The Elite's Last Stand: Negotiating Toughness and Fairness in the IIT-JEE, 1990-2005

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Introduction

For final-year middle-class high-school students all over India, the period from March to May is full of exams. There are the school-ending standardized mass exams conducted either by the education boards of state governments, or by the CBSE (Central Board of Secondary Education); these exams are often called "board exams" and they are seen as important, in terms of careers and jobs. And then there are the entrance exams: exams conducted to determine entry into the country's numerous engineering colleges and medical schools. An elaborately complicated system exists: some professional colleges are autonomous and conduct their own exams, some fall under the purview of a particular state which conducts the entrance exam, yet others (very few) use the results of the board exams to determine entry. The exams typically encompass Physics, Chemistry and Mathematics—for medical entrance exams, Mathematics is replaced by Biology—and each paper consists usually of multiple-choice questions. Students often spend the last two years of high school preparing for these exams; sometimes they neglect school and concentrate on their "coaching classes:" privately-run, sometimes residential, institutes that offer a thorough exam-oriented training that ranges from subject notes, solved problem sets graded by difficulty level to practice questions and mock tests.

At the top of this pyramid of entrance exams stands the Joint Entrance Examination (JEE) conducted to determine entry into the highly selective undergraduate programs of the Indian Institutes of Technology (IITs). For instance, on Sunday, April 10 2011, across almost 125 cities all over India (and distributed across more than 1000 exam "centers"), 468,280 candidates, most of

them 16-18 years old, took the JEE. The results were made public on 25 May, 2011. 13196 candidates were deemed "qualified" and were sorted, each qualified student being given an All-India Ranking (AIR). Every AIR was then asked his or her preference: for an Institute and a major. Students with better AIRs were more likely to be admitted to the institution and major of their choice. 9627 candidates were finally admitted, a stunning success rate of less than 3%.[1] To compare, in 2012, the state of Maharashtra conducted its MHT-CET (Common Entrance Test) exam to determine entry into its 348 engineering colleges (133,904 seats); only 280,042 students took this exam despite the vastly higher number of seats available.[2] These numbers should give readers an idea why Manu Joseph, in a recent, rather overwrought, op-ed, called the JEE "the mother of all exams." (Joseph 2012). The scale at which the JEE is conducted, the sheer number of students who aspire to get in, and who put in almost 2 to 3 years of effort, often to the detriment of their school work, as well as the exam's unimaginable prestige (inextricably bound up with the prestige of the IITs), may often seem strange to outsiders.

This essay is about a certain class of elites: the IIT establishment, primarily the faculty, that organizes the JEE each year.[3] My main goal in this essay will be three-fold: (1) to bring out the "social imaginary" (Taylor 2003) of these experts that underlies their discourse and their practices. I will argue that this imaginary consists of a longing for a world with meritocratic, modern institutions that is unfettered by cultural encumbrances, which has its root in the history of the Indian middle class, (2) to argue that these imaginaries are refracted into concerns over the

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[1] JEE Report 2011.

[2] See http://go2engineering.com/html/MHT-CET_Result_Comparison_for_year_2011_2012.htm. To take the US context, MIT, the college the IITs were explicitly modeled on, received 17909 undergraduate applications for the academic year beginning in fall 2011 out of which 1742 were accepted, a success ratio of 9.7%. Harvard received 34950 applicants, out of which 2188 were accepted, a success rate of 6.2%. See http://mitadmissions.org/apply/process/stats and http://www.admissions.college.harvard.edu/apply/statistics.html. Note also that none of these students were asked to select their majors before they were admitted.

[3] Peripherally, it is also about other elites who are very active in debates about the IITs and their future: mostly IIT alumni (who graduated with undergraduate degrees), but also industry figures and public intellectuals (and all these categories inevitably overlap).

"fairness" and "toughness" of the exam itself, and that these values are construed differently by different groups of people. These values help to underwrite the mythic status of the JEE, as well as its status as the embodiment of the social imaginary of the Indian middle class. (3) And finally, to argue that these values, in turn, shape the debates about the exam and can help us understand the changes to the form of the exam in the period 1990-2006. I use Thomas Hughes' concept of a large technological system (Hughes 2012) to show how these values shape the kinds of systemic problems that these elites perceive, as well as their solutions to these problems.

Using the theoretical toolkit of science and technology studies (STS), I hope to show through my arguments that the JEE is an interesting lens to think about the particular relationship between higher education, science and technology, middle-class elites, modernity and the democratic State in contemporary India. By taking a pragmatic stance on examinations—focusing not just on their outcome, but on the messy details of their changing form and organization—I will show that the form that an examination takes depends not just on its stated intentions (finding people endowed with a certain kind of competence) but also on the complicated institutional relationships that the exam's stakeholders—in this case, middle-class elites, interest groups, the State and institutions of higher education—are embedded in. Finally, this essay can be read also as an effort to understand the constitution of elite and expert practices.

What are these IITs and why do they play such a big role in the lives of the Indian middle class? The Indian Institutes of Technology were established at Kharagpur, Bombay, Madras, Kanpur and Delhi in 1951, 1958, 1959, 1960 and 1963 respectively. A new IIT at Guwahati in Assam began in 1994, and in 2001, the University of Roorkee was given the status of an IIT.[4] While education is typically a state subject in India (as opposed to central), the IIT Act, passed by the Indian

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[4] See (Pant and Rajguru 2003) for details about the IITs. In 2006, in a move that sparked controversy and debate, and which we will talk about in more detail, the Central Government established 8 new IITs, doubling the total number of seats, while at the same time, reserving 21% of all IIT seats for the Other Backward Classes (OBCs).

Parliament in 1961 declared these to be institutions of "national importance" which meant that they were funded and administered by the central government, while having considerable autonomy.

The establishment of the IITs was based on the recommendations of the Sarkar committee. On the eve of independence in 1945, the Sarkar Committee was appointed to review the state of technical education in India and to give recommendations to the Government of India about the "scope and number of higher technical institutions" needed for post-independence industrial development. The Sarkar Committee's interim report, which was issued in 1946, recommended that the Indian Government set up 4 institutes of technical learning in the four areas of the country (north, south, east, and west). The Sarkar committee looked to MIT as a model for these institutes; they favored MIT education which was built around the idea of teaching engineers the practical and theoretical sciences as well as the humanities.[5] Most members of the committee felt that existing technical colleges in India were far too deeply limited by their colonial origins and the narrow technical education they imparted to their students; they felt that a new start must be made by building new institutions.[6]

To some extent, the stature of the IITs in India comes from how differently they are structured, compared to the majority of other universities in India. The university education system in India is still governed by the "affiliating" university model started by the British. In this model, the university sets the syllabus and conducts standardized examinations, but leaves the teaching to its affiliated colleges. In contrast to British India however, the number of such colleges (including engineering colleges) has exploded in the post-independence period in response to rising demand (see Table 3). These colleges often lack infrastructure to train students, in terms of qualified teachers, as well other pedagogical resources (libraries, laboratories, classroom space, and so on).

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[5] It must be remembered that MIT education was itself transformed during the experience of the Second World War.
[6] The only dissent was by Nazir Ahmed who felt that the committee was neglecting the already existing infrastructures of technical education; and should build on them, rather than starting fresh. See (Sarkar 1946).

Even if a college is substandard, the university, by conducting an "external" examination, makes sure that the candidate who passes the examination is of a certain standard.[7] However, this leaves colleges no room to innovate and has resulted in an overall stagnation of higher education in terms of quality (Kapur and Mehta 2007).

In contrast to the messiness of other university systems, the IITs are often a model of efficiency. Set on pristine campuses, funded by the Central Government at levels other institutions can only dream of, with excellent educational infrastructure, and with a crop of students who are widely acknowledged to be the "best," they are responsible both for setting their syllabus and evaluating their students. Modeled self-consciously on MIT, they grade their students in terms of letter-grades and GPAs, in marked contrast to most institutions in India which operate on a percentage system (since a letter-grade system would probably not work for the standardized exam conducted by an affiliating university). The IITs thus offer a stark contrast to bureaucratic university systems and woefully under-funded colleges that are all-too-common in India.

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[7] For more on the affiliating university, see (Singh 2003).
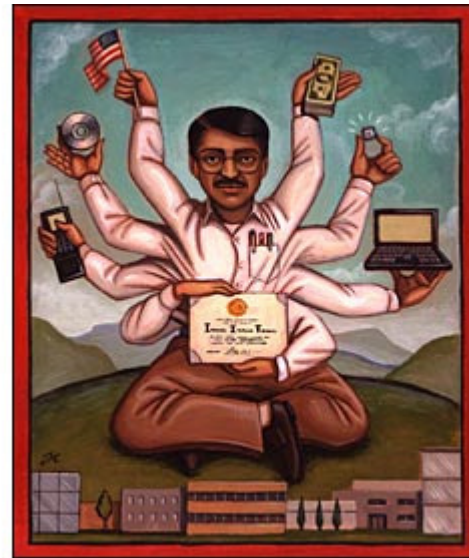
Figure 1: The representations of IIT graduates as the "global Indian." On the left is the cover of BusinessWeek. On the right is an illustration from an article in Salon magazine.

The other factor in the IIT's larger than life stature comes from the success of their undergraduate alumni in the United States (rather than in India). Starting from the 1960s, an increasing number of engineering graduates from India started to move to the United States for higher education and employment (Kapur 2010; Khadria 2000). This was particularly true of the IITs: an IITian was more likely to go abroad after finishing his education for higher studies than work in India.[8] The success of these students, often presented in exaggerated terms, for example, their role in the development of Silicon Valley (Kripalani, Engardio, and Spiro 1998; Salkever 1999; "Imported From India" 2003), gets wide circulation in Indian media. In one such article (Kripalani, Engardio, and Spiro 1998), we learn that "The Indian Institute of Technology is breeding American business leaders from Silicon Valley to Wall St." "[S]ome of the most prominent chief executives, presidents, entrepreneurs, and inventors in the world are graduates of IIT, India's elite institution of higher learning. Its impossibly high standards, compelling the mostly

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[8] One reason for this might be the close ties maintained by IIT faculty with their US counterparts. See (Bassett 2009).

male student body to average fewer than five hours of sleep a night, produce numerate graduates who are masters at problem-solving." It further suggests that the IIT system "provides a model for other Asians to emulate--and an example for U.S. companies and universities to ponder. For India has created, out of limited resources, a class of executives and entrepreneurs who manage to combine technical brilliance with great management skills. [...] [T]he IIT grad is the hottest export India has ever produced." (See Figure 1.)

In Rohinton Mistry's novel, *Such A Long Journey*, published in 1991 and set in a middle class Parsi household in Mumbai in the early 1970s, the protagonist Gustad Noble, a middle-aged man with three children, has his heart set on his oldest son being admitted to one of the IITs. One of the key plot points is that his son refuses to attend even after he has secured admission, an ominous event that starts off Gustad's "long journey." One of the passages, written from the son's point of view, captures what the dream of getting into an IIT is like:

> *With the age of ink came plans for the future. The dream of IIT took shape, then took told of their [the family's] imaginations. And the Indian Institute of Technology became the promised land. It was El Dorado and Shangri-La, it was Atlantis and Camelot, it was Xanadu and Oz. It was the hold of the Holy Grail. And all things would be given and all things would be possible and all things would come to pass for he who journeyed there and emerged with the sacred chalice.*
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> *To try and separate the strands of enthusiasm which went into that noble fabrication was futile. To determine whose idea it was, and who was to blame, was as difficult as identifying the monsoon's first raindrop to touch the earth. (Mistry 1992, 66–67)[9]*

The vital significance of getting into an IIT, the promise it held for young people (mostly boys) and their families is fairly clear.[10] Gustad Noble's son at least gets into an IIT (and rejects it), a situation that is increasingly a luxury for most students today. Take, for instance, the sheer rise in the number of students who take the JEE is plotted in Figure 4. From 12,771 students who took the

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[9] I suspect that Mistry may be projecting what the IITs meant in 1991, when the novel was published, back into 1971, when the events it describes took place.

[10] Mistry's book was adapted into movie directed by Sturla Gunnarsson from a screenplay by Sooni Taraporevala, and was produced in Canada. To see the trailer of the movie, which gives a prominent role to Gustad and his son's conflict over getting into an IIT, go to https://www.youtube.com/watch?v=te4N3sOlaXs.

exam in 1969, the numbers increased to 79559 students in 1990, 147,775 in 2001, a mind-boggling 299,087 in 2006, and 468,280 in 2011. Throughout this period, the total number of seats at the IITs stayed roughly the same (except in 2006, when 8 new IITs were started, doubling the total number of seats).

