



WHAT ARE CALIFORNIANS FIXING?

The devices Californians tried to fix in 2020 and why it's harder to repair than it should be.

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The authors bear any responsibility for factual errors.

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EXECUTIVE SUMMARY

Here in California, we want to fix our stuff – even during the COVID-19 pandemic.

As people try to stay at home as much as possible, it's more important than ever that our home appliances and devices are working. From kitchen appliances to laptops, gaming systems and televisions, our tech helps us stay home, stay safe, and stay sane.

But inevitably, things break or don't work right. You could throw it away, but don't want to be wasteful, and money is tight in this economy. In addition, due to supply chain disruptions and store closures, you might have difficulty finding some devices to buy, especially in the spring and summer of 2020.¹ Instead, you try to get your device fixed or to fix it yourself.

According to a review of data from iFixit, which describes itself as the “repair guide for everything, written by everyone,” over 6.8 million unique users from California went to www.iFixit.com to look up how to repair something in 2020.

Of those visitors, the top ten device types that Californians attempted to fix were laptops, cell phones, gaming consoles, automobiles, desktop computers, tablets, vacuums, appliances, speakers and gaming controllers. Laptop repair guides were the most popular, receiving 20.3 percent of all the page views. Cell phones were a close second, receiving 20.1 percent.

According to the repair shop owners and repair industry experts we interviewed, the pandemic also changed which devices we took to repair shops. We interviewed ten repair shop owners, seven of which reported an increase in business during the pandemic. They repaired more gaming consoles and computers than normal, and their customers were eager to get their devices fixed quickly.

Repair cuts waste, saves consumers money, and also promotes resilience that helps us manage a pandemic. Even as repairing our devices for learning and working became critical to staying safe, 6 of the top 10 most popular manufacturers of devices that Californians were trying to fix

ACCORDING TO iFIXIT DATA

6.8
MILLION

unique users from California visited iFixit to repair something in 2020.

ACCORDING TO iFIXIT DATA

6 of **10**

manufacturers of devices that Californians went to iFixit to repair often do not sell parts or provide service information.

restrict access to parts and service information – including the top four. Repair is popular, but the devices we most want to fix restrict access to what we need, underscoring the importance of Right to Repair reforms.

Repair is good for our pocketbooks and good for the planet

Every item that can be reused should be reused. The increasing trend of disposable electronics is creating a brewing ecological crisis.

Electronic waste is now the fastest growing waste stream in the world.ⁱⁱ In America, we discard over 416,000 phones per day, and approximately 46,000 per day in California.ⁱⁱⁱ Not only is the waste generated from discarded electronics highly toxic,^{iv} but the manufacturing of new electronics takes up an understated amount of energy and natural resources. According to the Institute of Electrical and Electronics Engineers, 165 pounds of raw material are required to produce one 8-ounce cell phone.^v The vast majority of the greenhouse gas emissions associated with cell phones comes from the production of the phone, not the cell phone's use.^{vi} With every American family disposing an average of 176 pounds of electronic waste annually, or 6.9 million tons in total, the rapid consumption of electronics is environmentally detrimental.^{vii}

Apart from its ecological benefits, repair saves us money. If Americans repaired electronics instead of replacing them, we could save \$40 billion annually.^{viii} Money has been tight for many Californians due to the global pandemic, and repair can help us reduce expenses. The pandemic has also highlighted the need for a resilient and more localized economy, to which independent repair is paramount.

FINDINGS

One of the most popular and utilized do-it-yourself repair websites is iFixit, which offers guides, videos and tutorials for consumers and professional independent repairers on how to fix everything from vacuums to cars to cell phones.

On iFixit, Californians can learn how to replace batteries and screens on our phones, upgrade the memory on our laptops, change the spark plugs on our cars, and many other repairs.

According to data from iFixit, the top ten devices that Californians attempted to fix most often in 2020 were laptops, cell phones, gaming consoles, automobiles, desktop computers, tablets, vacuums, appliances, speakers, and gaming controllers.

Laptop repair guides were the most popular in 2020, receiving 20.3 percent of all the page views. Beginning in early summer, the United States experienced a computer shortage as supplies dwindled and demands ballooned in the wake of remote work and learning.^{ix} The country as a whole experienced a shortage of 5 million laptops needed for remote learning this summer,^x with 700,000 extra laptops needed in California alone.^{xi}

The increased demand for computers due to the COVID-19 pandemic may have contributed to the higher-than-average page views for laptop fixes in 2020. In a previous analysis, cell phones were the top fix by far, receiving 27 percent of page views in 2018.^{xii} In 2020, cell phones were a close second, receiving 20.1 percent of page views.

