



Pokémon Contagion: Photosensitive Epilepsy or Mass Psychogenic Illness?

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ABSTRACT: We studied a reported illness outbreak occurring on December 16, 1997, involving more than 12,000 Japanese children who had various signs and symptoms of illness after watching an episode of a popular animated cartoon, Pokémon. While photosensitive epilepsy was diagnosed in a minuscule fraction of those affected, this explanation cannot account for the breadth and pattern of the events. The characteristic features of the episode are consistent with the diagnosis of epidemic hysteria, triggered by sudden anxiety after dramatic mass media reports describing a relatively small number of genuine photosensitive-epilepsy seizures. The importance of the mass media in precipitating outbreaks of mass psychogenic illness is discussed.

The new electronic independence recreates the world in the image of a global village.

Marshall McLuhan¹

THE WORD Pokémon is a shortening of the term “pocket monsters,” from the original Japanese name *Poketto Monsuta*. It was created as a video game for the hand-held Nintendo Game Boy system. Pokémon creator Satoshi Tajiri introduced the game in 1996, and within a few months it became a best-seller. After this success, Nintendo created a television cartoon version of the game. Animated by Shogakukan Productions and directed by Hidaka Masamitsu, it debuted in Japan on April 1, 1997.

Sales of Pokémon products generate more than \$1 billion annually for Nintendo, from such items as video games and tapes, comic and coloring books, Internet sites, magazines, clubs, music CDs, trading cards, and several feature films.² Pokémon has become a recognizable global icon that is so popular in the United States that *Time* magazine featured it on the cover of its November 22, 1999, edition. The animated television series airs in the United States on the Warner Brothers Network and attains consistently high ratings.²

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The television cartoon centers on young boys and girls who wander the world of Pokémon looking for small creatures (called Pokémon) to capture, befriend, and train for battle against other trainers (and their Pokémon) in the Pokémon League. The ultimate goal is for the children to collect one of every “species” and become Pokémon Masters. There are at least 151 Pokémon characters, each with unique powers and individual personalities. The most popular character, Pikachu, resembles a yellow rat and has the ability to shock opponents with electricity.

EPISODE 38

At 6:30 PM on Tuesday, December 16, 1997, Pokémon episode 38, entitled “*Dennou Senshi Polygon*,” meaning “Computer Warrior Polygon,” aired in Japan on TV Tokyo. The program was popular at the time of its broadcast and held the highest ratings for its time slot, with an average market share of about 15%.³ In the episode, Pikachu and its human friends Satoshi, Kasumi, and Takeshi have an adventure that leads them inside a computer. About 20 minutes into the program, the group encounters a fighter named Polygon. A battle ensues, during which Pikachu uses its electric powers to stop a “virus bomb.” The animators depict Pikachu’s electric attack with a quick series of flashing lights.

In all, millions watched the program. In one city, Toyohashi, more than 70% of the 24,000

elementary school students and 35% of the 13,000 junior high school students watched the program, for a total of more than 21,000 viewers in Toyohashi alone.⁴ In Tokyo, the Kawasaki education board investigated all public kindergartens and primary and middle schools in the area and found that 50,714 students, or 55% of the children, watched the episode.⁵

At 6:51 PM, the flashing lights of Pikachu's "attack" appeared on television screens. By 7:30 PM, according to Japan's Fire-Defense Agency, 618 children had been taken to hospitals complaining of various symptoms. News of the illnesses spread rapidly throughout Japan and became the subject of media reports later that evening. During the coverage, several stations replayed the flashing sequence, whereupon even more children fell ill and sought medical attention. The number affected by this "second wave" is unknown. Reported symptoms included convulsions, altered levels of consciousness, headaches, breathlessness, nausea, vomiting, blurred vision, and general malaise.^{6,8}

AFTERMATH

On December 17, 1997, TV Tokyo issued an apology, suspended the program, and said it would investigate the cause of the seizures.⁷ Officers from the Atago police station, acting on orders from the National Police Agency, questioned the program's producers about the cartoon's contents and production process. The Japanese Health and Welfare Ministry held an emergency meeting, discussing the case with experts and gathering information from hospitals. Meanwhile, video retailers across Japan removed the series from their shelves.

