 65 children, 35 (53.8%) of them girls. The participants' ages ranged from 9 to 17; the mean age was 11.5 years, and the median 11. All the participants were registered community members and content contributors at some level. All the participants (except two) were Israeli elementary school students who learned how to use the English version of Scratch at their school (the local Hebrew version was not available at the time of this study). The other two participants were Israeli children that spontaneously joined the online community and interacted with other community members. We decided to not exclude their data from the analysis and verified that their online behavior and specifically their contribution levels were average - not extremely active or passive. The students were introduced to Scratch through guided learning in the classrooms with the same teacher. They studied the application in a step-by-step process, registered to the online community as part of their learning process, and continued to use Scratch at home, both for creating new projects and for browsing through the community's projects.

Instruments and Procedure

The Scratch online community log files (September 2007 - July 2008) were used to analyze data concerning content contribution levels, participation patterns (we will use the terms "project creation" and "social participation" for the active production and active consumption patterns respectively), community feedback to individual investment (at the user and project level), and data concerning a project's measured complexity and a user's stated demographic information.

Study measures

- Project creation was measured by the number of original and remixed projects per user. In Scratch, every user can create a project using the authoring tool and then upload the project to the online community. Other community members can view the project, download its code, edit/repurpose the original project into a "remixed" project, and upload it again to the community. The online identity of the original creator as well as all following remix creators is kept in the project file.
- Social participation was calculated as the number of friends, comments, favorites, posting in galleries, and "love-its" rating. In the Scratch online community, members can participate socially by adding other members as their friends. Note that in Scratch friendship is not symmetrical, member X can add member Y as his friend but member Y is not obligated to add member X as friend as well. In addition, members can post comments on any project, can mark a project as their favorite, can associate a project into a user-created gallery of projects, and can mark a project as "love-it" as a form of recommendation.

- Community feedback at the user level was measured as the number of participants that defined a member as their friend.
- Community feedback at the project level was measured by the number of member's projects viewed, commented, marked-as-favorite, downloaded, remixed, or marked-as-love-it (by other community members).
- Project complexity was calculated per user, as the mean of all user projects' scripts and sprites. In Scratch, scripts are the pieces of code users assemble together, and sprites are the visual objects they move around the screen (i.e. characters, objects, background images etc.). These two complexity parameters highly correlated each with other ($r = .83$, $p < .01$). Note that project complexity is a technical measurement and is not an assessment of the project's quality. A project can have very few scripts and/or sprites and still be very interesting, engaging, or convey a complex interaction.

Results

Project Creation

From September 2007 until July 2008 the 65 users of the Israeli Scratch community created 6454 projects. Figure 1 shows the projects distribution. (Range: 5-1592, Mean: 99.29, SD: 232.66, Median: 49).

