

# PROPERTY AND IT: EXPROPRIATION WITH THE HELP OF IT

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# Selbstständigkeitserklärung

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# Abbildungsverzeichnis

# Abstract

What does the term “Property” imply in a legal sense? How did the legal claim to a Right of Property evolve and where is it heading? Do corporations deliberately pursue the expropriation with the help of IT and if so, which means have been used so far? By showing a short historical overview concerning the origin of Property, specifically Intellectual Property, this paper takes a shot at presenting an overview about legal property instruments and attempts to give examples of corporations shifting the boundaries of fundamental rights.

# 1. Introduction

In a complex modern world where individuals face the challenge of needing to keep up with the constant innovations, ideas, and breakthrough technologies, the boundaries of the fundamental rights developed by our civilization have a tendency to shift slowly. Globalization and free economic trade allowed private organizations to grow in size, enabling them to be of systematic relevance and achieve monopoly-like structures. While enabling individuals to have a greater range of options concerning their daily behavior and actions, they bring potential danger that may limit certain fundamental rights. The software industry is one, that is characterized by steady growth in recent years. It has a high impact on the economy and social structures. A computer program can change the functionality of something with a simple push of a button.

Hence, some organizations show a trend of overstepping boundaries and violating individual rights. While any physical breaches in an individual's legal space is perceivable, it gives opportunity to reprimand them. However, it proves to be much more complicated when Software is involved.

This issue appears to be mainly twofold. Firstly, due to the sheer quantity and complexity of laws, individuals are likely not able to understand the full scope of their basic legal rights. Secondly, with a trend towards embedding software in all kinds of hardware ("Internet of things" or "IoT"), the importance of software in daily life increases at such a rapid rate, that humans are unable to keep up with changes, let alone understand embedded software.

By now, it is by now understood that embedded software might provide features and functionalities that are not in the interest of the device's user or even of an entire society. Therefore, while being in full physical control of the hardware, one usually has neither physical nor logical control over the software. This phenomenon, where software is tweaked deliberately to limit the functionality of hardware in a way that does not serve the highest benefit of the user or society, but rather the software licensor, is summarized as "Software Doping".

Software Doping may be seen as deliberate intrusions on fundamental rights of the owners, specifically the right to Private Property.

The aim of this paper is to explain the term Private Property, specifically intellectual property, and its historical development will be made. Afterwards connections to various examples of Software Doping in modern economy will be given to create an understanding as to how companies show tendencies to expropriation with the help of IT.

## **2. Property**

### **2.1 Historical Overview**

As a phrase goes: “Those who do not know the past cannot understand the present and cannot shape the future”. Therefore, a brief, but detailed historical overview about property rights and their connection to various inventions is essential for understanding the status quo and tendencies towards the future.

The Idea of Property has always existed in one sense or another, however clear evidence of the concept of Private Property dates all the way back to the Persian Empire, which existed between 550 BC to 330 BC. Later, in his political philosophy work “Politiká” Aristoteles (384 till 322 BC) elaborately discusses property law and reports of Philolaus of Corinth, an ancient greek lawmaker at Thebes around 728 BC who passed laws concerning large-scale landed property.

Though grand inventions such as Achimedes’ screw were created in ancient Greece and Rome, legal protection for Intellectual Property like patents was not yet established back then. Nevertheless, early evidence of similar forms of patents existed since a Greek compiler, Athenaeus, of the third century A.D., mentions in his “Deipnosophistae” that several centuries B.C. there were culinary competitions in the city of Sybaris, which became well-known for its luxury. The successful cook, inventor of a new dish, was given with an exclusive right to prepare it during one year.

Due to Plato (428 till 348 BC) and his successor’s work, questions concerning the state and its ability to pass laws arose and a more intense approach regarding legislature was attempted. Religion also played its role during this period in time. Though it is not clear when exactly the “Ten Commandments” were established, there are traces leading back to the 7th century BC. One of these commandments states, “Thou shalt not steal”, and though there are discussion

as to whether originally this referred to kidnapping, later the wording definitely included material possessions.

During the Roman Empire, slaves were commonly used to get manual work done. Thanks to the Digest, a compendium of juristic writings on Roman law created around 530 AD, it is known, that slaves were considered property of another person. As such, it was also impossible for them to own property since they themselves were treated as such.

Around 375 A.D. the start of the invasion of Europe by the Huns took place, which is regarded as the starting point of the migration period, to which the foundations of the present European system of nations and states can be traced back.