The prototypical case today is the student who tries and tries and tries to get into an IIT (or another good-enough engineering school) and fails. In Chetan Bhagat's latest novel, *Revolution 2020*[11], the protagonist Gopal, a young man in his late teens, fails to clear the entrance exams, the JEE and the AIEEE[12], that are necessary to get into reputed schools of engineering. His father, despite his poverty, insists that Gopal stay for a year at Kota, Rajasthan, a town famous for its many, many "coaching classes" that help train students for engineering entrance examinations, particularly the JEE. Students move into this town, spend all their days studying for the entrance exams, and are thoroughly and rigorously coached (Srivastava 2011). Here is how Gopal talks about Kota:

> *However, my main challenge in Kota [...] was to enroll in a good study programme. I had spent the last three days doing the rounds of every coaching school. I took in their tall claims about zapping any primate into an IITian. I went through their super-flexible (not to mention super-expensive) fee structures. Bansal, Resonance and Career Path seemed to be everyone's top choices. Each of them had their own, rather difficult, entrance exams. In fact, Kota now had small coaching shops to coach you to get into the top coaching classes. From there, you would be coaching to get into an engineering college. Once there, you study to become an engineer. Of course, most engineers want to do an MBA. Hence, the same coaching-class cycle would begin again. This complex vortex of tests, classes, selections, and preparations is something every insignificant Indian student like me has to go through to have a shot at a decent life. (Bhagat 2011, 55)*

Needless to say, Gopal fails to get a good rank in the entrance exams again. He chooses not to become an engineer, and under the tutelage of a corrupt local politician, becomes an education entrepreneur—busy setting up substandard educational institutions for all the students who don't get into the prestigious schools—and becomes a very rich man (selling his soul in the process, naturally). The fictional cases of Sohrab and Gopal above, in the 1970s and today respectively,

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[11] Its subtitle is "Love, Corruption, Ambition" which should give readers a good idea of what it's about.
[12] AIEEE stands for All-India Engineering Entrance Exam.

should have made clear the socio-economic significance of the JEE (and other entrance exams) for the Indian middle class.

In this essay, I apply the tools of STS analysis to the organization of the JEE. By "organization," I mean the form of the examination (the structure of the exam, the kinds of questions asked, the difficulty level of those questions, the arrangement of the questions themselves, and so on) as well as the practices (setting the question papers, transporting them to venues, creating the answer keys, grading the answer papers, declaring the results) that allow the exam to be conducted. I will show that the changes to the organization of the exam can be explained, not only in terms of particular contingencies like the rise in the number of candidates appearing for the exam, but also in terms of what one might call "culture" of the elites who organize this examination. To understand this culture and its effects on the organization of the exam, I will use two theoretical concepts: the idea of the "social imaginary" (Taylor 2003) and the examination as a "large technological system" (Hughes 2012).

The philosopher and social theorist Charles Taylor (2003) defines "social imaginary" as the "ways in which people imagine their social existence, how they fit together with others, how things go on between them and their fellows, the expectations that are normally met, and the deeper normative notions and images that underlie these expectations.". The social imaginary is different from "social theory" in that "it is carried in images, stories and legends"; it makes possible "common practices and a widely shared sense of legitimacy" (2003, 23). However, a social imaginary is not just about a certain set of ideas that stand behind the actors' practices. Rather, the social imaginary is carried within the practices, even as it enables those practices and allows actors to make sense of them. This allows Taylor to avoid what he calls the "specter of idealism" (2003, 31). He suggests that it is both ideas and material practices which co-constitute each other, and that therefore neither is prior to (or "causes") the other. Taylor is interested in explicating the "modern

social imaginary," a set of ideas, practices and an underlying "moral order" that constitute modernity.

Like the anthropologist Chris Kelty, who uses Taylor's ideas about the "social imaginary" to explain the ethos of "geeks" (Kelty 2008), I attempt to do something similar with the JEE. First, I suggest that the elites who organize the JEE are animated by a social imaginary which underlies, is expressed, and maintained through the organization of the JEE and through the discourses around it. This social imaginary is committed to building a world that is driven by merit, where merit is often discovered through one's performance in standardized examinations. Merit, so operationalized and clearly defined, also makes possible a clear ordering of people and institutions; this is a world that is free of cultural encumbrances and history itself. I will show that this imaginary is itself linked to the post-Independence history of the Indian middle class and a certain vision of modernity.

For the JEE, this imaginary gets expressed in terms of ideas about "toughness" and "fairness." These two values sometimes reinforce, but also often conflict with each other: emphasizing fairness may compromise on toughness and vice versa. The IIT faculty see fairness in the fact that the JEE system is rigorous and incorruptible and no one enters the IITs without a good score in the JEE. They, therefore, have opposed any kinds of "quotas" in the IITs, both for the Scheduled Castes/Scheduled Tribes (SC/STs) in 1973 and the Other Backward Classes (OBCs) in 2006. The IIT elites see the JEE as a pristine island surrounded by a sea of corruption. Other actors conceive of fairness differently: thus social scientists see the *outcome* of the exam as the key to its fairness. The Government of India, which funds the IITs through its Ministry of Human Resource Development (MHRD), also sees the fairness of the exam in terms of its outcome: in terms of the kinds of students who succeed (especially in terms of politically salient categories) and those who don't. Typically, these contradictory interpretations of fairness lead to conflicts. I will show how these conflicts have shaped some of the changes to the organization of the exam.

The idea of "toughness," played out in debates among the IIT faculty, is about the ideal candidate for an IIT education. This debate takes place within a space of practices that shape how the exam is organized. These practices involve tinkering with the form of the exam along several dimensions: a one-tier vs. two-tier exam, the question of subjective vs. objective questions as part of the exam, the difficulty level of those questions, and the susceptibility of those questions to training.

The most fundamental of these is the debate over "subjective" versus "objective" questions; a terminology used by the IIT faculty themselves. Since the JEE is science exam, it consists of asking students to solve certain kinds of, and often, highly difficult, "problems." These problems can be expressed as "subjective" questions in which the student is expected not only to solve the problem but also demonstrate the way he reached his solution. In contrast to these are "objective" questions where the problem is expressed as a multiple-choice question. The reason this dichotomy gets expressed in the subjective/objective form is that the so-called objective questions can be *graded* objectively: the answer is either correct, or it is not. Grading is harder to standardize for the so-called subjective questions since different candidates may use different methods to arrive at the same answer; this becomes particularly difficult for a mass exam like the JEE where the number of candidates can reach hundreds of thousands, and as we will see later, the number of graders is limited (being restricted as much as possible to within the IIT system itself).

On another level, the debate over subjective versus objective questions is over the different strategies that students can use to solve a problem when expressed in an objective or subjective form. IIT faculty argue that expressing problems in objective, or multiple-choice form, reduces their difficulty level, and makes possible a variety of "tricks" that students can use to solve the problems. Coupled with the fact that starting from the 1970s, JEE test-takers started to be more and more intensively "coached," many IIT faculty argue that coaching classes are successful only at teaching students the tricks required to master the problems rather than any kind of true learning of

the subject. The IIT faculty fear that the successful JEE students are more a product of training rather than innate talent. Their solution to this problem has been to consistently tinker with the form of the exam: the right mix of subjective and objective questions, which makes the exam feasible (i.e. conducting the exam and publishing the results in approximately 3 months), as well as a filter for the right sort of IIT-worthy candidates.

Throughout the 1970s and onwards, we therefore see a number of changes. The number of candidates who appear for the JEE started to increase steadily (see Figure 4). This put pressure on the IIT faculty who now had to process and grade an enormous number of answer-papers. As a consequence, we see the relative proportion of objective questions start to rise: beginning in 1978, these objective questions comprised 10% of the total questions, grew to around 30% in the early 1980s and were approximately 40% in the 1990s (Manchanda 2008, 378). Around the same time, middle-class students started to devote more and more of their last two years of school to studying for the JEE. Coaching institutes grew more skilled at training students to solve the problems posed in the JEE; as a consequence, the IIT faculty steadily increased the difficulty level of the questions (although more and more of these questions were objective rather than subjective). As a consequence, the form of the JEE changed multiple times starting from the late 1980s. These changes are summarized in Table 1.

Table 1: Changes in the form of the JEE. Note that the key changes happen in the 1990s.

Year	Milestone	Number of candidates (approx.)
1961	First JEE is conducted. Papers consist of Physics, Chemistry, Mathematics and English.	19,500
1978	English stops being factored into the ranking.	29,477
1988	English exam discontinued.	72,298
1990	Exams offered in 13 other languages; "stealth" screening paper introduced as part of exam.	79,559
1995	Screening paper is taken out.	92,893
1997	Exam papers "leaked." Exam conducted twice.	91,279
2000	Exam broken up into "Screening" and "Mains" held 2 months apart.	128,625
2006	Screening exam abolished. 8 new IITs announced. Exam fully objective.	299,087

To understand these changes in the form of the exam, I will conceive of the JEE as an example of Thomas Hughes' concept of a "large technological system." (Hughes 2012). In order to do this, the examination itself must be considered to be a technology, an idea that is not new in sociology (Bourdieu 1990) or social theory (Foucault 1995). This idea of examinations often sees an exam as a social technology whose purpose is to differentiate between different sorts of people (Lemann 2000), and more often than not, social scientists will show that these are not the people whom the exam *claims* to differentiate amongst [e.g. see (Slaton 2010)]. An exam's claim to put into effect a certain kind of classification (meritorious or not, intelligent or not) is often a reflection of underlying social anxieties; moreover, the widespread adoption and acceptance of an exam's claims requires both the creation of a social and technical order (Carson 2006; Jasanoff 2004).

Within STS, an influential approach has been to see the examination not just as a technology of sorting, but also as a technology of the self. Andrew Warwick (2003) details how a new kind of science pedagogy emerged in Cambridge in the late 19th century. Physics had become mathematical, and it could not be talked about in words: instead the pen, paper and blackboard

became central to the practice of teaching. The written exam meant that the physics "problem" emerged as the key kind of examination question (and has remained so). Succeeding in the Mathematical Tripos came to be seen as the ultimate marker of elite status. To succeed, Cambridge undergraduates would undertake a punishing regime that lasted 2-3 years, practicing problem-solving. A new category of teacher emerged: the "coach"; coaches like Edward Routh would lecture to small groups of students, create their own notes with solved problems that were ranked by order of difficulty. The punishing regime of training required to succeed in an exam like the Tripos led to a new kind of identity for the Cambridge undergraduate: both, physical and mental activity were seen to be essential, and the physics scholar came to embody a certain kind of masculinity, that persists even today.

In this essay, I also build on this idea of the examination as a technology, both, of sorting and of the self. However, my focus will not be on the *outcome* of the exam (which is often the focus when an examination is seen as a technology of sorting and cultural reproduction) but rather, the process and *organization* of the exam. Thus, unlike Foucault, who sees exams as a site where publics are disciplined (which they are), I am proposing to open up the black-box of exams to see how they become the sites of contestations, and to see the different kinds of adjustments that happen there. This requires us to open up the black-box of the exam, to understand the debates and choices that shape the form that the exam takes.

Especially while organizing a mass exam like the JEE, several things need to be done. The question papers for the exam have to be created; decisions need to be made about the form of the exam and the kinds of questions to be asked, especially their difficulty level, and the kinds of strategies they afford students. Security arrangements have to be made so that the questions do not "leak." The exam needs to actually happen on a specific day and time. For this, arrangements have to be made at specific places; the question sets need to be delivered to these centers, invigilators

have to be present to supervise the students; answer-papers need to be delivered out of the centers to the sites where they will be evaluated. The answer-papers have to be graded—uniformly for all the students. The results need to be double-checked and cross-checked so that students do not suffer, selection criteria have to be figured out to separate the successful students from others, and the results of the exam have to be declared and delivered back to the students. All of this has to be done in a certain amount of time, and with limited resources: time, space, people, and money. Moreover, not only do all these pragmatic matters have to be taken care of, but the exam itself, and its outcome, have to be seen by its audience—here the students, their parents, and other publics—as credible.

Focusing on the organization of the exam allows us to see the exam as an example of Thomas Hughes' "large technological systems." (Hughes 2012). For Hughes, large technological systems include not only physical components and technological artifacts, but also consist of people, laws, and institutions that manage this system. The examples in the literature include electrical power systems (Hughes 1993) and systems built to improve the accuracy of ballistic missiles (Mackenzie 1993), and even investment banks. An analytically useful property of these systems is that they suffer from what Hughes calls "*reverse salients*." "Reverse salients are components in the system that have fallen behind or are out of phase with the others." These reverse salients may be artifactual (a material needs to be found that makes the light-bulb cheaper and longer-lasting) or social (consumers are not using electricity the right way); their solutions are often both social and technical. In fact, as Donald Mackenzie (1993) points out, the key to analyzing these systems is often what *counts* as a reverse salient for the system-builders, and what *counts* as a solution once a reverse salient is identified and agreed to, both of which depend on particular interests and values. Thus, the line of causation is not always from a reverse salient to a critical problem to a solution. System-builders often have solutions that are in search of problems, and the key to getting one's

solution accepted (with all the rewards that this entails) is to show it as a solution to a critical problem. Values, ideology, interests and just good old-fashioned pragmatism are often mixed together in irreducible ways in the evolution of large technological systems.

