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Establishing the Internet in Costa Rica: Co-optation and the Closure of Technological Controversies

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Research in science and technology studies has devoted significant attention to technological controversies and the mechanisms that actors employ to resolve them. This article contributes to this literature by developing the notion of co-optation as a dynamic of closure. Co-optation is conceptualized as the incorporation of an actor or group into the organizational structure of another group in order to avert threat or adapt to a context of change. Drawing on the history of the Internet in Costa Rica from 1990 to 2005, this study examines a controversy between two distinct models for the development of computing networks in this country: the academic, sociotechnical network and the state-sponsored, commercial project. The analysis shows that the dispute between these groups ended when the Costa Rican government co-opted leading figures of the academic network into its structure. The notion of co-optation helps us theorize shifts in the configuration of relations between groups that lead to the partial resolution of conflicts and have important consequences for the development of technological infrastructures.

Keywords BITNET, X.25, Central America, closure, controversy, co-optation, Costa Rica, Internet, monopoly, sociotechnical network

In January 1993 in Central America, a small network of computers connected to the Internet for the first time. A young physicist named Guy de Téramond, working in the basement of a building at the University of Costa Rica (UCR), celebrated this achievement, as some of his collaborators recall, by shouting enthusiastically, "A packet, a packet!" (Abel Brenes personal communication, May 23, 2006). De Téramond thus acknowledged the reception of the first messages using Internet technologies in Costa Rica. The new Internet network in this country, running with open-source software on various computers loaned by professors at UCR, also crystallized a long process of negotiations between different actors involved in the development of telecommunications infrastructures.

The connection to the Internet quickly became a site of controversy. On the one hand, the academic community in Costa Rica celebrated the emergence of what it saw as an opportunity to arrive at the crossroads of development. "Less than a year ago," a computer scientist wrote in 1994, "academics in this country were blessed with one of the major gifts that could have been given to us to benefit our research: 'The Incorporation of Costa Rica to the Internet"' (Bogarín 1994, 90).[1] Similarly, to de Téramond, computing networks represented an opportunity to "solve one of the worst problems of scientists in third world countries: isolation" (1990, 95). On the other hand, the Internet project radically departed from technological choices privileged by Costa Rica's national telecommunications monopoly—those based on the International Telecommunications Union's model (i.e., the X.25 network). The increasing popularity of the Internet thus triggered a set of disputes between the academic project and the state-sponsored X.25 project on matters related to the legal, technical, and economic validity of the academic venture. This conflict raises the following questions: How did the relationships between two competing projects shape the development of the Internet in Costa Rica? How did actors solve this dispute, and what were its consequences for the development of the Internet in Costa Rica?

Scholars in the social construction of technology (SCOT) and actor-network theory traditions have emphasized the role of controversies in shaping technological change (Abbate 2000; Callon 2006; Gillespie 2006; Misa 1992). Disputes over technical decisions and the mechanisms employed by actors to resolve them have become a privileged site to explore the contingent process of technological development (Humphreys 2005; Kling and Dunlop 1993; Spitz and Hunter 2005; Stalder 2002). In their seminal study on the social construction of the bicycle, Pinch

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and Bijker (1987) argue that artifacts can stabilize when actors involved in a controversy see their problems as being solved—a mechanism they call rhetorical closure—or when the central problem of a dispute is redefined in different terms. Furthermore, authors have noted that the provisional closure of controversies involves the constitution of sociotechnical networks of associations, alliances, and strategies of interaction between different types of actors (Bijker, Hughes, and Pinch 1987; Callon 1986; Gillespie 2007; Latour 1987). Law (1987) refers to this process of network building as "heterogeneous engineering," which he defines as "the association of unhelpful elements into self-sustaining networks that are, accordingly, able to resist dissociation" (114).

This study broadens our understanding of closure dynamics by developing the notion of "closure by co-optation." Researchers have examined objectives that motivate co-optation and the mechanics employed to secure it. In an influential work, Selznick (1966) refers to co-optation as "the process of absorbing new elements into the leadership or policy-determining structure of an organization as a means of averting threats to its stability or existence" (1966, 259). Researchers have also conceptualized co-optation as a key strategy of adaptation in changed conditions (Dickson 2000–2001; Fleron 1969). Considering the case of the Soviet political elite between 1952 and 1965, Fleron (1969) observes that co-optation allows a group to obtain certain abilities it lacks to adjust successfully to a new context. These skills "are acquired by coopting into the political elite members of existing various specialized elites in society, thus giving these elites direct access to the policy-making process" (Fleron 1969, 181). More broadly, Fleron (1969) observes that groups co-opt elites for a number of reasons: (a) to maintain or increase legitimacy; (b) to appropriate the skills of the co-opted elites; (c) to have greater access to these expert elites; (d) to share power; and (e) to share responsibility.