After the fall of the Western Roman Empire around 476 A.D., Germanic lords established their own kingdoms. Though it is known, thanks to Gaius Iulius Caesar "De bello Gallico" around 55 B.C., that Germanic Tribes did not have the concept of Private Property of land, they incorporated Christianity as well as administrative structures of the Roman Empire in their social structures. As such, not only the idea of Land Property found its way into their society, but German kings regularly claimed the right to be crowned as emperors by the Christian church throughout the Middle Ages (5th till 15th A.D.). Since having gained such a position the Christian Church was able to greatly influence sociocultural views and therefore European legislature to a great extent and Private Property was initially regarded as sin. These views diminished over time. It was argued, that if there was no Private Property, everything belonged to everyone which would lead to more disputes endangering social peace within a territory.

While these changes happened in central Europe, simultaneously around 560 A.D. the battle of Cúl Dreimhne took place in northwest Ireland, which is possibly one of the earliest conflicts over copyright, another form of Intellectual Property. The "Cathach" is the oldest extant Irish manuscript of a Psalter. St. Finnian lent it to St. Columba who made a copy, over which a dispute arose about the ownership of the copy. Apparently, due to King Diarmait Mac Cerbhaill's judgement in this matter 'To every cow belongs her calf, therefore to every book belongs its copy', a dispute arose which led a battle causing over 3.000 deaths.

As the number of "intellectuals" was fairly low back then, the focus lay on artisanship rather than the intellect and copying books took time and resources. Intellectual Property Rights (IPR)



were not of importance until the invention of the printing press around 1440 by Johannes Gutenberg. This led to radical social changes due to the rise in literacy. As less resources were needed to distribute ideas and knowledge, lots of piracy, plagiarism and a spread of controversial ideas took place. This revealed the need of authors as well as rulers to establish a regulated and controlled market, leading to forms of copyright law. The scale of distribution of ideas and knowledge tends to be underestimated; nevertheless, when considering the printing press as a key invention leading to the Age of enlightenment around 1700, it was a turning point for not only intellectual property law, but also human history as a whole.

The origin of Intellectual Property, as we know it today, is believed to be in the Statute of Monopolies 1623 of the Parliament of England regarding patent law and the copyright law.

However, there is evidence that during the 15th century the government of Venice formed a system of granting real patents. This was heavily inspired by their artisanship in glass making. Though punishable by death in Venetia, artists left to work abroad in other countries, seeking monopoly in their branch, since they knew the idea of patent systems. This started a spread of patents in Europe, where the first patents were granted in England by the end of the 16th century. Around 1603, when the reign of Queen Elizabeth ended, many monopolies were granted as rewards, limiting freedom of trade without having ties to new inventions. This led to Parliament fighting against the abuse of monopolies granted by the crown resulting in the aforementioned Statute of Monopolies Act in 1623.

Around the same time as the Statute of Monopolies Act, a new form of Intellectual Property was granted in Venetia called “registered designs” in printing inventions.

The Copyright Act, otherwise known as Statute of Anne, in 1710 marked a turning point in copyright law. The statute was not directed toward the authors of books and their rights. Rather, its intent was to restrain the publishing industry and destroy its monopoly power.

During the 18th century the steam engine marked the start of the Industrial Revolution and automatic textile machinery was invented leading to further advancements. Benjamin Franklin’s invention of the lightning rod around 1750 and the first aircraft by the Montgolfier brothers around 1783 kicked off free thinking and inventorship, since man’s dream of flight and besting nature’s wrath, lightning, were achieved.

The first federal Patent Act and Copyright Act by US Congress with the intent to restrict the power of the sovereign in granting monopolies and grant authors copyright of their works for a limited time was passed in 1790, just after the American Declaration of Independence in 1776. Ironically, the U.S. Copyright Act from 1790 apparently was almost identical to the Act of Anne 1710. The first French Patent and Copyright Law was passed in 1791 during the French Revolution from 1789 until 1799.

These legislative modifications focused on the inventor and his right to the invention as his property rather than societies gain of the invention. This marked major changes in patent law that other countries followed over the course of the 19th century.

Essentially the states were competing with each other on the “invention-market”. Hence, the call for change in legislature was mostly triggered by the threat of losing industrial and technological supremacy. States like France offered an extensive yet arbitrary array of rewards and incentives, like titles, loans and pensions. Additionally, in an obvious attempt to limit international diffusion of French discoveries, until 1844 patents were voided if the inventor attempted to obtain a patent overseas on the same invention. On the other hand, the first introducer of an invention covered by a foreign patent would enjoy the same “natural rights” as the patentee of an original invention or improvement.