Outraged mothers accused TV Tokyo of ignoring their children's health in the quest for ratings; other parents called for the implementation of an electronic screening device to block intense animation. Japanese Prime Minister Ryutaro Hashimoto expressed concern, stating, "Rays and lasers have been considered for use as weapons. Their effects have not been fully determined."⁹ While a Nintendo representative quickly explained that the only link between its game and the cartoon was the characters, the company's shares immediately dropped nearly 5% on the Tokyo stock market.⁹ TV Tokyo also placed warning labels on all future and past Pokémon episodes. Despite the scare, and buoyed by the show's enormous popularity and revenue-generating capacity before the illness reports, the Pokémon TV program returned to Japanese airwaves in April 1998. No further inci-

dents of collective illness coinciding with the program's broadcast have been reported.

Bright, flashing lights have been known to trigger seizures in epileptics. In 1994, British commercial television advertisements and programs were limited to a rate of three flashes per second.⁹ The limit followed a 1993 incident in which a noodle advertisement featuring fast-moving graphics and bright flashes triggered three seizures. After several teenagers had seizures while playing Nintendo video games, the company began including warning labels on much of its software. The notice stated that the games' graphics and animation could cause a *shūgeki*, a strong stimulation resulting in unconsciousness or seizures.

The Pokémon case was of concern and enigmatic due to the large numbers of children reportedly affected and the array of symptoms. Although bright flashes seemed to be the likely culprit, the flashes had been used hundreds of times before without incident. The technique, called *paka-paka*, uses different colored lights flashing alternately to create tension. It is common in *anime*, the distinctive Japanese animation technique used in Pokémon (and many other cartoons, such as Voltron, Sailor Moon, and Speed Racer). There was no apparent difference between episode 38 and the other Pokémon episodes. Producer Takemoto Mori had used virtually identical *paka-paka* in most of the previous episodes, with slight variations in color and background combinations. "During editing, that particular portion didn't call my attention or bother me," he said.¹⁰ All Pokémon episodes were screened before airing, and no problems were reported.

A clear genesis of the Pokémon panic remains elusive. After 4 months, Nintendo announced that it could find no obvious cause for the outbreak, and Pokémon returned to the airwaves. Further research was left to the scientific community. Hayashi et al¹¹ surveyed patients in the Yamaguchi prefecture (population 1,550,000) and found 12 affected children with no history of epilepsy. During the program, 2 had fainted and 10 had had tonic-clonic convulsions. Eleven of the 12 had photosensitivity or epileptic abnormalities on electroencephalogram. They concluded that the children had latent photosensitive conditions, which had predisposed them to have seizures when exposed to the flashing lights. Hayashi et al estimated the incidence of seizures triggered by Pokémon at 1.5 per 10,000, 10 times the incidence found by British researchers.¹²

Yamashita et al¹¹ studied all children in 80 elementary schools in the central Fukuoka prefecture on Kyushu Island (population 470,807). On December 22, 1997, 6 days after the outbreak, teachers asked whether any pupils had had symptoms after seeing the Pokémon episode. Questionnaires were also sent to medical facilities in the prefecture. Of the 32,083 enrolled students, only 1 had a convulsion, while 1,002 reported minor symptoms. Since half of all boys and girls saw the program, Yamashita et al¹³ estimated that 6.25% of the children were affected. A survey of 12 hospitals in the prefecture found that 17 children aged 2 to 15 years were treated for convulsions. Tobimatsu et al¹⁴ studied 4 children who had been affected by Pokémon and diagnosed photosensitive epilepsy in all 4. They hypothesized that "the rapid color changes in the cartoon thus provoked the seizures."¹⁴ The researchers believe that the children's sensitivity to color, in particular rapid changes between red and blue, may have had an important role in triggering the seizures.

Furusho et al¹⁵ surveyed children who visited pediatric clinics from January 8 to February 28, 1998. Of the 662 children surveyed, 603 (91%) watched the Pokémon episode. Of those, 30 reported complaints: 2 reported seizures, 9 headaches, 8 nausea, 4 blurred vision, 1 vomiting, and 2 each reported vertigo and dysthymia (depression). Sixteen of the children did not have symptoms during or immediately after viewing the program, but much later.

