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Imaginary Worldplay in Childhood and Maturity and Its Impact on Adult Creativity

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ABSTRACT: The childhood invention of imaginary worlds or paracosms may prepare for creative endeavor in adulthood. To test hypotheses concerning the incidence of childhood worldplay and its connection to mature work, this study queried MacArthur Fellows, selected for their creativity, and compared them to Michigan State University (MSU) students. Whereas previous research declared paracosm play to be uncommon and associated with the arts, this study found it reasonably common among MSU students (3%–12%), about twice as frequent among MacArthur Fellows (5%–26%), and prevalent in the backgrounds of scientists and social scientists as well as artists. A majority of Fellows with assessed worldplay in childhood reported connections between early paracosm play and mature endeavor. Childhood worldplay deserves further study as early apprenticeship in creative imagination.

Ongoing discussion in the fields of psychology and creativity studies concerns whether groundbreaking individuals are "Jacks of all trades" or specialists (Kaufman & Baer, 2005; Sternberg, Grigorenko, & Singer, 2004). One aspect of this debate that may profitably draw closer attention is the role that general imaginative preparation in childhood may have for more specialized creative endeavor in adulthood. Over the last few hundred years in the West, artists, scientists, inventors, and others have observed that the creative adult recaptures in his or her work process some aspect of child's play (Apostolos-Cappadona & Altschuler, 1994, pp. 101, 115; Clark, 1981, pp. 2, 15, 17; Cobb, 1977, p. 88 and *passim*; Gopnik, Meltzoff, & Kuhl, 1999, pp. 12–13; Remy, 1991/1991, p. 10; J. L. Singer, 1973, p. 6). Others have insisted that the individual's personal history of childhood play itself informs mature capacities. For example, the neuroanatomist and Nobel Prize winner, Ramon y Cajal, argued:

> The games of children are an absolutely essential preparation for life; thanks to them the infantile brain hastens its development, receiving, according to the hobbies preferred and the amusements carried on, a definite moral and intellectual stamp upon which the future will largely depend. (as cited in R. Root-Bernstein, 1989b, p. 314)

Taking our cue from observations such as these, we essayed a study of creative play in childhood and its perceived connections to adult innovation and invention amongst MacArthur Fellows, a group of individuals known for creative contribution within and across disciplines.

One of the most remarkable forms of creative play in childhood is the invention of make-believe worlds, often referred to in the psychological literature as *paracosms* (Cohen, 1990; Cohen & MacKeith, 1991; MacKeith, 1982–1983; Silvey, 1977; Silvey & MacKeith, 1988; D. G. Singer & Singer, 1990, pp. 111–116; Taylor, 1999, pp. 136–141). Unlike other forms of make-believe, *worldplay,* as we call it, involves the persistent and consistent evocation of an imagined place (often, but not always) inhabited by imagined people or beings. Such a world is not to be

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confused with the disturbing fantasies of some psychotic children and teens (Green, 1964; Lindner, 1955, pp. 221–293), but belongs to normally developing children who distinguish between what they imagine and what really exists (Cohen & MacKeith, 1991, p. 14; Silvey & MacKeith, 1988, pp. 173–174). However, whether they play in an imaginary land with several intimates or by themselves, the make-believe does not wisp away at the end of the day. The imagined world organically builds over months, sometimes years; it accumulates behind-the-scenes narratives, geographies, cultures, social and political institutions, and even ecosystems. Indeed, children who create make-believe worlds frequently do so in ways that are materially inventive. They document what is playfully imagined by composing alphabets and languages, writing down stories and histories, or drawing pictures and maps. Such documentation may, in fact, be regarded as a *sine qua non* for worldplay in its most recognizable guise, thus differentiating it from other forms of creative play involving imaginative reenactment, imaginary friends, or daydreams (Cohen & MacKeith, 1991, pp. 107–111; J. L. Singer, 1973, 1975; Taylor, 1999).

At present, researchers in psychology and creativity studies know a bit about childhood worldplay and almost nothing of its bearing on creativity, whether juvenile or adult. In 1988, Silvey (posthumous) and MacKeith catalogued 64 paracosms described by 57 adults who had responded to Silvey's (1977) published appeals soliciting personal experiences with worldplay. In the same article, they compiled a list of 15 paracosms described in published autobiographies and memoirs. Cohen and MacKeith (1991) later placed Silvey's sample of paracosms in a context of psychological and creative development. The researchers shed light on paracosm play in two ways: first, by establishing its developmental profile; second, by categorizing its forms and contents.

Judging by the interview materials received from their 57 respondents, Silvey and MacKeith (1988) and Cohen and MacKeith (1991) argued that the invention of imaginary worlds typically peaks around the age of 9, continues for some months or years, and then fades by the late teenage years. They also discerned five typical content categories: paracosms based on or invoking fantasy play with (a) toys; (b) particular places and local communities; (c) imagined islands, countries, and their peoples; (d) imagined systems, documents, and languages; and (e) unstructured, idyllic worlds. Some of their data appeared to indicate that as world-inventing children matured, their focus tended to shift from the personal intimacy of toy families to the social interactions of larger establishments, thence to the increasingly abstract cultural, economic, and political systems that characterize society at large. Two out of three girls in the sample continued to focus on the personal interactions of characters, whereas most boys focused on systems, bureaucracies, or histories with little emotional content. Therefore, although paracosms invented by boys and girls were nearly equal in number, those that modeled the real world, with minimal interest in personal life, predominated (Silvey & MacKeith, 1988, p. 186).

The paracosm materials collected by Silvey and MacKeith (1988) were eminently suited to characterizing worldplay but not to ascertaining its incidence, relation to subsequent profession, or functionality as preparation for creative work. Despite a lack of relevant data, the researchers nonetheless surmised that the invention of imaginary worlds was "uncommon" in early or late childhood and "very uncommon" in teenage years (Cohen & MacKeith, 1991, p. 111; MacKeith, 1982–1983, p. 265; Silvey & MacKeith, 1988, p. 175). They also argued that the invention of imaginary worlds appealed to "dreamy" types with an affinity for the arts; a point seemingly confirmed by the preponderance of well-known writers and artists on their supplemental list of published worldplay recollections. Paradoxically, the relative absence of adult careers in the arts among their 57 paracosmists led Cohen and MacKeith (1991) to conclude that worldplay did not sustain or enhance creative potential in the average individual, but rather steered make-believe away from the fantasy of play toward something "more like work" (pp. 53, 103–104). Overall, they built a case for a fascinating, if somewhat disappointing, byway in the development of ordinary imagination (Cohen & MacKeith, 1991, p. 22).

These conclusions may be questioned. By their own admissions, Silvey and MacKeith (1988) and Cohen and MacKeith (1991) did not investigate potential rates of worldplay in either a general or an artistic (or otherwise creative) population. Neither did they formalize the actual distribution of adult professional activity amongst their sample of paracosmists or discuss in any systematic way perceived connections between imaginative endeavors in childhood and adulthood. Moreover, their assumption that worldplay often strangled

the imagination prematurely limited potential investigation of imaginative skill sets that may have been acquired in worldplay.

Based on our previous research on play, avocations, and creativity (R. Root-Bernstein, Bernstein, & Garnier, 1995; R. Root-Bernstein & Root-Bernstein, 1999, 2004), we made a number of alternative hypotheses concerning the incidence, appeal, and effect of worldplay. First, we hypothesized that highly creative individuals would be more apt to have invented worlds in childhood than individuals in a general population; second, individuals with childhood worldplay would work in a diverse range of disciplines across the arts and sciences; and third, these individuals would find play, especially worldplay, important to adult endeavor and would perceive connections between childhood play and adult work. As a corollary to all three hypotheses, we also supposed that the long-term advantages of childhood worldplay would involve early practice navigating the creative process.

To test these hypotheses, we queried MacArthur Fellows, a group of highly successful individuals selected by the John D. and Catherine T. MacArthur Foundation for extraordinary originality and exceptional promise. In a professional, private vetting process, MacArthur Fellows are anonymously nominated from a wide range of disciplines in the sciences, social sciences, arts, humanities, and public affairs professions. We compared these Fellows to a control group of students enrolled in a variety of courses at Michigan State University (MSU). The entrance level for this large, land-grant institution is moderately difficult (on average, students score between 1,040 and 1,260 [combined scores] on the Scholastic Achievement Test), and the student body, at least in comparison with the MacArthur Fellows, represents a population of individuals selected for ordinary achievement. Therefore, we expected to establish rates of paracosm invention in both a general and a creative population, determine the subsequent career plans or paths of those who had invented paracosms as children, and tease out any perceived connections respondents might entertain between childhood worldplay and adult creative endeavor.