According to Bertocchi and Spagat (2001, 596), co-optation can also occur when members of a group are placed into a "new, privileged group that separates itself from its group of origin," rather than incorporated into the structure of the co-opting group. The common denominator in these mechanisms is the transformation of a group by a shifting of the location of its key members. That is, in a process of co-optation, members of a group are either integrated by another group or relocated into a new grouping altogether. Finally, scholars have also defined co-optation as the appropriation of countercultural values and symbols by a dominant group or culture rather than the assimilation or relocation of the actors and groups themselves (Tiefer 2000; Villenas 1996). For instance, Thompson and Coskuner-Balli (2007) contend that, in the case of markets, "A key premise of co-optation theory is that the capitalist marketplace transforms the symbols and practices of countercultural opposition into a constellation of trendy commodities and depoliticized fashion styles that are readily assimilated into the societal mainstream" (136).

This article illustrates how co-optation can lead to partial resolution of technological controversies. The concept of co-optation is used here primarily to foreground how the Costa Rican government incorporated key members of the academic Internet project into its working organization (the Ministry of Science and Technology), giving them access to policymaking structures. By incorporating these actors into its structure, the government also integrated technological solutions and values that linked the Internet to certain conceptions of national development. As a dynamic of closure, this strategy brought a partial end to disputes about the legal, technical, and economic validity of the academic network and allowed the state-owned monopoly telecommunications provider to adapt to the changing technological environment.

By examining this controversy, this analysis also contributes to the project of historicizing the emergence and evolution of the Internet in Latin America. Although scholars have paid increasing attention to the history of computing in this region (Aguirre and Carnota 2010; Medina 2005; 2008), relatively little research has been devoted to the history of the Internet. Yet by the mid-1990s, Latin American and Caribbean countries had one of the highest Internet growth rates worldwide (Hahn 1996; Pasch and Valdés 1997; Tamayo, Delgado, and Penagos 2009; Tanner 1999). The history of the Internet in Costa Rica thus illustrates the complex relations among different actors that shaped the network's early development in the region.

This study draws on archival research and 44 interviews with actors involved in the establishment of both the academic and state-sponsored projects in Costa Rica. The account begins with an explanation of the rationale behind these projects, the differences between them, and the early establishment of the Internet in this country. The interactions between these groups and the process of co-optation that solved their disputes are analyzed next. The article concludes with a discussion of how the notion of closure by co-optation extends our knowledge of closure dynamics. This notion helps us theorize shifts in the configuration of relations between groups in dispute that lead to the partial resolution of conflicts.

IN SEARCH OF A NETWORK: X.25, BITNET, AND THE INTERNET

By the end of the 1980s, the *Instituto Costarricense de Electricidad* (ICE), Costa Rica's state-owned monopoly telecommunications provider, had established one of the most advanced telephone and electricity infrastructures in Latin America. Networking of computers had been goal at ICE since the mid-1980s, although the project required

a different set of technologies and knowledge from those it was involved with in the past. To advance the establishment of computing network infrastructures, ICE's subsidiary *Radiográfica Costarricense* (RACSA) initiated plans to implement a set of technologies—X.25 developed by the International Telecommunications Union's Consultative Committee on International Telegraphy and Telephony (CCITT) (Abbate 2000, 154–78; Grier and Campbell 2000). The X.25 model allowed the monopoly to use the telephone infrastructure while also retaining control of access to computing networks in the country.

In 1987 RACSA launched its first X.25 network, named RACSAPAC, and undertook the first projects to provide access to public datasets. Bulletin board systems (BBS) enthusiasts were among the first clients of the network, who used it to access BBS in the United States or to create the first systems of this kind in the country. Moreover, other public institutions and nongovernmental organizations adopted the X.25 network to conduct various projects. For instance, in 1990 the *Omar Dengo Foundation* implemented an ambitious program to provide access to computing networks as an educational tool in public schools (Fonseca 1991).

Although X.25 attracted a certain number of clients, Costa Rican academics did not meet RACSA's venture with enthusiasm. During their visits to academic institutions in the United States at the end of the 1980s, a small group of Costa Rican scientists had become aware of other networking technologies that seemed much more promising for their work than the X.25 network. In the United States, these computing networks were still largely in the hands of academic communities. BITNET (Because It's Time Network), for instance, enjoyed its peak of popularity in the late 1980s (Grier and Campbell 2000). In addition, NSFNET (National Science Foundation Network) had become the backbone of the Internet by the end of the 1980s, and the National Science Foundation funded many universities to establish an Internet connection (Abbate 2000; Hafner and Lyon 1998). Claudio Gutiérrez, a former president of the University of Costa Rica, who had served as a faculty member at the University of Delaware since 1980, recalls his first contact with these networks:

> In 1979 and 1980, in my first visits to MIT [Massachusetts Institute of Technology], the University of Edinburg, SRI [Stanford Research Institute], and Carnegie Mellon, I could observe the practitioners of artificial intelligence sharing information among them, showing each other technical memos, and, in general, coordinating their work and making it progress. . . . A few months later, when I joined the University of Delaware's faculty, I had the satisfaction of obtaining my first "ARPA address." (Gutiérrez 2006, 406–407)

To make "progress," Gutiérrez led many frustrated attempts to establish a connection with these academic computer networks in the early 1980s. Although unsuccessful, Gutiérrez's initiatives allowed a group of scientists in Costa Rica to gather more frequently and meet with potential allies who could help them overcome the project's most significant challenge—to finance the connection to a technology that was unknown in the country. The total cost of the project, estimated at the time to be $45,000 (de Téramond 1994), included the acquisition of infrastructure and a monthly payment for a satellite link to the United States.

