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MICHAEL TENNEN
1878 261ST ST
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For example, you want to explore the effects on mouse behavior of switching on a particular gene that controls some aspect of brain function, but, thankfully for the mouse, you do not want to open up its skull or stick a needle in its brain. "If the infrared fluorescent protein can be made to turn back into an infrared phyto-

chrome, you could have the switch all ready and just waiting for enough infrared light," Tsien speculates. Because infrared light can penetrate the skull, it can reach the phytochrome and remotely switch the gene on, resulting in observable changes in the mouse's behavior.

It is the next evolutionary step for fluo-

rescent proteins, remarks Tsien, who believes that phytochromes represent a class of proteins with enormous potential. If he is correct, then in the coming years, expect more scientists to see the (infrared) light.

Bianca Nogrady is a science and medical writer based near Sydney, Australia.

VIRTUAL REALITY

Avatar Acts

When the Matrix has you, what laws apply to settle conflicts? **BY MICHAEL TENNESEN**

How much legal weight should actions in the virtual world carry back in the real one? For most people, the answer might be "none," but as online communities conduct actual financial transactions and draw in more participants, some legal experts think that it may be time to extend brick-and-mortar jurisprudence into the virtual realm.

By some estimates, about 100 million users worldwide populate online communities. Second Life, the creation of Linden Lab in San Francisco, provides its active-user base of one million with a real-time experience on their personal computer, in which they use digital characters called avatars to wander around castles, deserted islands and other fantastic 3-D environments. Through their avatars, they can meet and talk to thousands of online participants, even cuddle on couches and have simulated sex with them.

Such immersive experiences have led to several reports of online activities triggering real-world conflicts. Last November one woman filed papers for divorce on the grounds that she caught her husband's avatar being overly affectionate with someone else. (He countered that his wife drove him to virtual infidelity because of her addiction to *World of Warcraft*.) In fault-based divorce courts, such a claim would

be perfectly legitimate, says Greg Lastowka, a professor of law at Rutgers University who is currently writing a book called *Virtual Law*. But he likens it to complaints such as "my husband plays golf all the time and has no time for me"—grievances that are shy of adultery.

But with the average player spending 20 hours a week in these environments, players often put more weight into virtual

affairs than lawmakers do. When Chinese gamer Qiu Chengwei acquired a virtual sword in the online game *Legend of Mir 3*, only to have a friend borrow it and sell it online for \$800, Qiu went to the police. Told that there were no laws to protect virtual property, Qiu actually killed the thief. "If somebody is going to die, and somebody else is going to spend the rest of his life in jail for a virtual crime, then we better take it seriously," Lastowka remarks.

More nebulous, though, is behavior between avatars that would be criminal in the physical world. One case involved "virtual rape," according to Benjamin Duranske, a San Francisco attorney and founder of the Second Life Bar Association, which meets once a month in Second Life. In a blog, he recounts a Brussels public prosecutor who had called for an investigation of a rape charge involving a Belgian user of Second Life. The case apparently later died, perhaps because, as Duranske proposes, "most laws prohibiting violence are applied only to real people, not computer characters."

The case echoes an earlier incidence of virtual rape a decade ago, as described by Julian Dibble for the *Village Voice* in 1993. This incident took place in *LamdaMOO*, a text-based virtual community, and concerned a hacker known as Mr.



COME HERE OFTEN? About 20 hours a week, actually—that is the average time members spend in realms such as *Second Life*. Conflicts here can open up new legal questions.

Bungle, who took control of other avatars who were then made to describe violent, explicit acts on the screen. The article spawned a conference at New York University in 1994 where participants discussed the possibility of self-governing on the Internet, which could entail a virtual community limiting or canceling another player's account. (Cancellation is what happened to Mr. Bungle's creator.)

Indeed, members of today's virtual communities must agree to a "terms of service" contract, which enables companies to adjudicate conflicts by, for instance, suspending the offending account. But establishing a new account to create another predatory character is simple enough. And as Lastowka says, "virtual worlds don't want to police their users. They just want to collect their profits." (Linden Lab takes a cut from users conducting business in Second Life.) Online communities, he points out, will always have "griefers" and "goon squads" who

wait at game portals to kill new avatars or take sexual advantage of someone who has not figured out how to push the "no" button.

Courts could set precedents as cases arise from the virtual world. South Korean courts, for instance, have done so a number of times in dealing with virtual property; in contrast, U.S. courts have shied away from the issue. The scope of the online realm suggests that legislation may be desirable. Virtual commerce is worth about \$1 billion annually and is set to get bigger as the six- to 12-year-olds on Club Penguin and other virtual games grow up. Lastowka and Duranske think society is headed toward a virtual Internet that, Duranske says, "is going to be a major revolution in the way we interact." Whether the law can keep pace with that revolution remains to be seen.

Michael Tennesen maintains his first life as a science writer near Los Angeles.

Data Points The New Boomers

More Americans were born in 2007 than in any other year in history. According to preliminary data from the National Center for Health Statistics, births topped the previous record of 1957, at the height of the baby boom. Birth rates have been inching up in recent years, for reasons that are not entirely clear. Women living in the U.S. in 2007 will have an average 2.1 children over their lifetimes, a number that demographers consider the bare minimum to sustain population levels without immigration. In addition, U.S. women are having far fewer babies than in the 1950s—before the birth-control pill became available—when the average was nearly four children per woman. But the population is almost twice as large now, which is the main reason behind the record-breaking number of births.



U.S. IN 1957

Population: **171 million**
 Births: **4,308,000**
 Births per 1,000 women ages 15 to 44: **122**

U.S. IN 2007

Population: **301 million**
 Births: **4,317,119**
 Births per 1,000 women ages 15 to 44: **69**

Population numbers are U.S. Census Bureau estimates: www.census.gov/popest/estimates.html; NCHS reports are available at www.cdc.gov/nchs/products.htm

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