Method

In February of 2002, we prepared a short query about the invention of imaginary worlds to send to MacArthur Fellows (see Appendix A). Section I asked Fellows to briefly describe their work, their hobbies, and any childhood play they considered relevant to either. Section II asked whether the Fellow had invented an imaginary world in childhood. Section III asked whether imaginary worlds in the arts, humanities, and sciences remained important to them as adults. This section did not suppose a childhood experience with worldplay, although those individuals who felt they invented worlds both as children and as adults were additionally able to address whether they saw some connection between the two. All surveys were to be considered anonymous, and all remarks were kept confidential unless Fellows indicated otherwise.

Ninety percent of individuals given MacArthur awards from 1981 through 2001, or 505 individuals, were contacted by e-mail and by post. After a lapse of some time, the process was repeated for those Fellows who had not responded. Out of 505 contacts, 106 responses made for a one-fifth response rate.

In the spring and fall of 2003, eight classrooms in the sciences, humanities, arts, and general education departments at MSU were also polled. Students were given the opportunity to fill out an anonymous query like that sent to the MacArthur Fellows; however, instead of professional affiliation, they were asked to list future career plans. Based on enrollment data, approximately 1,000 students attended the polled classrooms; about 1 in 5, or 262, completed the questionnaire.

Certain disparities may have affected thoroughness of response. Due to the in-class setting of the query, students had approximately 10 to 15 min to reflect and respond to query questions, whereas Fellows devoted self-determined amounts of time to formulating their answers. Age differences between the two populations may also have affected responses. MacArthur Fellows included individuals born in each decade spanning 1920 to 1960; at the time of query, over one half were aged in their 50s and 60s. In contrast, nearly all students were born in the early 1980s; no more than a handful were born in the 1970s or the 1960s. We considered the possibility that students, closer in years to childhood play, might have had more accessible memories of early worldplay and that Fellows, further advanced in years, might have had less accessible recall of childhood world invention. However, the observation by previous researchers that childhood worldplay held long-term significance for individuals well into adulthood argued that this possible effect of age difference would be mitigated.

Preliminary evaluation of responses revealed that many of the positive reports of worldplay by MacArthur Fellows and MSU students were "false positives." This may have been due to priming by the query itself, which had been designed to solicit from respondents a conscious commentary on their experiences with play as children and as adults. Respondents described play of many sorts as involving the invention of imaginary worlds whether or not that play fit the definition supplied in the query. Fellows and students described a great deal of make-believe reverie (daydreams) and enacted make-believe (sociodramatic) play in addition to constructed make-believe, wherein paracosm play might be said to typically fall, at least when it comprises the crafting of props, models, or other documents of play (Cohen & MacKeith, 1991, pp. 110–111; Piaget, 1946/1962, pp. 110–113). Cohen and MacKeith included some play-acting games, daydream fantasies, and modeling games within their paracosm sample as well as the more distinct kind of worldplay involving the material elaboration of stories, drawings, maps, or histories. They did so as long as three basic criteria were met: play persisted over weeks, months, or years; it elaborated a consistently conceived place; and it "mattered," that is to say, was personally important to the child (Cohen & MacKeith, 1991, p. 14; Silvey & MacKeith, 1988, p. 174). We also found it necessary to apply these criteria to the query responses to assess positive self-reports for recognizable (definitional) worldplay. (In addition, previous researchers had required that the child distinguish between imagined and real worlds, to restrict their study to a normal imagination. We did not apply this criteria in assessment, assuming—for the purposes of this study—that successful adults and functioning college students made adequate distinctions between reality, on the one hand, and fantasy or conjecture, on the other.)

Based on criteria established by Silvey and MacKeith (1988) and Cohen and MacKeith (1991), we devised a checklist or rubric (see Appendix B). We also looked for evidence that the world in question actually involved imaginary dimensions (i.e., imagined places and, possibly, imagined people) beyond the "here and now" of playacting; that those imaginary dimensions were conceived in some detail rather than none (specific vs. general notions of place or persons); and that the play was private or intimately shared, rather than public. In addition, we looked for evidence that respondents had documented their worlds with written stories, maps, drawings, or other artifacts. These extended criteria allowed distinctions to be made between worldplay and common sociodramatic play. It also allowed us to accept as imaginary worlds a couple of reported instances of imaginary friends, when these friends inhabited a fully conceived place. One Fellow who "talked Jenny" with an imaginary friend eventually elaborated a complete society of "woods-girls" whose adventures she recorded in pictures and stories.

Evaluating self-reports of worldplay was not an "either–or" proposition. Imaginary worlds, as recalled and described, were more or less persistent and more or less consistent. Some children played "dolls," whereas others played "Dollyland." Some continually repeated invariant scenarios; others continuously returned to evolving ones. Imaginative play rarely met all criteria for the invention of imaginary worlds. For instance, one imaginary town and one imaginary zoo, both recreated day after day and dismantled at night to make room for family activities, were certainly persistent but weak in consistency and specificity. The stories, characters, and even the settings changed daily, although they occupied the same imaginary play space.

Faced with this kind of polymorphous play experience, we used the rubric to establish a profile for each self-reported world. Some traits were required; others were corroborative. In its final form, the rubric established a checklist for imaginary worldplay or paracosm play that (a) *required* the notion of a specific "other" place, either partly or wholly imaginary; that (b) *might include* the notion of specific persons, either partly or wholly imaginary; and that (c) *must include* the consistent repetition over some period of time of a specific scenario, as evidenced by the naming of places and characters or the elaboration of a continuous narrative or other systematization. In ambiguous cases, we looked for indication that the play had been private or intimately shared as opposed to communally practiced. This and other evidence of the child's creative control helped tip the balance toward worldplay. Internal consistency of assessment across the two data samples was achieved by a repetition of review by a single evaluator; no attempt was made otherwise to determine the reliability of the rubric.

In this manner, positive responses to worldplay by MacArthur Fellows and MSU students were categorized into two groups: researcher-assessed worldplay and researcher-assessed nonworldplay. Initially, a third

group was also included—researcher-assessed ambiguous. We sorted the data in two ways. The first, more stringent assortment did not include ambiguous cases; the second, more relaxed assortment incorporated the assignment of ambiguous cases into the other two groups. As it turned out, both assortments generated similar profiles for Fellows and for MSU students, especially when the two sample groups were compared to each other.

The researcher-assessed data were evaluated for incidence of childhood worldplay in the two sample populations and its distribution across current or intended professional endeavors. In addition, the two sample populations were compared using a chi-squared analysis (assuming the student population to represent the "expected" distribution) to evaluate the significance of the results. Finally, self-reported connections between worldplay and adult creative endeavor were evaluated to confirm and interpret the statistical findings.

Results

To address our first hypothesis that highly creative individuals would be more likely than others to have invented worlds in childhood, we considered the following data.

Of the 106 responses, 16 Fellows declined participation; some cited personal discretion or protection of current creative inspiration. "This cuts too close to home," wrote one Fellow. Another wrote, "Sacred territory, … these are subjects I prefer not to discuss for fear of disturbing the muse the wrong way!" Others cited lack of time or interest. Ninety applicable responses remained. Of these self-reports, 39 individuals (43%) indicated that they did invent imaginary worlds in childhood; 51 (57%) indicated they did not (see Table 1).

The responses were reevaluated according to the rubric. Of the 39 self-reports of worldplay among MacArthur Fellows, only 18 qualified as recognizable instances of imagined world invention in the first, stringent assortment; 23 in the second, relaxed assortment that included ambiguous cases. In the first, stringent assortment, worldplay examples included the model city, "rather Incaic in its conception," that one Fellow built out of small stones in the woods near his home when he was around 9 years old. The city had institutions and a history. In the second, relaxed assortment, acceptable examples included the genealogical records kept by another Fellow for "a cast of imaginary characters" whose adventures in the "real world" had "evolving histories."

In that second, relaxed assortment, the remaining 16 nonworldplay responses described related make-believe, typified by the ephemeral play world reported by one Fellow who "rampaged around the woods [with a friend] pretending to be Indians"; the book worlds described by another Fellow as "entirely derivative of what I was reading—voraciously—at the time—fairy tales, Mary Poppins, 'Greek myths,' 'girl nurse/detective/orphan/whatever' stories"; the invented game "built of elaborate models and 'set-ups'" of World War II scenarios with "very complex war-gaming rules" described by yet another; and two very different forms of imaginative play that involved animistic communion with nature: "I felt that all things, animate and inanimate spoke to me, if I was quiet and patient enough,"

Table 1. *Survey Results for MacArthur Fellows and MSU Students*

	MacArthur Fellows		MSU Students	
Responses	106		262	
Nonapplicable	16			
Self-reports: Yes	39	43%[b]	105	40%[b]
Self-reports: No	51		157	
Applicable total	90		262	
Assort 1: Recognizable worldplay	18	20%[b]	29	11%[b]
A 1: Not worldplay	12		68	
A 1: Ambiguous	9		8	
Assort 2[a]: Recognizable worldplay	23	25.5%[b]	32	12%[b]
A 2[a]: Not worldplay	16		73	

Note. MSU = Michigan State University.
[a]Ambiguous responses distributed into "recognizable worldplay" and "not worldplay" categories. [b]Percentage of applicable total.

wrote a Fellow. "Especially trees, but also sticks, clouds, rocks, any and everything, even bottle caps or toys." (See Table 2.)

