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Publication Date

2019

Peer reviewed|Thesis/dissertation

UNIVERSITY OF CALIFORNIA,
IRVINE

Wine, Fraud and Expertise

THESIS

submitted in partial satisfaction of the requirements
for the degree of

MASTER OF ARTS

in Social Ecology

by

Valerie King

Thesis Committee:
Professor Simon Cole, Chair
Assistant Professor Bryan Sykes
Professor George Tita

2015

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ACKNOWLEDGMENTS

I would like to thank my committee members, Professor Simon Cole, Assistant Professor Bryan Sykes and Professor George Tita.

ABSTRACT

Wine, Fraud and Expertise

By

Valerie King

Master of Arts in Social Ecology

University of California, Irvine, 2019

Professor Simon Cole, Chair

While fraud has existed in various forms throughout the history of wine, the establishment of the fine and rare wine market generated increased opportunities and incentives for producing counterfeit wine. In the contemporary fine and rare wine market, wine fraud is a serious concern. The past several decades witnessed significant events of fine wine forgery, including the infamous Jefferson bottles and the more recent large-scale counterfeit operation orchestrated by Rudy Kurniawan. These events prompted and renewed market interest in wine authentication and fraud detection. Expertise in wine is characterized by the relationship between subjective and objective judgments. The development of the wine fraud expert draws attention to the emergence of expertise as an industry response to wine fraud and the relationship between expert judgment and modern science.

INTRODUCTION

In December 1985, at Christie's of London, a single bottle of 1787 Château Lafitte Bordeaux, was auctioned for \$156,000, setting a record for the most expensive bottle of wine ever sold (Wallace 2008). This bottle was extremely rare. Especially well-preserved, the wine rested, supposedly untouched, for nearly two centuries before it had been discovered in a hidden cellar during excavations in Paris (along with many other bottles). Not only was 1787 Lafitte the oldest vintage red wine placed for auction, but also the bottle was purported to have belonged to Thomas Jefferson and was engraved with the initials, "Th.J." Due to the rarity of the wine, its condition, and especially the association with a Founding Father of the United States, the anticipated price of the wine was catalogued as "inestimable" by Michael Broadbent, Auctioneer and founding director of the Christie's wine department. The auction exceeded all expectations, and the final bid surpassed the previous record for a single bottle of wine sold by more than \$100,000.

At the time, the auctioning of the Jefferson 1787 Lafitte piqued the attention of American billionaire William "Bill" Koch, an avid collector of art and antiques. He soon after obtained four "Th.J." engraved bottles for himself, at a cost of approximately one-half million dollars (Keefe 2007). These bottles included a 1787 Branne Mouton, 1784 Branne Mouton, 1784 Lafitte, and 1787 Lafitte. Koch's Jefferson bottles were stored and displayed among other rare wines in his private cellar for many years, until in 2005, when the Jefferson wines were marked for exhibition at the Boston Museum of Fine Arts, and Koch launched a private investigation to establish the provenance, or the origins, of the four bottles.

The investigation revealed the following: The Jefferson cache had been discovered under mysterious circumstances; The initial consignor, Hardy Rodenstock, a German wine collector

and major figure in the wine community, refused to disclose where exactly the cellar was located. After being unable to locate any confirmatory documents, except for Christie's authentication by Auctioneer Michael Broadbent, Koch contacted the Thomas Jefferson Foundation. The foundation, which manages and studies the private documents and records of Thomas Jefferson, concluded that the bottles were unlikely to have belonged to Thomas Jefferson; there was no record for them. At the request of Koch, the Jefferson bottles underwent carbon-dating to determine the approximate age of the wine. The results suggested that the bottles contained mixtures of wines, and some contents of the mixtures were dated after 1962. After further testing, it was revealed that the initials "Th.J." had been engraved using a modern electric instrument. Unfortunately for Koch and others who had purchased Jefferson bottles, these wines were counterfeit.