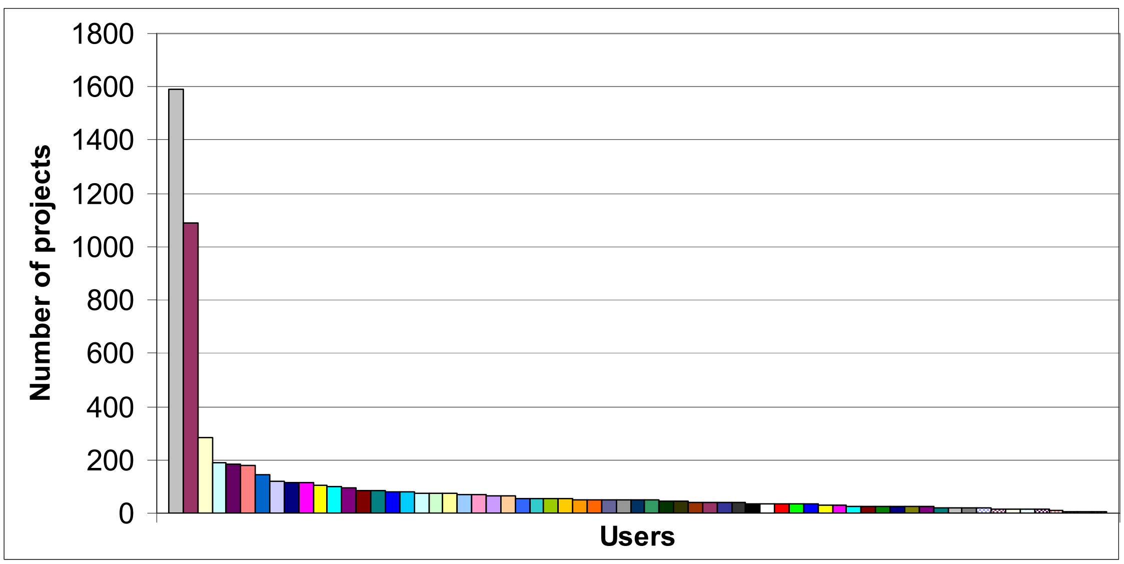

Figure 1: Distribution of projects created by Israeli Scratch community (September 2007 - July 2008)

Figure 2 presents three levels of content contributions among the Israeli Scratch community users – moderate, active and very active contributors.

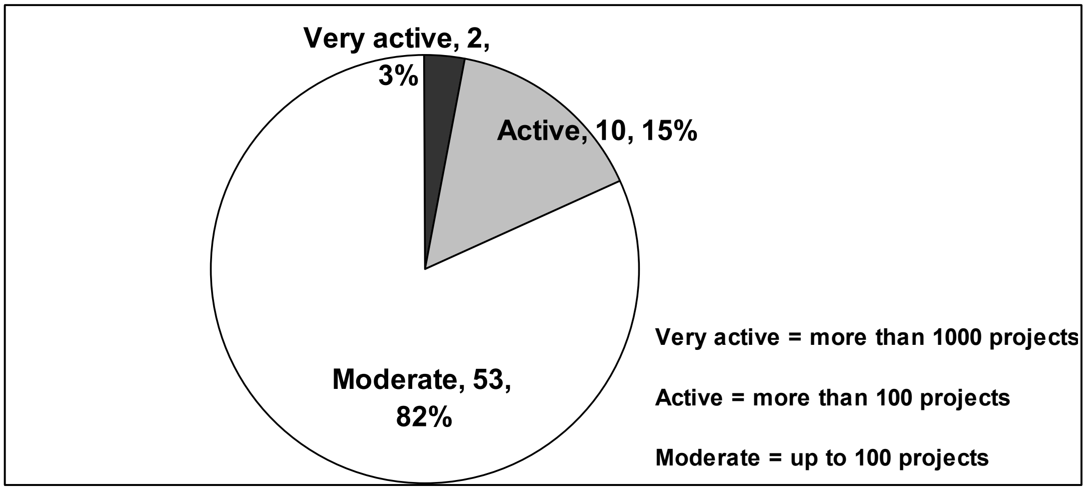

Figure 2: Levels of content contribution among Israeli Scratch community users: moderate, active, and very active

Figure 3 presents the distribution of projects created by each category of content contributors (i.e., moderate, active and very active users).