Given the number of cases in both first and second assortments, the invention of imaginary worlds among the applicable sample group of 90 Fellows lay between 20% and 26%. It remains unknown whether the 400 MacArthur Fellows who did not respond to the query invented imaginary worlds in the same, greater, or lesser numbers. Nevertheless, we felt it possible, based on the sample, to establish a reasonable range for the incidence of worldplay among this group of innovative individuals. If we assumed, on the one hand, that the one-fifth sample fairly represented the whole, 26% might be a maximum proportion of MacArthur Fellows who engaged in the childhood invention of imaginary worlds. If we assumed, on the other hand, that the 23 individuals represented all MacArthur Fellows with this childhood experience, then 5% of all Fellows invented worlds in childhood. The reality is presumably between 5% and 26%.

Of 262 responses received from MSU students, 105 responses (40%) answered yes to worldplay in childhood; 157 (60%) answered no. (See Table 1.) The self-reported positive response rate was thus 40%, which is similar to the 43% self-reported positive response rate of MacArthur Fellows. (See Table 1.) These self-reports were assessed using the rubric. Due perhaps to the anonymous nature of the student query, to student age, or to the lack of a cover letter or cover introduction to worldplay in participating classrooms, the rate of false positives was much higher among students than among Fellows.

Seventy-three positive student responses actually described sociodramatic play, make-believe borrowed from book and entertainment narratives, imaginary companions, ephemeral daydreams or bedtime stories in the absence of a consistent imagined place (a category that did not appear in the MacArthur sample), language games in the absence of an imaginary world, and disparate and irrelevant forms of play. (See Table 2.) Such responses reported, for example, a favorite play space behind the sofa, play in the trees in imitation of the Berenstain Bears™, an imaginary family that lived in the garage, daydreams of being an alien sent to earth (based on the television show, "Mork and Mindy"; Marshall, 1978–1982), pretended communication with trees and animals, and a "gorilla game" in which, by climbing, the child "evolved from small monkey to a chimp … to a gorilla." None of these positive responses involved the invention of paracosms.

Others did. These included the invented land of "Mystica," inhabited by people and other creatures and replete with maps and histories. They also included a "rainbow house" where the child "lived with imaginary animals and cartoons I loved" and bed stories woven around people who "lived in the clouds and at night would come into your dreams." In the first, stringent assortment, 29 students provided evidence of such recognizable worldplay, with 8 students providing ambiguous evidence. In the second, relaxed assortment, 3 of those ambiguous play experiences were reassigned to recognizable worldplay. Therefore, at a maximum, 32 students had invented imaginary worlds in childhood. The incidence range of researcher-assessed worldplay in the student responders was thus 11% to 12%. (See Table 1.) Once again, if we assume that responders are typical of all students, then 11% to 12% represents the maximum rate of worldplay in that general population. If we assume that all students who participated in

Table 2. *Types of Play in Positive Responses Assessed as Other Than Worldplay (Second Assortment) Among MacArthur Fellows and MSU Students*

	MacArthur Fellows	MSU Students
General play worlds	10	37
Book, film, or TV worlds	1	6
Imaginary companions	2	9
Daydreams/bedtime stories		3
Invented games	1	
Language games		4
Other	2	14
Total	16	73

Note. MSU = Michigan State University.

worldplay responded to the questionnaire, then the rate for all students in the sample is a minimum of 3%.

A comparison of incidence rates for the MacArthur and student samples reveals an obvious discrepancy between the two populations. Although students and Fellows self-reported worldplay at a similar rate, the actual incidence of researcher-assessed worldplay amongst Fellows (5%–26%) was about twice that amongst students (3%–12%), whether stringent or relaxed criteria, minimum or maximum data were used.

As a means of addressing our second hypothesis, that individuals who invented imagined worlds in childhood would be apt to work in a wide range of professions, we also looked at what kind of professions occupied worldplaying MacArthur Fellows in their maturity and compared these to the professions that MSU students who invented worlds in childhood foresaw for themselves. Innovative individuals often cross disciplinary boundaries in their work (Feist, 2004, p. 74; Hjerter, 1986; Plucker & Beghetto, 2004, pp. 161–163; R. Root-Bernstein, 2003; R. Root-Bernstein & Root-Bernstein, 2004, pp. 127–151). MacArthur Fellows are no exception to the rule. In the interests of simplicity, however, we utilized the disciplinary categorization of Fellows employed by the MacArthur Foundation. The Foundation organizes its appointments in five groups: arts, humanities, public issues, social sciences, and sciences. As expected, the arts include choreography, music, visual and performing arts, and creative writing. The humanities include the scholarly study of history, musicology, and philosophy of science as well as the writing of biography or translation. The social sciences cover disciplinary work as far afield as economics and linguistics, archeology, and psychology. The sciences cover some 20 fields from biology, chemistry, and physics to agriculture, medicine, and computer science. The public issues category includes diverse work in the areas of community affairs, education, human rights, international security and arms control, journalism, labor, public health, and public policy.

Over the years spanning 1981 to 2000, the MacArthur Foundation appointed one fourth of its Fellows in the arts, a bit more than one fourth in the sciences, one fifth each in the humanities and public issues professions, and one tenth in the social sciences. (See Table 3.) When we looked at the professional breakdown of our sample—Fellows appointed in the years spanning 1981 to 2000—we found that it mirrored the group as a whole fairly closely. Twenty-six percent of the sample worked in the arts, 12% in the humanities, 18% in public issues professions, 15% in the social sciences, and 29% in the sciences (Table 3). These proportions reflect an almost exact match, except that we received one third less responses from individuals in the humanities than we might have expected and one third more responses in the social sciences. It is not unreasonable, therefore, to extrapolate our results to all MacArthur Fellows.

More to the point, the data validated our expectation that individuals inventing imaginary worlds in childhood participate as adults in a wide variety of disciplines. When we looked with both stringent and relaxed criteria at sampled Fellows with assessed worldplay, the distribution crossed all professional categories. In the second assortment, the distribution ranged from 19% for sampled Fellows in the public issues professions and the sciences to 46% of Fellows in the social sciences. (See Table 4.)

The disciplinary distribution of childhood worldplay among MacArthur Fellows proved significantly different from the same distribution in the con-

Table 3. *Breakdown of MacArthur Fellows by Professional Fields: Sample Compared to Pool*

	Arts		Humanities		Public Issues		Social Sciences		Sciences		
	n	%	*n*	%	*n*	%	*n*	%	*n*	%	Total
Sample[a]	23	26	12	13	16	18	13	14	26	29	90
Pool 1981–2000	154	26	98	17	107	18	57	10	171	29	587

[a]Sample drawn from MacArthur Fellows Directory, 2000–2001, compiled by the Jefferson Institute, which included 507 out of 587 appointed Fellows (attrition due to death or disinterest).

Table 4. *Breakdown of Assessed Worldplay Among MacArthur Fellows by Professional Field*

	Arts	Humanities	Public Issues	Social Sciences	Sciences	Total
Sample No.	23	12	16	13	26	90
Positive self-reports	11	6	6	8	8	39
% worldplay by professional field	48%	50%	37.5%	61.5%	31%	43%
Assort. 1: Assessed worldplay	4	4	1	4	5	18
A 1: Not worldplay	5	0	3	2	2	12
A 1: Ambiguous	2	2	2	2	1	9
A 1: % worldplay by professional field	17%	33%	6%	31%	19%	20%
Assort. 2[a]: Assessed worldplay	5	4	3	6	5	23
A 2[a]: Not worldplay	6	2	3	2	3	16
A 2[a]: % worldplay by professional field	22%	33%	19%	46%	19%	26%

[a]Ambiguous responses distributed into "assessed worldplay" and "not worldplay" categories.

trol population. The intended professions of MSU students were fit within the categories established by the MacArthur Foundation. This meant adding careers in landscape design or theater management to the arts; careers as translators or ministers to the humanities; and careers in various technologies, medicine, and nursing to the sciences. Students who indicated criminology, social work, or business as career choices were placed in the social sciences because these professions represented practical application of scholarly fields in this category. Students who planned to become lawyers, teachers, journalists, and politicians were placed for similar reasons in the public issues category.