How is the JEE system a large technological system? First, because its "product" is an examination that is administered to literally hundreds of thousands of students all over the country. This is not unlike what a business does: create a certain kind of product, create channels to distribute and sell the product, collect information about consumers and consumer behavior, and make sure that the product retains a kind of credibility amongst its intended publics. Second, conducting this examination requires administrative coordination between the IITs and is often handled by creating an organizational unit whose purpose is to ensure the successful completion of the JEE for that year. Third, this organizational unit includes both people and artifacts (computer systems for grading and sorting students, the question and answer-sheet used in the examination, etc.). Moreover, the people in this organizational unit exist in a particular kind of hierarchy. Fourth, as an analyst, the system can be pragmatically separated from its "environment"—and as I will show, the actors in the system make a particular point of distinguishing themselves from the environment. Finally, the system can be seen to be beset by "reverse salients" (bottlenecks that impede the system's working and growth). The cause of these reverse salients can be either internal or external or both—from within the system, or from the environment, or a combination of the two. The solutions to these reverse salients are irreducibly socio-technical.

The particular constitution of this system and its organizational culture can be used as units to explain some of the key changes to the JEE. For instance, as the number of students appearing for the exam increased throughout the 70s and the 80s, it became difficult to grade the answer-sheets. The grading thus became a key reverse salient, and the introduction of objective questions made the grading manageable. However, the solution is as much a result of the organizational culture within

the system as it is a response to a change in the environment: the rising number of candidates. For instance, as we will see in the discussion of the social imaginary of elites, the JEE system is characterized by distrust for its environment which is seen as corrupt and without integrity. The IITs themselves, on the other hand, are seen as bastions of meritocracy and rectitude. It is not surprising that the IIT elites chose to keep the grading as far as possible within the confines of the JEE system; it is in that sense that objective questions emerged as the solution to the problem of increasing examination candidates.

However, the introduction of objective questions conflicted with the values of fairness and toughness because (a) they were seen as examples where students could demonstrate their learning abilities rather than their conceptual understanding, and (b) they were seen as unfair to students who could not afford to be coached. Another reverse salient was thus created. A solution to this problem was the idea of a two-tier exam. A two-tier exam consists of a fully-objective screening exam that screens out unworthy students. The relatively fewer students who succeed in the screening exam are then asked to solve subjective questions (here conceptual problems in Physics, Chemistry and Mathematics). Again, this solution must be seen as not just a technical solution to a pragmatic problem (the grading of the objective screening exam can be done by computers, the subjective grading of the relatively few selected candidates is done inside the system) but also as an expression of particular values: the "merit" of a candidate is seen in his innate talent; the years of coaching a candidate goes through to succeed are distrusted and seen only as a measure of his endurance; and at the same time, the administration of the exam is kept within the system itself.[13]

This idea of the two-tier exam, which seems to have been on the minds of the JEE faculty at least since 1980, was first implemented in 1990, and even then, almost through the back-door. This

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[13] Naturally, new solutions to existing problems open up new reverse salients. Thus for the two-tier exam, it raises the immediate question: how many candidates should the first-leg of the exam screen out? How can we know for sure that the screening exam is not screening out deserving candidates? And so on.

particular back-door was the Government's edict to the IITs to conduct the JEE in 13 Indian languages. The questions would be in English and Hindi but students would be allowed to answer in 13 other vernacular languages. A new reverse salient opened: how would the question papers be translated? How would the answers written in different languages be graded? How would the model answer paper to assist the graders be prepared? Again, this reverse salient only makes sense against the background of the organizational culture within the system which saw the performance of these high-stakes tasks as being done only *within* the system. A partial solution to this problem was introducing a screening exam with objective questions. An objective screening exam would bypass the problem of grading papers in different languages. Grading the subjective questions (which would be in multiple languages) of only those who succeeded in the screening exam—a relatively smaller number—thus solved the problem of grading, while still keeping this particular task within the system. Each reverse salient and its solution has depended on the values and interests of the system-builders, in this case, the IIT faculty. I will be concentrating on the 1990 language episode in some detail.

To summarize, I will attempt to explain the various discourses around the JEE (discourses produced usually by the IIT faculty and alumni) as well as the changes to the form of the exam in terms of a particular social imaginary embodied by middle-class elites. In this imagination, the ideal world is meritocratic and filled with modern institutions such as the IITs that are unfettered by cultural encumbrances. When it comes to the JEE, this imaginary is often expressed in terms of the values of fairness and toughness. These values along with the organizational culture of the JEE system can often help us understand the shape and form that the exam has taken.

For evidence, I draw on several sources. First, I draw on books and articles published about the IITs and the JEE, both in scholarly as well as popular forums (newspaper articles, advertisements, self-help books and so on). For example, a fair number of books have been published about the

IITs – their histories, their idiosyncrasies, the characteristics of their students and so on (Deb 2004; Manchanda 2008; Subbarao 2008; Gulhati 2007; Modi, Kumar, and Kothari 2012; Pant and Rajguru 2003). Mostly written by alumni or professors, they offer an interesting window into their experiences, and a key source for an analyst to locate the social imaginary of these elites. Second, I draw on Government reports. The most important of these are the JEE reports that are issued by the IITs every year and which report, among other things, certain statistics about the JEE. I was able to access these reports from 1990 onwards at the JEE office in IIT-Bombay. I also use other reports issued by the Govt. of India, such as the reports of the committees appointed to review the IITs, among others.

The next two sections will attempt to flesh out the argument in detail. The next section situates the social imaginary that is often expressed through the discourses of these elites in the history of the Indian middle-class and the political economy of education in post-Independence India. This is followed by a section that looks at the values of fairness and toughness and what these values mean to different groups. By seeing the JEE system as a large technological system, these values can be used to explain some of the changes in the form of the examination.

An Asocial, Meritocratic World: Situating the Social Imaginary of Elites
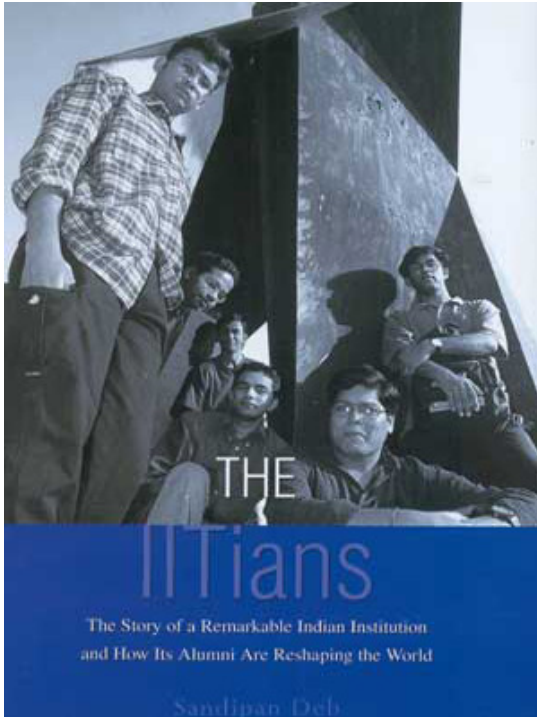
Figure 2: The cover of Sandipan Deb's book *The IITians*. Notice the low-angle shot of a group of young men standing against the backdrop of something that looks like the pyramids.

A line occurs on page 26 of "The IITians: The Story of a Remarkable Indian Institution and How its Alumni Are Reshaping the World," a book by ex-IITian and journalist, Sandipan Deb. Published in 2004, it is an engaging book that is built out of interviews with many now-successful IIT alumni as well as professors, skillfully interspersed with the history of the IITs themselves as well as meditations on future of the institution.

> *How did this Third World nation manage to invent an entrance examination system that is the toughest and fairest of its kind in the world, and maintain the integrity of that system through half a century, so that even an Indian President's son stands as much (or, to be more precise, as little) chance of getting through? (Deb 2004, 26)*

It is worth unpacking this line in more detail since I believe it expresses concisely the social imaginary of a particular class of elites: IIT faculty and alumni, whose voices Deb brings to the

page. The imaginary is rooted in the history of the Indian middle class and stresses the idea of world which should be free, meritocratic and with equal opportunities for all. It suggests a certain Westward-looking self ("Third World Nation") as well as a certain longing for one might call (in a different context) a "natural aristocracy[14]." This natural aristocracy is confined to a select few ("as little chance of getting through") but is open for membership to everyone, and has no particular relationship to class ("the Indian President's son" is not automatically entitled to membership). Moreover, this natural aristocracy can be found and selected through examination systems—a belief in the power of examinations to work as sorting mechanisms.

Deb's almost poignant quote frames both, a literal and a rhetorical question. As a rhetorical question, it suggests a feeling of wonder at how such a thing –the success of the JEE – has come to pass. The phrasing "how did this ...Nation" suggests that Deb thinks that the JEE's status, its integrity and its image, are all flukes. In a nation that is full of examples of how not to do things, the JEE's credibility, underwritten by its toughness and fairness, is something of a mystery. Yet, the line is also a literal question to which, Deb suggests, his book provides a partial answer. In much of the book, Deb interviews several IIT professors and alumni who worry that this system will be undermined and suggest that the best way to protect this system is to leave it alone. This suggests that these elites believe that the key reason for the system's credibility has been its autonomy. This has consisted of letting the elites run the institution with minimum interference from politics in general and the Government, in particular. The IITs, and the JEE, thus become embodiments of the social imaginary of these elites, examples of what the project of nation-building should be like, and a model for other projects of nation-building, which, sadly, have had nothing like the success that the IITs have enjoyed (from their point of view).

To historicize this social imaginary and to understand its origins, I now turn to the history of the Indian middle class and the political economy of higher education in post-Independence India. The

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[14] The term was famously used by Thomas Jefferson in a letter to John Adams. Here, I only use the term in a loose way. But the point remains that the IIT elite do see themselves as engaged in the task of nation-building, and believe that a meritocracy is the best way to go about it.

middle class in India was a direct product of the introduction of western education in the middle of the 18th century. In his infamous Minute on Education (1835), Thomas Macaulay expressed his belief that English (and in particular, Western) education would create a "class, Indian in blood and colour, but English in tastes, in opinions, in moral and intellect".[15] His intention, more than anything, was to create a class that could serve in the colonial administration in various capacities. There were some members of this class who went on to become Indian Civil Service (ICS) officers, but most worked for the colonial government in administrative and clerical capacities.

The middle class that arose in India had therefore three pronounced characteristics: (1) it had a pre-dominant urban bent since the Universities were concentrated in the capitals of the Provinces (such as Bombay and Calcutta). (2) It was not an "industrial" middle class since industrialization in India was constrained in its very nature. *Therefore the expansion of this class could only happen through two channels: the expansion of education and the rise in the number of government jobs.* (3) Finally, this middle-class itself was invested in the distinctions of caste, gender and language. This, mostly upper-caste, class, however, developed a national consciousness, primarily by creating an autonomous inner *cultural* space that was authentically Indian even as they accepted the West's superiority in the outer zone of the economy (Chatterjee 1993)—which then served as the basis for the Indian nationalist movement. However, it also differentiated itself, structurally, from the other segments that existed: e.g. the vernacular rural middle-class, the landed middle-class etc through existing distinctions of caste, language, and gender (Fernandes 2006, 1–28).

After independence in 1947, the Government of India took on the job of building a "mixed" economy. A mixed economy would involve both public (i.e. Government owned and managed) and private sectors. India's mixed economy was heavily biased towards a public sector. There were areas of the economy (heavy industries, education, etc.) where the private sector was kept out; in the

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[15] The "Minute on Education" can be read in full at this link:
http://www.columbia.edu/itc/mealac/pritchett/00generallinks/macaulay/txt_minute_education_1835.html.

areas of the economy (primarily consumer goods) where the private sector was allowed, a system of quotas, licenses and permits kept it tightly circumscribed. Public-sector jobs became the new means of sustaining the urban middle-class.

Table 2: The distribution of public and private sector jobs in the (organized) Indian economy is shown. We see that public sector jobs are dominant – both in terms of their absolute number and as a percentage of total jobs. [Source: (Nayar 1990, 366)].

Year	Number of jobs (millions) - Percentage of total jobs	
	Private Sector	Public Sector
1961	5.04 - 41.7%	7.05 - 58.3%
1971	6.76 - 38.6%	10.73 - 61.4%
1981	7.39 - 32.3%	15.48 - 67.7%

Table 2 shows the distribution of (organized sector) jobs in India over the post-independence period. The trend is easily distinguishable. Private-sector jobs show a modest increase while the number of public-sector jobs increases much faster and they start to occupy a larger share of organized sector jobs. A similar trend is seen in the institutions of higher education established after Independence (Table 3). The number of colleges (both technical and general) rises dramatically, as does the number of students who enroll in higher education.

Thus, on the one hand, education continued to be seen as the ticket to success and to stable, middle-class jobs. In keeping with this, there was a substantial expansion of higher education, first predominantly by the Government. Later, when Government funding decreased, but demand for higher education stayed the same, the private sector stepped in to establish institutions of higher education (Kapur and Mehta 2007). On the other hand, the expansion of the jobs themselves never happened, and the jobs that existed were mostly created by the State. The competition of a expanding number of graduates for a small amount of jobs became a key facet of middle class Indian society.