EPIDEMIC HYSTERIA OVERVIEW

Hysteria is characterized by the impairment or loss of sensory or motor function for which there is no organic basis.^{16,17} The modern name for hysteria is "conversion disorder" (the converting of emotional conflicts and anxiety into physical symptoms). Epidemic hysteria refers to the rapid spread of conversion symptoms and anxiety states. It has several distinct features: lack of plausible organic basis, transient and benign symptoms, appearance in a segregated group, extraordinary stress, rapid onset and recovery, symptoms spread by sight or sound, and dispersion down the age-scale beginning in older or higher-status persons. While often referred to as a diagnosis of exclusion, even before tests are complete, it is possible to render an accurate diagnosis based on the presence of the aforementioned criteria.

Epidemic hysteria is most commonly reported in small, cohesive social units within enclosed settings, such as schools and factories.

Wessely¹⁶ identified two types of hysterical reactions in groups: anxiety and motor hysteria. Anxiety hysteria has a rapid onset and recovery period, usually 24 hours, and is precipitated by the sudden perception of a threatening agent, typically a strange odor or rumor of contaminated food. Common symptoms include headache, dizziness, nausea, hyperventilation, and general fatigue. Essentially, they are physiologic reactions to sudden anxiety. There is rarely evidence of extraordinary preexisting group tension before the outbreak. Symptom patterns reflect the effects attributed to the imaginary agent. Stomach pain, nausea, vomiting, and diarrhea are typical of suspected food poisoning cases,^{19,21} while instances of suspected toxic gas leaks commonly include headache and dizziness.^{21,22}

Students or factory workers who are in close visual or social proximity to the affected group member, or subsequently affected members, are at the highest risk of redefining the situation and attributing the illness symptoms to a plausible odor or agent in the environment. In cases in which authorities do not offer a convincing explanation or are perceived as taking insufficient measures to investigate an incident or eliminate the suspected presence of an imaginary agent, episodes often persist for days or weeks, and in rare instances, months. Most reports involve an identifiable index case, in which the first patient exhibits illness symptoms that are usually highly visible and dramatic.²³ Often, unknown to the group, the index case involves a physical illness such as an epileptic seizure, influenza, or schizophrenia. Symptoms are often spread through line of sight.

Mass motor hysteria incubates more slowly than anxiety hysteria, and it develops in an atmosphere of accumulating long-term group stress. It is prevalent in intolerable social settings, most commonly in schools enforcing extreme disciplinary measures. Symptoms include altered states of consciousness, melodramatic acts of rebellion (histrionics), and psychomotor agitation whereby building anxiety over long periods results in disruptions to the nerves or neurons, triggering temporary bouts of muscle twitching, spasms, and shaking. Symptoms appear gradually and usually take weeks or months to subside.

There have been numerous reports of school and factory episodes of this type in Western countries before the mid-20th century, which correlated with strict educational policies or dehumanizing factory conditions before the rise

of unions.²¹ Modern-day reports are rare except in non-Western schools and factories, where episodes remain prevalent amid strict capitalist discipline or academic regulation coupled with limited or nonexistent grievance channels.

Mass motor hysteria was common in European convents between the 15th and 19th centuries.^{25,26} Outbreaks of demon possession and histrionics frequented those orders imposing the strictest Christian discipline. With no means to redress the male-dominated church hierarchy, disempowered nuns often attributed the presence of evil spirits to a despised local church figure. Lengthy church-sanctioned exorcisms and inquisitions were conducted, often resulting in the authority being executed, imprisoned, or banished. Episodes typically endured for 1 to 3 years, since the repressive conditions continued to be enforced during the adjudication process and engendered a continuation of the nuns' symptoms.

In theory, both motor and anxiety hysteria can be alleviated by removing the stressful agent. This may be easier said than done due to the emotionally charged nature of many outbreaks and the difficulty that is often encountered in convincing skeptical group members. In anxiety hysteria, the key is to persuade those affected that the "toxic" agent has either been eliminated or never existed. Episodes of motor hysteria are frequently interpreted by the affected group to confirm the presence of demonic forces, making it vital to convince group members that the offending "spirits" have been eliminated or appeased.