Koch then took legal action to expose the fraud (Casey and Wagner 2011). Having purchased four bottles separately, Koch filed multiple lawsuits. He filed complaints against Hardy Rodenstock, the discoverer of the Jefferson cache and initial consignor of the 1787 Lafitte, alleging that the bottles and their discovery were a fraud. A default judgment was issued when Rodenstock refused to acknowledge the suit. Koch also filed complaints against Eric Greenberg, another consignor who Koch suggested had known the wine was counterfeit. Then, Koch targeted Zachy's Wine Auctions for reckless or negligent auctioning and negligent misrepresentation. A jury awarded \$12 million against Greenberg, and Zachy's settled privately. Koch filed additional lawsuits against other auction houses that were also settled. Within a decade, he had spent more than a million dollars investigating and litigating these cases.

The 1787 Lafitte is the most infamous high-profile case of collector counterfeit wine (Robinson, 2015). Since the counterfeit revelations, the Jefferson bottles have brought a great

deal of publicity to the issue of wine fraud (Holmberg 2010). The case demanded the attention of the wine community and set the stage for wine fraud to become a serious matter of concern. In response to the issue of counterfeit wine, there was a need for credible experts who could authenticate wine and detect fraudulent bottles. The past several decades demonstrated increasing interest in wine authentication and developing techniques to detect fraud. The expertise involved in wine authentication is the subject of this thesis.

What makes a credible wine fraud expert? On what grounds does someone lay claim to expertise in wine fraud or wine authentication? In this thesis, I trace the emergence of wine fraud expertise at the intersection of wine, expert judgment, and science. In the first chapter, I offer an historical overview of the fine wine market and describe the origins of wine fraud and its contemporary manifestation: fine wine forgery. The second chapter is anchored in a scholarly work by Steven Shapin (2016), who considers the relationship between subjective and objective judgments of wine. Subjective and objective judgments present challenges for wine expertise. The third chapter analyzes the emergence of wine fraud expertise. I discuss examples from authenticity in art and forensic science that also characterize wine authentication. The development of the wine fraud expert draws attention to the emergence of expertise as an industry response and the relationship between expert judgments and modern science.

FINE WINE AND COLLECTOR FRAUD

The Fine and Rare Wine Market

What are the origins of the market for fine and rare wines? From where does its value originate, and who would be inclined to consume or collect fine and rare wines? A general understanding of the history of wine sheds light on these questions. Below, I describe what I have identified as three essential developments of the wine industry that generated interest in fine and rare wines. These events initiated a culture of investing, collecting, and consuming fine and rare wines. In this section, I review select historical developments that led to the establishment of the collector wine industry and describe the various configurations of wine fraud that occurred throughout these developments.

While the historical origins of viticulture are essential to the emergence of wine trade, at least three major developments contributed to the contemporary global market for fine and rare wine: first, new production technologies enabled wine to be stored and to age; second, classification systems resulted a hierarchy of wines as wine flourished in The Golden Age; and third, the last century has witnessed the introduction of New World competitors and global expansion of the fine and rare wine markets, that is, the renewal of wine's Golden Age. Fundamentally, wine's Golden Age allowed for the distinction of wine. Consuming and collecting such wine, that is exercising taste for fine wine, would be established as an expression of economic status and cultural prestige. Of course, many things had to occur to arrive at this point, beginning with the origins of wine itself.

According Dominé, Supp, and Ulbricht (2017) the origins of viticulture are suggested to have occurred at least 6,000-7,000 years ago, when nomadic peoples cultivated grapevines and other berries. Since the dawn of viticulture, wine has witnessed vast geographic expansion. The