Compared to European States the U.S. managed to establish a more successful patent system back then, when looking at the sheer amount of patents registered since 1790 and legal enforcement of such. Patents were not seen as monopolies. It was argued that social welfare increased through innovation, rather than monopolizing existing technologies that belonged to the public already.

Further, the U.S. treated inventors more favorably and created the first modern Patent Office, which was established in 1836 and offered trained employees who, different to other states back then, examined applications on their quality of “invention”.

The 1869 Report of the Commissioner of Patents compared the \$35 fee for a US patent to the significantly higher charges in European countries such as Britain, France, Russia (\$450), Belgium (\$420) and Austria (\$350).

The idea in the U.S. was that disclosure of the information concerning the invention was the price to pay for the patent property right. The fees were meant to cover administrative

expenses. This would lead to increasing willingness and motivation of inventors to disclose information or invent things, ultimately leading to better industrial and technological advances.

The difficulties of managing a split between social welfare and Intellectual Property Rights (IPR) policies only enlarged with growing corporates and IT based inventions.

Due to the territorial principle, stating that Intellectual Rights Protection is only granted locally, authorities pushed to develop treaties to ensure protection of IPR across their borders. The Paris Convention, adopted in 1883, applies to industrial property in the widest sense, including patents, trademarks, industrial designs, utility models, service marks, trade names, geographical indications and the repression of unfair competition. This international agreement was the first major step taken to help creators ensure that their intellectual works were protected in other countries. By 2022, 179 out of 195 states worldwide became contract members.

In 1886 the Berne Convention, with 10 European States participating, set the stage to provide protection of works and the rights of their authors over different countries. Over the course of time, more countries would participate and by 2022, 181 out of 195 states, including the U.S. in 1989, became parties of it.

In 1941 inventor and entrepreneur Konrad Zuse invented the first fully automatic digital computer "Z3". Back then, the distinction between hardware and software was not regarded as necessary and although the term software is still not uniformly and clearly defined, John W. Tukey first coined it in 1958.

In the 1970s a boom of software firms emerged, due to IBM charging software and hardware separately on invoices thanks to the U.S. government's decision in the 1970s. This triggered discussions as to how software as intangible property may be protected by laws.

In 1994 the Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPs) was signed by members of the World Trade Organization (WTO) to further harmonize IPR. TRIPs partly referenced to the Paris and Berne Convention and established minimum standards concerning regulation of Intellectual Property. Among other things, it regulated Computer Programs and Compilations of Data under Article 10: "Computer programs, whether in source or object code, shall be protected as literary works under the Berne Convention (1971)."

## 2.2 Definition of Property

Property is a system of rights that gives people legal control of valuable things. Legal control entails the right to alter, sell, rent, abandon, all the way to even destroy aforementioned things. Property is an absolute right, thus it is not only effective within contractual relationships, but against any third party. It may be defined as the authority, a bundle of legal rights, or sometimes even complete control, a person holds over something. Depending on the nature of property, the owner may deal with it however they wish.

Since Property is an absolute right, it must be precisely delineated in order for everyone to abide to it. Therefore, a similar numerical limitation, also described as *numerus clausus*, of property rights has been created by most governments. Since there are different kinds of legal systems, the specific laws concerning property also varies. Most legal systems distinguish between land property and all other kinds of property, tangible and intangible, and private and public property.

Intangible Property or otherwise also called Intellectual Property Rights include all rights in intellectual property. As they are absolute rights, they give their holder both, the “positive right” to use their Intellectual Property in any way they want and the “negative right” to defend against any kind of unlawful infringement of this right.

The design of the protection systems under intangible property law represents a balancing of the different interests directed at the intangible good. Basically, there are four different interests to consider; the creator’s, the consumers, the competitors, and the general public’s interests.

The main interest from the creators' point of view is of economic nature. However, copyright law as the author’s personal right for example, particularly focuses on the personal and idealistic interest. Consumers and competitors interests lie in unhindered and inexpensive access to intellectual property. The general public’s interest is mainly the enrichment of culture or technical knowledge.

Ultimately, the core problems when considering Intellectual Property Law lies in establishing the right balance of interest, which is up to the legislator and the key values of a legal system and the principle of territoriality, meaning a sovereign state is only able to offer the protection within its jurisdictional territory.

The European Union differentiates Intellectual Property between two types of rights: industrial property, which includes inventions (patents), trademarks, industrial designs and models and designations of origin, and copyright, which includes artistic and literary property.

Each of these instruments of legal protection serve different types of intangible property rights and have a different scope of protection. To put it in simple terms, a musician's song cannot be protected with patent law, however, if all other conditions are met, patent law can protect an inventor's invention. On a global scale the legal instrument generally designed to protect Software, (e.g. as in computer programs) is copyright. Some countries like the U.S. however permit legal protection of Software in form of Patents.