EPIDEMIC HYSTERIA IN JAPAN

Periodic outbreaks of collective frenetic emotional displays labeled as mass hysterical outbreaks have been recorded in Japan, occurring in 1705, 1771, 1830, and 1867. These episodes conspicuously coincided with oppressive feudal regimes and accompanying social crises and may have functioned as cathartic responses to long-standing repression by releasing pent-up anxiety. Norman²⁷ labeled these events as a combination of hysteria and ritual through which a collective catharsis was achieved under the guise of *okage-mairi*, a custom involving a pilgrimage to give thanks to the Sun Goddess by visiting the Ise Shrine. Outbreaks were characterized by collective frenetic dancing, crying, singing, obscene and bizarre behavior, amnesia, trance states, and transient ailments. In 1771, Shinto philosopher Motoori Norinaga described an outbreak firsthand. People flooded

roads to make the pilgrimage, many carrying paper pictures that depicted obscene or absurd figures or events.

There is much roistering and noisy talk going on and some of it of a nature similar to the pictures. The people go along clapping their hands, shouting, singing "okage de sa! nuketa to sa!" and becoming more and more excited. Both young men and old women forget their natural modesty and indulge in this frenzy so that it is quite a disturbing sight to see. They seem to have abandoned themselves to utter madness, as well as ribaldry and horse-play.²⁷

These episodes resemble the more famous medieval dancing manias²⁸ involving masses of Europeans who, it has been widely argued, were engaging in a ritualistic mass catharsis by partaking in pilgrimages to St. Vitus shrines and chapels during periods of famine, pestilence, and disease to obtain divine favor. Mora²⁹ and Rosen^{30,31} take this view. Mora stated that dance manias were a socially acceptable means of "expression, through ritual, of deeply rooted emotional conflicts," with participants engaging in psychotherapeutic coping strategies in response to individual or societal problems.²⁹

In modern times, epidemic hysteria outbreaks in Japan have taken a different form to reflect changing fears that characterize the industrial age—namely, environmental contaminants. Twentieth century outbreaks commonly involve the sudden manifestation of mass anxiety symptoms of a transient, benign nature. These have occurred in response to the perception of an imaginary or exaggerated harmful agent thought to be in the immediate environment.³³⁻³⁴ The one known exception to this trend occurred in 1960, when a Japanese hospital staff of mostly women was swept by an epidemic characterized by digestive disorders and mood lability that has been interpreted as an outbreak of epidemic hysteria.³⁵ The modern trend of epidemic hysteria in Japan manifesting in response to environmental concerns continued into the mid-1990s, as several incidents of sudden anxiety hysteria typified by fainting and breathing problems were reported in the Japanese subway system. These were triggered by a few well-publicized real attacks involving sarin nerve gas by the Aum Shinrikyo sect.³⁶

Stress frequently plays an important role in cases of mass hysteria, and Japanese youth are under tremendous academic and social pressures to achieve. Japanese schools in particular are notorious as stress-generating institutions, and students with low or mediocre grades have been known to kill themselves. The week that

Pokémon episode 38 aired, many Japanese youths were preparing for high school entrance examinations and were therefore already under added pressure.³⁷ However, this does not explain why mass hysteria reports among Japanese students is relatively rare in the scientific literature, and the incidents reported are linked to sudden anxiety from strange odors. Stress as a cause is also problematic. Groups of people are under great stress all the time, including platoons of soldiers and communities experiencing floods or famine; yet, there are few if any reports of mass hysteria affecting these people. Why? Because extraordinary stress per se does not and cannot trigger epidemic hysteria. Psychosocial stress occurs in combination with a specific context in which there is a perceived harmful agent.

However, another aspect of Japanese culture may contribute to mass hysteria—the strong compulsion to conform. Robert Riel, a cross-cultural training manager, observes, “One of the most important traits of the Japanese mindset is its collective nature. In Japan, *we* comes before *I*—a concept that is taught early on. Unlike Western children, who are taught to be independent self-thinkers, Japanese children are educated in a way that stresses interdependence, and reliance on others. Many Japanese habits and customs stem from this desire to maintain the group.”³⁸ This type of collective social order makes a fertile ground for contagion. Some facets of Japanese culture may also foster acting out. When Japanese rock star “Hide” Matsumoto hung himself in May 1998, three people tried to follow him in suicide; one 14-year-old girl hung herself using a towel, the same method Matsumoto used. A rash of Japanese youth suicides also followed the death of singer Yutaka Ozaki in 1992.³⁹