Table 3: The increase in the number of institutions of higher education is shown below for the post-Independence period. The number keeps on increasing; higher education is still the dominant way of becoming a part of the Indian middle class. [Source: Statistics of Higher and Technical Education issued by the Ministry of Human Resource Development (MHRD) in 2007-08. Accessible at http://mhrd.gov.in/statistics_data]

Year	Number of Colleges			Number of students enrolled
	General education	Technical education	Of national importance	
1950-51	370	208	27	396,138
1960-61	967	852	45	962,256
1970-71	2285	992	82	3,311,737
1980-81	3421	3542*	110	4,857,383
1990-91	4862	886	184	4,924,868
2000-01	7929	2223	254	9,541,826
2005-06	11698	5284	350	14,323,566

Not surprisingly, starting from the 1960s (the decade in which the last of the IITs was set up, and the first JEE was held), India experienced a massive incidence of graduate unemployment[16]. A consequence of this was that the mostly upper-caste middle class started to grow disillusioned with the Government and looked for "privatized strategies" in terms of jobs and higher education (Khandekar 2010; Fernandes 2006).   Going abroad for post-graduate education was one of these strategies. Getting into an elite technical institution, which was seen as a ticket to going abroad, or to getting a good private-sector job, was another. In Figure 3, we see that the number of migrants from India to the United States rose sharply in the 1960s after the US liberalized its immigration regime (Bassett 2009). Many of these migrants were high-skill, middle class professionals.

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[16] I use the words graduate and post-graduate in the sense that they are used in India. In the US, they would correspond to under-graduate and graduate respectively.
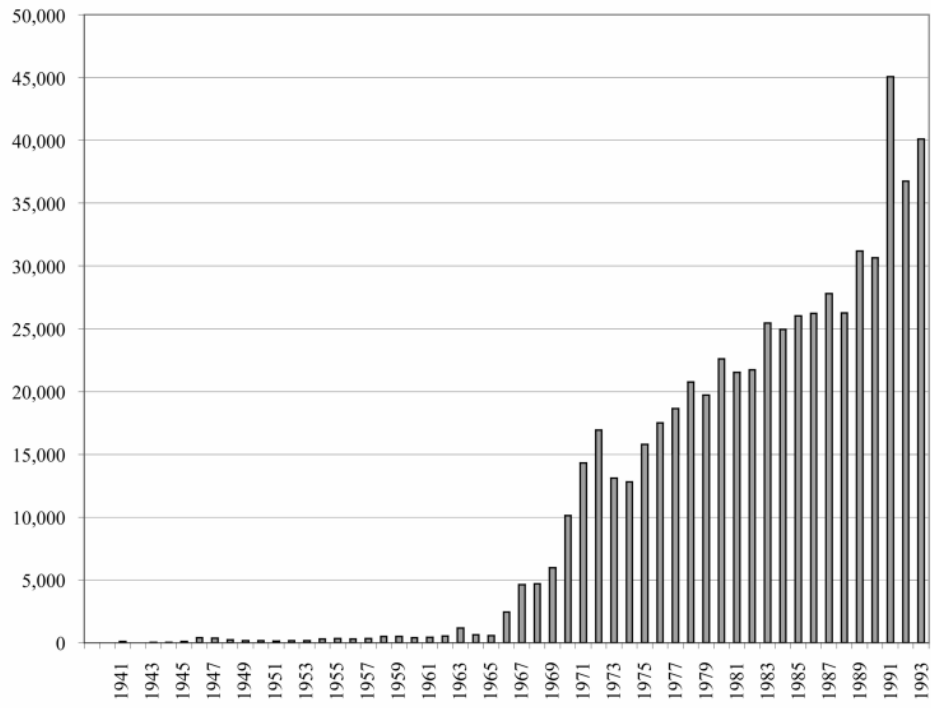
Figure 3: The graph shows the number of immigrants from India to the United States. The number of immigrants rose sharply after the US liberalized its immigration laws in 1965. The new migrants were mostly high-skill workers who worked in the tech industry. From (Bassett 2009).

A factor in this switch to privatizing strategies was the rise of low and middle-caste groups in India under the banner of the "OBC" (Other Backward Classes) category. For now, it suffices to say that a separate political movement of the numerically-stronger middle-castes (groups that fall between the high castes and the untouchables) gathered strength in the post-Independence period. By coalescing under the banner of the "OBC" category, these groups have tended to demand the scarcest social goods: stable public-sector jobs and opportunities in educational institutions that provided a ticket to those jobs. These dynamics underlie what is called "quota politics" (Jaffrelot 2011) where groups ask for "quotas" in public sector jobs and educational institutions. For instance, a 20% quota in jobs and schools for the former untouchables (now called Scheduled Castes/Scheduled Tribes, or SC/STs) has been in force since independence. Movements by the

lower and middle-castes for their own quotas started after Independence, and many States implemented quotas at the state level for these classes. However this was typically resisted at the national level (until 1990).[17]

A conflict thus arose between these rising democratic movements and the traditional urban middle class elites for the limited number of jobs. As a consequence, these elites were pushed out of government jobs into the private sector, or chose to go abroad, mostly to the United States (Kapur 2010; Khadria 2000). This was particularly true of the IITs: an IITian was more likely to go abroad after finishing his education than work in India. Leslie and Kargon (2006) quote this wonderful line commonly used at IIT-Kanpur: "When a student enrolls at an IIT, his spirit is said to ascend to America. After graduation, his body follows." This phenomenon, often called the "brain drain," has led to many contentious debates in India.[18] Many of these elites, graduates of prestigious institutions of higher education like the IITs, are today valorized as the "globalized Indians" (Khandekar 2010; Radhakrishnan 2006).

Political scientist Devesh Kapur (2010, chap. 7) sees the emigration of Indian elites starting from the 60s, primarily to the US, as one of the safety valves of Indian democracy. He suggests that because elites could emigrate, the fight over the distribution of political power and economic resources was less contentious than it might have otherwise been.

> *Indian emigrants are positively selected from the social and economic elite (whether measured by caste, class, or education and skills). This elite emigration has lubricated the political ascendancy of India's numerically dominant lower castes. The introduction of universal franchise in India following independence signaled the death-knell of the political hegemony of India's high castes. In recent decades, as the inexorable logic of numbers has reshaped the political landscape of India and lower and middle castes have gained a greater share of political power, they have sought to use this newfound access to redistribute economic resources. The vast social churning engendered by Indian democracy has led to hitherto socially marginalized*

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[17] Today, in India, over 50% of the seats in Government jobs and educational institutions (especially institutions of higher education) are reserved for SC/ST and OBC categories.

[18] For an analysis of the "brain drain" phenomenon in the IITs, see (Sukhatme and Mahadevan 1988).

groups coming into political power and challenging the entrenched political power of upper castes. The question was not if this would happen, but when and at what cost. No group gives up its privileges without a fight, and the "silent social revolution" in India could have been much more contentious but for the possibility of exit open to India's elites—both to the private sector, and ultimately, outside the country. (Kapur 2010, 21)

Kapur suggests that the elite capacity to migrate was aided by the fact that they possessed easier-to-exchange human capital (i.e. advanced degrees, or what Bourdieu would call institutionalized "cultural capital" (Bourdieu 1986)) rather than economic capital in the form of land. In that sense, "exit" was an option for these elites and they exercised it, exiting first from State employment to the private sector (itself very small) and, then, to greener pastures abroad (primarily the United States).[19]

But not all elites exited. The IIT faculty, in particular, is an elite class, many of them with PHDs from Western universities. Leslie and Kargon (2006) report that when IIT-Kanpur was being set up (in the early 1960s), out of the approximately thousand applications received, about 20% were from the United States and Europe. About 33% of the Indians who were chosen as faculty had PHDs from the United States. The admission policies of these elites reflected a commitment to a particular meritocratic moral order that emphasized the fairness and toughness of examinations, values seen too often as being eroded outside the IITs, in the "vast social churning" of democratic politics. It seems natural then that the IITs have fought long, hard, and successfully to maintain their autonomy from the Government. Reservations for SC/STs came to the IITs only in 1973, when they were adopted in the rest of the country in the 1950s, and that too after a long fight by the faculty. Similarly, reservations for the OBCs happened only in 2006, and only after the Government had drastically expanded supply, by setting up 8 new IITs.

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[19] Kapur also hints, with a whiff of conspiracy, that while these elites may have lost political power, they have not yet lost economic power and this might be one reason for India's top-heavy education system, where higher education is sometimes emphasized to the detriment of primary and secondary education. "Why has a country whose national elites have been committed to poverty eradication and whose intellectuals profess deep concern about the welfare of the poor done so poorly on one of the most basic tools for empowering the poor -- literacy?" (p181). He suggests that the comparative lack of investment in primary and secondary education is an instance of "pedagogic suppression," a way of maintaining the distinction between the elites (which by now include both middle and lower castes) and the masses.

The social churning engendered by democracy and the universal franchise in post-Independence India (abetted in large force by the political economic organization of the Indian economy around the State) helps explain, to some extent, the social imaginary of elites embodied by IIT faculty and alumni. This imaginary is expressed through the values of fairness and toughness (as suggested in the quote that opened this section). In the next section, I will look closely at these values and how they shape practice in terms of the actual organization of the JEE.

Fairness, Toughness and the Organization of the Exam

The underlying moral order of the JEE is pithily expressed in the phrase "toughest and fairest." This implies, on the one hand, that this exam is a difficult one, and on the other, that this difficulty is a source of pride. It also implies that the exam is fair, in spite of its difficulty, and that the preservation of this fairness and its overall integrity is a matter of the deepest concern. In this section, I will attempt to flesh out these two values of "fairness" and "toughness" that emerge in discourses about the JEE. In the following sub-sections, I will outline the different meanings of fairness and toughness for different groups, and how these come together in the organization of the exam.

For the IIT elites, fairness implies a certain method of selection that is neutral to a particular kind of power (the power of money and class). For other groups, fairness is seen more as an approach to outcomes, in this case, being admitted to the IITs. Finally, for the IIT elites, fairness is inextricably tied to the autonomy of the IITs—an indication of these elites' disillusionment with the Indian State. Questions about fairness always seem to bleed into questions about the toughness of the exam. I will explore how ideas about the ideal IIT student are mapped onto the exam procedure that can select these students. These ideas usually lead to debates about the value of subjective versus objective questions, as well as the value of a one-tier versus two-tier examination system. Last, I will consider a case-study where all these issues—of fairness as a method versus outcome, of the

autonomy of the IITs and its preservation, as well as the definition of a deserving student and a good exam—all come together. This is the case of 1990 when the Government asked the IITs to conduct the JEE in 13 regional languages (besides English) which I will analyze using the lens of a large technological system.

Fairness as Procedure

The JEE faculty's notion of fairness is a clear expression of their social imaginary that sees the JEE system as a lone bastion of merit and integrity in a sea of nepotism and corruption. Fairness, in this case, consists of a resolute adherence to a certain set of technocratic protocols: no one, however powerful, is allowed to circumvent it. Thus, Shashi Gulhati, a professor at IIT-Delhi since the 1960s recounts how his telephone conversations with parents of prospective students have changed over the years in his book "*IITs: Slumping or Soaring?*" In the 60s, he recounts, he would actually have to persuade parents to send their sons and daughters to an IIT, after they had been admitted. In the late 70s and the early 80s, the phone call happened about a year before admissions and the conversation resembled the following:

> *Our son Sumit is very keen on joining the IIT. He talks about it all the time. Can we count on your help for his admission - you must know the people on the selection committee or what have you.*

> *No uncle, it doesn't work that way. he will have to take a nationally conducted exam called the Joint Entrance Examination (JEE). Admissions are then on the basis of one's rank in the JEE.*

> *Yes, yes, I know all that but there is also an interview.*

> *Not an interview, Uncle, but counseling, where, depending on one's rank, one is asked to choose from the options available, options in terms of the specific course and the specific IIT.*

> *My brother-in-law knows your Director very well, should I ask him to talk to the Director?*

> *Uncle, the Director will say exactly what I have told you.*

> *You mean you and even the Director cannot help at all.*

> *No uncle, not even the PM [prime minister]. But I can help. I can pick up the application form for JEE for Sumit and send it to you.(Gulhati 2007, 4–6)*

This odd, intentionally cartoonish conversation is revealing in a number of ways. As an elite, Professor Gulhati is painting a portrait of IIT faculty members like himself and the broad public clamoring for entry into the IITs. The public is seen as conniving, if comically so. The world outside is seen as full of nepotism and corruption ("My brother-in-law knows your Director very well"), the world inside the gates of the IITs is clean and meritocratic ("the Director will say exactly what I have told you"). To be sure, the passage does not really vilify the public; rather, the comical effort to pull strings is seen as understandable, as a symptom of the malaise that has gripped the rest of the world. And the conversation, if fictional, ends well. Professor Gulhati persuades the anxious parent that the best way to enter the IITs is to work hard—a solution, the passage seems to imply, the rest of the country should take to heart and adopt, rather than scheming their way to education and jobs. By the 1980s," says Professor Gulhati, "it began to *finally* dawn on people that here was one system in India that was incorruptible and totally on merit."[20] [my emphasis].