## **2.2.1 Patent**

A patent is a sovereignly granted industrial property right on an invention. It grants the owner of the patent the right of some kind of monopoly on this particular invention. These rights include to commercially manufacture, offer or use a protected product, or to apply a protected process for example. Simply put, the owner has the exclusive right to produce, sell or for example use this particular invention. In exchange for these exclusive rights and their protection in the form of a patent, the inventor has to disclose his invention to the public.

The purpose of the patent is to provide mutual benefit. On one hand, it rewards the inventor for his inventiveness with a form of monopoly rights and protection from piracy or thievery concerning this invention. In exchange, the inventor has to disclose his invention to the general public, therefore enriching public technical knowledge.

Due to aforementioned history and the potential issues coupled with monopolies, different states passed various patent laws with different requirements and standards in regard to inventions in order for them to be registered as a patent. In other words, among other differences, states interpret the meaning of an "invention" differently.

The European Patent Convention (EPC), an international treaty signed by 39 states, does not define the meaning of "invention", but it does provide a non-exhaustive list of subject-matter and activities that may not be regarded as inventions, i.e. that are expressly excluded from patentability.

The question of patentability concerning computer programs have been a matter controversial discussion. According to the EPC they are not regarded as inventions. This does not apply if the computer program causes a further technical effect. Patentability is therefore not possible, if a computer program only causes “normal” physical interaction between the program (hardware) and the computer (software).

Under certain conditions a computer program has patentability according to the EPC.

The U.S. patent law does not clarify if software is patentable, so it was up to the Supreme Court to decide on the matter. In 1972 the first software related case *Gottschalk v. Benson* was decided in Supreme Court, however it would take up until 1981 concerning the case *Diamond v. Diehr*, where a computer program to mold rubber was subject to the question of patentability. After this case software patents began to be granted regularly.

## **2.2.2 Copyright**

Copyright is an instrument designed to protect the form, rather than the content. It entails two kinds of purposes of protection; it protects the author in his intellectual and personal relations to the work and in its use and offers exclusive rights in regard to those kind of works for a limited period of time. Most European copyright law places the author and the relationship to the work in the foreground. It goes beyond the mere protection of economic interests. The U.S. copyright system however, provides only basic and even dispensable protection of the author's personality and primarily focuses on freely disposable economic interest. The European Union is trying to set standards to reduce national discrepancies, however copyright law is not at the same level of harmonization as patent law.

Copyright law protects works or creations of different literary, creative, intellectual or artistic form. Nevertheless, ideas or pure information is not protected, only the specific form in which they are expressed.

The European Union passed the Computer Programs Directive 2009/24EC to harmonize the legal protection of computer programs under copyright law. Article 1 of Directive 2009/24EC states, that “...Member States shall protect computer programs, by copyright, as literary works within the meaning of the Berne Convention for the

Protection of Literary and Artistic Works. For the purposes of this Directive, the term 'computer programs' shall include their preparatory design material."

According to Article 2 of Directive 2009/24EC, "the author of a computer program shall be the natural person (...) who has created the program (...)."

## **2.2.3 Trade secrets**

Keeping know-how confidential and not disclosing it to the public is common practice, since it may be the reason that one company is more successful than another. While the IPR explained previously should provide a legal framework to share information with the public and simultaneously protect the provider of the information, keeping business information confidential will not change, since there are always ways to bypass the law. While legal instruments to protect trade secrets exist, they are commonly not defined as Intellectual Property Rights and are therefore not close to the legal protection of such. In 2016 an EU legal framework on the protection of undisclosed know-how and business information (trade secrets) against their unlawful acquisition has been installed, namely Directive (EU) 2016/943.

On the other hand, it can prove to be even more advantageous to keep trade secrets, since secrets cannot easily be stolen or imitated or in cases of Software Doping, be proven unlawful or deceitful.

## **3. Software Doping**

### **3.1 Definition**

To gain a better understanding of the term "Software Doping", some fundamentals of computer systems must first be laid.

An item utilized by many people on a daily basis shall be used for illustration: an iPhone. An iPhone is a "data processing system". Data processing systems may be defined as functional units for processing data, where processing is defined as the performance of mathematical, transforming, transferring or storing operations.

In simple terms, they are "computers" that process sets of data to obtain information about that data or to modify that data. They consist of hardware and software.