The group gained a critical ally when Guy de Téramond, a Costa Rican physicist, returned to the country in 1989 after a two-year stay at Stanford University. Upon his return to Costa Rica, de Téramond started a project to establish a link to BITNET, following the example of a few other countries in Latin America. De Téramond criticized the X.25 network for the technical problems that he believed were inherent architecture of its networking protocols, such as complexity and unreliability. Moreover, he envisioned X.25 technologies as the embodiment of commercial interests that were in stark contrast to the collaborative principles that had guided the development of the TCP/IP protocols of the Internet (de Téramond 1990; 1994).

RACSA evinced virtually no interest in networks that it considered trivial academic projects and made plans to expand the X.25 network, following the model of the telephone monopoly. In its perspective, the future of academic networks was uncertain, and any investment represented a risky venture. Furthermore, the Internet was seen as a departure from established patterns of technological stability and commercial success. The controversy between X.25 technologies and alternative protocols in Costa Rica paralleled a debate that unfolded worldwide after the creation of X.25 in the mid-1970s (Abbate 2000; Gillespie 2006). Abbate articulates the difference between X.25 and the Internet in words that could have been used to describe the Costa Rican case:

> ARPA and CCITT protocols had not been designed to work together . . . they were clearly meant to be alternative approaches to building networks. . . . The carriers expected every network in their system to use X.25. [Their] model was the telephone system, and they assumed that their monopoly on telecommunications would allow them to create a single, homogeneous public data network. (2000, 155, 162)

De Téramond's role in aligning different interests and assembling them within a sociotechnical network located at the University of Costa Rica was crucial for setting the BITNET project in motion and establishing it as a legitimate alternative to X.25. Through a process of heterogeneous engineering (Law 1987), de Téramond gathered a group of actors for whom BITNET became the indispensable expression of scientific development. With funds

provided by state-funded National Council for Scientific and Technological Research (CONICIT), a small group of engineers and assistants, led by de Téramond, established the first link to BITNET in the country. The Costa Rican node at UCR connected to Florida Atlantic University on November 8, 1990. It was the first link to BITNET in Central America and one of the first in Latin America, preceded only by Argentina, Brazil, Chile, and Mexico. As part of the agreement, de Téramond's group at UCR connected seven other public institutions to BITNET between 1991 and 1992, installing, for the first time, online information search and e-mail applications.[2] According to a 1993 report, BITNET had 1,500 users in Costa Rica from 30 different organizations (mostly related to academic research), including 50 users from El Salvador, Guatemala, and Nicaragua who connected using their local X.25 networks.

Although BITNET's use in Costa Rica was ephemeral (it lasted a little longer than 2 years), it played a crucial role in the development of its Internet infrastructure. As UCR's former president, Claudio Gutiérrez, maintains, "BITNET broke the taboo" (personal communication, November 29, 2005). That is, the BITNET venture showed academics that options beyond RACSA's model were possible. Moreover, from a political viewpoint, the BITNET project placed UCR in a leading position in the development of computing networks in the country, despite RACSA's persistent efforts to attract more clients to the X.25 network. After the success of the BITNET experience and its increasing acceptance within the Costa Rican scientific community, de Téramond's group at UCR (now named the Networks Unit) shifted its attention to the Internet. This shift represented "a completely unknown territory" (de Téramond 1994, 72).

The plan to establish an Internet link required a strategy similar to the one used to implement BITNET connections. First, several financial alliances had to be pursued to fund the project. Second, new political agreements were required to guarantee the project's legitimacy. The former was achieved through a grant from the Agency for International Development and the latter through the establishment of an academic network called the National Research Network of Costa Rica (de Téramond, et al. 1991). Under this singular "regime of alignments" (Gillespie, 2007), de Téramond's group established the first Internet access in Costa Rica on January 26, 1993, connecting 12 nodes located in different buildings at UCR. Three months later, in April 1993, his group set up a link to the Internet at other public universities, such as the Institute of Technology of Costa Rica and the National State Distance University, and thereby created the first Internet network in Central America. The enthusiasm of the Costa Rican scientific community for the Internet connection is nowhere clearer than in an anthology of essays published in 1994 (MICIT 1994). "Costa Rica's entry into BITNET and the Internet," an early user wrote, "is [an achievement] whose potential is unimaginable and whose resources are inexhaustible" (Cerdas 1994, 19). In another writer's opinion, "[Computer networks] have made it possible to surmount the limitations imposed by geography" (Fonseca 1994, 134–135).