The theme of nepotism and politics appears in several other throwaway remarks and is delivered with a distinctive rhetorical force. For instance, here is M. S. Ananth, the Director of IIT-Madras in the coffee-table book "IIT: India's Intellectual Treasures."

> *"The exam is so competitive," says Professor M. S. Ananth (Director of IIT-Madras) that in the past "16 children of IIT Directors did not qualify to attend IIT." When asked if any further efforts were made, he replies, "Nothing could be done. They did not qualify." (Pant and Rajguru 2003, 1)*

In yet another case, a story is told about an IIT Director getting a call from the head of the Planning Commission (a powerful technocratic advisory body to the Government of India) who inquired if his son might be able to scrape through. The Director tells the Commissioner that this was possible but only if the Commissioner can increase the number of positions in the IITs by advising the Government to do so.[21]

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[20] In the 1990s, he reports, the calls would come even earlier, about two years before the exam and would usually involve questions about the kind of coaching students needed to get a good rank in the JEE.
[21] This makes fun of the Planning Commission's status as the primary advisory body to the Central Government.

Stories like these appearing in prominent publications are interesting for two reasons. First, their style is often one where someone, usually an IIT faculty member, speaks truth to power. Power here is embodied in prominent political posts, stand-ins for the rough and tumble of political democracy: the President, the Prime Minister, and the Planning Commissioner. Second, these stories have the feel of myths: in the sense that they circulate, and are told over and over, providing meaning and purpose, both for the story-teller and the audience. This gives us an idea of how important the integrity of the IIT system and the intrinsic (and carefully maintained against all odds) fairness of the JEE are to a particular set of stake-holders (the faculty and the alumni). Pervading through many of the texts that I cite is a fear that the integrity of the IITs (and the JEE) will be undermined. For instance, to pick one instance among many others, the JEE Report of 1992 says:

> *The confidence that the IIT JEE system has built over the years is due to meticulous care, built-in checks and balances and devotion of the concerned people. Thus there is a tremendous amount of responsibility on the organizers for preserving the image the JEE System has built over the years* **as well as fortify it against the external and external elements who try to undermine the very foundation of the system**. *It is necessary to take a note of this at the JAM [Joint Annual Meeting] and initiate remedial measures before it is too late. [my emphasis]*

Accompanying the elation, there is also a fear that the exam may be favoring certain kinds of students over others, primarily students with higher-income. However this fear is expressed differently by IIT faculty and by social scientists. Social scientists stress that the JEE as an institution tends towards the reproduction of existing class divides, while IIT faculty fear that it is the proliferation of different kinds of coaching institutes for the JEE that may be depriving deserving, but lower-class, candidates of their rightful spot in the IITs undergraduate programs.

Fairness as Outcome

As we have already seen, fueled by a State-driven economy, and rising democratic movements of formerly disenfranchised groups, the Indian Government has typically initiated what is commonly called "quota politics." Quota politics stresses the idea of fairness as outcome; typically, this is

guaranteed by creating quotas in government jobs and educational institutions for different groups. This led to two interventions by the Indian State into the IIT admissions process, despite the protests of IIT faculty: the first, in 1973, reserved approximately 20% of IIT seats for SC/STs. The second, in 2006, reserved an additional 20% of seats for OBCs (this was accompanied by a substantial expansion of supply; 8 new IITs were announced). I will be looking at these incidents in more detail in the next sub-section.

The idea of fairness as outcome is also used by social scientists who have criticized the JEE for reproducing class. In 1968, Rajagopalan and Singh (1968), wrote a piece titled "The Indian Institutes of Technology: Do They Contribute to Social Mobility?" In this paper, they interviewed 237 students (86.5% of the total admissions to an undisclosed IIT) about their "social background." The authors found a number of striking points: most of these students lived in urban areas, a significant number were high-caste Brahmins (about 21%), they were all male, 58% had fathers who had at least a college degree, more than 50% had fathers who were engaged in service-based white-collar occupations, and only 6.3% of them had done their schooling purely in a regional language (most of the others had shifted from a vernacular medium school to an English medium school at some point). Their conclusion: "in actual practice, admission appears to be determined by a set of socio-cultural factors." These include: "awareness of the existence of technological education, appreciation of its importance, (perhaps more important) the ability to afford that education, as well as the quality of education previously received."

This piece, along with others (Varma and Kapur 2010; King 1970a; King 1970b) take a typical social-science approach to the question of exams. The authors argue that successful candidates in the exam are characterized by a particular kind of social background: they are all middle-class with their parents occupying a certain income bracket, usually male and living in a city, studying in

English-language schools. The exam, they argue, reproduces class, even if the exam tests for a certain kind of merit. Merit, in this context, is class.

Surprisingly, the IIT elites would agree with this although their criticism and fears take on a different dimension. On May 9, 1976, the Times of India reported on an "analysis" made by A. K. Basu, the chairman of admissions at IIT-Delhi ("Affluent Students Fare Better in IIT Exams" 1976). "The typical successful candidate," we are told, "was about 17 years old belonging to a family of five with the father or guardian earning around Rs. 14,500 annually. He hailed from a city and had studied in an English medium school." The IIT council, the report tells us, had "decided to institute a study on how to improve equality of opportunity for candidates from villages." The report goes on to note:

> **For, as Mr. Basu notes, talent cannot be considered to be the monopoly of city dwellers.** *The poor performance of village candidates must be attributed to lack of orientation and preparation rather than lack of ability.[my emphasis]*.

The concern with the relative admission rates of the affluent vs. the non-affluent, the urban vs. the rural, and the English-educated vs. the vernacular-medium educated has been constant with the IITs. When candidates register for the exam, they are asked a number of questions, from the occupations and income-brackets of their parents, to their native language and language of instruction, to where they are from. These statistics are then published in the JEE reports that are created after the process for a year is finished. Yet, while these details continue to be asked, and statistics continue to be published, year after year, very little seems to have been done about it.

In later years, the IIT faculty's concern with the fairness of their selection procedure seems to have shifted from just the urban/rural or affluent/poor divide to the fact that coaching classes, set up to coach the students to take the JEE, were exacerbating this divide. Thus Professor Indiresan, the former director of IIT-Madras observes:

> *Admission by nationwide tests where hundreds of thousands appear has made the selection process mechanical. Writing such tests is trainable, and training offers significant advantage. Thus India's professional colleges, including the*

> *IITs, have shut their doors to a vast pool of talent among the poorer sections of the society (who cannot afford the training), and are missing out on true scholars not interested in rote learning. (quoted in Gulhati 2007, 160).*

He also observes:

> *If I had my way, I would scrap the JEE in its present form, because it has become a trainable exam. As long as one has the stamina, and does not get bored, you can get through the JEE. It's almost like being an Olympic athlete: try again and again and again.* ***But if the JEE is scrapped entirely, there could be political interference in IIT admissions, and that would be disastrous.*** *To some extent, the coaching class syndrome and the willingness of the **middle-class student** to devote four or five years of his life to this entrance examination is turning the JEE into more a test of endurance than of intelligence or talent for science. (quoted in Deb 2004, 53 my emphasis)*

These reflections lead us to two other factors with which this fear of training driving out deserving candidates (i.e. the value of fairness) is inextricably intertwined: the fear of the IITs losing their autonomy to the government i.e. "political interference," as well as the concerns over the "toughness" of the exam ("more a test of endurance than of intelligence or talent for science").

Fairness as Autonomy

The IITs are recognized as institutes of "national importance" and are protected by the IITs Act, passed in 1961. The Act highlights that each IIT be managed by a Director, a Deputy Director, a Board of Governors and a Senate. The Senate (which consists of all the professors in the IIT) is responsible for academic matters while the Board of Governors takes care of the day-to-day administration. The Director is the key figure and will make the final calls for both administrative and academic decisions. Technically, the IITs report to (and are funded by) the Ministry of Human Resource Development (MHRD) in the Central Government (which manages secondary, technical and university education). In the management of the IITs, the MHRD is advised by the All-India Council of Technical Education (AICTE) and by the IIT Council. The Directors of the IITs all have positions on the IIT Council, which also consists of other government arms involved in education,

members nominated by the Government, and by three members of parliament. [22] However, the IIT council rarely meets; it met 5 times between 1995 and 2005 (Gulhati 2007, 56).[23]

The IITs, thus, have a great deal of autonomy when it comes to dealing with administrative and academic matters. Especially when it comes to the JEE, the MHRD has mostly tended to leave them alone. However, because the Government is accountable to other publics, directives often come down to the IITs through the IIT Council and are often fought by the IIT Senates and the Directors. In the Director's Report of 1983, an IIT director states: "A University needs to have three basic freedoms; freedom to decide what to teach, whom to teach and who will teach." The report lists three instances when these freedoms were infringed. The first freedom about "whom to teach" was infringed in 1973 when a "reservation policy was thrust on the IITs" due to which "nearly a quarter of the seats were to be filled not as per merit but on a diminished standard." The second freedom of "who will teach" was infringed when the Government decided that the pay-scales of IIT professors would be the same as those in other Government-run universities. The third freedom of "what to teach" was infringed in 1980 when the IITs were asked to shift from a 5-year B.Tech program to a 4-year program, to "fall in line with the national pattern of education [...] ignoring the unanimous view of the Senates of all IITs."[24] (quoted in Gulhati 2007, 107).

Of all these freedoms, the one that most relates to this essay is the freedom of "whom to teach" since this is directly related to the organization of the JEE. In my readings, I have found three instances of this. The first, as we saw before, happened in 1973 when the Government decided that the IITs need to implement an affirmative action program (about 22.5% of IIT seats be reserved for the Scheduled Castes and Scheduled Tribes). The second happened in 1990 when the Government

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[22] See (Pant and Rajguru 2003, 3). The full text of the IITs Act can be found here: www.iitb.ac.in/legal/IITsAct.pdf.
[23] "It meets so infrequently that it may as well not be there" says Professor Gulhati. By now, this should not surprise readers – the IIT elite do not look favorably on the Government. (Gulhati 2007, 51).
[24] Readers will be unsurprised to know that this director is again Professor P. V. Indiresan who has provided this essay with many of its good quotes.

decided that the JEE be conducted in multiple languages, that students should be allowed to write the exam, not just in English, but in 13 other regional languages. The third happened in 2006 when the IITs were asked to implement a second round of affirmative action quotas (around 21% of the total IIT seats) for the Other Backward Classes (or OBCs). I will investigate the first of these (the introduction of SC/ST quotas) in this section. The second episode will be examined later in another section.[25]

Let us take the first case: the introduction of SC/ST quotas in 1973. In 1973, on the recommendation of a committee, 22.5% of the seats in IITs were reserved for SC/ST students (approx. 20 years after this had already been implemented in the rest of the country). The IITs resisted but finally gave in. Over the years, the performance of SC/ST students has remained a problem for the IITs and in the next ten years, they experimented with several forms of admission. First, these students were admitted irrespective of their performance in the JEE; they were admitted as long as they had passed the higher secondary examination and had appeared for all papers of the JEE .From 1975 to 1977, this policy was changed slightly, because there were still a number of reserved seats that were not filled. SC/ST students were now granted admission if they had secured 50% marks in their higher-secondary exams, even if they had not taken the JEE. In 1978, the performances of these students were analyzed, found to be unsatisfactory, and the policy was changed yet again. Today, SC/ST candidates are now admitted if they have demonstrated a certain level of performance both in their higher-secondary examinations and the JEE. They may directly qualify by securing more marks than the cut-off for the JEE. Or, they can get in if they secure marks that are at least two-thirds of the last-ranked successful candidate in the JEE. Finally, if the quota is still unfilled, the remaining seats are offered to candidates who have taken the JEE as long

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[25] This essay will not explore the introduction of OBC quotas in the IITs in 2006, as part of the overall decision to extend the OBC quotas to the institutes of national importance. Interested readers may refer to (Deshpande 2006) on the broad question of what the 2006 decision meant.

as they clear a year-long preparatory course. Only if they perform satisfactorily in this course can they begin the engineering degree program.   As a compromise, this seems to have satisfied both sets of stake-holders: the IIT elites and the students themselves (Manchanda 2008, 321–323).