While hardware is the physical, tangible component, software is the intangible part and may be defined as a collective term for programs and the associated data. To use the illustration above, the hardware is the object itself, meaning the iPhone, which is touchable or perceivable. On the other hand, the operating system, programs and applications such as "WhatsApp", as well as the generated data running on the iPhone are software.

Although commands are executed by the hardware, the commands to be executed come from the software. The two components therefore have a symbiotic relationship with each other. They need each other to fulfill their intended functions.

For demonstration and comprehension purposes the "cooking a dish" metaphor might be of help. The ingredients represent the hardware while the recipe represents the software. A dish is only enjoyable when having both components.

However, this is precisely where the crux of the matter lies. As soon as the software, or metaphorically speaking the recipe, is changed, the functionality of the hardware, metaphorically speaking the ingredients, also changes, leading to a different action which respectively would result in another dish.

If the software is deliberately changed in a way that does not serve the highest benefit of the user or society, but rather the software owner, it is summarized under Software Doping.

It is often very difficult to detect Software Doping in different markets and it occurs much more frequently than one assumes. Due to the Internet of Things (IoT) more software is integrated into hardware, to share information faster and more precise. In other words, more things become "smart". In consequence, this means there are more possibilities of potential Software Doping. Under the disguise of "security" and "complexity" manufacturers encode programs, that limit or change the functionality of the hardware to their advantage. To facilitate the understanding of how these programs function, some examples will be given.



## **3.2 Automotive Industry**

The Automotive Industry is a prime example for tendencies of expropriation with the help of IT and as consequences of this, Software Doping. Thanks to huge technological improvements, automotive vehicles began to become safer, faster and more efficient. Considering that not only the material components of vehicles improved, but the software programs installed in them as well. Nowadays, when talking about a car, the expression of driving a computer describes the action better than simply a car. Depending on how things are used, they impose gain or danger.

Automotive vehicles being advanced to the point that they mirror computers come with potential dangers for consumers. The functionality of the material components, or rather the “how the components work or interact with each other”, can be altered depending on how the boarding program was encoded.

Before cars transformed into driving computers, they were purely of mechanical nature. The car consisted only of material components, it functioned in the way the buyer wanted and the buyer could use it however wanted. To put it differently: it was one’s property as a whole.

This changed to a degree after automotive vehicles advanced and software became a natural component in cars. In a sense a trade-off happened from full property over a car to somewhat restricted property over higher advanced cars.

By selling the car as hardware and only licensing the implemented software, the owner does not have full control as in the original sense of property as before.

As a consequence, negative symptoms started to show, also known as “Software Doping”. Among the following examples some may be more prominent than others, however all of these issues relate to the original expropriation tendencies with the help of it.

### **3.2.1 Diesel emissions scandal**

One of the biggest serious corporate scandals revolving around Software Doping was the Diesel emissions scandal, otherwise also known as the Volkswagen diesel scandal, starting in 2014. Car manufacturers installed a boarding software into their

diesel engines with a defeat device. On one hand, it is legal to install a defeat device to protect the engine from damage, when starting the engine or other conditions, that are included in the test procedure. On the other hand, if the implemented software has different functions than the allowed purposes in said test procedure (Software Doping), it is illegal. The inbuilt devices would recognize when standardized emissions testing was conducted and lower emissions to pass the test under laboratory conditions. Under real-world driving conditions, the cars would emit much higher levels.

Originally, the International Council on Clean Transportation (ICCT), an independent non-profit organization, reported discrepancies concerning emissions between European and American models of vehicles. However, this was simply the tip of the iceberg, which started a whole avalanche of lawsuits and other legal consequences. Using Japanese on-board emission testing system revealed, that the levels of nitrogen oxide emitted by a Volkswagen Jetta were 15–35 times greater than dictated by the US standard (31 milligrams per kilometer), depending on road and driving conditions. Likewise, those for a Volkswagen Passat were 5–20 times greater. The Volkswagen Group installed the software in 11 million diesel vehicles worldwide, including 590.000 in the United States.

The Volkswagen Group replicated the study done by the ICCT and claimed that the discrepancies found, particularly those in nitrogen oxide levels, were based on a “software error”. In December 2014 they recalled nearly 500.000 affected vehicles to revise and install new software. Even so, after the ICCT replicated these tests with the modified vehicles under real-world conditions no improvement in nitrogen oxide levels were found. At the same time, the U.S. authorities had to decide on the approval of VW's 2016 models and threatened the Volkswagen Group not to certify until the discrepancy was resolved.