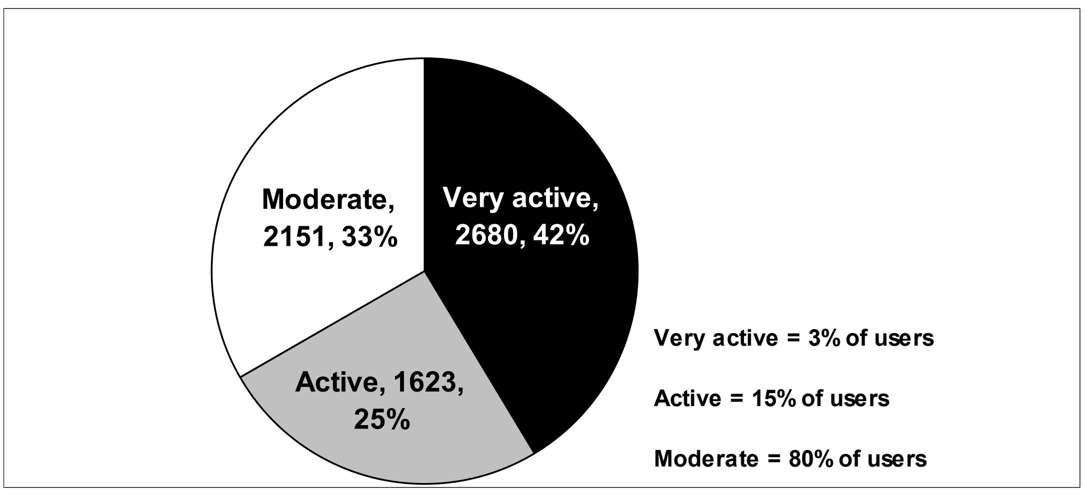

Figure 3: Number of projects created by each category of content contributors

Salient characteristics of project creation were the number of original projects (Range: 5-1592, Mean: 92, SD: 229.2), remixed projects (Range: 0-85, Mean: 7.29, SD: 14.27), and projects downloaded by the user (Range: 0-221, Mean: 20.43, SD: 32.3). Different measures of project creation participation type, such as creating original or remixed projects, viewing others' projects, and downloading their code, significantly correlated to each other (Table 1).

Table 1: Correlations between measures of project creation participation

	Total Projects	Original Projects	Remixed Projects	Views
Views	.356(**)	.352(**)	.149	
Downloads	.664(**)	.661(**)	.201	.690(**)

** $p < .01$

Social Participation

The most salient characteristic of social participation was the number of friends a user has added (Range: 0-296, Mean: 11.94, SD: 47.03). As Table 2 shows, statistically significant correlations were found within different measures of social participation investment, such as making friends, posting in galleries, writing comments, giving "love-its", and favorites rating.

Table 2: Correlations between measures of social participation

	Favorites	Friends	Galleries	Comments
Friends	.385(**)			
Galleries	.143	.416(**)		
Comments	.122	.295(*)	.389(**)	
"Loveits"	.196	.168	.317(**)	.642(**)

* $p < .05$, ** $p < .01$

However, different measures of project creation and social participation did not correlate significantly with each other (all *p*'s > .4).

Community Feedback

As Table 3 shows, statistically significant correlations were found within different measures of the community feedback at the *project* level, such as the number of member's projects viewed, downloaded, commented, marked-as-favorite, or marked-as-love-it by other community members.

Table 3: Correlations between community feedback measures

	Be viewed	Be favorite	Be commented	Be loved
Be commented	.321(**)	.476(**)		
Be loved	.550(**)	.630(**)	.638(**)	
Be downloaded	.541(**)	.389(**)	.280(*)	.326(**)

* $p < .05$, ** $p < .01$

Multivariate regression analysis indicated that four types of community feedback (project viewed, loved, commented, and favorited by others) explained 42.2% of variance in projects downloaded, $F(4, 60) = 10.94$, $p < .001$. Project downloads were predicted by viewing projects by others, $t(60) = 5.15$, $p < .001$, $\beta = .62$, marking it as favorite, $t(60) = 3.45$, $p < .001$, $\beta = .45$, and receiving "love-it", $t(60) = 2.14$, $p < .05$, $\beta = .36$.

However, the community feedback at the *user* level (i.e., the number of participants that defined a member as their friend) did not correlate significantly with any form of the community feedback at the project level (all *p*'s > .1). Since community feedback at the user and community feedback at the project level were not correlated, in the following section we examine separately community gratification mechanisms for each level.

Participation and Community Feedback: User Level

At the user level all participants receive community feedback in the form of "befriending" - the number of participants who defined a user as their friend. As Table 4 shows, this variable is correlated with both project-creation (i.e., viewing and downloading projects of others) and social participation measures (i.e., making friends, marking projects of others as favorites, adding them to galleries, writing comments, and giving "loveits" rating).