However, this does not mean that IIT elites are happy since they see this as just one step in the Government's long-term plans to exert control. Thus, the Director's Report of 1983 continues (this is at time when the reservation policy was accepted but it was still unclear what the best way of admitting SC/ST students would be):

> *They (Members of the Parliamentary Committee on Scheduled Castes) are concerned that most SC/ST students are unable to cope with their studies in the IITs and some feel that our standards are too high. Some members of the Committee have gone so far as to say that what we need is an Indian standard and not an international standard of instruction whether we need or need not be aware of the latest developments in Technology, it is necessary to debate the fundamental question whether, just because a group of people cannot cope with a certain level of education, they should have the veto power to deny such an education to the rest; whether social justice should imply that there shall be no institution at all in the country where merit shall be the criterion and also while the socially-deprived should have special privileges, the talented need have no rights of their own (quoted in Indiresan and Nigam 1993).*

In a 1993 essay, two former IIT directors assert:

> *Such large divergence in entry performance has brought into the IIT system a significant number of academically deficient students who have considerable difficulty in coping up with the system in spite of remedial measures. This has led to many problems in the IIT system. Firstly, nearly 50 per cent of reserved seats remain vacant as SC/ST students are unable to secure minimum threshold marks. Of those admitted, almost 25 per cent are asked to leave the Institutes due to poor academic performance - thus losing their self esteem. With the political clout of SC/ST, reservation and attendant problems have brought political interference in the functioning of IITs (Indiresan and Nigam 1993).*

However, events look different when seen from the point of view of the students themselves. These students report that the competition in the IITs is cut-throat. (Some of the actual descriptors include murderous, stiff, intense and fierce.) They point out that this competition is promoted and encouraged. (These views were also shared by non SC/ST students). They find the coursework difficult because it is a big jump from what they learnt at school. They find that their family backgrounds and cultural interests are significantly different from the other students. They also

worry that they have been labeled as different, as having received special benefits during admission, by the other students. (Non SC/ST students confirm that they do believe that the SC/ST students have been given special privileges.) (Kirpal et al. 1985).

Rukmini Bhaya Nair's (1997) book *Technobrat: Culture in a Cybernetic Classroom* is a sympathetic account of teaching social theory to IIT-Delhi undergraduates, and manages to skillfully highlight certain taken-for-granted attitudes within IIT undergraduates. The most of important of these is a certain feeling of difference: these students feel different from the rest of the country. "Most of my class seemed perfectly comfortable with the proposition that some – especially themselves—were more equal than others, and rightly so." The characteristics of an IIT undergraduate, she says, include "a ruthless competitiveness, emotional attrition, a focused but extremely narrow vision of social goals, relentlessly instrumentalist attitudes and an annoying complacency – the complacency of already "having arrived" at nineteen." These students "also appear supremely indifferent to politics, but this is a misconception. It is not that they are a-political; rather, to them, politics primarily means strategy (a Machiavellian/Chanakyan wily planning for power) and never ideology (Gandhianism, Marxism, or even Thatcherism)." (1997, 25) When the class discussed feminism, and the vexed, if hardly-talked about issue of the low number of women in the IITs (about 5%), Nair was "amused" by her class's intransigence [to the notion that there was something inherently unfair about the low number of women in the IITs] but also "alarm[ed]". "For insensitivity towards gender forms a larger pattern consistent with [these students'] attitudes towards *all* the disenfranchised – the 'backwards' who sought reservations, the poor, the disabled. This precisely was the middle-class culture of indifference to which engineers as a species were heirs in action. The bottom-line was: anyone who hadn't 'made it' belonged to the category of the undeserving. They had failed to compete." (Nair 1997, 211). The point of quoting Nair is not to express moral criticism of these attitudes but to show these attitudes correspond particularly well to the post-

Independence phenomenon of elite disillusionment with Government. It is one indication of how elite "exit" is expressed.

Toughness: Finding/Making the Ideal Student

As the prestige of the IITs increased through the late twentieth century, the number of students taking the JEE rose and rose. The rise in the number of candidates is shown in Figure 4. Success in the exam became more and more sought after, and coaching classes arrived on the scene with elaborate pedagogic techniques to help students cross the hurdle of the JEE.

Questions about the best way of sorting students have haunted the JEE-makers. True to their social imaginary, the JEE faculty have typically focused on the instrumentalities of sorting while preserving the autonomy of their system from the democratic churning happening outside. They alone would conduct the exam, decide what kinds of questions were to be asked, grade the papers and decide on the cut-offs that separated the deserving students from the rest. Their task therefore became one of managing the rise of the candidates while still preserving their autonomy.
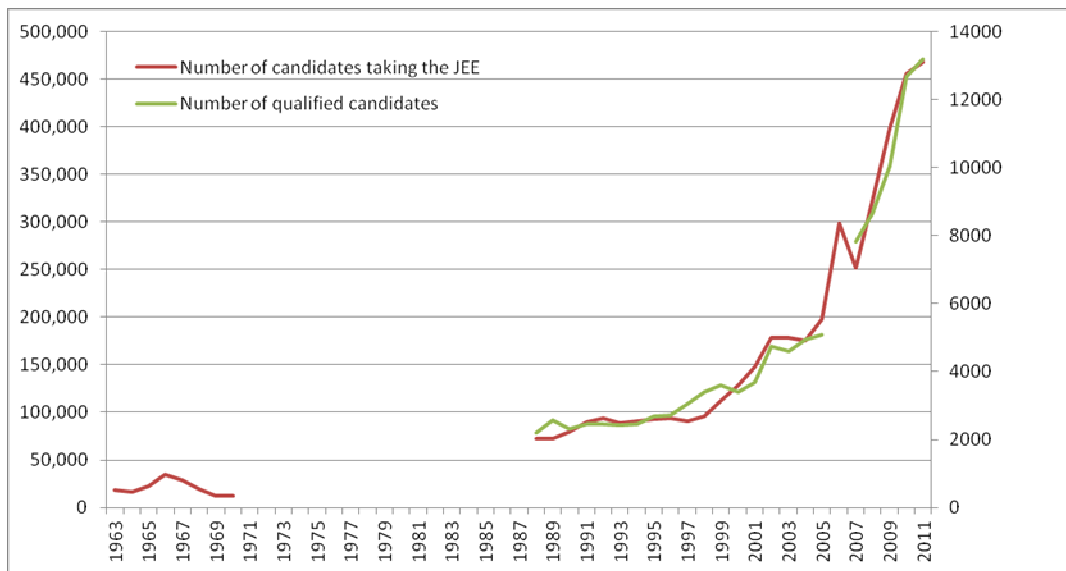
Figure 4: The graph shows the rise in the number of candidates who appeared for the JEE. The number of qualified candidates jumps up sharply in 2006 when 8 new IITs were started. Source: JEE Reports 1990-2011. Also (King 1968).

The debate raged over what kinds of questions to ask: whether problems would be expressed as subjective questions, graded both for the rightness of the solution and the method used to reach it, or as objective, or multiple-choice questions, graded only for the rightness of the answer. On the one hand, objective questions made grading easier, especially when one considered the sheer number of papers to grade by a limited group of (trust-worthy) people. On the other, the ability to solve subjective questions was what truly separated the truly deserving candidates from others.

Some of this debate is illustrated by the striking metaphors of physical activity used by the IIT faculty while talking about the quality of students and the selection procedure.[26] For instance, Dr. B. Roy, a professor in Aerospace Engineering says "We are certainly getting more brawny students than the brainy ones. Surviving two years in Kota and several such 6 hour tests ensures that." Professor K. D. Joshi gives this striking metaphor for the JEE: "Sometimes I feel tempted to compare the JEE with a swimming competition where we assemble all the contenders on one bank of a river and ask them to get to the other. In the past, we could actually seem them swim. But now we have no way of knowing whether they crossed the river by actually swimming or by taking a ferry, or, if they can afford it, whether they hired a helicopter! All we care is who made it to the other bank, and among those who did, who were the fastest." (quoted in Manchanda 2008, 377).

Surprisingly, these thoughts lead the faculty to a point where they believe that determined and hard-working students may not be the right candidates at all. Professor Joshi again: "Sadly, in a fiercely competitive system, this [the success of determined and hard-working candidates] is inevitable. About the only thing we can do is to design the selection process in such a way that those who have had a relaxed childhood, have cultivated healthy thinking habits, and who go entirely on their own, will find it easier than those who are always on the run. In the present set-up, this is unthinkable." (quoted in Manchanda 2008, 377). Sandipan Deb puts this in the following way:

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[26] One example, that I have already mentioned, is the anxiety over whether the JEE is turning out to be a measure of "endurance" rather than "talent."

What also worries IIT alumni and professors is that someone who has spent five years, from the ages of fifteen to nineteen, madly slogging to get into an IIT, to the exclusion of every other activity, would be a somewhat unidimensional person, with only the ability to study and solve a certain specific range of problems, the types that the JEE asks examinees to solve. Imagine a young man of nineteen, who has not seen a film for five years, read a storybook for five years, seen very little television for five years, has never tried to woo a girl. What sort of a person would he be?

My hunch is that he is going to have low awareness of the world around him and how it functions, low social skills, minimal leadership ability and not too much aptitude for creative and innovative thinking. I sincerely hope that I am completely mistaken in believing this, but the evidence seems to suggest I am not far off the mark.[27] (Deb 2004, 49).

The interesting thing in these comparisons and misgivings is the mismatch between the examination as a technology of sorting and as a technology of the self. An exam that shapes the self is not seen as an exam at all. The comparison between physical and mental activity serves to ground this belief. Physical activity requires endurance, and therefore is teachable. But mental activity is not and *should not* be—at least not the kind of mental activity that separates IIT-level students from others. How, then, should these students be chosen? What might be an effective technology of testing that allows testing for "talent" rather than "endurance" and allows the detection of multi-dimensional, rather than uni-dimensional individuals?

The IIT elites focus on the questions themselves: whether they should be subjective or objective, and their level of difficulty. To up the ante on the institutions that have mushroomed to train students, the IIT faculty raised the difficulty level of the questions. Coaching classes typically teach by the collecting the different sorts of problems that appeared in past examinations, and making their students practice each variety of problems in sufficient detail, a standard pedagogical technique of the sciences (Kuhn 1970; Kaiser and Warwick 2005; Warwick 2003). However the IIT elites feel that this is different from the standard method in the sciences. Says K. D. Joshi, "These questions were quite different from the textbooks where the thrust was on developing the

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[27] The gender in this quote seems to me completely intentional. For the IIT undergraduates are predominantly young men.

theory and not so much on problems. In fact, students soon began to study only those problem sets and not the textbooks. This changed the whole equation." The JEE makers went to great lengths to make sure that no problems were repeated.   For instance, Joshi remembers "proposing some good problem and its being knocked out on the ground that it already appeared as Problem 47 in Set No. 11 of some reputed coaching class." The IIT faculty had become, as he puts it, "obsessed with outdoing the coaching centers." (All quotes from Manchanda 2008, 375).

The second line of debate was over the kinds of questions that should be asked in the JEE: subjective or objective questions (these terms are actor's categories).   The clearest form of "objective" questions are what we would call multiple-choice questions, where the answer to a problem is one of the alternatives provided, and choosing that answer guarantees full marks to the student. The student is not evaluated for his process of getting to the answer; he may well have chosen the answer randomly. "Subjective" questions are problems whose answers the student has to work out. Each problem has a specific answer but the student is evaluated not just for the correct answer but also for how he arrives at it. Students may sometimes be awarded points for method, even if they haven't reached the correct answer. At the same time, they may be awarded no points at all for the right answer if they arrived at it with wrong methods.

The first objective or multiple-choice questions came into the JEE in 1978, a year where changes were made to "both in the pattern of the examination and the nature of the questions." Professor K. D. Joshi points out that in 1978 the Mathematics syllabus of the JEE was changed drastically. "Pure geometry was gone. Calculus was in. Also from 1978, objective type questions were started." He points out that there are very few left like him—"old timers"—but he points out that they can feel a "qualitative difference" in the nature of the questions. Professor Dipan Ghosh points out before the multiple-choice questions made their appearance, "the questions asked were just a reduced version of the way we set questions in regular courses in IIT, viz., problem solving. Take for example,

Physics. In the old days Halliday and Resnick's Physics was the textbook in the IITs. You'd find the JEE questions to be similar to those we asked students to solve here, only the difficulty level changed." Professor Joshi believes that the JEE's "golden days" lasted until 1978 when it did not contain any objective questions. He estimates that the proportion of objective questions has grown steadily "from 10% in 1978 to some 25-30% in the early 1980s, and about 40% towards the 1990s." (All quotes from Manchanda 2008, 374–75).

The IIT faculty's objections to objective questions then boil down to two factors. First, that these questions are more trainable. Second, that they can be crammed or learnt, and that they test more for a candidate's capacity for endurance and practice, than any kind of innate talent—which is often seen as being displayed in a candidate's elegant solution to a problem. The "objective-type multiple-choice format" in Sandipan Deb's elegant phrasing, "cannot differentiate between the naturally brilliant grasshopper and the slog-your-butt-off ant," a distinction that is "very fundamental to the JEE system." (Deb 2004, 47).

Yet, objective questions are also easier to grade, considering the procedure that the IITs follow for grading the JEE papers. All papers are anonymized and every examiner is given "solved answer sheets, indicating marks that should be awarded to a student for solving various stages of the problems correctly." These examiners, it should be clear, are usually IIT professors themselves; those outside the organization are not really trusted. If a student has performed some unconventional moves in his way to solving the problem, it is up to the examiner to make the judgment: whether the student has just made a wild guess, or whether he has peered into his neighbor's answer-paper. A second team of examiners then performs "random checks of the graded papers" to verify the "uniformity of evaluation." As an IIT professor points out, "there cannot be

total objectivity." However, the JEE system "ensures that there cannot be more than 1 or 2 percent deviation from the guarantee of uniformity in marking papers."[28] (Deb 2004, 47)

The question for the IIT faculty therefore becomes: is there a way that subjective and objective questions could be combined so that one achieves the best of all possible worlds: easy grading, and yet, the possibility of being able to find students with talent? The answer to this is clearly yes. It is the two-tier exam: the first tier consisting of objective questions that allow the examiners to weed out non-deserving candidates, and a second-tier consisting of objective questions that separate the "naturally brilliant grasshopper and the slog-your-butt-off ant."