FIGURE 1 – Top 10 devices Californians attempted to repair in 2020 according to iFixit data

Eight of the top ten devices that Californians tried to repair are consumer electronics. Because consumer electronics represent the majority of devices that Californians tried to fix in 2020 and they feature similar types of problems, we focused on these devices to determine the problems that Californians were trying to solve in 2020 and identify potential barriers that stand in the way of a Californian’s right to repair their stuff.

Rank	Device Type
1	Laptop
2	Cell phone
3	Gaming console
4	Automobile
5	Desktop computer
6	Tablet
7	Vacuum
8	Appliances
9	Speaker
10	Gaming controller

Most popular fixes for consumer electronics

The top ten issues in consumer electronic that Californians attempted to fix were replacing batteries, screens, hard drives, buttons, logic boards or motherboards, forcing a restart, repairing or replacing casing, repairing speakers, replacing a solid-state drive, and disassembling a device.

FIGURE 2 – Top 10 problems in consumer electronics that Californians were trying to fix in 2020 according to iFixit data

Rank	Problem
1	Battery
2	Screen
3	Hard drive
4	Button
5	Logic / Motherboard
6	Force restart
7	Casing
8	Speaker
9	Solid-state drive
10	Disassembly

The battery was the most popular problem that Californians were fixing in 2020, receiving around 18 percent of all page views. Among the battery fixes, approximately 29 percent were for laptops, and 23 percent were for cell phones.

Batteries in both phones and laptops are consumable; they last about two years before degrading.^{xiii} When discarded lithium-ion batteries wrongly end up in the recycling, they are known to cause facility-wide fires.^{xiv}

Swapping out the battery is a simple way to extend the lifespan of electronics by several years. However, manufacturers use unusual and proprietary screws and excessive adhesives, making it far more difficult to swap out batteries.^{xv} In addition to these tactics, some manufacturers are serializing parts to devices, making replacement outside of the manufacturer itself more difficult. In October of 2020, YouTuber Hugh Jeffreys discovered that the camera could not be swapped in the newest iPhone without losing certain functions.^{xvi} Now, camera, screen and battery swaps all cause functionality loss or error messages if they are done outside of Apple's control. While Apple began showing an error message for non-OEM batteries in 2019,^{xvii} iFixit sees the recent part serialization on the newer iPhone as another step toward consolidating repairs.^{xviii}

Barriers to repairing our stuff

Despite the best efforts of websites like iFixit to provide Californians with the tools and knowledge to repair our stuff, some manufacturers create unnecessary and unwarranted barriers, especially in the world of consumer electronics.

Barriers to consumers to easily fix their electronic devices include:

- Limiting a consumer or even a professional independent repairer from accessing the tools, parts, schematics, or software needed to perform simple repairs.
- Only making parts available to their own repair staff, even if you wanted to pay fair market value for the part.
- Limiting important manufacturer information that would allow consumers to address known issues, like when Apple did not tell consumers that they slowed down older phones in the “Batterygate” scandal.^{xix}
- Serializing parts to the device, so that a consumer or independent repairer could not replace certain parts without losing some functionality.

Some manufacturers embrace repair

When we reviewed Californians’ use of iFixit we found that of the top ten manufacturers that produced things Californians tried to fix, two of them manufacture automobiles and eight of them manufacture consumer electronics. Three of them manufacture gaming consoles and controllers: Sony (PlayStation), Nintendo, and Microsoft (Xbox).

FIGURE 3 – Top 10 manufacturers of devices that Californians tried to fix in 2020 according to iFixit data

An analysis of the eight consumer electronic companies that made this top ten list, combined with expert advice from Repair.org, found that six of them do not sell the parts or tools necessary to repair their devices to the public. This includes the top four manufacturers of devices Californians are most trying to fix.

Rank	Manufacturer
1	Apple
2	Samsung
3	Sony
4	Nintendo
5	HP
6	Honda
7	Microsoft
8	Google
9	Toyota
10	Dell

Because of the automobile Right to Repair law, Honda and Toyota provide access to repair information and tools.^{xx} The automotive Right to Repair was further solidified with the passing of a 2020 ballot question in Massachusetts, which gives independent repair shops access to the same telematic data that car dealers automatically receive. The ballot measure passed with 75 percent approval.^{xxi}

Apart from Honda and Toyota, which are obligated to provide repair information to independent shops, some manufacturers of consumer electronics tout repair-friendly products despite a lack of a Right to Repair law. HP^{xxii} and Dell^{xxiii} provide manufacturer parts for sale and free access to technical support manuals, and therefore make manufacturer-quality independent repair largely accessible to Californians.