viticulture originating from the Mediterranean region would eventually thrive under the Egyptian Pharaohs, during which time wine-making knowledge vastly improved, and the Egyptians invented pressing methods to extract grape juice. From Egypt, the wine trade propelled economic links with Ancient Greece, where wine became an important element of Greek culture. Viticulture then proliferated across the Roman empire and into central Europe, until the demise of the Roman Empire and the wine trade in tow. The aftermath of the fall resulted in economic turmoil, devastated viticultural regions, and uncertainty of the wine trade in the Italian region. The market likely recovered due to the development of coastal cities, and the establishment of Florence as an economic center. The success of wine in France can be attributed to medieval monasteries that harnessed viticultural practices in the Burgundy region. Rulers, such as Charlemagne, who promoted viticulture, promoted wine trade in France and Germany. Spain also played a significant role in exporting wines to England, and by the 16th century, had brought European vines to the Americas. By this time, England had become a world power and developed as a commerce center for global trade, where the wine trade would thrive.

Alongside progress in global trade, several advancements in wine production brought about the possibility to collect and store wine. Lukacs refers to these developments as ‘wine’s modernization’ (2012, 97). During the Enlightenment, vintners became more attuned to the details of viticulture in an effort to produce more stable wines of higher quality. Likewise, scientific discoveries in the chemical processes of fermentation and the contributions of yeast provided knowledge that vintners could then use to produce superior and consistent wines; wine-making could be a human controlled process (Lukacs 2012, 101). This knowledge prompted an occupation with producing wine that would not spoil quickly.

Two major technological advancements led to the production of wine that could be stored: the glass bottle and the cork (Lukacs 2012, 105). The modern glass wine bottle emerged throughout the seventeenth century, where glass-makers pioneered new methods that would result in a heavy, durable bottle. Instead of clear glass, higher-heat produced dark green or brown bottles; glassmakers designed the punt that would allow the bottle to stand upright, and the height was increased, and the neck elongated to produce the wine bottles that are familiar today. Bottles at this time were largely an item that belonged to the consumer, which they would use to purchase an amount of wine and seal themselves. The invention of the glass bottle ‘virtually guaranteed stability.’ The standard use of corks to seal bottles did not occur until the eighteenth century when glassblowers were able to produce more uniform bottles. Prior to that, merchants purchased the bottles and used their own corks to seal the wine that they had received in casks. Not only did these inventions allow for the storage of wine, they also enabled the maturation of wine, and wine-drinkers soon sought to age wine. This was in stark contrast to all previous wine consumption, in which the wine had to be consumed quickly before it turned sour.

Drinking aged wine, which contains the softer and more delicate flavors that develop over time, came into fashion among England’s elite. The potential to age wine garnered interest among the aristocracy, who possessed the affluence to purchase the more expensive bottled and aged wine from premier producers and who also owned a place to store it, resulting in the development of the wine cellar. Cellaring then became a trend among England’s eighteenth-century elite, and this population’s tastes would come to dictate the wine market. Thus, scientific and technological advancements, such as the innovation of the glass bottle and cork, gave rise to the ability to store and age wine, a condition that would be essential to the

development of a fine and rare wine market that has been characterized by a particular taste for aged wine.

The second significant development of the fine and rare wine industry occurred as wine trade continued to into the nineteenth century, reaching a period which is now referred to as The Golden Age. The Golden Age marks an era in which the European wine industry flourished (Dominé et al. 2017, 24). European wine became a symbol of cultural status and tradition, and in the Bordeaux region there was the beginnings of the “chateau,” or wine estate. At this time, wine from Bordeaux gained international recognition (Lukacs 2012, 141).

The major contributing event that launched this period was the introduction of the Bordeaux wine official classification system. Wines from this region were among the most sought after, and published at the World Fair in 1855, chateaus of the Bordeaux region were divided into first, second, third, fourth, and fifth growths, or crus (Dominé et al. 2017, 25). “Nothing like this public classification existed anywhere else at the time. It served as a formal validation of distinction, both for individual wines and for the region at large, since it codified what in actuality were still emerging traditions” (Lukacs 2012, 142). The ranking system was based on market value, categorizing high quality wines that achieved consistent sales records. The Bordeaux classifications ‘became a self-fulfilling prophecy’, establishing the permanent distinction of the top vineyards of the region. Only one official change has been accepted since the classification was first published¹ (Vins de Bordeaux n.d.). The chateaus designated Premier Grand Cru are still among the most sought-after wines.² During the Golden Age, wine production rose dramatically across central Europe, with the establishment of chateaus and

¹ In 1973, Chateau Mouton-Rothschild was elevated to Premier Grand Cru.