Unlike the MacArthur Fellows, the students sampled at MSU did not fall as evenly across professions. Because so many intended careers in law, business, and education, the public issues and social sciences categories together represented more than one half of all students. The arts and sciences claimed almost evenly another one third of students. Six percent of students had not yet made a career choice. When we determined the incidence of worldplay in each category, we found that students in the humanities, arts, and public issues professions were more likely than students in social sciences or sciences to have invented imaginary worlds by a factor of two or more. (Stringent and relaxed assortments differed little from one another. See Table 5.)

We observed two gross differences between our two populations: Worldplay is more common among MacArthur Fellows than among MSU students, and it appears among Fellows working in the social sciences and the sciences much more frequently than would be predicted from the student responses. These differences, as presented in Figure 1 for the first, stringent assortment of sample respondents and Figure 2 for the second, relaxed assortment, proved significant using

Table 5. *Breakdown of Assessed Worldplay Among Michigan State University Students by Intended Professional Field*

	Arts	Humanities	Public Issues[a]	Social Sciences[b]	Sciences	Undecided	Total
Sample No.	40	9	86	62	50	15	262
Positive self-reports	19	6	33	24	19	4	105
% worldplay by intended profession	47.5%	67%	38%	39%	38%	27%	40%
Assort 1: Assessed worldplay	6	2	12	5	3	1	29
A 1: Not worldplay	12	2	17	18	16	3	68
A 1: Ambiguous	1	2	4	1	0	0	8
% worldplay by intended profession	15%	22%	14%	8%	6%	7%	11%
Assort 2[c]: Assessed worldplay	6	3	14	5	3	1	32
A 2[c]: Not worldplay	13	3	19	19	16	3	73
% worldplay by intended profession	15%	33%	16%	8%	6%	7%	12%

[a]Includes those intending careers in law, education, and journalism. [b]Includes those intending careers in business. [c]Ambiguous responses distributed into "assessed worldplay" and "not worldplay" categories.

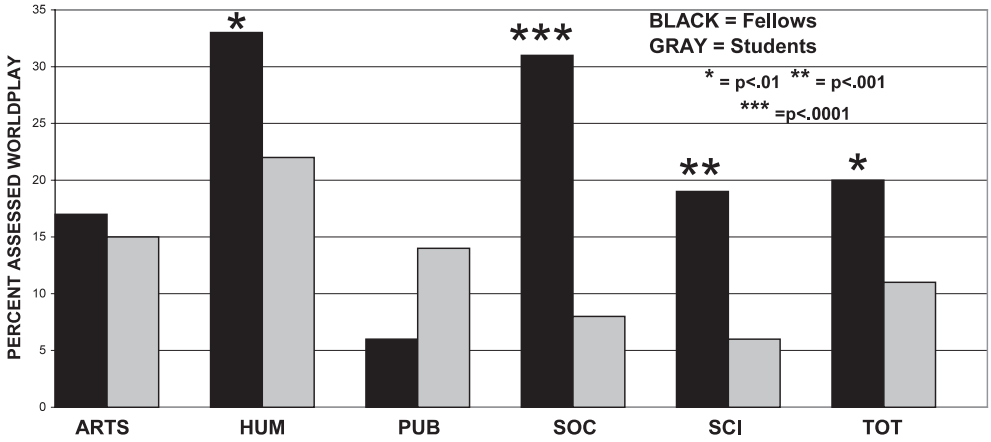

Figure 1. *Childhood worldplay (1st assortment): MacArthur Fellows and Michigan State University (MSU) students. See Table 6 for statistical values. HUM = humanities; PUB = public issues; SOC = social sciences; SCI = sciences; TOT = total.*

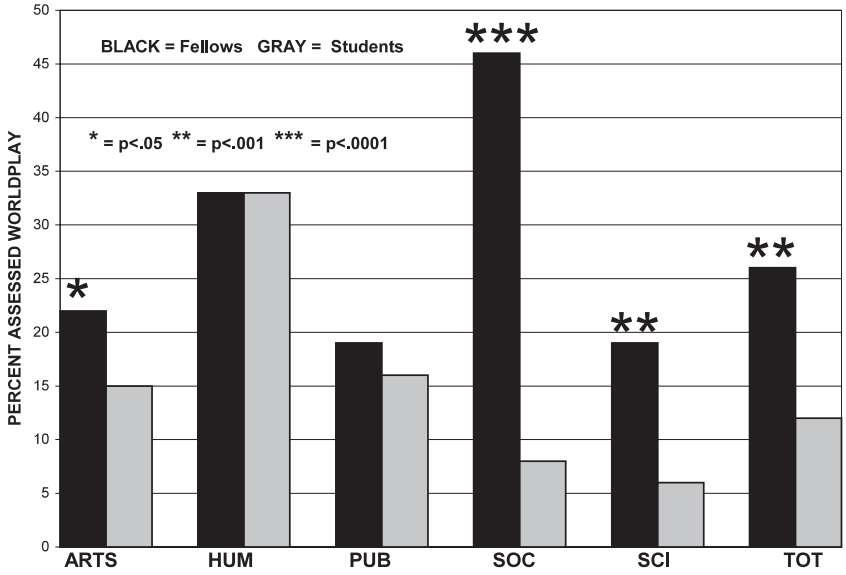

Figure 2. *Childhood worldplay (2nd assortment): MacArthur Fellows and Michigan State University (MSU) students. See Table 6 for statistical values. HUM = humanities; PUB = public issues; SOC = social sciences; SCI = sciences; TOT = total.*

chi-squared analysis, a measure of the discrepancy of observed results from expected figures. (See Table 6 for statistical values for all figures.) Once again, the first and second assortments yielded similar profiles for the compared groups. The greater rate of worldplay among MacArthur Fellow scientists ($p < .001$) and social scientists ($p < .0001$) than among students entering those fields is highly significant. This is less certain when it comes to MacArthur Fellows in the humanities ($p < .01$ in the first assortment) or MacArthur Fellows in the arts ($p < .05$ in the second assortment). MacArthur Fellows in public issues professions displayed no higher rates of worldplay than did students intending to enter these fields.

We addressed our third hypothesis, that individuals with childhood worldplay would find that kind of play relevant to adult endeavor, by considering the number and tenor of query responses to questions regarding its importance. These responses we accepted at face value, as indicative of respondent *perceptions* of con-

Table 6. *Statistical Values for Figures 1, 2, and 4*

	Expected %[a] (Students)	Observed % (Fellows)	χ^2	*p*
Chart 1: Childhood worldplay, first assortment[b]				
Arts	15	17	1.92	.17
Humanities	22	33	7.03	< .01
Public issues	14	6	5.27	.02
Social sciences	8	31	71.81	< .0001
Sciences	6	19	29.88	< .001
Totals	11	20	6.62	< .01
Chart 2: Childhood worldplay, second assortment[b]				
Arts	15	22	3.80	.05
Humanities	33	33	-0.02	> .99
Public issues	16	19	0.63	> .90
Social sciences	8	46	196.2	< .0001
Sciences	6	19	29.88	< .001
Totals	12	26	18.51	< .001
Chart 4: Worldplay in adult work[b]				
Arts	50	30	26.64	< .001
Humanities	11	58	225.64	< .0001
Public issues	40	31	3.36	.08
Social sciences	21	46	37.67	< .001
Sciences	6	38	181.56	< .0001
Totals	27	39	6.27	< .01

[a]Percent expected to have worldplay based on the data from the Michigan State University student survey. [b]$df = 2$.

nections between childhood play and adult work. First and foremost, we found many sampled Fellows reporting worldplay in adulthood—specifically, the invention of (or participation in) imaginary or possible worlds in their vocations or avocations. In the context of the query, it was suggested that the imaginary worlds of adulthood might refer to the make-believe realms of paintings, plays, films, and novels, whereas possible worlds might refer to the hypothetical constructs of scientists and others. Fifty-seven percent of Fellows who responded to the survey answered that they, in fact, did create or participate in such worlds in adult vocation or avocation; over two thirds of these 51 individuals (39% of entire group) specified that this worldplay involved the invention of imagined or possible worlds in their vocational work. (See Figure 3.) For purposes of comparison, MSU students were also asked if they expected to invent or participate in imagined worlds in adult vocation or avocation. Fifty percent of all students expected to involve themselves in some way in worldplay as adults; about one half of this group, or 27% of all students, specified that they expected to do so in their work. It is interesting to note that recreational worldplay unrelated to work was also specified by students (8%) and MacArthur Fellows (1%), but far less frequently than vocational worldplay (Figure 3).

