While many people wish they didn't have to, recharging their smartphone battery is one of the many things people need to do. This is especially true today when several everyday tasks revolve around those small devices. Unfortunately, keeping a phone alive has become more complicated than ever. Many cords don't label the devices they work for, and instead expect consumers to know whether they need USB-C, Micro USB, Lightning, or another cord entirely. If they buy the wrong cord, that could result in more waste and lost time. For this reason, people have tried to standardize the charging port. After all, it would be much simpler if the same kind of cord worked for everything. The issue of deciding if a standard charging port should exist has been heavily debated. Creating a standardized charging port could be harmful to innovation, but it could alternatively help consumers and help bridge the socio-technical gap being created between the users and the technology, but the cord of choice would need to be revisited and redecided upon consistently in order to minimize that harm to technological innovation.

Apple's iPhone is easily one of the most widely used phones today, yet it uses an unusual charging port: the lightning. Originally introduced in 2012, this cable was a profound improvement from Apple's previous 30-pin cord. As Putu Agus Dharma Susila puts it, "the Lightning is more convenient to use because it can be inserted either face-up or face down" (Susila). In 2012, this was one of the best ways to charge a phone. However, that was 11 years ago. Today, there's a new popular cord in USB-C. Nick Steinberg from Lifewire produced an in-depth comparison between the two cords. Just when comparing power delivery alone, Steinberg writes "USB-C offers a higher power delivery rate than Lightning and delivers a faster charge under the same voltage" (Steinberg). This creates the question of why Apple would insist on using this cord. The answer is simple. It's all about money.

Apple's unusual choice of charging port has created a socio-technical gap, which is described by Mark Ackerman in *The Intellectual Challenge of CSCW: The Gap Between Social Requirements and Technical Feasibility* as "the great divide between what we know we must support socially and what we can support technically" (Ackerman 180). While this idea is typically used to describe algorithms and software, it can also apply for this topic of hardware and charging cables. Apple looked to innovate on their charging port with the lightning, which became the new main source of power for the iPhone. Since Apple has control over this new cord, the question is how they decide to bridge the gap between their new technology and the social world of iPhone users. Their solution has worked well for the company, but socially places them further from the consumer. Last year, an article from Tom Sykes reported on the price of the lightning to SD card reader, writing "Apple has quietly upped the price of its Lightning to SD Card Camera Reader in the UK, with the accessory now priced at £35, compared to the previous selling price of £25" (Sykes). Apple has a monopoly over the lightning port and its accessories. While the same accessories with other ports may be cheaper, iPhone users don't have a choice. Lightning is all they get on their phone. Apple is able to capitalize on this and price however they want. While iPhone users could use third-party accessories, that also comes with complications. Susila writes "Official Lightning connectors contain an authentication chip that makes it difficult for third party manufacturers to produce compatible accessories without being approved by Apple" (Susila). Apple has all the control over the port. Even when another company wants to make an accessory for iPhone, Apple would stand in the way either denying the ability to do so, or demanding money for the license. Ultimately, a socio-technical gap has been created between Apple and their monopoly over the lightning port, and the userbase of the iPhone, who are forced to use this specific cord.

Last October, this issue was in the minds of those in UK Parliament when a law that would make USB-C a standardized charger was passed with 602 votes in favor. This legislation would affect small electronic devices like headphones, video game consoles, cameras, and, of course, smartphones. They would all be required to use USB-C charging by the end of 2024. One of the main reasons why this law gained so much support in Parliament was the potential long-term positive impact on the environment. Ethan Peltier, a writer for The New York Times, writes, "They have argued that fewer wires would be more convenient for users and better for the environment, as mobile phone chargers are responsible for 11,000 tons of electronic waste per year across the bloc, according to estimates by the European Commission" (Peltier). For reference, 11,000 metric tons is around 20 million pounds of electronic waste every year from mobile phone chargers alone. By removing the need to consistently buy new chargers, consumers are happier, and the environment is healthier. However, not everyone was happy about this new law. Apple, in particular, was distressed about the standard port. After all, they already have a monopoly over the lightning port. It would only hurt them financially to change it. In an interview, Greg Joswiak, Apple's senior vice-president of worldwide marketing, said, "Obviously, we'll have to comply" (Olmstead). Joswiak works for Apple's marketing team, and he definitely knows what he's saying. Rather than saying iPhone will use a USB-C port, he simply says that they will comply. People have assumed "complying" might result in a phone without a charging port, whose charging relies solely on wireless charging technology. Apple has been experimenting with wireless charging using MagSafe, a set of magnets on the back of Apple devices that can charge them. If this technology can improve over the next few years, it is very possible an iPhone without a charging port could exist. No matter what happens, though, one thing is clear. Something is going to change.

Thierry Breton, the European commissioner for trade, said the new law which made USB-C a standardized charging port is "not at all against innovation. It's not against anyone. It's for European consumers" (Peltier). However, it is difficult to tell where this innovation can come from now that companies are forced to use this specific port. After all, the argument has been made that if this law were passed 10 years ago, USB-C may not have been used at all. Companies would have just continued using the same charging cables today. This creates an issue for tech designers. They need to figure out to allow innovation to occur while also appeasing to the public, and now the UK Parliament. Specifically, the question being posed to tech designers today is how to bridge the gap between the social, the people using these devices, and the technical, the devices now required to use USB-C.

The solution to this problem is simple, but it requires effort from both manufacturers and lawmakers. First, the manufacturers, the people designing these new methods of charging, need to continue innovating. It may sound difficult, but it could easily happen. As Breton said, "manufacturers, including Apple, could choose to offer two charging ports on their devices if they wanted to keep a non-USB-C connector" (Peltier). The door is open to either continue using older ports such as the lightning, or for people to innovate and experiment with new forms of charging which may ultimately be faster. All of this is possible while keeping USB-C as an option. When the time comes that there is improvement, this needs to be recognized by lawmakers. Technology can improve rapidly over time, and if technology is going to be controlled by the law, then the law needs to keep up. This law could be maintained by voting on a standard port every several years in order to ensure that innovation can occur and can be recognized. Ultimately, a standard charging port is great for consumers, but requires more determination from manufacturers and a little bit of time from the lawmakers.

Charging ports, specifically the Apple lightning, have been a topic of debate for years, resulting in a socio-technical gap between the consumers and the producers. UK Parliament is trying to close the gap by establishing a standard charging port with USB-C, but there are fears that the standard port could harm innovation, even though those fears can be easily remedied. No matter what happens, the law has been passed, and soon most devices will sport a USB-C port. With all the spotlight on charging ports, many people wonder what innovations will be next. Perhaps wireless charging will overtake wired charging in popularity, or even crazier, smartphones may not need to charge at all. While these are all design fiction in 2023, the improvement between the 30-pin cord and the USB-C shows that if things go right and technology is allowed to be innovated upon, then the future is bright for charging ports.

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