The two-tier exam had originally been broached as far back as 1980. Prof. Joshi who was intimately involved in the organization of the JEE in the 70s and 80s says, "[...] in 1980, [I] had prepared write-up pleading for a two stage JEE. The proposal was considered but rejected at that time." (Quoted in Manchanda 2008, 374). It was again turned down in 1985.[29] Not surprisingly, the two-tier examination format also turns up as an aside in the 1986 all-IIT Review (Nayudamma 1986), where we hear that:

> - *Some of the professors in IIT feel very strongly that there should be a Part I*
> *objective test for preliminary elimination and a Part II in the manner as at*
> *present being done.*

Again, nothing was done. However, the Screening exam was first introduced in 1990, almost in response to the Government's edict to the IITs to conduct the JEE in 13 regional languages, in addition to English. We will study this case in detail in the next sub-section.

In summary, we see that the two-tier Screening-Main exam format was seen as a solution to a number of problems—whose formulations only make sense within a social imaginary that prized fairness and toughness. The first problem was the rise in the number of candidates for the JEE which led to logistical problems in terms of organizing the exam, particularly with respect to

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[28] It should be pointed out that this standardized way of grading examinations—"mechanical objectivity"—is common to many other exams in India, all of which are held on a mass scale. For the JEE, of course, this aspect assumes even greater significance, considering the high stakes of the exam.

[29] Manchanda (2008) finds evidence of this in the minutes of the IIT-Bombay Senate meeting on 16 Feb 1985.

grading (for which there was only a small pool of people available). This, in turn, led to a debate about the merits of subjective versus objective questions in being able to sort the right kind of candidates. Objective questions were seen as trainable and less difficult, particularly in light of the growing number of coaching classes while subjective questions were seen as relatively untainted and impermeable to training but more difficult to grade. The question of grading became particularly important in light of maintaining the JEE's autonomy from the Government, therefore all tasks, as much as possible, had to be performed within the IITs themselves. The two-tier exam format was seen as a solution to all these problems—both tough and fair, at the same time.

*Case Study: The Introduction of Regional Answering Languages, 1990*

The second incident that was thrust upon the IITs, violating their autonomy of "whom to choose" was in 1990 when the Govt. directed the IITs to conduct the JEE in thirteen regional languages. In looking at the IITs' response, this case-study brings together all the issues that were discussed in the previous sub-sections: the social imaginary that sees the IITs as the last bastion of a moral order that is underwritten by meritocracy, competing notions of fairness, and finally, ideas about the meritorious student and debates over the right kind of exam forms that might help shape/find such students. I will be considering the JEE system as a large technological system with its own set of practices.   The decision to conduct the JEE in multiple languages led to a number of logistical difficulties (reverse salients) for the system. I will show how the dialectic of revere saliens and their solutions within this system is shaped by particular values and social imaginaries.

The JEE report of 1990 states plaintively:

> *A letter dated 4th September 1989 for the conduct of JEE 1990 in Indian Languages along with English was received by Prof. N. C. Nigam, Organizing Director from the Secretary, IIT Council (Annexure 1). After deliberations on this item, JAM 1990 [Joint Annual Meeting of the Directors and Chairmen, Undergraduate admissions committee of the IIITs] decided to make every effort to implement the decision of the IIT Council.*

What lay behind this directive issued by the Government to the IITs? A brief snippet from the report of the Nayudamma committee (Nayudamma 1986) might hint at an answer. "The Committee could not cover some aspects of interest for lack of data and time," the report states. One of these is "whether JEE preferentially helps the urban elite." As we have seen the question of whether the JEE helps urban/affluent students was a topic of active discussion from the late 1960s onwards. By 1986, the Mandal Commission report had been tabled at the Center, and state level reservations for the Backward Classes were already in effect—the "silent revolution" had begun. It resulted in a significant directive from the Government to the IITs.

A clear precursor to this decision is the decision taken in 1988 to scrap the English language paper. While the decision does not seem to have caused the same amount of consternation within the IITs, it did inspire a Times of India article with the headline "IITs can't afford to ignore English" (D'Mello 1987). The report mentions "students, engineers and senior managers in industry" and asserts that a "majority" of these hold that "the decision will have adverse effects on the academic life and careers of most IIT students." It goes on to note that a "sizable section" of this same group believes that "the scrapping of the English paper is a positive step as it would lead to deserving candidates from vernacular medium school[s] joining the IIT in larger numbers." The decision, the report states, came from the IIT council. The council had received "requests from the government asking them to consider the possibility of conducting the JEE in all state languages in addition to English." The council appointed a committee to look into the issue and the committee recommended that the English paper be dropped but rejected the suggestion of conducting the exam in multiple languages. The decision was accepted by the IIT council which decided that "till satisfactory arrangements were made about other languages, the examination should be conducted in English."
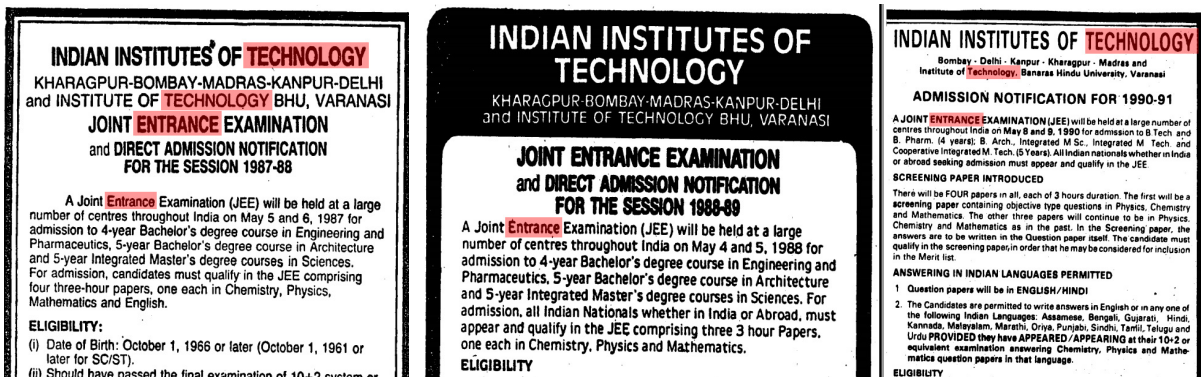
Figure 5: The JEE advertisements for 1987, 1988 and 1990 are shown above. These are taken from *The Times of India*. The advertisement for 1987 shows English, while the one for 1988 shows only three subjects: Physics, Chemistry and Mathematics. The change is not even remarked on. The introduction of the 13 answering languages is however mentioned with a separate heading "Answering in Indian Languages Permitted."

But the issue still simmered—and in 1990, the IITs were asked to conduct the examination in multiple languages. Unlike the case of the removal of the English exam, this move seems to have attracted little attention. The Times of India ran a small piece of less than a column (as opposed to the "IITs can't afford to ignore English" article which ran for multiple columns, and was given a prominent position and an actual byline) reporting on this change ("IIT Entrance Exams in Indian Languages" 1988). "The issue," the article says, "was raised in Parliament earlier this week and a large number of members also gave a memorandum to the Prime Minister." It continues: "The demand for conducting IIT entrance examinations in Indian languages was also voiced by several student bodies."

Clearly, the IIT establishment accepted this result, but not without a fight—although the JEE 1990 report does not indicate this. In an essay published in 1993, two IIT Directors, former head of IIT-Madras P. V Indiresan (79-84) and then IIT-Delhi director N. C. Nigam (director, IIT-Delhi 89-94) call this introduction of languages "forcible" and conclude that it has "implications for the quality of the program."

> *The forcible introduction of 13 Indian languages in the conduct of JEE beginning in 1990 has been another matter of academic concern. More than 80,000 students presently appear in JEE, which is rated among the most*

respected examinations in the world. The decision to introduce Indian languages, over- ruling the concerns of IITs, reflects the slackening of "political-will" regarding the special status of IITs. Besides concerns for the quality of the examination, induction of students with inadequate background in English – the medium of instruction - has its implications for the quality of the programme. (Indiresan and Nigam 1993)[30]

The IITs did manage to get one change to the original proposal. The original announcement stated that "students will be allowed to answer question papers in these languages and the question papers will also be available in these languages along with English" ("IIT Entrance Exams in Indian Languages" 1988). The actual outcome, however, was that the question papers were available in English and Hindi but students could opt for any one of the 13 regional languages to answer the questions. Professor Asoke Mookherjee, writing in *Current Science*, presents the opposition from the IITs as futile, and the discussion as fait accompli:

> *The Senates of all IITs discussed the proposition threadbare. It was a somewhat pointless exercise, since the decision came as a fait accompli and the IITs were simply asked to work out the modalities of implementing the decision. (Mookherjee 1992)*

The modalities, it turned out, were fairly daunting. In 1989, 72716 students took the JEE. The tasks of providing each of these students the option of having the question paper in two languages, as well as the option of writing the answers to these questions in 13 other languages, the consequent complications in grading these answers, and having the results out on time, looked difficult. In response, the IIT establishment seems to have adopted a different strategy. As the JEE 1990 report elaborates:

> *JAM 1990 took the following decisions.*
>
> > *(1) A Screening paper of THREE hours duration will be introduced. This paper shall be the first paper in the schedule. This paper shall be in three independent sections containing objective type questions in Chemistry, Physics and Mathematics.*

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[30] The controversy over English highlights a potentially interesting issue for STS. On the one hand, engineering and technology are seen as non-linguistic, independent of language; the sciences and mathematics are seen to have a language of their own. However, we see from the opposition of the IIT faculty that this is only true in theory and not in practice.

JEE 1990 thus had 4 papers, each of 3 hours duration, instead of 3, as had been the case in the previous years. The first paper would be the screening paper—and the other three papers (Physics, Chemistry and Mathematics) consisting of subjective questions would follow. The key, of course, was that the Screening paper would be graded first, and only the answer-sheets of those who performed satisfactorily in the screening paper would be graded for the other 3 papers. Once the Screening exam had served its purpose, and located a key set of students, its use would be over. Now, the other three papers would come into play—and the final list of qualified candidates would be determined only based on these three papers (which consisted of subjective questions only). As the JEE 1990 report puts it:

> *A very important step was to choose a proper model from among the models suggested by the Task Force, for preparing the merit list of the qualified candidates. It was decided that for JEE 1990, the Screening paper shall be used for screening purposes only and the award in this paper shall not be included in preparing the final merit list of the qualified candidates. That is, the awards in Chemistry, Physics and Mathematics only shall be used in preparing the final merit list. [JEE Report 1990, 6]*

It was also decided that two separate cutoffs would be used in the Screening exam: one for students in the "General" category, and a lower one for the SC/ST category. "The cut-off mark[s] for SC/ST candidates was kept very low." Finally, the cut-off to determine the qualified candidates from the Screening exam was itself kept low "in the absence of any experience of conducting JEE with a Screening paper." However an analysis of the "Screening paper results vis-à-vis the final results" was to be done; this would help in "deciding suitable number of candidates for inclusion in the merit list of Screening paper."

The interesting point is that the switch to a two-tier examination system, which as we have seen was long demanded (since 1980) as a solution to the problem of choosing the right IIT-worthy candidates from a rapidly rising number of prospective candidates, was implemented, almost by the back-door, as it were. As we saw in the previous sub-section, the Screening-Main examination format had been conceived to solve a different set of problems: how does one conduct the JEE

within the system, while managing both, the rise in the number of candidates as well as the exam's ability to find the right sort of candidate, one who was relatively untainted by training and was not just a "slog-your-butt-off ant." When asked to conduct the exam in 13 regional languages, the Screening test became necessary, not just for its main purpose of sorting, but to manage the complicated logistics of the conducting the exam in multiple languages. The two-tier exam form was drawn from an existing repertoire of solutions and adapted to solve a particular problem (reverse salient) at hand.

What did the logistical burden of conducting the exam in 13 additional languages look like? The JEE 1990 report provides some indication of this (even after adopting a Screening-Main two-tier exam format[31]) in a section entitled "Actions Taken for the Implementation of the above [i.e. relating to the introduction of 13 languages] Decisions." (JEE 1990 Report, 5-9). The section begins: "The introduction of languages has introduced many complexities in the JEE operations." The first step is described as the "simulation of the translations of earlier question papers and model answers." In order to do this, the IITs conducted a search amongst the faculty members to find those who had the expertise to translate English questions and answers into other languages. When such experts were not found within the IIT faculty, they were looked for outside the IITs, e.g. in the "Language Academies."