When it came to adult worldplay at work, reports surfaced in every discipline. (See Figure 4 and Table 6.) At the low end amongst MacArthur Fellows, 30% of artists specified adult worldplay in their work; followed by 31% of individuals in the public issues professions, 38% of scientists, 46% of social scientists, and 58% of those in the humanities. The professional distribution of expected worldplay amongst MSU students provides a telling contrast. Students majoring in science were the least likely to expect worldplay to have vocational importance (6%), followed by those undecided about their careers (7%), those in the humanities (11%), the social sciences (21%), the public issues professions (40%), and the arts (50%). The greater rate of reported worldplay at work amongst MacArthur Fellows compared to expected worldplay at work among MSU students is highly significant with regard to the sciences and the humanities ($p < .0001$) and the social sciences ($p < .001$). The greater rate for students in the arts ($p < .001$) was also significant.

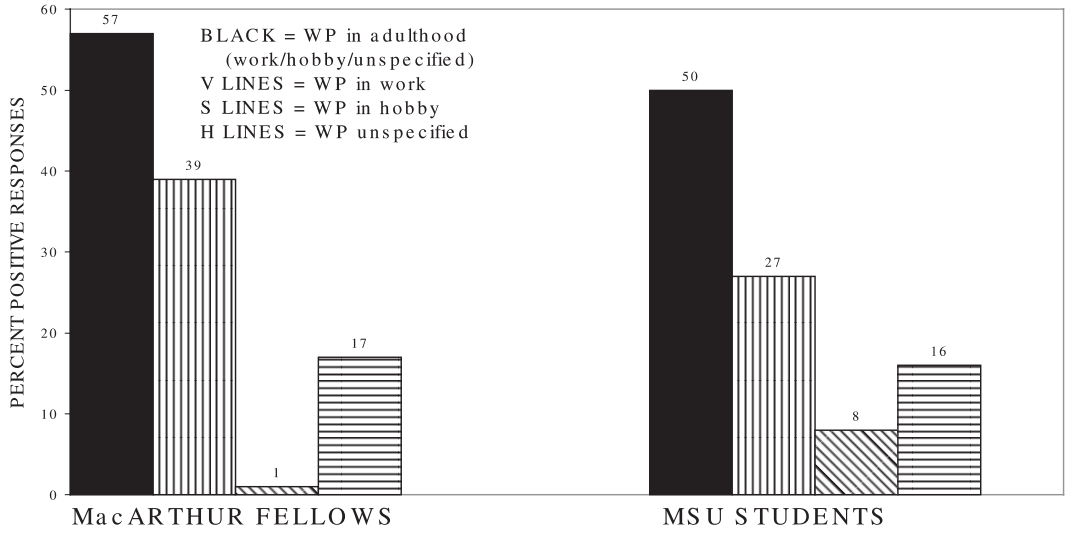

Figure 3. *Worldplay (WP) in adult vocation or avocation: MacArthur Fellows and Michigan State University (MSU) students. V = vertical; S = slant; H = horizontal.*

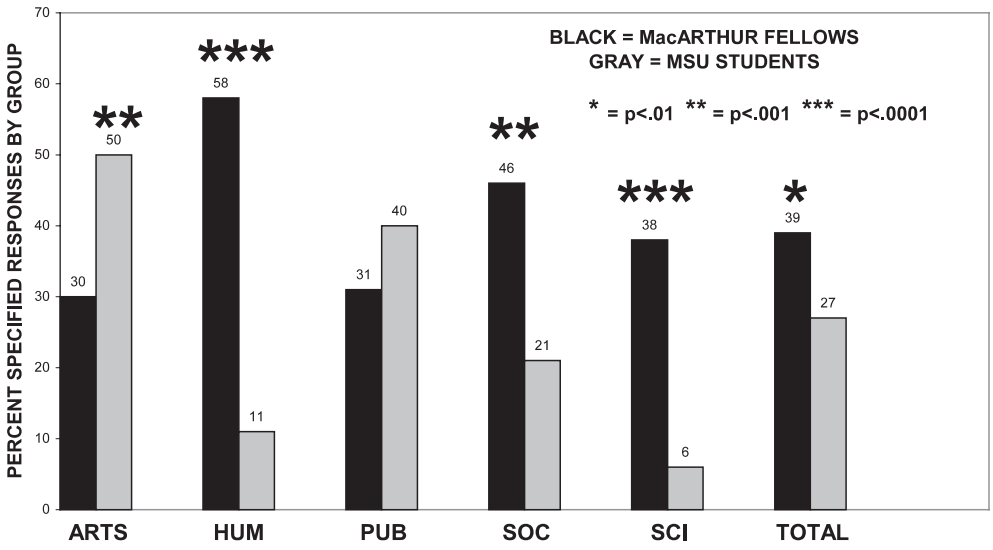

Figure 4. *Worldplay in adult work: MacArthur Fellows and Michigan State University (MSU) students. See Table 6 for statistical values. HUM = humanities; PUB = public issues; SOC = social sciences; SCI = sciences; TOT = total.*

Among those who invented imaginary worlds as children, many Fellows (61%) and students (72%) saw connections between that childhood play and their adult vocational worldplay. (See Table 7.) Far fewer said there was no connection, did not know, or did not answer the question. As one of the Fellows appointed in the arts remarked, "everything links." Like worldplay itself, however, perceptions of connection varied across professional fields. (See Table 6.) MacArthur Fellow artists who invented worlds as children were most apt to see direct connections between that play and adult endeavor (100%), followed by their peers in the humanities (75%), the social sciences (66%), and the sciences (40%). Fellows in the public issues professions saw no connection between early and mature worldplay. Among worldplaying

Table 7. *Connections Between Childhood and Adult Worldplay: MacArthur Fellows and Michigan State University Students*

	Arts	Humanities	Public Issues	Social Sciences	Sciences	Undecided	Total
MacArthur's: Assessed worldplay (second assortment)	5	4	3	6	5		23
Perceived connection child/adult worldplay	5	3	0	4	2		14
%	100%	75%	0%	67%	40%		61%
Students: Assessed worldplay (second assortment)	6	3	14	5	3	11	32
Perceived connection child/adult worldplay	4	3	12	3	0	1	23
%	67%	100%	86%	60%	0%	9%	72%

students, those in the humanities were most likely to see connections to anticipated adult worldplay at work; followed by those in the public issues professions, the arts, and the social sciences. In all four of these professions, connections were anticipated over three fifths of the time. In the sciences, connections between juvenile and adult worldplay at work were barely expected one tenth of the time.

Respondent Comments

In many cases, students and MacArthur Fellows explained on the survey form what they meant by vocational worldplay, thereby opening a window on how they understood the playful invention of imagined or possible worlds to be akin to adult work. One student wrote, by way of explication, "I want to write short stories"; another wanted to "mak[e] movies"; a third expected to invent worlds "with every song I write"; and a fourth was already in the habit of creating "a story to go along with my piano pieces so I can emotionally involve myself in the music." These students recognized worldplay in their self-expressive processes. Others saw worldplay as a strategy for success in the workplace. "I think make-believe or hypothetical worlds or situations will be very important in teaching," wrote one. "My future career [in public relations] will require that I am able to look at multiple possible situations," wrote another. "If I want to win cases," wrote a future lawyer, "I have to create the world for the jury. In every case I will be creating a 'possible' world and allowing the jury to decide its strength." A student intending to be a bioethicist wrote, "Biotechnology will bring what can only be imagined today." This last student considered adult worldplay to be much more serious than childhood worldplay (he did, by self-report and by assessment, invent worlds as a child). Echoing widely held distinctions between work and play, he did not, therefore, see a direct connection between the two activities: "I think a lot more critically in my adult worlds where as a child it was just fun." Nevertheless, the invention of possible worlds in adult work was more than just vague metaphor for him and for many other students as well. It was part and parcel of the imaginative projection of alternative scenarios that they expected to guide successful professional activity.

Many MacArthur Fellows also explained or qualified their responses to vocational worldplay, revealing an understanding of adult worldplay very similar to that of the students. For one Fellow in the arts, "work involves creating a world with characters and a unique, specific logic … ." For another in the social sciences, work required constant conjecture of "possible alternative worlds by reference to existing power arrangements, interest-formation patterns, etc., and that generates 'mid-range' theorizing." Scientists also referred to the world-inventing aspects of theorizing, often qualifying their imaginative invention, in the words of one individual, as "something abstract that can then lead to concrete hypotheses testable by experiments," rather than some imaginary place "not relevant to physical nature did." Nevertheless, for another Fellow, theoretical models did involve a suspension of disbelief most often identified with fiction:

> In a real sense to do theory is to explore imaginary worlds because all models are simplified versions of reality, the world. Part of the art of it all is what gets put in and what gets left out. However, it is "bounded imagination" in that one's experience, tool kit, etc. says … pay attention to these features. Because lots gets left out

> of any model, part of the art has been described as the suspension of disbelief … I will, for a while, believe in this simple world, even though I know lots of ways it fails to capture nature.