The increasing interest in the Internet became a crucial factor in RACSA's change of attitude towards the network. Concern, rather than indifference, came to characterize RACSA's view of the development of the Internet in academic communities. These concerns eventually translated into more systematic plans to explore the potential of the Internet as a commercial opportunity. Yet, for the time being, RACSA's efforts remained largely concentrated on expanding the X.25 network in the country and strengthening projects for its development in Central America.

Similarly, the founders of the academic Internet project initiated plans to extend the use of the Internet in the Central American region. Using infrastructure installed at UCR and funds provided by the Organization of American States (OAS), several members of the academic Internet network participated in the connection of many Central American and Caribbean countries (Hahn 1996). De Téramond's collaborators were in charge of specifying technical equipment necessary to connect each university selected by OAS for the project. OAS, in turn, had to acquire the equipment and ship it to each location. Then Costa Rican engineers traveled to each country, installed the equipment, and trained a small group of local engineers in no more than five days. The first regional link to the Internet was established on February 28, 1994, between Costa Rica and Nicaragua. This initiative constitutes the first time that a Latin American country connected to the Internet through another's infrastructure. Several projects in different countries followed this pioneering experience, in which either a connection to the Internet was set up or a link to the Costa Rican network was established: Panama (June 1994), Honduras (June 1995), Jamaica (August 1995), Guatemala (December 1995) and El Salvador (July 1996).

As the Internet became more popular in Costa Rica's universities, other groups became interested in the network. Facing increasing pressure from these actors, RACSA's was forced to rethink its approach. The commercial access to the Internet heated up the controversy even more.

FROM PARALLEL DEVELOPMENT TO CONTROVERSY

Although RACSA had largely ignored academic networks thus far and focused on the growth of X.25, the Internet

presented a set of new issues that were difficult to overlook. For instance, the Internet had gradually defeated X.25 in the worldwide standards battle (Abbate 2000). By the mid-1990s, it was becoming increasingly recognized as a network with commercial potential in the United States. In Costa Rica, two parallel events between 1993 and 1994 significantly changed RACSA's approach to the Internet. First, a small group of its engineers and workers became interested in de Téramond's project at UCR, raising concerns about the future of the X.25 network within the company. Second, a significant group of customers (including some BBS enthusiasts) migrated to the academic network and left the monopoly with an expensive, underutilized network. The former seemingly trivial academic networks had now become a serious threat.

As a result, RACSA began a serious study of the Internet and, in 1993, authorized the group of Internet advocates within the company to run a pilot project to estimate the possibility of transforming the threat into a commercial opportunity. As one of the engineers involved in this project recalls, "It was more a test of the concept rather than an implementation project. Yet, it was because of this project that [the Internet] and its business model launched and developed at RACSA" (Juan Carlos Blanco personal communication, March 7, 2006). To set the pilot project in motion, this group of enthusiasts turned to de Téramond for help. De Téramond agreed to collaborate, and, between 1993 and 1994, engineers from UCR provided some technical equipment and training to RACSA's workers in charge of the project. The process of convincing RACSA's authorities about the commercial possibilities of the network involved a set of presentations and demonstrations to managers, engineers, and marketing strategists. These demonstrations consisted of using Telnet to access online resources in American institutions, such as the Library of Congress and MIT. RACSA's authorities witnessed these presentations with suspicion and financial concern. According to Gabriela Guido, leader of the pilot project, "Breaking the X.25 paradigm was not easy. There was a natural resistance to change. Although people knew that X.25 had accomplished its cycle, there was no clarity as to which path was the best" (personal communication, September 19, 2006).

Despite the doubts, RACSA established the first commercial access to the Internet in Costa Rica on April 1994, using infrastructure provided by the academic project. A record of early clients includes several companies, technology, tourism and consulting firms, international embassies, and academic institutions. Between 1994 and 1996, the Internet project at RACSA began to grow, with e-mail and the rising World Wide Web as the dominant applications of the network's traffic. Ironically, the Internet soon became RACSA's most significant source of income.[3] In Gabriela Guido's view:

> The growth of [clients] was the driving force . . . it was a snowball effect where you had to go with the tendency to avoid being swept away by it. Those who were skeptical and questioned the viability of the project subsequently became its leading proponents. (personal communication, September 19, 2006)

However, as the clients of the state-sponsored project increased and the Internet proved its economic value, the relationship between RACSA and the academic group soured. The frictions between these groups centered primarily on the legal validity of the academic network in the context of ICE's national telecommunications monopoly. RACSA's authorities were convinced that, given that computing networks involved the use of telecommunications infrastructure, the company should become the only Internet service provider (ISP) in the country. From this perspective, while the academic project had accomplished an important pioneering work by installing the Internet for the first time, the commercial expansion of this network required a stronger enforcement of monopoly laws. The academic community, on the other hand, argued that restrictions to their pioneering work would result in significant obstacles to scientific development. To smooth things out, some of the monopoly's authorities convinced de Téramond to join the Board of Directors of RACSA as a way to facilitate the commercial development of the Internet. Yet he resigned 6 months later after constant disagreements with members of the board.