Six companies that made the devices that Californians most commonly tried to fix via iFixit's website, Apple^{xxiv} along with Samsung,^{xxv} Google,^{xxvi} Sony,^{xxvii} Microsoft,^{xxviii} and Nintendo^{xxix} frequently do not offer the parts, tools, schematics, and information necessary to repair their devices for sale to consumers.^{xxx}

Limiting consumers' ability to access the necessary parts and information makes repairs more difficult, and in some cases impossible. For example, without access to diagnostic software, you cannot replace the home button on an older iPhone – the phone will not recognize the new button. For other repairs, sourcing parts is difficult and repair technicians might be unable to find a suitable part to complete the repair.

How the COVID-19 pandemic has impacted Right to Repair

The COVID-19 pandemic changed Americans' and Californians' lives in countless ways – including what we needed to fix and how we fixed it. As a result, Californians fixed more laptops and computers, as well as more gaming consoles and controllers.

The pandemic, especially in the earliest wave, highlighted the ways restricted repair options make it more difficult to respond to challenges. For example, because Americans were staying home and using appliances more often than normal, appliance repair technicians were in short supply in 2020, all while Americans found it difficult to find new appliances available for purchase.^{xxxi}

While some homeowners lacked access to new appliances, many schools found it difficult to get computers for remote learning. Independent repair and refurbishment could have addressed

the shortage of 700,000 laptops in California in early summer.^{xxxii} The shortage demonstrated a stark digital divide, in which children from families who could afford more than one internet-connected-device were better prepared for online education than families who could not.^{xxxiii}

One refurbisher, John Bumstead, noted how frequently his field deals with activation-locked devices, sharing a photo of 550 locked tablets -- perfectly functional equipment, yet locked from use by the manufacturer.^{xxxiv} If there were fewer barriers to repair, including activation locking, refurbished computers could help boost our capacity.



Apple refurbisher John Bumstead on Twitter, June 22, 2020

Unfortunately, barriers to repair are not limited to consumer electronics. Biomedical repair technicians, or people who repair medical equipment and machinery, spoke out during the COVID-19 pandemic about the barriers they faced to repairing medical equipment, including ventilators. U.S. PIRG Education Fund released a report in July 2020 after surveying 222 biomedical repair technicians, or biomed, about their experience repairing critical medical equipment during the pandemic. Nearly half reported that they had been denied access to “critical repair information, parts or service keys” within the five-month period between March and July.^{xxxv} As a result, U.S. Senator Ron Wyden and Representative Yvette D. Clark introduced the Critical Medical Infrastructure Right-to-Repair Act of 2020.^{xxxvi} The limited Right to Repair bill would allow biomed easier access to repair information in order to service critical medical equipment, including ventilators. Congress has not yet advanced the legislation.

Repair businesses become critical during the pandemic

“We used to repair devices, now we repair lifelines.” - Andrew Harding, owner of Salem Techsperts in Salem, MA

Repairing devices during the pandemic was a challenge. Supply chain interruptions made it difficult to consistently stock parts, and stores and factories had to change operations to take necessary health precautions.^{xxxvii} Meanwhile, customers were increasingly reliant on their devices, which drove demand for repair services.

To get a sense of how repair shops were impacted, we interviewed 10 repair shops and spoke to industry leaders who work with repair shops across the country. Seven of 10 repair shops said that their business increased in the months after the pandemic began in March.

“We actually did better during the pandemic than we ever have,” said Bryan Harwell, Owner of Replay’d, a gaming console and cell phone repair shop in Allston, Massachusetts. While there are relatively few shops that specialize in gaming repair, our iFixit data analysis shows that gaming console repair surged in 2020. “We’re seeing 20 of them a week, and I’m the only person who can fix them,” said Harwell.^{xxxviii}

Other electronics repair shops reported increases in laptops, computers, and tablets -- devices essential to work-from-home and remote learning. Tom Hintenach, owner of Electronics Unlimited in central Maryland, reported an increase in sales of refurbished computers.^{xxxix} Andrew Harding, owner of Salem Techsperts in Salem, Massachusetts, reported an uptick in customers needing computer screen repairs, who were disappointed by the high price of the part replacement.^{xl} Other repair shop owners, like Andrew Flagg of Mountain Computers in Reno, Nevada, noted a backlog in computers and part shipments due to disruptions in the supply chain.^{xli}

Even more than normal, shop owners reported that customers were more eager to get their devices fixed. “Everything that walks in the door needs to be fixed yesterday, and it’s incredibly stressful,” said Harding on how desperately people have needed their devices in 2020. “We used to repair devices, now we repair lifelines.”