DISCUSSION

Massey et al.⁴ studied “the jerks,” a hysterical epidemic in which many attendants of emotionally charged nocturnal religious revival meetings during the 17th and 18th centuries in parts of the southern United States had psychomotor agitation of the arms or limbs and often collapsed afterward. After examining firsthand accounts, they suggested that the jerks may have been triggered by epilepsy, which was then imitated by hypersuggestible group members. They stated that among the throngs of participants “there were perhaps some who had epilepsy. Some meetings were held during the evening with only light from torches flickering

in the night. Did this trigger any seizures? Did those few with epilepsy set the stage by example to trigger mass hysterical response from others?”⁴⁰

The outbreak of illness symptoms coinciding with the broadcast of the Pokémon television program fit the profile of mass anxiety hysteria triggered from either observing someone having a genuine seizure or learning of the illness from mass media reports or word of mouth. While epidemics of mass anxiety hysteria are often triggered by the sudden stress and uncertainty surrounding a single index case of real illness, a few mass anxiety hysterias have a viral, bacterial, or toxicologic component that triggers or contributes to the psychogenic illness outbreak. One example is an epidemic collapse in three British secondary schools, which coincided with a viral infection.⁴¹ Radovanovic⁴² reports that an influx in respiratory infections accompanied an epidemic hysteria episode in the former Yugoslavia during 1990. Another case involved three fourth-graders at a California school who on September 23, 1998, inadvertently ingested lysergic acid diethylamide (LSD) and were hospitalized. Eleven other students who had sampled a white powder from a vial believed that they too had ingested LSD and were hospitalized. Despite symptoms ranging from violence to hallucinations, test results were negative, and the students were released within a few hours.^{43*} In other instances, actual events such as a chemical leak have served as a trigger.⁴⁴

The Pokémon episode meets many of the criteria for epidemic hysteria: many of the children’s symptoms had no identifiable organic basis; other than the verified cases of seizures, the symptoms reported were minor and short-lived; the victims were nearly exclusively school children in early adolescence; and anxiety from dramatic media reports of the first wave of illness reports was evident. Most of the Pokémon-induced symptoms, such as headaches, dizziness, and vomiting, are less typical of seizures than of mass hysteria. Conversely, symptoms that are typically associated with seizures (eg, stiffness, tongue biting) were not found in the children. Three symptoms (convulsions, fainting, and nausea) that were found in the Pokémon victims are associated with both seizures and mass hysteria (Table 1).

*Oral communication, Solomon Moore, *Los Angeles Times*, Los Angeles, Calif, March 14, 2000.

TABLE 1. Comparison of Symptoms Typical of Seizures, Mass Hysteria, and Pokémon Episodes

Symptom	Gran Mal Seizure	Mass Hysteria	Pokémon Episode
Convulsions/muscle spasm	Yes	Yes	Yes
Fainting/loss of consciousness	Yes	Yes	Yes
Nausea	Yes	Yes	Yes
Drooling/frothing	Yes	Yes	No
Sudden crying	Yes	Yes	No
Loss of bladder control	Yes	No	No
Bluish skin	Yes	No	No
Biting tongue	Yes	No	No
Headaches	No	Yes	Yes
Bad/Blurry vision	No	Yes	Yes
Dizziness	No	Yes	Yes
Vomiting	No	Yes	Yes
Shortness of breath	No	Yes	Yes

While the mass media are rarely implicated in triggering epidemic hysteria outbreaks, their reporting of these typically exacerbates the situation. Media reports and publicity fuel the hysteria as news of the affliction spreads, planting the idea or concern in the community while reinforcing and validating the veracity of the illness for the initial victims.⁴⁵⁻⁴⁷ This may result in emotionally charged public meetings and reporting of misinformation⁴⁸ or social protest movements that thrive on mass media publicity surrounding a hysteria outbreak.⁴⁹ In the Pokémon episode, the jump in the number of reported cases is strong evidence for the role the mass media played (Table 2). According to news accounts of the time, the number of children said to be affected remained around 700 the evening of the Pokémon episode (Tuesday night) and the next day. The next morning, the episode dominated the Japanese news. Japanese children who had not heard about their peers from the news or from their parents learned of it that morning, when the seizures “were the talk of the schoolyards.”⁵⁰ Once the children had a chance to hear panicky accounts of what had happened through the mass media, their friends, and their schools, the number of children reported the next day to have been initially affected—2 days earlier—increased by 12,000.