This controversy also involved the technological and economic models espoused by both groups to expand the Internet network in the country. The failure of the X.25 experiment had forced RACSA to look for alternatives to recoup investments. Therefore, the company privileged the installation of dialup access to the Internet in households at a relatively high fee. In contrast, de Téramond believed that only the deployment of dedicated lines would guarantee the scalability of the Internet in the long term. From his perspective, dialup connections did not represent a real solution for securing the development of the network in the country. In addition, he argued for giving free Internet access to members of the academic network. In a letter published by *La Nación*, the country's largest newspaper, in April 1996, de Téramond blamed RACSA's mismanagement as the main reason for undermining Costa Rica's leadership in the development of the Internet in Latin America:

> The Internet in Costa Rica, which in mid-1994 had a privileged position in Latin America along with Mexico, Brazil, and Chile in the total number of connected nodes, starts to lag behind other countries [by 1996], in part because of the growing limitations of resources, but mostly because of the restrictions imposed by RACSA and ICE. As an example, the price paid to RACSA for the use of the satellite in Costa

> Rica is significantly higher than its counterpart in the United States! (de Téramond 1996)

Despite the criticism, RACSA started legal inquiries about the legitimacy of UCR as an Internet service provider. Furthermore, by mid-1996, RACSA attempted two more radical strategies to eliminate what now seemed to be its major competition. First, the company asked Panamsat authorities, who were responsible for the satellite connection of Costa Rica's network to the Internet, to technically downgrade the academic network. By forcing UCR to disappear as an Internet service provider, RACSA aimed to pave the way for the subsequent growth of the commercial Internet network. Second, assuming that the academic network would be shut down, RACSA made plans to seize UCR's clients by automatically making them its clients. The frictions between these groups were abundantly clear in a September 1996 letter sent by Panamsat representatives to the president of Costa Rica and other political figures, in which they responded to RACSA's formal request to downgrade the academic network. In the letter, Panamsat asked Costa Rican authorities to overcome "nontechnical difficulties" between both projects and find ways to conclude their negotiations without damaging the access of the "Costa Rican educational community to the Global Information Superhighway." The academic project was able to keep its autonomy only because of the intervention by the Ministry of Science and Technology. This growing controversy between both groups was also reported in local newspapers. For instance, *El Financiero* reported:

> RACSA has questioned [UCR's] operations comparing it to Millicom, the cellular phones operator that had to cease operations [between 1991 and 1993] because of the monopoly. . . . RACSA is conducting a [legal] inquiry to learn how to handle companies that provide aggregated value on the Internet, since the Telecommunications Law does not contemplate that component. (Bermúdez 1997, 21)

The distance between the academic project and RACSA widened from 1996 to 2000 as both groups established alliances with new actors to legitimate their sociotechnical models. In April 1997, for instance, the academic community inaugurated a satellite station donated by the Organization of American States to UCR. Through this station, they channeled the academic network's link to the Internet without using the monopoly's infrastructure. This strategy allowed the academic project to grow significantly. By mid-1997, the network connected 27 academic institutions to the Internet (primarily universities, research centers, and non-government organizations). For its part, RACSA established several political and commercial alliances to establish itself as the legitimate ISP in the country. In particular, RACSA fostered agreements with cable companies in order to provide faster access to the Internet and continued to invest in dialup accounts (which reached a total of 42,000 in the year 2000).

CLOSURE BY CO-OPTATION

Besides the significance of this conflict for both groups, the controversy also constituted threat for Costa Rica's government. On the one hand, disputes involving RACSA had raised concerns about its parent company, ICE, and its role in the development of telecommunications infrastructure in the country. In particular, actors arguing for the privatization of telecommunications had interpreted Costa Rica's recent lost of leadership in the development of the Internet in Latin America as a sign of ICE's deficiencies. In a column published in April 1996, *La Nación*'s editorialist, Julio Rodríguez, thus argued:

> We [Costa Rica] were at the forefront in this unparalleled dimension of technology [the Internet], but we have begun to loose ground because of RACSA and ICE. This lag has a logical explanation: if ICE and RACSA have lost determination, because of their own responsibility and because of government intervention, they will also constrain other sectors of society, academic and private. (Rodríguez 1996)

In early 2000, the Costa Rican Congress approved preliminarily legislation (popularly known as the "ICE Combo") that authorized a gradual opening of the energy and telecommunications markets to private participation. However, several social groups opposed privatization and organized the biggest public protests in Costa Rica's recent history (Campos and Raventós 2004–2005; Monge 2000; Solís 2002). The Costa Rican government was thus forced to back down on plans of privatization. It now had to reconcile the telecommunications monopoly with growing concerns about the role of ICE and RACSA in the development of advanced infrastructure. On the other hand, the rise and prominence of UCR in the development of the Internet had brought into focus difficulties in the interpretation and enforcement of the monopoly laws that the government had not been able to solve. Under what conditions was UCR entitled to operate as an ISP? No clear answer had emerged. In this sense, although the Internet had made it possible to interconnect the academic and commercial networks through certain gateways, an agreement over legal issues proved much more difficult to reach.