² Premier cru château includes Château Haut-Brion, Château Lafite-Rothschild, Château Latour, and Château Margaux, and added later, Château Mouton Rothschild.

increased yields, French wines were once again proven as a major competitor. Italy's wine producers also achieved successes in the market, as scientific advancements were introduced, wine merchant firms were formed, and a viticultural institute was established. Germany had developed wine regulations, improving wine quality in the region alongside heightened yields. This time period is also characterized by increases in both wine production and quality, as well as the flourishing of the wine industry in Europe (Dominé et al. 2017).

The developments of the Golden Age, and, especially, the introduction of the official classification system of Bordeaux (and subsequent regional classifications), elevated European wine markets to grand proportions. The ranking system and the increase in quality of wine resulted in an established hierarchy of wines that remains in effect today. Because of the hierarchy, consumers and collectors would now be able to easily discern wines of superior quality. Elites continued to express a taste for superior wine and now sought distinguished wines from chateaus with the highest classifications. Demand for such wines increased during the Golden Age and would eventually surpass production. The Golden Age continued to produce exceptional wines until the devastating onset of phylloxera.

Phylloxera is the name of a louse that attacks and damages the roots of vines. The pest originated in the United States, where *labrusca* vines grown on the east coast had developed resistance. When American vines were imported to plant in Europe, phylloxera attacked the vulnerable *vinifera* roots of the European vines, and the effect was identified first in southern Rhone in 1863. In a matter of decades, the majority of vines throughout France and spreading quickly across Europe, were lost (Dominé et al. 2017, 26). Wine production dramatically decreased. The only possibility to save European vines was to graft them onto American rootstocks. Dominé, Supp, and Ulbricht provide estimates that now “around eighty-five percent

of vines are grafted onto American rootstocks” (2017, 25). Towards the end of the nineteenth century, only a few small areas were unaffected by phylloxera. Phylloxera damaged wine producing regions in all of Europe.

Wines produced prior to the phylloxera catastrophe, and likewise wines produced with pre-phylloxera vines not planted with American roots, would become increasingly valuable. These wines, grown on the roots original to the *vinifera* vines, were considered to be the most traditional and genuine wines of the region, superior to wines produced with American rootstocks. It is believed that older vines produce finer and higher quality wines. For this reason, ungrafted wines are extremely valuable. Such wines are among the most expensive and difficult to acquire, and older vintages are increasingly rare. A notable rare wine is 1945 Domain de la Romanée-Conti. Not only was 1945 a great year for Burgundy, this wine is the last to originate from ungrafted vines, and only 600 bottles were produced (Broadbent 2006). In October 2018, the 1945 Romanée Conti set a new record for the most expensive bottle of wine ever sold at \$558,000 (Woodard 2018). Similar pre-phylloxera wines perform exceedingly well at auctions.

The third major development occurred relatively recently. As the European wine market eventually recovered from the destruction caused by phylloxera, global trends that took place from the second half of the twentieth century were instrumental to further progressing the fine and rare wine market. New World competitors emerged after the early century witnessed American prohibition and world wars that marked a sweeping decline in European wine production. Around the 1960s, the American wine industry began to thrive with the revival of California’s Napa Valley and new technologies that enabled Australian wine producers to compete in the global market (Dominé et al. 2017, 28). At the 1976 Paris Wine Tasting, now

also known as the Judgment of Paris, California wines were placed in a blind tasting against the finest French wines. To everyone's astonishment, the top scoring wines were from California: the 1973 Stag's Leap cabernet sauvignon the 1973 Chateau Montelena chardonnay (Godoy 2016). The outcome of the 1976 tasting demonstrated that fine wine was not exclusively French wine. This led to new wine establishments in the United States and around the world; New World competitors could aspire to create wines on par with European, and especially French wines. Additionally, the modern industrialization of both Old and New World wine meant that greater quality wines could be produced on a larger scale (Dominé et al. 2017, 28).