Other scientists pointed to related imaginative aspects of their work, such as reconstructing processes with the mind's eye, modeling interactions and empathizing within a system, and "making up a good story that fits the facts."

In addition, a few Fellows spontaneously revealed active adult fantasy lives with self-reported elements of worldplay. These included the Fellow who thought of the tendency to practice "my skills by debating adversaries or giving speeches when I'm alone (in the car or walking to the metro)" as "imagined versions of real-life settings in which I find myself." They also included the Fellow who confessed, "my [spouse] and I play an elaborate imaginary world game all the time." And in a totally unexpected finding, another 5 MacArthur Fellows revealed some tendency to "still return occasionally" as adults to researcher-assessed childhood worlds. Twelve MSU students assessed for juvenile worldplay also responded variously that they "still [play] in this [childhood] world today"; "still slip into parts occasionally"; "still go there today," "but only in my head"; or spend time in the childhood paracosm "sometimes," "very rarely now," or in dreams.

It is worth noting, finally, that worldplay was not the only childhood play deemed important to adult vocation or avocation. Over one third (38%) of MacArthur Fellows also sang the praises of other forms of imaginative play, as well as physical and manipulative play. One Fellow appointed in the humanities wrote:

> My childhood was fairly rough and tumble, always racing around the neighborhood, building things, starting "businesses," coming up with new "inventions" (that never worked), launching ourselves into outer space, saving bugs in jars, digging holes to China—in memory, at least, all fresh, unfettered, and teeming with possibility. My work today is pretty much the same thing.

Others focused on prescient role playing, on hobby interests such as astronomy or history, or the early learned joys of taking things apart and putting them together, which they still do in their professions today. Students at MSU pointed variously to the importance of reading, games of make-believe, and even sports as preparation for adult work. Wrote one:

> I chose to study English because as a child I loved to read. I loved using my imagination to visualize the worlds in books. I chose law because perhaps I can also visualize the world I would want to be in and help make it a reality. This task relies on the same skills of imagination and visualization formed through reading and games of make believe as a child.

Discussion

As a result of this study, we can begin to address notions about the rate, professional appeal, and perceived connections between childhood worldplay and adult work with somewhat more certainty than before.

Our first hypothesis concerned the frequency of worldplay. Silvey and MacKeith (1988) and Cohen and MacKeith (1991) argued that worldplay was uncommon enough to be considered rare. However, Taylor (1999), whose work on imaginary friends has contributed to the discovery that it is much more prevalent than previously realized, proposed that the more researchers look for the invention of imaginary worlds, the more they will find of that imaginary play as well (p. 139). Our results confirm her expectation. We estimate the incidence of worldplay in a general population at 3% to 12%. On the one hand, the invention of imaginary worlds is certainly less frequent than play with imaginary friends, which in several recent studies has been found in anywhere from one third, to two thirds, to three fourths of young children, as criteria for defining that play are relaxed (Bower, 2005, p. 200; Harris, 2000, p. 32; D. G. Singer & Singer, 1990, pp. 97–100; J. L. Singer, 1975, p. 135). On the other hand, worldplay is far more frequent than synesthesia, an often unvoiced condition of commingled, cross-modal sensation estimated to occur anywhere from 1 person in 2,000 to 1 in 200, again depending on definitions of the phenomenon (Cytowic, 2002, pp. 8, 8l; Domino, 1989, p. 18; Hornik, 2001, p. 56).

By these measures, worldplay is a palpable presence in the landscape of imagination and play. If it is also silent, like synesthesia, this would appear to be due not to rarity but to its private and personal nature. At a minimum, the invention of imaginary worlds in a

general population represents a childhood leisure activity roughly as common as adult participation in the United States in hobbies such as attending dance performances (3.6%), flying kites (3.2%), or making models (1.7%) at least once a year (U.S. Census Bureau, 2004–2005). At a maximum, worldplay in the general population approaches the frequency of photography (11.4%) as an adult hobby. Moreover, worldplay appears to be more common among a select, creative population such as MacArthur Fellows (5%–25%). At minimum frequency, this rate for creative individuals corresponds to adult yearly participation in hobbies such as chess (4.6%), drawing (6.7%), or playing a musical instrument (7.6%); and at its maximum to adult attendance at art museums (27%; U.S. Census Bureau, 2004–2005).

Our second hypothesis concerned the professional distribution of individuals who invented imaginary worlds in childhood. Silvey and MacKeith (1988) and Cohen and MacKeith (1991) argued that the appeal of worldplay lies in its artistic dimensions and thus presumably grooms a child for creative work in the arts rather than in other fields. This expectation was not met in our analysis of either our general or our select populations. Students and Fellows in every profession participated in worldplay. (See Figures 1 and 2 and Tables 4 and 5.)

By and large, both general and select populations were characterized by higher proportions of childhood paracosmists in the humanities, followed by the arts and sciences. (The 2 populations differently ranked the social sciences and the public issues professions; further discussed later.) In addition, a greater percentage of Fellows than students were likely to have worldplay in their background in every professional category—with the exception of the public issues professions in the first assortment and the humanities in the second. Indeed, the comparison of professional rates for students and Fellows revealed that for four of these disciplinary categories, the social sciences and the sciences, and to somewhat lesser extent the humanities and the arts, these greater numbers were significant. (Figures 1 and 2.) In the end, it seems that scientists and social scientists selected for their creativity are more likely to have childhood worldplay in their background than a general population of students planning to go into these fields.

We attach a caveat to this apparent tie between childhood worldplay and adult creativity in specific fields or in general. Due to generational differences between our two populations, the relative rates of worldplay may also reflect historical changes in childhood pastimes. Although worldplay has a documented reach at least as far back as the 18th century (Malkin, 1806/1997), certain 20th-century entertainment technologies, such as television and, more recently, personal computers and the Internet, may have profoundly altered the landscape of imaginative play (D. G. Singer & Singer, 2005). In particular, students born in the 1980s may have been affected in two ways: first, by distractions away from self-invented (created) worldplay that television viewing may provide; second, by attraction toward commercialized (consumed) worldplay that computer simulation games and online virtual reality games may provide. Fellows may have invented more imaginary worlds as children because overall they had less entertainment options and more free time for imaginative play, whereas students may have invented less worlds because they had more entertainment options and less free time—or simply because they had readily available commercial forms of imaginary worldplay. Even if the observed differences between our two populations are largely generational, however, they must give pause, for the benefits of self-invented imaginative play, as reaped in adult endeavor, appear to be considerable.

Our third hypothesis concerned the importance of worldplay to adult endeavor and awareness of connections between mature worldplay and the childhood invention of imaginary worlds. Thirty-nine percent of Fellows and 27% of students responded positively to the question of adult worldplay in their work (Figure 3). Juxtaposing these perceptions to self-reports of childhood worldplay (Fellows, 43%; students, 40%) indicates that more adults reported worldplay in an assortment of childhood make-believe than framed mature work in the same way. Juxtaposing respondent perceptions of adult worldplay to assessed rates of childhood worldplay (Fellows, 26%; students, 12%) indicates that it was unnecessary to explore bona fide worldplay as a child to consider aspects of that play valuable to adult work.

The distribution of vocational worldplay across disciplines, as presented in Figure 4, reveals suggestive differences between our two populations in these perceptions of value. MacArthur Fellows in the humanities or social sciences were more likely to report voca-

tional worldplay than individuals in the sciences, with individuals in the public issues professions and the arts less likely to so do. Among students, those planning careers in the arts and public issues professions were more likely to anticipate adult worldplay in their work than those planning careers in the social sciences, and these were more likely to do so than those planning careers in the humanities or sciences.

These differing professional profiles suggest interesting biases toward imaginative strategies in the workplace. The student profile for anticipated adult worldplay is very nearly the opposite of actual adult worldplay generated by sampled Fellows. A closer look at the public issues professions, wherein students were more apt than their MacArthur counterparts to anticipate vocational worldplay, offers an explanation. Students in this disciplinary category fell into three major career tracks: law, journalism, and education. Whereas 14% of students heading toward law anticipated vocational worldplay and 33% of students heading toward journalism and careers in writing did so, a much larger 50% of those heading for careers as teachers expected to create or participate in imaginary worlds with the children in their classrooms. (The student focus in this category was on early elementary education. Teachers of art and music were categorized in the arts; high school teachers were categorized by discipline, e.g., science teachers in science, etc.)

Such strong recognition of the role of worldplay or, at the very least, of imaginative play in education may reflect the growing influence in educational practice of Paley, Singer and Singer, and others who advocate fantasy play in preschool and kindergarten classrooms (Paley, 2004; D. G. Singer & Singer, 2005; D. G. Singer, Singer, Plaskon, & Schweder, 2003; J. L. Singer & Lythcott, 2002). Professional coaching may dispose education students to acknowledge more readily the invention of imaginary worlds in their work, especially so because the context of childhood play remains in place.