Table 4: Correlations between project-creation and social participation and the community feedback - at the user level

	Views made	Downloads made	Add friends	Add favorites	Add to galleries	Add comments	Add "loveits"
Befriended	.557(**)	.339(**)	.665(**)	.302(*)	.786(**)	.563(**)	.409(**)

* $p < .05$, ** $p < .01$

In order to assess the community feedback at the user level, the number of participants defining a user as their friend was regressed on the number of views, downloads, user's friends, galleries a user participated in, comments made, favorites and "love-its" added to other projects. Those seven predictors explained the 81.1% of variance in community feedback, $F(7, 57) = 35.04$, $p < .001$. The number of participants defining a user as their friend was predicted by making friends, $t(57) = 4.90$, $p < .001$, $\beta = .35$, participating in galleries, $t(57) = 7.87$, $p < .001$, $\beta = .53$, and writing comments to others' projects, $t(57) = 2.37$, $p < .05$, $\beta = .23$.

Participation and Community Feedback: Project Level

As Table 5 shows, project feedback positively correlated with social participation (i.e., adding projects to galleries, and writing comments), but negatively correlated with the project investment in the community (i.e., creating original projects or remixing projects of other members).

Table 5: Correlations between different forms of project and social investment and the community feedback - at project level

	Total projects	Original projects	Remixed projects	Ad to galleries	Ad comments
Be viewed	-.324(**)	-.310(*)	-.291(*)	.225(*)	.199
Be loved	-.182	-.176	-.137	.080	.214(*)
Be downloaded	-.245(*)	-.238(*)	-.159	.237(*)	.287(*)

* $p < .05$, ** $p < .01$

Gender Differences

No statistically significant gender differences were found in participation patterns (all *p*'s > .20) or in project complexity ($p > .30$).

Discussion

Content Contribution – Project Creation

Our findings indicated a long tail distribution in content contribution (see Figure 1) – typical also in adult content creation communities such as Wikipedia (Ravid, 2007) or educational Wikibooks (Ravid, Kalman, & Rafaeli, 2008). Unlike Wikipedia research results (Tapscott & Williams, 2007), in this study we found a high percentage of active and very active content contributors (see Figure 2) - 15% of the users (active) shared more than 100 projects, and 3% of the users (very active) shared more than 1000 projects. More importantly, active and very active users together (18%) created 67% of the community's projects (see Figure 3). This differs from content contribution in Wikipedia where 2.5% of registered users contributed 80% of all the content (Tapscott & Williams, 2007).

Possible explanations for the Scratch Israeli community's high percentage of active content contributors are: (1) youth might be more active content contributors than adults; (2) programmable medium can increase participations compared to non-programmable tools (such as text in Wikipedia or videos in YouTube); or (3) specific design features of the Scratch community site may increase participation (e.g. the "new projects" placement on the home page immediately after uploading). The findings indicate that high frequency of project uploading correlated with increased project's views ($r = .32$, $p < .01$), and the chance of users to receive friendship requests (befriending) ($r = .25$, $p < .05$). These data indirectly support the third (site design) explanation for content contribution.

Two Distinct Participation Types

As hypothesized, measures of project creation and social participation were not correlated, indicating that there are two distinct types of participation among Israeli Scratch community users – the "project creation" and the "social participation" types. These findings differ from Sylvan's (2007) data; it seems that relatively weak correlations between the project creation and social participation in the international Scratch study may reach statistical significance because of the large sample size (effect size measures were not reported).

Similarly to Ravid et al.'s (2008) study, our findings showed that the most active "project creators" and "social participators" were different users: when a user was very active in some participation type he or she was relatively passive in other participation types. Ravid et al. suggested that different participation patterns in Wikis require different abilities (subject-matter knowledge vs. writing skills). However, Scratch project creation does not require prior knowledge; most of the participants in our study started using the application at the same time, with the same teacher, receiving similar training. In addition, our findings indicated that project complexity was not correlated to participation types – meaning that the active "project creators" do not create more complex project than the active "social participators". Thus, we suggest a possible explanation based on Rubin's (1994) uses and a gratification model. Different participation types may fulfill different Scratch users' needs: users with salient social integrative needs prefer social participation, while users with salient cognitive or affective needs prefer project creation. This explanation requires further research.