In addition to the expansion of wine production in the New World and increased participation in wine consumption, fine wine moved into Asian markets. Global economic progress resulted in a larger population that had both the interest and the financial means to purchase fine wine. Older vintages from Bordeaux and Burgundy can cost thousands or sometimes hundreds of thousands of dollars per bottle. Many of these wines will be purchased as an investment or to become part of a collection, rather than to drink and enjoy. Scarcity and demand are what defines the market for fine and rare wines and sets the value for wines that sell at auctions, in retail shops, and in private sales. Thus, the contributions of New World wines and a global increase in demand for fine wine has led to a renewal of wine's Golden Age.

As wine evolved over the past several thousand years, many significant transformations have contributed to the development of the fine and rare wine market. A necessary condition for the industry was the invention of the bottle and the cork, enabling fine wine to be stored and aged. Moreover, during the first Golden Age of wine, the establishment of classification systems cultivated distinction of quality. The phylloxera disaster that followed rendered greater distinction of fine aged wine. Developments in the second half of the twentieth century

introduced New World competitors and global expansion of the fine wine market, creating ever greater demand for fine and rare wine.

Today, the fine and rare wine market is a multi-billion dollar industry. In 2018, auction sales alone surpassed \$479 million (Meltzer 2019). This does not account for estate-direct purchases or retail and private sales, which comprise a significant portion of the market. As with other luxury goods, antiques and collectibles, demand for rare, prestigious items generates significant opportunities for fraud.

Wine Fraud

Wine fraud has existed in various forms for nearly as long as wine has. Even the earliest markets for wine faced adulteration. During each of the developments described in the previous section, wine fraud was a serious problem. This section describes times at which fraud was widespread and the industry's efforts to reduce it. Responses to wine fraud have taken the form of new laws and regulations, transformations in the supply chain, industry adaptations to counteract fraud, and more recently, wine authentication.

For as long as there has been a demand for wine, there has been wine adulteration and fraud. Prior to the industry adoption of the glass bottle and cork, wine was both stored and sold directly from casks. In contrast to selling a sealed bottle of wine, wine from the cask starts to spoil as soon as it is poured. Moreover, the remaining wine in the cask also deteriorates, as more liquid is replaced with oxygen. For merchants at the time, if the wine was not sold before it spoiled, potential profits would be lost. This created an incentive to modify the wine so that it could be stored longer. Adulteration became a practice among wine merchants and tavern owners, who would frequently blend the spoiled wine with good wine (Phillips 2000, 109).

Experiments to prolong the life of wine involved adding wax, gum, purple dye, and other substances. Other various recipes to restore wine included adding grapes, cardamom, hot boiled corn, or sand, to name a few (110). In addition to adulteration to delay spoiling, merchants and tavern owners could easily deceive buyers by passing off a cheap wine as more expensive (Lukacs 2012, 63). The public was well aware of this, and fear of fraud led to intervention against these practices, such as laws in fourteenth and fifteenth century London which ordered that corrupt wines would be poured out and the casks destroyed (Phillips 2000, 109). Other laws restricted the types of wine that a tavern-keeper could sell, in an effort to prevent adulteration.