It seems likely that similar professional prepping may also be at work in student anticipation of vocational worldplay in the arts. Fifty percent of students in this category expected to invent imaginary worlds in their work in arts and applied arts careers (Figure 4). At this rate, they were significantly more likely to anticipate vocational worldplay than MacArthur Fellows in the arts were to claim ongoing worldplay at work. Nonetheless, the smaller group of Fellows in the arts with assessed worldplay in childhood did provide corroborating evidence for this professional bias. All (100%) saw connections between their early and mature inventions of imagined worlds (Table 7). These data strongly suggest that ties between childhood worldplay and adult endeavor are readily *recognized* in the arts, where "imaginary worlds" are similarly created in fiction, music, dance, and the visual arts.

To judge by student response to anticipated vocational worldplay (Figure 4), there is less institutional expectation in the humanities and social sciences that the reconstruction of bygone days or the projection of future scenarios, both of which must adhere to known facts, resemble "imagined worlds" of childhood. This is despite the fact that individual MacArthur Fellows—those with assessed worldplay in childhood and professed worldplay in adulthood—reported such connections between two thirds and three fourths of the time (Table 7).

Students were even less apt to expect the theorizing of "possible worlds" in the sciences to resemble the childhood invention of imaginary worlds. Students entering the sciences, as well as those heading for careers in medicine, farming, or computer technology, were least likely to anticipate vocational worldplay (6%), despite the fact that over one third (38%) of MacArthur scientists reported such invention in their work (Figure 4) and MacArthur scientists with childhood and vocational worldplay connected both two-fifths of the time (Table 7). It may be that mature worldplay is less relevant to practical careers in the sciences than to research-oriented careers (although this was not the case for applied careers in the arts). It seems more likely that students of science in general are not adequately introduced to the imaginative or playful aspects of their discipline and may therefore underestimate the creativity necessary to succeed in it. Indeed, there is little overt acceptance in institutionalized science of imaginative elements in discovery and research (R. Root-Bernstein, 1989a, 1989b; R. Root-Bernstein et al., 1995; R. Root-Bernstein & Root-Bernstein, 2004).

In addition to the many Fellows and students who reported or anticipated vocational worldplay in the workplace, a handful of Fellows and students spontaneously revealed continued play as adults in imaginary worlds began in childhood. Reference to such continued play as adults was diffident, reflecting reticence to reveal what many in Western culture consider a frivolous use of adult

time. As one Fellow commented with regard to his early fantasy play, "I feel awfully bashful about it. I am embarrassed by the childishness of it." The same embarrassment could attend private worldplay in maturity. "As you get older," wrote one student, "they [parents/others] are less likely to think highly of it." Social pressures of this sort are no doubt at work in the observed decline of juvenile worldplay by the late teens or early 20s. Silvey and MacKeith (1988) and Cohen and MacKeith (1991) found very few young adults clinging to old paracosms or inventing new ones of a personal nature. In this light, it is all the more remarkable that some MacArthur Fellows, well into middle and late adulthood, should continue to engage in childhood worlds. Indeed, given the private and "embarrassing" nature of such play, many more Fellows (and students) may continue such pastime than is currently known. J. L. Singer (1975) noted strong links between daydreams and originality of thought (pp. 67, 163). MacArthur Fellows and others who extend their childhood worldplay into adulthood may similarly nurture imaginative and creative capacities.

As a corollary to our hypotheses, we proposed that if individuals were to find long-term advantage in childhood worldplay, that advantage would most likely be found in the early training it provided in creative process—rather than, or in addition to, early introduction to the crafts of writing, drawing, or other readily recognized continuities of form. How worldplay accomplishes that creative preparation is the subject of a phenomenological study currently underway. In follow-up interviews, some MacArthur Fellows suggested an array of process connections that coalesce around the capacity to concentrate deeply and persistently on a self-generated system. The experiences of Galway Kinnell, Laura Otis, and R. Stephen Berry illustrate some of these points.

As a child, the poet Galway Kinnell (personal communication, July 3, 2003) built a little village in the basement with older siblings and populated it with lead soldiers. He remembers the salient feature of that play as a kind of absorption:

> I don't know how far [my sisters] fell, but I fell all the way into that world. That was the first time in my life that I really experienced transcendence of consciousness … that time had been separate from ordinary time. And then later in my life, when I started writing, I noticed something that I connected with that trance. When I was really involved with a poem I entered the world of the poem.

The connection between the invention of imaginary worlds in childhood and adulthood for Kinnell is "the capacity to concentrate … that ability I sometimes have to totally disappear into whatever I'm writing about." Importantly enough, that ability to disappear also involved the ability to empathize—"to go out of yourself and into other beings and write about them almost as if from within." Both capacities were first exercised in that long ago game of "Little Men."

Similarly, the scientist-turned-literary scholar, Laura Otis (personal communication, March 6, 2003), likens her research to childhood worldplay because both have involved the discovery, synthesis, and organization of knowledge. When she was young, Otis drew pictures and wrote stories about a girl named Jenny who lived in an imagined world "purer" and "cleaner" than the real one. "The real interest of it was in planning things, picturing what their houses would look like, how they would get food, how they would make food." Otis, who earned degrees in neuroscience as well as comparative literature, received her MacArthur for creative scholarship concerning interactions between the world of science and the world of literature. She refers to her historical research as akin to her childhood worldplay, "because to write a book—it takes about five years for me to produce a book and you have to keep going back to the same world; you have to go back to the chess game and remember where all the pieces were." Moreover, she finds herself negotiating a give-and-take between the discovered reality that comes "from outside of you" and the "system that you are organizing." For Otis, there is a discipline to establishing order that binds worldplay in childhood to adult research.

In a somewhat different vein, the physical chemist, R. Stephen Berry (personal communication, March 18, 2004), allows that worldplay may have served him as early practice in experimental modeling. As a teen during World War II, Berry created an analogue world at war with some friends:

> A few of us really loved maps and the sense that you could have these portrayals of what was going on in the world in the form of a map was somehow fascinating … . We would imagine say two or three or four countries in an imaginary continent that were typically at war or would sometimes be at war and without having definite characters we could have one country invade another and take over a big piece of it and you'd erase part of the map.

The link between this play and his science is indirect for Berry, yet compelling:

> I would be curious about the extent to which imagining a possible world, but still consistent with the real world, awakened an awareness in doing science later on [that] you could be inventive by doing just that kind of thing. I think that a lot of original ideas in science come from some kind of mind play that stays within the bounds of reality, but still asks about something that you have never seen or known to happen.

Berry's comments linking the theoretical models of scientists to the invention of imagined, or possible worlds, recalls the remarks of the Fellow, cited earlier, on "bounded imagination." Within the limits described by a scattering of data, the scientist imagines a fully described reality—a task analogous to that of the historian or even the poet, who, too, must stay true to realities of human experience.

Conclusions

In a study such as this, the data have inevitably been affected by the biases inherent in self-selection and self-report (Csikszentmihalyi, 1996, pp. 16–19). Undoubtedly, the Fellows—and students, too—who responded to our queries had more time, interest, and forbearance for a study of play and creativity than those who did not. Their self-reports assuredly concealed all manner of conscious and unconscious deception about childhood make-believe, mature imagination, and connections between the two. Nevertheless, self-reports may be accepted at face value as phenomenological data suggestive, singly, of individual experience and, in sum, of shared human behaviors. With this cautionary note in mind, we come to the following conclusions.

Worldplay is more common in both general and select populations than existing literature suggests; indeed, it appears to be more prevalent among creative adults than among average students, although some of the difference between these two populations may be generational. Worldplay also figures in the childhood of individuals at work or anticipating work in a wide range of disciplines. Particularly in the social sciences and sciences, creative (older) individuals were significantly more likely to have engaged in childhood worldplay than students anticipating careers in these fields. In addition, over one half of the study's select and general populations recognized an important role for worldplay in their adult vocations and avocations. Many perceived mature worldplay in their work; others in their recreation. Still others continued to engage in worlds first invented in childhood. Finally, the prevalent perception of connection between childhood play and adult endeavor argues that the invention of imaginary worlds is not some obscure form of make-believe, but rather a phenomenon of wider cognitive import.