Community Feedback: User and Project Levels

As hypothesized, feedback at the user level was given to both "project creators" and "social participators" – community members added them as friends. The majority of the variance associated with community feedback was explained by the following seven predictors: number of views, downloads, user's friends, galleries a user participated in, comments made, favorites and "love-its" added to other projects (see Table 4). A similar group of predictors accounted only for the 37% of variance in friendship network on the international Scratch community study (Sylvan, 2007). This difference can be explained by mixed (online and offline) communication between Israeli users versus online only interactions in the international Scratch website. Similarly, in Blau and Caspi's (2008) study online interactions through Wiki technology were affected by offline relationships between the classmates.

However, feedback at the project level was different for "project creators" and "social participators". Table 5 details the correlations between different forms of investment and the community's feedback. As hypothesized, community feedback at the project level positively correlated with social participation investment, but opposite to our hypothesis negatively correlated with project creation investment. In other words, an active "project creator" received less feedback on her projects, while an active "social participator" received more feedback on her projects. A possible explanation is that community members primarily left feedback on projects of their friends.

These findings also address a possible reason why participants download projects of other users. On the one hand, social forms of community feedback (project viewed, loved, commented, and favorited by others) explained a large percentage of variance in projects downloads. On the other hand, there was no statistically significant correlation between downloading and remixing ($p >$ .30). Those findings indicate that downloading is done mostly for social reasons and not for project-creation reasons (i.e. downloading for remixing project).

Gender Differences

Consistent with a previous international Scratch study (Sylvan, 2007), we found no significant gender differences in participation patterns or in project complexity. It seems that Scratch opens similar possibilities to both genders in programming, learning and participation.

Conclusions and Implications

This study investigated the participation patterns, users' contribution and gratification mechanisms, as well as the gender differences of Israeli learners in the Scratch online community. The findings supported our hypotheses: (1) Participation patterns reveal two distinct participation types: "project creators" and "social participators", which suggest different user needs. Project creation and social participation measures were not correlated. (2) Community members gratified "project creators" and "social participators" for their investment in the community. Feedback at the user level was given to both "project creators" and "social participators" – community members added them as friends. The majority of the variance associated with community feedback was explained by seven predictors: number of views, downloads, user's friends, galleries a user participated in, comments made, favorites and "love-its" added to other projects. However, feedback at the project level was different for the two participation types - active "project creators" received less feedback on their projects, while active "social participators" received more feedback on their projects. As hypothesized, community feedback at the project level positively correlated with social participation investment, but opposite to our hypothesis negatively correlated with project creation investment. Our interpretation is that project feedback is influenced by friendship, namely that community members primarily give feedback to projects of their friends. (3) No gender differences were found in participation patterns or in project complexity, suggesting that the Scratch environment provides similar opportunities to both genders in programming, learning and participation. Further research is needed to better understand the motivation for participation in each of the participation types.

Looking more broadly, this study takes us one step further in our understanding of children's behavior, roles, and responsibilities within an online community of learners. With the increasing time children spend online in general, and in online communities in particular, educators should remember that in the same way that children in a classroom have different learning styles, children also show different participation patterns online. A good educator, or a good designer of an online community for learners, should support these different participation types and plan or design an appropriate learning experience for each student. For example, when dividing a classroom into small groups, it would be beneficial if there are members of both types (social participators and content contributors) in each group. In another example, an educator could identify the "very active" content contributors within a classroom and turn them into early adopters of an online community for learners by "populating" a new community with content before the rest of the class joins. In summary, gaining a better understanding of children's natural participation patterns within an online community can give educators concrete methods and tools that can maximize the potential of the online community as a productive and motivating learning experience.

Online communities are proliferating and children spend more time online. As a result, there is a greater need for a better understanding of children's online participation patterns. Our insights are that online participation patterns unveil children's needs and can be a driver for quality learning experiences. The rich opportunities children have online, such as meeting like-minded children, engaging in creative activities and in intellectual discussions - should not be missed due to digital literacy barriers between educational systems and the connected society.

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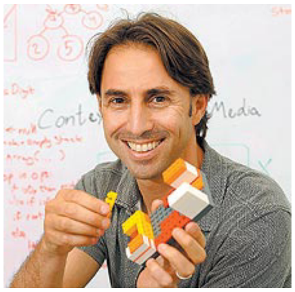
Biographies



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