To resolve these difficulties, the Costa Rican government opted for a strategy of co-optation. This approach provided an alternative solution to the problems generated by the controversy after efforts to change the monopoly legislation failed. In June 2000 President Miguel Angel Rodríguez offered the position of Minister of Science and Technology to Guy de Téramond. De Téramond accepted this offer as an opportunity to expand his model of

Internet development on a larger scale, far beyond the range of action of UCR (de Téramond 2005). In addition to de Téramond's appointment as Minister, the government hired his collaborators at UCR, absorbing the core group of engineers and workers from the academic project.

Besides shifting the location of key members of an oppositional group by incorporating them into the policy-making structure of the government (Selznick 1966), this strategy operated as co-optation in two additional important ways. First, this process allowed the government to incorporate into its structure the set of technical solutions and values espoused by de Téramond in the academic Internet project (Thompson and Coskuner-Balli 2007; Tiefer 2000). Once part of the Ministry of Science and Technology, the newly appointed team designed a national project to extend the use of the Internet in Costa Rica through a fast and robust broadband network infrastructure—the Advanced Internet Network *(Red Internet Avanzada*). According to de Téramond, this network represented the logical extension and natural outcome of the initiative undertaken at the dawn of the 1990s at UCR. In this sense, he maintained,

> [This] project had been written ten years before. [We tried] to make possible what we had seen ten years earlier as a dream. . . . We had the vision of a developed country, we acted guided by what we thought Costa Rica should be. (de Téramond personal communication, November 2, 2005)

Second, the co-optation of key figures of the academic project also allowed ICE to adapt to a changing environment marked by the increasingly important role of computing network technologies, to allay critics of the telecommunications monopoly, and to share responsibility with the Ministry of Science and Technology in the execution of its new infrastructure plan (Fleron 1969). ICE had thus far played an ambiguous role in the controversy. It had concentrated investments mainly on telephone and electricity technologies, while allowing both UCR and RACSA to use its infrastructure. To achieve its new initiative, the Ministry of Science and Technology sought an alliance with ICE that could potentially turn this institution into a key Internet service provider in the country. Instead of using cable modem technologies to offer broadband access to the Internet (as RACSA had done), de Téramond opted for another solution that would allow ICE to take advantage of its existing telecommunications infrastructure with a relatively small additional investment: the Asymmetric Digital Subscriber Line (ADSL). ICE envisioned a new business opportunity in de Téramond's project that would require only a minimal investment and agreed to finance and execute the new venture.

The adoption of the view of the Internet as a symbol of national development, consistently advanced by de Téramond (1999; 2002; 2005), was crucial in implementing the ministry's new project and facilitating ICE's involvement in it. In de Téramond's view, "The Advanced Internet Project was designed to support and facilitate economic growth and development in all areas of commerce and in the financial sector, for large and small enterprises, with high bandwidth and low costs" (de Téramond 2005, 4). Similarly, in the description of the project, de Téramond and Alvaro Retana (ICE's telecommunications manager) specified the benefits of the plan in the realms of commerce, public administration, education, and daily life. In conclusion they argued, "The limits of this powerful tool [were] only to be found in the imagination" (de Téramond and Retana 2001, 21). This strategy allowed the spokesmen of the project to capture the interest of many transnational corporations operating in the country as well as local companies related to the technology industry. Some critics of the telecommunications monopoly also espoused the link between the Internet and national development and thus became temporary allies of ICE's new infrastructure plan. Journalists and editorialists from *La Nación*, for example, exalted the new government's project as "the true Internet solution" (Urbina 2003) and "the most important strategic plan in the technological development of the country" (Herrera 2002b). They also lauded this plan as "a qualitative jump in communications" (Urbina 2002), that would allow the country "to become one of the most advanced and thus bring new commercial activities" (Feigenblatt 2002), as well as create "more job opportunities, . . . improve education, health, time-saving and conditions for the expansion of enterprises' operations, among other things" (Herrera 2002a).

This process of co-optation brought closure to the controversy on a variety of levels. To begin with, UCR, a crucial actor in the establishment of BITNET and the Internet in the 1990s, disappeared as a major player in the development of networking technologies once de Téramond and his collaborators became a part of the Ministry of Science and Technology. Although this process of co-optation championed the academic model over the commercial scheme, it also allowed the government to appropriate UCR's technological solutions while limiting its involvement in the development of the Internet in Costa Rica. Between 2000 and 2005, when the Ministry of Science and Technology and ICE implemented the Advanced Internet Network, UCR's network lost the majority of its members. Early proponents of the academic project thereafter argued for the incorporation of what remained of the original network into the new infrastructure developed by the government (Abel Brenes personal communication, May 23, 2006). Finally, in January 2005, UCR, the founder and leading member of the project, abandoned the academic network to pursue other plans, using ICE's new broadband infrastructure. From the standpoint of UCR's authorities, by inspiring the development of the new, national Internet

network, the academic project "had accomplished its mission" (Yamileth González personal communication, April 18, 2006).