During the Golden Age, higher quality wine became more valuable, and demand for fine wine increased dramatically. These two elements together brought about fraud. First, production simply could not match demand. Early wine fraud occurred as a reaction to scarcity (Lecat, Brouard, and Chapuis 2017). Second, Europeans developed a taste for fine wine, and consumers sought higher quality wine. Wine merchants filled this opening in the market by selling wine with a false label, blending wines to mimic the high-quality producers, or topping off high-quality wines to sell greater quantities. At this time, glass bottles and corks were in use, but the wine-makers did not bottle their own wine. Instead, wine merchants, or *négociants*, bottled and labeled the wine themselves before delivering it to the market. This is how fraud became widespread during the Golden Age; merchants were able to create fake wines by mislabeling bottles. In addition to this, the phylloxera epidemic drastically reduced production, while consumer demand remained stable. *Négociants* were eager to satisfy the market by producing wine from dried grapes or passing off wine from other regions as more distinctive varieties. It was easy for merchants to deceive consumers by mislabeling the cheap wine to sell for a greater profit. This type of fraud was reduced in the twentieth century when wine estates

began to do their own bottling. The supply chain adaptation reduced the problem of mislabeling, but it did not completely eliminate négociants, and there have been recent large-scale incidents of fraud (Mustacich 2018; Pfanner 2012).

Wine-makers also put significant pressure on the French government to take action against fraud. French vintners, recovering from the phylloxera, faced a crisis of overproduction, depressed export markets, and widespread fraud that originated during the onset of the disease (Phillips 2000, 290). Wine-makers were frustrated with the government for failing to confront the crisis. After holding a series of rallies, the French government passed a number of laws to control wine production, including raising taxes on sugar and requiring declarations of crops and yields. They also passed laws to prevent fraud, such as banning the sale of substances that were frequently used in fraudulent wine. Importantly, the government established an agency whose role was to repress fraud and passed a legal definition of wine. These laws marked the beginning of legal efforts to protect French wine. In 1930, France legislated Appellation d'Origine Contrôlée (AOC). AOC regulations define geographic boundaries for wine producing regions, and they also set standards for the varieties of wine that can be produced in the region, as well as specifying techniques of production. Other jurisdictions followed suit and have adopted their own appellation laws, posing various restrictions on viticulture, production, and labelling. In the United States, where wine controls are less strict, appellations refer to geographic divisions known as American Viticultural Areas (AVAs). While wine merchants no longer adulterate wine to delay spoiling, in spite of laws and regulations, wine fraud still occurs. In 2010, France convicted nearly a dozen wine producers for mislabeling blended wine as the more expensive pinot noir variety and exporting the misrepresented wine to the United States (Fichot 2010). Charters presents a continuum of ethical behavior in wine, from legal to unhelpful, misleading,

and illegal (2006, 230). One example of misleading but not illegal behavior is the addition of oak chips to wine during aging. This practice enables the producer to give wine an oaky flavor without the added cost of aging the wine in oak barrels. Similar additive practices occur regularly, but they are not considered illegal. The legality of such practices varies between jurisdictions.

Contemporary wine fraud may be defined as “attempts at misleading the wine drinker (and/or wine collector) into believing that he or she has bought a different/better product than is actually the case” (Holmberg 2010, 106). There are important differences between two variations in wine fraud, which Holmberg refers to as consumption fraud and collector fraud. Consumption fraud targets wine drinkers and the general wine market, while collector fraud deceives exclusive buyers in the private market. As mentioned in the previous section, the second half of the twentieth century introduced New World competitors, expansion into Asian markets, and a renewal of the Golden Age. The market for consuming, collecting, and investing in fine and rare wines is thriving. Moreover, the financial value of wine, especially fine wine, has dramatically increased, attracting investors and entrepreneurs to the market. George and Charney (2015) offer one example of a case of Chateau Lafite Rothschild 1982 gaining a 21,000% increase in auction price from 1986 to 2010. Recent years have seen an increased demand for fine wine and increased motivation for fraud (George and Charney 2015, 101). However, with this success, the contemporary fine and rare wine industry faces the challenges of an additional form of fraud: fine wine forgery.