One common component of mass hysteria is an exaggerated overestimation of risk to a perceived threat. For a hysteria to spread, those affected must not only perceive the risk as real and present, but also believe they are vulnerable to it. Researchers surveying epileptic patients have found that “more than a quarter of those surveyed indicated that they thought that a substantially greater proportion of people with epilepsy were at risk from [video games] than the estimated real risk suggests. One in 13 perceived that every individual with epilepsy is

TABLE 2. Sequence of Events Surrounding Pokémon Episode

<i>Tuesday, December 16, 1997, 6:30 PM</i>
Pokémon episode 38 (“Computer Warrior Polygon”) airs, flashing lights segments begin at about 6:50 PM; Fire-Defense Agency claims that between 6:50 and 7:30 PM, 618 children were taken to hospitals with convulsions, headaches, and vision problems
<i>Tuesday, December 16, 1997 (later that night)</i>
Evening news reports that hundreds of children were taken to hospitals from Pokémon fits, some news shows rebroadcast scene suspected of causing seizures. Second wave of children (number unknown) is affected after hearing or watching news
<i>Wednesday, December 17, 1997</i>
Pokémon attacks are “the talk of the schoolyards.” “Television and newspaper headlines Wednesday morning were dominated by the reports.” ⁵¹ Number of victims reported by mass media ranges from >600 to >700
<i>Thursday, December 18, 1997</i>
<i>Yomiuri Shimbun</i> newspaper reports that nearly 13,000 children had “at least minor symptoms,” with 685 taken to hospitals
<i>Friday, December 19, 1997</i>
<i>Yomiuri Shimbun</i> reports on completed investigations by the newspaper and local boards of education, finding the number of children reported to have experienced “fits, nausea, and other symptoms” to be 11,870

at risk of a seizure as a result from playing video games. . . . [T]he proportion of individuals with epilepsy surveyed who saw themselves to be at risk from video games is two to three times the estimated real risk.”⁵² This risk overestimation may have been associated with the cartoon version of Pokémon.

CONCLUSION

The late Canadian cultural theorist Marshall McLuhan observed that the technological revolution has recreated the world in the form of a “global village.”⁵³ The continuing reliance on mass communications, especially television and the Internet, give the novel nature of the Pokémon illness outbreak added significance. Technological innovations are occurring at unprecedented rates and have the potential to influence significant numbers of people beyond the typical number in traditional mass hysteria episodes. Rapid and perpetual technologic innovations are changing the face of how and where we work, how we interact with others, how we play, and many other facets of everyday life. Epidemic hysterias that in earlier periods were self-limited by geography now have free and wide access to the globe in seconds. The 1938 Martian panic radio broadcast exemplifies the potential impact of the mass media in spreading social delusions, since it is estimated to have frightened about 1.2 million Americans.⁵⁴ The incident is not considered a case of epidemic hysteria, however, since illness symptoms were not associated with the episode.⁵⁵

Although a small number of persons affected by the Pokémon animation were confirmed as having photosensitive epilepsy, most of those examined or retrospectively surveyed by physicians clearly were not. Indeed, the incidence of photosensitive epilepsy is estimated at 1 in 4,000.³ Such an incidence (0.025% of the population) cannot explain the number of children affected (in some cases nearly 7% of the viewers). The question remains, what were the vast majority of children experiencing? Inexplicably, no outbreaks of mass illness symptoms associated with viewing television were reported before and have not been reported since the episode. The large numbers of children affected and the transient, benign nature of their symptoms, which were typical of anxiety, are consistent with a diagnosis of mass anxiety hysteria.

Given the chameleon-like nature of hysteria, it should not be surprising that, as we enter the new millennium, it would manifest in a television-related setting. Epidemic hysteria has been known to take many forms, depending on the historical and cultural context. These include shaking, crying and glossolalia accompanying Melanesian cargo "cults" and Holy Spirit movements^{34,36}; running and laughing "fits" in central and southern Africa^{37,38}; demon possession in Malaysia^{34,71}; fainting in response to imaginary bug bites in the southern United States^{74,75}; clay eating among Australian Aborigines⁷⁶; and strange odors in modern Western schools and factories. The Pokémon illness symptoms are without precedence, given the large numbers affected, and may be a harbinger of future technological hysterias that have the capacity to affect unprecedented numbers of people at a phenomenal speed.

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