As UCR declined as an ISP, RACSA, on the other hand, was allowed to expand its technological and economic models. From 2000 to 2005, RACSA strengthened its agreements with cable operators in order to lower the prices of their broadband connections. During this period, the company also implemented a set of initiatives to attract more clients. In September 2001, RACSA launched two projects, called "900 en Línea" and "Internet X-press," which allowed new users to access the Internet without a formal contract. RACSA's number of clients increased significantly from 2001 to 2003 (an average of 17 percent a year). As a result of the parallel downturn of UCR as a player in the Internet development field and the expansion of RACSA, concerns about the implementation of monopoly laws receded into the background. Instead of altering the legislation (as originally intended by the government through the "ICE Combo"), the process of co-optation downplayed the relevance of legal debates about the monopoly for the groups involved in the new telecommunications market (in which both ISPs were sponsored by the state).[4]

Yet the success of this co-optation dynamic in helping the government stabilize in a context of political instability and bolstering ICE's adjustment in an environment of technological change also had other, significant consequences for some of the actors originally involved in the dispute.[5] In particular, the co-optation of de Téramond and his collaborators helped ICE turn into a strong player in the development of the Internet. As a result, RACSA, the subsidiary, was placed in direct competition with ICE, its owner, in the Internet connection race—a situation that did not violate any monopoly laws. Costa Rica's telecommunications monopoly was being divided against itself. As ICE finally inaugurated its new Internet infrastructure, in 2005, RACSA struggled to make its network grow. (For instance, the company's number of clients only grew a tiny 3 percent from 2004 to 2005.) Less than 2 years after the inauguration of the Advanced Internet Network, ICE outranked RACSA as the largest ISP in the country. This turn of events triggered a new controversy between these two state companies that is still developing.[6]

CONCLUDING REMARKS

This study examined the relationship between the academic, Internet project and the state-sponsored, networking project in Costa Rica over the course of 15 years. It shows that in the early 1990s, UCR led the establishment of BITNET and the Internet against the skepticism of RACSA. In RACSA's perspective, the Internet represented a trivial academic project rather than a real commercial option. In contrast, the X.25 network was seen as a vehicle to extend the telephone's operational model into new technological domains. Shortly after the success of the UCR project, however, RACSA envisioned the Internet as a new business opportunity and started plans to develop commercial access to the network. Despite some initial collaboration between both groups, a controversy soon emerged. On the one hand, RACSA hoped to become Costa Rica's exclusive ISP supported by monopoly laws and thus attempted to shut down, both technically and legally, the academic network. UCR, on the other hand, interpreted RACSA's plans as an affront to scientific development and continued plans to expand the academic network in Costa Rica and the rest of Central America.

The disputes over the legal, economic, and technical validity of the academic project were resolved by the adoption of co-optation as a mechanism of closure. To avert the threat posed by this controversy to the stability of the telecommunications monopoly, the Costa Rican government co-opted leading figures of the academic project into the Ministry of Science and Technology. Sharing responsibility in its execution, the Ministry of Science and Technology and ICE developed a new project to extend the Internet network in the country that built on the technological solutions and values espoused by the co-opted group. This strategy of co-optation also helped ICE, a key institution in Costa Rica's democratic imaginary, to adapt to a context of change marked by the rise of networked computing technologies.

The history of the Internet in Costa Rica invites a reconsideration of processes of closure as theorized in science and technology studies. Scholars in the social construction of technology theory have traditionally turned to the concept of closure to describe how technologies and their meanings stabilize (Bijker 1995; 2010; Kline and Pinch 1996; Pinch and Bijker 1987). This process usually involves a rhetorical negotiation between groups that leads to a certain agreement. As Humphreys (2005) summarizes, "Closure overall refers to a rhetorical process through which relevant social groups perceive their problems with an artifact to be solved or closed" (242). However, the process of closure analyzed here centered less on rhetorical moves to make the disputes seem resolved than on creating suitable political conditions for the government to both downplay certain problems (such as debates about the telecommunications monopoly) and legitimate a set of solutions (such as the technological model of UCR) associated with the Internet by other relevant groups. By affording access to policymaking structures, co-optation in the Costa Rican case changed what Bijker (1995), drawing on the work of Foucault (1995), calls "micro-political power," that is, the capacity of a group to "transform and structure the actions of actors" (Bijker 1995, 263). This strategy provided the government with a new capability to make the

academic project disappear as an ISP while appropriating its technological solutions. In addition, co-optation allowed a key state institution—ICE—to take on a more leading role in the development of the Internet infrastructure in the country.

Scholars associated with the SCOT framework have also emphasized the importance of the stabilization of the meaning of technology as a crucial dimension of the process of closure. In the case explored in this article, co-optation helped the co-opting group not only to participate in the rhetorical negotiation of the meaning of the Internet but also to gain new political ground to establish a certain interpretation of the network as its dominant meaning in the country. Both the Ministry of Science and Technology and ICE, for example, resorted to de Téramond's notion of the Internet as a symbol of scientific development and extended it to other social domains, such as commerce, education, and daily life. This strategy proved key in helping these institutions to assuage criticism against the telecommunications monopoly and capture temporary allies for developing their new project.