The second step involved verifying the accuracy of the translations. In order to do this, experts were asked to cross-check each others' translations. Two particular operations are described. The translation of the previous question papers into Hindi (remember that question papers were to be available only in English and Hindi) were done both at the IITs in Kanpur and Delhi, and the veracity of each translation was verified at the other site. Sometimes, the translation of a question paper into a different language was given to

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[31] While the JEE 1990 report presents an account of the difficulties of managing the multiple-language exam format *after* deciding on the two-tier exam format, it is entirely possible that the modalities and possibilities of conducting the exam in 13 languages were explored *before*, and the two-tier exam format accepted after seeing how difficult it would be to manage the exam within the IIT system itself.

another expert to re-translate into English; the re-translation was then compared with the original question paper. Glossaries of certain technical terms that appeared repeatedly were prepared. Care was taken so that actual English technical terms were affixed in parentheses to the vernacular terms (i.e. students were provided both with the vernacular term as well as its technical English equivalent).

"Feverish preparations" were made so that the translators were all found and recruited before the question paper-setting commenced. *However a decision was made that the translations of the model answers into the regional languages would be done after the examinations are over*: either during the time when the Screening exam was being graded, or when the evaluation of the Screening exam was complete. It turned out that one of the members of the paper-setting team could also translate the paper into Hindi during the paper-setting period itself. It's not clear whether this was just happenstance, based on "the data available [about translation expert within the IITs]" or whether one of the translation experts was added to the paper-setting team. The other members of the paper-setting team, who had "working knowledge of "Hindi", were also requested to verify the translations. The report states that "*this step would greatly help in keeping the confidentiality and secrecy, which were the hallmarks of the earlier JEE*."

These preparations reveal interesting features of the JEE system as an organization. First, we see that there are patterns of trust that underlie the workings of this system. A clear distinction exists between IIT faculty and other staff. The high-stakes jobs—setting the question papers, transporting them, grading them, deciding on the cut-offs to determine successful students—are performed by faculty. ("The answer scripts of Chemistry, Physics and Mathematics in Hindi from the Bombay and Kharagpur zones were airlifted to Delhi by a senior faculty representative of the Chairman, JEE of the respective Institute, for evaluation. The award slips were carried back in sealed confidential envelopes by the same representatives.") The low-stakes, administrative work(data entry, data processing and so on) is done by other employees who work as part of the JEE office of the IITs.

Trust in outsiders, those outside the system, is almost absent. Earlier, I excerpted a paragraph from the JEE 1990 Report warning about the problems that the JEE system faces from "internal and external elements."[32] One of the problems listed is that of "sheer numbers." The Organizing Institute, it states, meaning the IIT that is in charge of implementing the JEE, has to shoulder a number of logistical responsibilities, all of which have to be carried out in limited time and in "total secrecy." It continues: "*The disproportionately large numbers of registered candidates in some of the zones put tremendous constraints for mobilizing a large contingent of personnel with integrity and reliability to man the confidential and delicate operations* [my emphasis]." Other problems include the unreliability of transport and communication infrastructure. The report suggests that perhaps some of these organizing duties might be shared between all the institutes rather than just one. It also suggests, perhaps wishfully, that "equitable distribution of candidates amongst all the zones may be one of the solutions" to these difficulties.

This is clear from the way the JEE-makers found translators for the exam system. As we have seen, when it came to translating the question papers into Hindi, the JAM looked for (and compiled a database of) IIT faculty who had the expertise to do the job. They initiated a complex series of measures (in "simulation," by asking different faculty to translate prior JEE papers and then comparing between translations). The solution was to have a member of the paper-setting team itself perform the translation. Other experts outside the IITs (say from the language academies) were sought only if in-house experts were not found. In order to create glossaries of terms, the IITs did seek out "State Educational and Language Boards"; however this was a task of secondary importance and did not involve any access to the question-papers themselves.

Seen in this light, the decision to have question papers only in English and Hindi makes sense. The IITs were more likely to have faculty members with expertise in these languages (it is also perhaps a reflection of the politics of language in India) and since setting the question papers was the task with most at stake (confidentiality and secrecy), it was important that one of the IIT faculty on the question-paper team translate

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[32] It will amuse readers that this line appears verbatim in many reports between 1990 and 2000.

the questions himself. (Perhaps it was for this reason that the question papers were only to be in English and Hindi.) The task of writing model answer solutions in different languages was considerably less important and help from outside the system was considered legitimate.

The two-tier format solved some of these problems by keeping the final number of papers to be graded in multiple languages relatively small. 79,559 candidates registered for the examination, which, the report points out, is an increase of 9.4% over the previous year and perhaps in response to the introduction of the regional languages. The break-up of the students who chose the different answering languages as well as those selected by the Screening Test is shown in Table 4. The Screening test clearly reduced the problem of finding graders capable of grading in different languages; it thus functioned as a device to keep the organization of the JEE within the system itself.

Table 4: Number of candidates for the JEE 1990 distributed by answering languages. We see here that the Screening test drastically reduced the number of answer-scripts that the examiners had to grade in the different languages. [Source: JEE 1990 Report].

Answering Language	Number of Candidates	Number of Candidates selected by the Screening exam	Number of Qualified Candidates
Assamese	77	4	0
Bengali	1,304	324	5
English	61,725	21,482	2,274
Gujarati	729	44	1
Hindi	14,501	2,935	40
Marathi	3	0	0
Sindhi	1	0	0
Tamil	496	38	1
Telegu	723	131	1
Kannada, Malayalam, Punjabi, Oriya and Urdu	0	0	0
Total	79,559	24,958	2,322

In considering the JEE as a large scale technological system, we see that the increasing number of students as well as the imposition of 13 new answering languages can be both considered to be "reverse salients," impediments to the working of the system. Yet, the "critical problem" that the system-builders identified and their solution to this problem—introducing objective questions mediated through a screening exam—are anything but self-evident. They become clear only when

seen as expressions of a certain social imaginary characterized by values of fairness and toughness, and which emphasizes the separation of the system from its environment to preserve the system's integrity.

Conclusions and Future Work

The JEE's story, of course, does not end in 1990. The "stealth" two-tier examination was taken down in 1996 and the JEE became, again, a one-tier exam with three papers in Physics, Chemistry and Mathematics. The IITs were successful in reducing the number of answering languages from 13 to 6 (excluding English) since the number of candidates opting for the other languages were too few (less than 10). In 1997, the JEE papers were "leaked" and the exam was conducted again in July – a difficult exercise which the JEE system was able to perform successfully. The IIT faculty investigated the paper leak and took comfort from the fact that the fault lay not in their own system but outside. [While the report does not specify this, it seems as if the papers were leaked when they were being printed, something that the IITs do not do themselves.]

The experience of 1997 and concerns over the security and secrecy over the exam seem to have led to the formalization of the two-tier format in 2000. The Screening exam now become official and was conducted a few months before the Main exam, rather than on the same day. Naturally, this also meant more work for the JEE system: centers for conducting the exam had to be recruited twice every year, instead of just once. Grading had to be done twice, rather than once (although the grading for the Screening was now mechanized and done with computers). And the vexing problem of how many students to pick for the Main exam remained.

For a variety of reasons, this official two-tier format was discontinued in 2006. One reason for this was the second all-IIT review conducted in 2004 that saw the two-tier format as too disruptive for students' school schedule. A second reason seems to be that the debate between the IIT faculty over the value of subjective vs. objective questions seems to have been resolved in favor of

objective questions. One reason for this may be the rise in the number of JEE candidates which reached a mind-boggling 299,087 in 2006 (from 198,059 the previous year, although the opening of 8 new IITs contributed significantly to this). A second reason may be that a task-force appointed to look this question recommended that the JEE revert to a one-tier format with objective questions. In an interview, Prof. Idichandy, the head of the task-force, asserts that while "the screening test is a test of the aptitude of the student while the main examination is a test of his/her analytical ability," his task force was "convinced that an objective type examination can be designed to test both aptitude and analytical ability."[33] These changes deserve further scrutiny through the lens of the large scale technological system concept.

The discussion above will have made clear that the organization of the JEE is related to the struggles over the autonomy of the IITs, their freedom of "whom to choose," which was, to a certain extent, in conflict with other trends in India (which were happening through the channel of democratic politics). Fairness, in this conflict, has meant different things to different groups. The rise of "quota politics" is seen by interest groups as a matter of fairness, but the loss of autonomy that the IITs experience, is also seen by the IIT faculty as a matter of fairness and freedom. The IIT faculty also see the fairness of the JEE being breached by the rise of coaching classes that train students to take the JEE. However, their response cannot be characterized as a form of affirmative action, but rather, consists of tinkering with the questions asked in the exam itself so that it acts as a sieve that picks the right students.

The solution to the problem of rising students and the organization of a multiple-language exam consisted of the "objectivization" of the exam [my term]. The introduction of the Screening test in 1990 is particularly interesting. The screening test accomplished two purposes: it made the grading of the multiple-language answer papers manageable, and it allowed the IITs to conduct the grading

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[33] http://www.rediff.com/money/2005/oct/11inter.htm

within the existing JEE system. The objectivization led to a project of mechanization: the IITs embarked on projects to build and acquire systems that would allow them to grade papers using machines – not an easy task when the exam is to be conducted on a scale as large as the JEE. Finally, the objectivization and the mechanical grading made possible the calculation of new kinds of metrics: such as measuring the reliability and consistency of the examination questions. I hope to analyze some of these questions—very interesting from an STS standpoint—in future work.

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Appendix

One of the key developments in post-Independence India has been the rise of low-caste interest groups in India. These groups have, been influential in the rise of what is often called "quota politics," the reservation of public sector jobs and of seats in institutions of higher education. My summary in this Appendix will primarily follow (Jaffrelot 2011). After Independence, affirmative action programs in favor of the untouchables, or the Scheduled Castes (SCs), as they were now called, were adopted and inscribed into the Constitution in 1950. About 15% of administrative jobs and seats in educational institutions were reserved for the Scheduled Castes (the figure came from the 1951 census). In 1951, an additional 7% was reserved for tribal peoples, the bureaucratic moniker for them being the "Scheduled Tribes" (STs). The adoption of these quotas was fairly unproblematic, and one reason for that might have been that these quotas were never filled, because

of lack of qualified candidates. In terms of administrative jobs, while the number of SCs in the high-skill or "Class 1" jobs has been rising over the last 4 decades (0.53% in 1953 to 8.23% in 1987), SC quotas are most readily filled in the low-skill or "Class 4" jobs (remaining roughly around 20%) – a classic case of the occupational hierarchies of caste being reproduced through a policy meant to change them.

But the question of the reservations for SCs and STs was never a controversial one (although, as we have seen, it came to the IITs only in 1973 over the vociferous protests from its faculty). The controversial question was whether the Indian State would also introduce quotas for the lower and middle castes – castes that were not upper caste but were not untouchables either. Movements by these caste groups had already started in South and West India, and affirmative action for these groups was already underway in certain provinces (but not, as Jaffrelot points out, in the Hindi-speaking states). Post-Independence, they were christened "Other Backward Classes" (OBCs) – the use of the term "class" being deliberate since Nehru and other progressive leaders felt that the debate about affirmative action for these groups should be conducted in terms that were not exclusively caste-based.

The first national level Backward Classes Commission was appointed in 1953 but its recommendation that a set of 2399 castes that made up 32% of the Indian population be offered a set of affirmative measures – "from a 70% admissions quota in vocational training institutions to a 25 to 40 percent reservation of vacant positions in the civil service, depending on class" – was rejected by Nehru's Government primarily because caste played such a big role in the determination of the backward classes, and also because they believed that these distinctions would soon disappear as a more "socialist pattern" of social organization emerged in response to the Government's Five-Year Plans. However while quotas for OBCs were rejected by the Government at the Central (or Federal) level, state governments started forming their own Backward Classes commissions and

reserving jobs and educational seats at the state level (in state bureaucracies and educational institutions run by state governments). In some states the reservations of jobs were as high as 66% (including reservations for SCs and STs). The Supreme Court in 1963 took a different stand: it suggested that taking caste as an indicator of backwardness was unconstitutional and capped reservations at the state level to 50% (although legislative and judicial battles at the state level continued, and quotas existed in some form or the other).

A second Backwards Classes Commission at the national level was appointed in 1978 by the Janata Government, the first non-Congress government at the national level since Independence. The Commission was headed by B. P. Mandal and came to be known as the Mandal Commission. The Commission recommended that 27% of the posts in the public sector be reserved for OBCs (identified as 3743 castes, or 52% of India's population). The Commission's recommendations were only implemented by the Janata Dal coalition government of 1989. The act sparked off many protests – including 63 self-immolations by students. It was finally approved by the Supreme Court in 1992, where the judges also legitimized the use of caste as a marker of backwardness, and lifted the 50% ceiling on reservations that the Court had set out in 1962.

The next big step at the national level occurred in 2006, when the national government implemented the Mandal Commission's recommendations for educational institutions managed by the Central Government (the original implementation in 1990 only referred to administrative jobs in the central government). This meant that the elite schools run by the Central Government such as the IITs, the Indian Institutes of Management (IIMs) and the All-India Institute of Medical Sciences (AIIMS) would now also be subject to reservations for OBCs. This move also aroused protest (although nothing compared to those in 1990). However in the case of the IITs, the Central Government sought to soften the blow by drastically expanding supply, by creating 8 new IITs, thereby doubling the total number of seats.