After almost one year of claiming that it was only technical glitches, VW finally admitted, that this discrepancy was due to the installed defeat device. In retrospective some voices claim, that the Volkswagen Group intentionally stalled for time, since damage compensations would lower due to consumers using the vehicles with the default device for a longer period of time, reducing their market value.

After this incident, the authorities reacted and began expanded testing of the automotive vehicle market. Opel was caught cheating shortly after. The company also installed a defeating device in their software to cheat the emission test and gain

approval to sell their cars. During standardized tests, only the front wheels would rotate, causing the software to change program and decrease the nitrogen oxide output of the vehicle. Yet, when all four wheels rotated, as under real-world conditions, the defeat device software would not turn on, causing the value of nitrogen oxide to regularly double.

During further extensive testing, the U.S. Environmental Protection Agency (EPA) took notice, that Fiat Chrysler Automobiles also cheated emission tests. They implemented a software as a defeat device in Fiat Chrysler diesel vehicles that led to “substantially” higher than allowable levels of nitrogen oxide. While Fiat Chrysler Automobiles was not charged with intentional cheating on the tests, they were accused for not notifying the government of using this software. Fiat had to react to these accusations, recalling and repairing over 100.000 vehicles that were equipped with the default device software.

Renault was accused of implementing a “fraudulent device” in their cars. The emission performance would vary greatly in some engines when comparing tests under laboratory conditions versus under real-world driving conditions. According to the authorities, it created “the suspicion of the installation of a ‘fraudulent device’ which specifically modifies the functioning of the engine to reduce emissions of NO<sub>x</sub> (nitrogen oxides) in conditions specific to the regulatory tests.” Some of the cars with the implemented device had emission that would exceed the carbon dioxide limit by over 300%. Yet, when confronted with these accusations Renault reacted rather composed and stated, that they were committed to make improvements when comparing laboratory and real-life conditions, yet in a legal sense, no rules regarding the approval of their models were violated.

The Deutsche Umwelthilfe (DUH), a non-profit environmental and consumer protection association, claimed Porsche vehicles were also violating environmental law. According to their tests, some of the Audi and Porsche diesel vehicles, that have an Audi built engine, show extreme levels of nitrogen oxide released under real-world driving conditions. The Porsche Panamera model showed discrepancies up to 8.3 times of the legally permitted value. After a Software update done by the company, further testing was done and the difference to the legally allowed value improved drastically. However, discrepancies still existed up to 2.4 times over the legally allowed value.

The list of automobile manufactures selling cars that showed considerable discrepancies between standardized testing under laboratory tests and real-world conditions goes on. The underlying issue in all those cases show that licensed software influenced the functionality of the hardware in a negative way for the consumer or public. Therefore, its hardware was definitely not functioning to the highest benefit of the consumer or society. Rather, to sell more automotive vehicles under the pretense of being “clean cars”, some even deliberately used “Software Doping”. Ultimately, it was impossible for consumers to catch these corporations in their fraudulent actions, and if not for the random test done in 2014, even the authorities would not have realized. By keeping the software as their property in the form of Trade secrets and securing the software by careful encoding, they were able to bypass the test of the authorities and commit fraud.

### **3.2.2 Function on demand**

As previously stated, automotive vehicles are driving computers nowadays. They also develop into more complex computers every year. The extent of the possibilities that the software can utilize is limited by the hardware. Automotive manufacturers have therefore started to build cars that are identical in hardware, programmed their software differently and sold them as different models or varieties of a model. Here is where the term “function on demand” becomes interesting. Since the hardware components relevant for certain functions is already built into different sold models, that possess an online connection, certain functions can be upgraded or even purchased afterwards. The perplexing part about this business concept is the limits of these vehicles are programmed and restricted by the software from the beginning, rather than limited by the hardware. In other words, the customer pays for the full equipment, but does not have access to all the functions. In order to understand this concept, we will look at a few recent examples.

Tesla has long been considered the pioneer in the production of electronically powered cars. The company was founded in 2003 and its first mass-produced product was launched in 2008. As Tesla markets their cars “Over-the-air upgrades are an essential part of the Tesla ownership experience and enable your car to improve with the touch of a button.” However, after closer examination of this offer, one realizes that the

hardware that is supposed to perform these functions is already built in. One therefore wonders what was payed for.

Around 2017 Tesla offered its Model S e-car in the basic S60 and the more expensive S75 version. The two of them differentiated in terms of their range. Yet, the battery built into both versions was the same. The only difference was the programmed software, which throttled the battery in the basic S60 version. If a customer wanted to “upgrade” their e-car by having a “larger energy supply”, a release of the software lock would be possible by paying a “delay surcharge”. Developing a product, then throttling it down with programming and market the original as the “better” version is highly questionable and borders on fraud if all other conditions are met.