In fact, childhood worldplay does appear to provide an early apprenticeship in absorption and persistence, discovery, synthesis, and modeling. Indeed, we suggest that early immersion in worldplay may achieve five outcomes of relevance to mature creativity. First, worldplay may exercise imaginative capacities including imaging, empathizing, and modeling that we have explored elsewhere as tools for thinking (R. Root-Bernstein & Root-Bernstein, 1999). Second, worldplay may exercise the capacity for continued imaginative play, especially in older children and teens, well after the intense exploration of make-believe in early childhood typically fades. Third, worldplay may exercise the capacity for problem solving within a self-consistent, alternate, modeled system—regardless of that system's fantastical or realistic make-believe context. Fourth, because worldplay ties the daring, rule-breaking/rule-making effervescence of play to the exigencies of convergent problem solving, it may nurture both the ability and the audacity to imagine potentially new and effective solutions to perennial human challenges. Fifth, worldplay may provide early training in the invention of culture by bridging the gap Igor Stravinsky (1942/1970) once posed between a virtual imagination and a creative one (pp. 60–70). The virtual imagination is one in which the conceived idea remains personal, inarticulate, and functionally ephemeral (although often embedded in memory). The creative imagination instantiates the virtual and makes it communicable to local or global society in some durable and formal way through mediums of culture as diverse as visual art, music, dance, experiment, hypothesis, and technological invention.

Implicit in this framework of outcomes is the sense that imagination and make-believe exercise general, not specialized, skills that are relevant to pursuits across the arts, humanities, social sciences, and sciences. This understanding distinguishes our evaluation

of worldplay from that of previous researchers in the field, who have conceived of imagination as the capacity for fantasy and fantasy as the capacity for fictional narrative and associated arts. Such conflation is unnecessarily restrictive and misleading. As some of the scientists queried in this study have pointed out, it is necessary to imagine what needs to be discovered before discovery can be made. Indeed, recent studies have stressed that imaginative play inherently exercises the human capacity to consider and explore alternatives to perceived reality, to simulate (Harris, 2000). That this capacity is as necessary to the sciences, the social sciences, and the humanities as it is to the arts begs more recognition by researchers in creativity studies. Here we specifically argue that the playful, imaginative, and problem-solving aspects of worldplay in childhood and adolescence may make it an indicator of early creative passion (M. Root-Bernstein, in press), a "learning laboratory" in creative process (McGreevy, 1995), and a potential predictor for mature creative endeavor in a wide range of fields.

Finally, we argue that worldplay at any age and in many guises presents a microcosm with which to explore the complex nature of creativity itself. Mature worldplay at work, in particular, may add a nuanced perspective to the ongoing discussion of creative individuals as generalists or as specialists. Creativity is such that an individual must combine previously disparate elements of knowledge and action into something novel and effective. The need to be novel, to unite hitherto disparate elements, presupposes unusual breadth of experience often across very different disciplines (M. Root-Bernstein & Root-Bernstein, 2003; R. Root-Bernstein et al., 1995; R. Root-Bernstein & Root-Bernstein, 2004; Sternberg, 2003, pp. 114, 126). The need to be effective requires focus and persistence (Ghiselin, 1954, pp. 15–20; Plucker & Beghetto, 2004, pp. 160–161; Sternberg, 2005, p. 304). By channeling the individual's capacity for make-believe into the invention of an imagined cosmos, involving the particularization of its many aspects, worldplay may very well stimulate the generalist and the specialist together.

Questions remain. How do generational shifts in childhood entertainment affect the landscape of imaginative play? Why (and how) do some people retain the childlike ability to play well into maturity? Do they benefit from recognizing elements of imaginative play in the processes and products of their work? Does their ability to engage make-believe in the workplace (or in leisure hours) enhance learning and knowledge making? A society that wishes to value and promote creative culture needs answers to the role of make-believe—and imaginary world invention—in play and at work.

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Appendix A

Dear MacArthur Fellow:

We write to you as a fellow MacArthur Prize recipient and as students of human creativity to ask if you would take a moment to answer the enclosed query concerning childhood worldplay.

Worldplay involves the repeated, self-consistent elaboration of an imagined place inhabited by imagined people or beings. These worlds, or paracosms as they are sometimes called, may be as impossibly fantastic as a land of talking toys or as plausibly realistic as a human colony on Mars. Almost always they are creative, in the sense of making or bringing something new into existence. Worldplay finds its focus in the composing of alphabets and languages, the writing of stories and histories, the drawing of pictures and maps, the building of models or the generating of statistics—all meant, in one way or another, to document the inner imagination.

Very little is known about worldplay, the children who indulge in it, or the connections that may exist between such juvenile invention and adult creativity. To that end we hope to survey individuals at work in the arts, sciences and humanities, identify those who imagined worlds as children, and interview those willing to explore how their early inventive play may (or may not) have prepared the way for mature creative activity.

Thank you for your time and consideration. We look forward to receiving your reply.

WORLDPLAY QUERY

I. ADULT CREATIVE ACTIVITY

1. Name:

2. How do your describe your vocation(s)?

3. Do you have any avocations or hobbies? Please list, indicating how much time you give to them.

4. Has childhood play of any kind been important to your vocation(s) or your avocation(s)? Please explain.

II. CHILDHOOD Worldplay

Worldplay involves the repeated and self-consistent elaboration of an imagined place inhabited by imagined people or beings. This world may be fantastic or realistic. Very often, languages are invented for these people, as well as a culture of behaviors, technologies and institutions.

5. Did you invent such an imagined world as a child? Please explain. IF THE ANSWER TO THIS QUESTION IS NO, SKIP TO PART III. QUESTION 11.

6. What age were you when you first invented this world? How many months or years did you play with this world?

7. Did anyone play this imagined world with you? Who?

8. Did you tell your parents or guardians about this imagined world? What was the response?

Worldplay often finds its focus in the composing of alphabets and languages, the writing of stories and histories, the drawing of pictures and maps, the building of models or the generating of statistics—all meant to document the inner imagination.

9. Did you document your imagined world in some way? Please explain.

10. Do you still have any of this documentation?

III. CONNECTIONS BETWEEN CHILDHOOD PLAY AND ADULT CREATIVITY.

The philosopher Kendall Walton argues that games of make-believe alter as we mature, but in no way disappear. “In order to understand paintings, plays, film and novels,” he writes, “we must look first at dolls, hobby horses, toy trucks, and teddy bears.”

11. How important to you are the imagined worlds (fantastic or realistic) elaborated in film, literature, art, dance, music, etc?

Francois Jacob, biochemist and Nobel prizewinner, said that science, too, “is a game … of continually inventing a possible world, or a piece of a possible world, and then comparing it with the real world.”

12. How important to you are the possible worlds explored by humanists or scientists?

13. Do you create imagined or possible worlds in your adult vocation(s) or avocation(s)?

(IF YOU DID NOT INVENT IMAGINARY WORLDS AS A CHILD, PLEASE SKIP TO QUESTION 15.)

14. Do you see a connection between your childhood worldplay and your invention of, or participation in, imagined or possible worlds as an adult?

IV. PERSONAL FEEDBACK

15. Please indicate:

____ The Root-Bernsteins may attribute my remarks in this query to me in their research and writing.

____ I wish my remarks in this query to remain confidential, i.e. without name attribution.

16. Are you willing to be interviewed about your childhood or adult worldplay? If so, please fill out preferred contact information below.
ADDRESS:
PHONE:
EMAIL:

17. Any comments or suggestions you'd like to make about this query?

Appendix B. RUBRICS:

ASSESSING ***IMAGINARY WORLDPLAY***

- ☐ notion of **specific** place, either partly or wholly imaginary
  - ○ "toylands"
  - ○ particular, local places (such as orphanage, stable)
  - ○ islands/countries/peoples
  - ○ systems, bureaucracies, languages
  - ○ idyllic daydream worlds (utopias)

WHICH MAY INCLUDE

- ☐ notion of **specific** persons, either partly or wholly imaginary

AND MUST INCLUDE

- ☐ consistent repetition over some period of time of specific scenario, e.g.
  - ○ specific place (e.g. a name) and
  - ○ specific persons (e.g. names, personalities) or
  - ○ a continuous narrative or
  - ○ evidence of systematization

CORROBORATING FACTORS

- ☐ evidence that the play mattered or matters
  - ○ specificity of recall or
  - ○ documentation (making of props) or
  - ○ statement of value
- ☐ private

ASSESSING ***GENERAL MAKE-BELIEVE PLAY WORLDS***

- ☐ notion of **general** place, either partly or wholly imaginary
- ☐ notion of **general** persons, either partly or wholly imaginary
- ☐ evidence of ephemeral nature
  - ○ indication that worlds changed according to whim
  - ○ lack of documentation
  - ○ lack of specificity of recall
  - ○ lack of continuous narrative or systematization
- ☐ enacting stories in books, radio, tv, film, video games
  - ○ explicit statement required
- ☐ public

ASSESSING ***IMAGINARY COMPANIONS***

- ☐ notion of persons, either partly or wholly imaginary
  - ○ explicit statement of imaginary friends *and*
  - ○ absence of imaginary place, etc

ASSESSING ***DAYDREAMS***

- ☐ ego involvement, as center of attention etc.
- ☐ changing scenarios
- ☐ explicit statement