Across the board, repair shop owners discussed the difficulties associated with repairing certain electronics. Harwell reported a lack of access to diagnostic software, hindering him from

diagnosing problems. When that happens, Harwell has “to be the bearer of bad news and tell [the customer] that their PS4 is basically junk.”

In some cases, repair is difficult because of how devices are made. Flagg said that the recent MacBook Pros are difficult to repair by design: “The mac mini (circa 2014) is one of the most difficult devices to upgrade and repair. Nearly impossible without the right tool, and horrendous to disassemble.” Harwell comments on the same trend for consoles and smartphones. “What’s changed is the ability to repair items. They’re just adding more screws...and it takes more time for us to take them apart, and that’s billable time for our customers,” said Harwell.

Appliance technicians also noted a lack of design for repairability. “It used to be unusual for an appliance not to last more than 20 years,” said Dean Landers, owner of Landers Appliance in Baltimore, Maryland.^{xiii} Now, appliances typically last between five and ten years.^{xliii} Landers attributes this to the newfound trend of “flimsy” parts “made with plastic,” and generally designed “without repair in mind.”

Myles Ong, owner of J & M Appliances in Reno, NV, said that parts which used to be replaceable are now soldered to circuit boards.^{xliv} When this is done, replacing the part can cost twice as much.

Another tactic electronics manufacturers use to inhibit repair is restricting parts, or making them obsolete. “In the past, parts would be available for at least 10 years,” said Ong, “now, they’re only available for three to five.” Right to Repairs reforms in Europe have addressed this, by requiring manufacturers to stock appliance spare parts for seven years.^{xlv}

With parts less and less available and new electronics making machines more and more complex, even the flashiest appliances may only last a few years. “You can buy a \$1200 washer, a \$2000 washer, or a \$300 washer, surprisingly enough, they’re all the same,” said Ong.

| CONCLUSION

A significant number of Californians want to repair their devices. The top products those Californians are trying to fix are consumer electronics. Unfortunately, for much of the stuff Californians are trying to fix, we can’t get the information, schematics, diagnostic software, parts and tools we need.

Making it hard to fix electronic devices increases the number of fixable devices that enter our waste stream and the number of new devices that need to be produced. Not only does this cost consumers money as we are forced to purchase unnecessary new devices, but it also requires us to waste materials and energy producing those devices.

Additionally, as the COVID-19 pandemic highlighted, restrictions to repair undermine community resilience. It makes it harder to make do with what we have, and more dependent on the global supply chain.

The easiest action the consumer electronics industry can take is making its devices with repairability in mind. Making repair more accessible will increase the likelihood that people repair their devices, save money, and prevent another device from entering our waste stream.

If the electronics industry wants to become more transparent, sustainable and consumer-friendly, manufacturers should adopt and adhere to basic Right to Repair principles which include providing the information, schematics, software, tools, and parts necessary to repair their devices for free or at fair cost. California's governor and legislators should consider taking action to ensure Californians have the ability to repair their stuff.

METHODOLOGY

According to iFixit, 6.88 million unique visitors from California accessed their repair guides from November 2019 to November 2020. We collaborated with them to determine what devices Californians are trying to fix, what problems they are trying to fix, and what manufacturers make the things they are trying to fix.

We obtained the total number of unique users from California that accessed iFixit.com from the company, which calculated this number based on Google Analytics data. We also obtained the pages that were viewed by browsers in California and the number of views those pages had in California.

We were able to group the pages by manufacturer, device type, and problem by viewing the guides and sorting them accordingly.

After we had created lists of pages sortable by device type, manufacturer and repair category, we calculated the total views within those categories. We created a top 10 list of the most

common manufacturers of devices that Californians tried to fix in 2020. We used the same methods for device type.

Because more than half of the top ten devices Californians tried to fix in 2020 were consumer electronics, we drilled down into what types of repairs were being attempted. We isolated consumer electronics and identified the problems that people were trying to fix. We grouped the problems into categories and used the total number of pages per problem to determine the top ten problems that Californians tried to fix in their consumer electronics.

To determine which manufacturers did not make spare parts, service information or other repair resources available, we reviewed the information available through company online stores and consulted with the Repair Association's Executive Director Gay Gordon-Byrne. The Association, also known as Repair.org, represents independent repair technicians and advocates for Right to Repair. Gordon-Byrne confirmed which manufacturers do not provide access to parts and manuals.

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