Another important mechanism of closure theorized in the literature on scientific and technological controversies is the establishment of sociotechnical networks (Callon 2006; Latour 1987). Crucial in this process is the formation of alliances and associations between different types of actors in order to strengthen the network. For instance, de Téramond's heterogeneous engineering (Law 1987) was a key factor in the development of both BITNET and the Internet and in the defense of their technical and legal legitimacy. However, to put an end to the controversy, the Costa Rican government did not seek to ally with the academic project at UCR but rather to absorb its leading proponents. This decision has various explanations. First, the deployment of co-optation as a dynamic of closure allowed the government to resolve the most critical issue of the controversy (i.e., the debates about the legal validity of the academic network) without having to establish an alliance with any group involved in the conflict. Through co-optation, the government was able to make the academic project disappear as an Internet service provider and thus minimize the concerns about the need to either change or enforce telecommunications monopoly laws. Second, this strategy also enabled the government to access specialized knowledge and benefit from it even when the co-opted group had left its co-opting organization (Fleron 1969). Co-optation thus helped diminish the risk of losing this knowledge by incorporating it into the government's organizational structure rather than having access to it by means of a temporary association or alliance. Third, co-optation allowed the government to transform de Téramond's heterogeneous engineering into additional support for the implementation of its new infrastructure plan. When de Téramond and his associates joined the government, the Ministry of Science and Technology and ICE also incorporated their set of previously established alliances.

To summarize, processes of co-optation may change the configuration of political relations between conflicting groups and the conditions under which other dynamics of closure (such as the rhetorical negotiation of the meaning of technology and the establishment of sociotechnical networks of associations) are made possible. In this new regime of alignments (Gillespie 2007), discussions about the legal, technical, and economic validity of the academic project lacked the relevance they had held for groups in dispute before the co-optation process. However, shifts in the configuration of relations between actors do not lead necessarily to the final resolution of conflicts, as critics of the concept of closure have warned (Law 2004; Mol 2002). In the Costa Rican case, frictions between both state-sponsored telecommunications providers, ICE and RACSA, intensified as a result of the market configuration enabled through this dynamic of co-optation. In this sense, the controversy analyzed here was partly extended into a new phase of confrontation between groups that, while invoking new arguments, revived old disputes.[7]

Finally, this study shows that the establishment of the Internet in Costa Rica can also be thought of as a contextualized, sociotechnical achievement. Although the Internet's victory in the "standards war" in the United States provided an important basis for its international adoption, as Abbate contends (2000), the technology still had to survive many local controversies that shaped the conditions of its singular reconstruction. In Costa Rica, the Internet was established in the context of institutional disputes that linked technologies, politics, and economic interests in locally distinct ways. Similarly, its acceptance also required the implementation of other, "less efficient," technological systems (e.g., BITNET) in order to ascertain its political and sociotechnical viability. Acknowledging the local reinventions of the network is an ongoing task for Internet historians and scholars. By assessing the controversies that surrounded the establishment of the Internet on a national scale, and the singular ways in which actors partially resolved these disputes, this essay hoped to provide a step in this direction.

NOTES

1. Quotations from interviews and primary sources in Spanish are my translation.

2. In 1992, a project under the name of "Hurricane" (*Proyecto Huracán*), funded by the United Nations Development Program and the Canadian International Development Agency, established the second Internet access in the country. Unlike de Téramond's approach, Hurricane was based on dial-up connection, UUCP (Unix-to-Unix Copy), and the X.25 network.

3. Given the success of the commercial Internet project during this period, RACSA officially shut down the X.25 network in December 1999.

4. Similarly, Engelhardt and Caplan (1987, 14) speak of "closure through loss of interest," in which participants loose interest in the controversy and thus "[cease] to appeal to rational grounds for resolution either through sound argument or through fair principles of negotiation."

5. De Téramond and his collaborators left the Ministry of Science and Technology at the end of the Rodríguez administration, in 2002, leaving ICE in charge of the implementation of the Advanced Internet Network. This phase of execution of the project was characterized by plentiful suspicions of corruption at the heart of the monopoly's and the country's government. The public bills for the acquisition of the infrastructure became the site of continuous disputes between different actors involved (Siles 2008). The project was finally launched in 2005, 3 years later than expected.

6. Costa Rica's approval of the Central American Free Trade Agreement with the United States in October 2007 marked a new stage in the historical development of the Internet in this country. Throughout 2008 and 2010, the Costa Rican Congress set the legal terms that would allow the entry of private telecommunications operators into the country, a controversial component of the agreement.

7. The division of labor between these institutions has been a recurrent subject of debate since ICE's acquisition of all the shares of RACSA, in 1975. These debates intensified in 2010, as authorities negotiated the implementation conditions of the Central American Free Trade Agreement.

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