Headlines like “Tesla has to recall 70.000 vehicles due to software issues leading to false messages on their display and therefore gradually stopping the power supply” or months before “Tesla had to recall 285.000 cars due to safety reasons caused by software”, raise the justified question of where the focus of programming should rather lie.

## **3.3 Tech Companies**

### **3.3.1 Hewlett-Packard (HP)**

Another prominent example for Software Doping happened with the manufacturer HP Inc. and its printers. Beginning of 2016 HP Inc. automatically installed a software update onto some of their printers, that would detect, whether third-party color cartridges were used or original ones from HP. This was possible via the chips on the cartridges. When the original cartridge was detected, the software would simply send commands to the printer, the hardware, to print whatever the user wanted to print. If third-party cartridges were detected, the software would block the printing and report an error. This software update would only activate at a later point as well to hide the connection with the update was the trigger for the error. At some point voices grew louder comparing the software update to Malware, since it also conceals the time of infection of a system and thus the connection with, for example, a software update.

To understand this software issue better, two figures have been displayed below.

```

procedure PRINTER(cartridge_info)
  READ(document)
  while PAGES_TO_PRINT(document) > 0 do
    READ(paper_available?)
    if  $\neg$ paper_available? then
      TURNON(alert_signal)
      WAITUNTIL(paper_available?)
      TURNOFF(alert_signal)
    end if
    PRINTNEXTPAGE(page_out,document)
  end while
end procedure

```

**Fig. 1.** A simple printer.

```

procedure PRINTER(cartridge_info)
  if BRAND(cartridge_info) = my-brand then
    (... same code as Fig. 1 ...)
  else
    TURNON(alert_signal)
  end if
end procedure

```

**Fig. 2.** A doped printer.

Figure 1 and Figure 2

As one can see in the figures above, the difference between Fig. 1 and Fig. 2 lies in an implemented coding line in the software of Fig. 2. The software-doped printer in Figure 2 would not print, even though third-party cartridges show the same technical standards and therefore limit the functionality of the printer.

Out of many possible reason, the most obvious from an economic point of view is the monopoly position. New ideas on how to win the Ink war between printer manufacturer and copier industry called for new measures. HP Inc. would profit from selling more cartridges since they created a form of monopoly for consumers that bought their printers.

As so often, HP Inc. as the manufacturer denied those accusations, claiming to know nothing concerning the issue of Software Doping. A day later however, the corporation claimed the process was an unintended consequence of a firmware update of the affected printers. After further questioning, the company changed its opinion yet again, rectified themselves with security claims. The update was supposed to protect their intellectual property and innovative products.

HP Inc. fixed the update after different parties would protest against these actions. Not only angry consumers, but also stores and competitors would protest against these business practices.

### 3.3.2 Canon

The ink industry serves as a great example for these expropriations with the help of IT. Even before chips were implemented on cartridges, printer manufacturers searched for ways to create some form of monopoly. Canon tried to patent an “invention” that its competition tried fighting off. The “invention” was a t-shaped separation of the ink chambers.

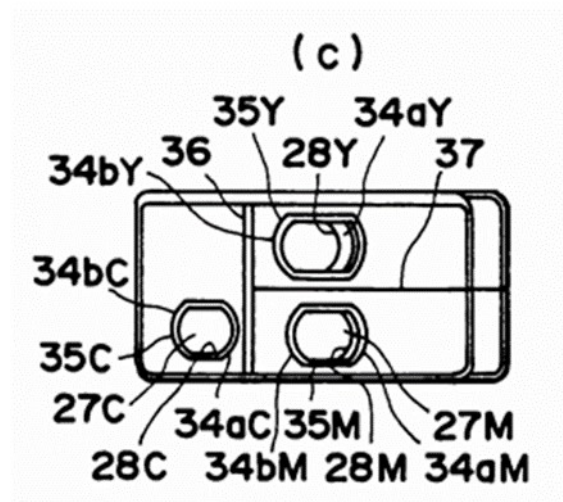


Figure 3: No invention: Canon patent on "T-shaped partition wall"

Since an overly detailed approach in this matter would be beyond the scope of this paper, an over-simplified approach was chosen instead. Pelikan Holding, the competitor of Canon, claimed, that the attempted patent for Canons invention, depicted above in Figure 3, was not possible in a legal sense. The t-shaped separation was no invention to begin with. Consequently, patent law cannot protect it. In the end, the court concluded that it was not an invention and Canon lost the process.

Canons attempt shows yet again, that in an indirect matter corporations may try to use legal instruments, such as patents, to establish a form of monopoly.

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Figure 4: Brother Industries Inc. patented cartridge LC1240

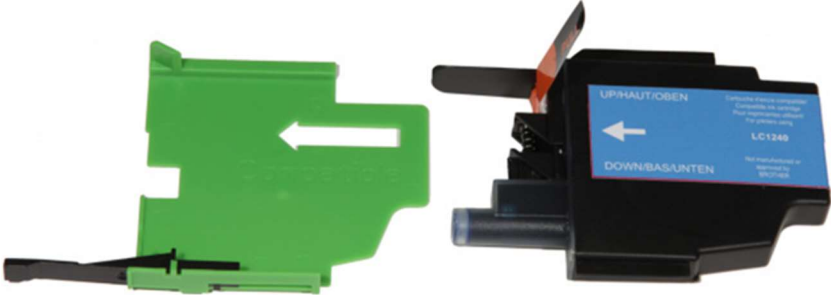


Figure 5: Adapter built by competitors

### 3.3.4 Apple Inc.

Apple Inc. is the largest technology companies by revenue worldwide and is one of the top 3 phone manufacturers. According to estimates, the market share of iPhones is currently around 17.2% worldwide. Between October 2021 to September 2022 Apple sold over 237 million iPhones.

Apple Inc. therefore created a mobile operating system exclusively for its own hardware in 2007. They are very peculiar about their software and therefore hold an incredible amount of Intellectual Property Rights worldwide.

Among other technical issues users had with the product, one of the more prominent ones was the "Error 53". Apple offers over the course of time to update the software of



iPhones to fix bugs, increase security and to provide the latest features. However, the iOS 9 update triggered quite the uproar. Without warning or disclaimers, the iPhone was either automatically or manually updated from an older software to iOS 9, and with that some were rendered useless. Any data on the iPhones seemed to have been lost and users were no longer able to use their iPhones. After the software update was installed, the phone checks whether the original components are still in use. If iPhone owners let third-party repairers change components, the original components were no longer in use. Specifically the reason was the missing alignment with the original Home button and Apple's Secure Enclave. If that was the case, the software locked the phone without warning.

Apple Inc. was aware of this Error and rectified the Software Update and “bricking” the iPhone as a security measure to prevent access to fingerprint data. On this note, Apple Inc. never wanted third parties to carry out any kind of repairs on their products anyway. When asked on for ways to fix these iPhones, Apple employees recommended buying a new iPhone.

“We protect fingerprint data using a secure enclave, which is uniquely paired to the touch ID sensor. When iPhone is serviced by an authorized Apple service provider or Apple retail store for changes that affect the touch ID sensor, the pairing is re-validated. This check ensures the device and the iOS features related to touch ID remain secure. Without this unique pairing, a malicious touch ID sensor could be substituted, thereby gaining access to the secure enclave. When iOS detects that the pairing fails, touch ID, including Apple Pay, is disabled so the device remains secure.”

Later the Seattle based law firm PCVA sued Apple Inc. for rendering iPhones useless. They claimed, “Apple’s failure to give a warning about the consequences of its update on phones, including the loss of all information in the phone, has consumers crying foul.”

In Australia Apple Inc. was sued by the Australian Competition and Consumer Commission (ACCC) in 2017, leading to a fine amounting to 9 million Australian dollars. They claimed, “Apple violated customers' rights under Australian Consumer Law to repairs for devices bricked by Error 53.”

Apple Inc. apologized and announced, that this Error was indeed a security measure to prevent fraudulent action, however, it was not intended to affect customers, but

rather designed to be a factory test. Thanks to a software update released at a later point, consumers could reactivate devices.

In contrast, to the other examples given so far this is a more delicate matter. Apple profited from these practices due to customers having to purchase new smartphones from them or pay Apple for related services. Therefore, a form of monopoly was created, in an unnatural manner. However according to Apple that was not the intention.

The touch ID sensor was the “key” to enter the phone as well as other apps and functions, including Apple Pay. Therefore, higher security standards were needed to protect this “key” to sensitive data in case some other third-party tried to take illegal actions.

The intention of securing sensitive data more tightly is definitely a necessary duty of the manufacturer when offering those services. Nonetheless, the method of its executions was seriously problematic. To secure data, it is not the proper method to render other peoples’ property useless without even putting up a disclaimer. The possibility itself is already highly questionable.

This is a perfect example of expropriation with the help of software.

## **4. Legal Trend in regards to IT**

### **4.1 EUIPO**

### **4.2 USPTO**

## **5. Conclusion**

## 6. List of References