George and Charney define forgery as “an object made in fraudulent imitation of something” (2015, 103). It is different from blending cheap and fine wine or producing fake wines by mislabeling the bottle. Fine wine forgery aims to copy the authentic wine, and there

are enormous potential profits. This type of fraud targets collectors seeking the rarest and most expensive wines, often purchasing as an investment or to become a prized piece of one's collection, rather than to consume. According to Jancis Robinson, the most commonly counterfeited wines are Chateau Cheval Blanc 1921 and 1947, Lafite 1787 and 1870, Lafleur 1947 and 1950, Latour a Pomerol 1961, Margaux 1900, and Petrus 1921 and 1947 (Robinson 2015b). Note that these are all wines from the Bordeaux region and are extremely rare.

The remainder of this paper will focus primarily on collector wine fraud for several reasons. In contrast to consumer fraud, in which victims often do not realize the fraud, collector wines are stored for many years before they are resold, and the period of storage presents greater opportunities for fraud detection (Holmberg 2010, 112). Moreover, recent scandals have generated greater interest in counterfeit wine and detection in the fine and rare wine industry. There are professionals and consultancy firms that specialize in rare wine authentication and training professionals to detect fraud.

It has been suggested that counterfeit wine is a multi-billion dollar industry (Micallef 2018). However, reliable estimates do not yet exist, and collecting international data about counterfeit wine is remarkably difficult. Wine fraud in the general market regularly goes unnoticed as it is consumed (Holmberg 2010). In contrast, collector wines can remain in circulation for many years before they are detected. A lot of counterfeit wines are not reported for a number of reasons. Collectors who discover fraudulent wines in their cellars sometimes return them to a retailer, who may refund the collector and resell the counterfeit bottle to another unknowing client. Other times, a collector turns a blind eye to that possibility, enabling the wine to re-enter circulation at a time of the collector's choosing. When it is brought to the attention

of the authorities, wine fraud is often dealt with by local law enforcement agencies, making it difficult to collect data on national and international levels (George and Charney 2015, 102).

Moreover, with the global expansion of the fine wine market in recent decades, counterfeit wine has gained prevalence in China. For some time, China has been seen as the hub for counterfeit goods, and wine is no exception (Bull 2016). Especially outside of urban areas, many buyers purchase more expensive wine, believing that they are getting a higher quality product, when in fact they are purchasing fake wine. The average wine consumer is unaware of the issue and likely does not have enough knowledge about wine to proceed with caution. There are many obstacles to collecting data on counterfeit wine in these regions. Future studies should aim to overcome these challenges and generate valid and reliable estimates.

There have been significant efforts to curtail counterfeiting in the fine and rare wine industry. “Many [producers] now realize that taking measures to ensure traceability and authentication is a key part of protecting their brand” (Robinson 2015c). In recent years, wine producers have utilized new technologies to fight fraud (McCoy 2014). Many labelling strategies have been created to make forgery more complicated. An embossed label fused directly to the bottle is one such technique, while other brands have used watermarks and laser etching. Some producers use proprietary paper that contains ultraviolet signatures, or they may incorporate special color-shifting ink. Tamperproof capsules, constructed with QR codes that get damaged when the wine is opened, have been created to prevent refilling bottles with cheaper wine. Wineries also use holograms, encrypted text, and security chips to prevent fraud. Modern technologies have allowed producers to take part in preventing counterfeiting. Tampering with fine wines will become more difficult for contemporary bottles than it has been for older vintages (Holmberg 2010). However, such advancements are not immune to the sophisticated

efforts of counterfeiters; as new technologies emerge to prevent forgery, forgers develop techniques to circumvent them. Moreover, new technologies cannot retroactively secure older vintages on the secondary market (Robinson 2015a).

In addition to the efforts of wineries to prevent counterfeiting of their wine, there are attempts on the part of auction houses as well as collectors to identify fraudulent wines in circulation. While the condition of the bottles and notes on provenance have been traditionally recorded in the auction catalogue, auction houses now require documentation that the wine they are selling is authentic (Gittleson 2014). Collectors, too, often make efforts to ensure the wine they are buying is genuine and to authenticate their own cellars. Collectors may hire wine consultants to authenticate their own cellar before they place wine for auction, or they may enlist authentication services to evaluate wines they are considering purchasing from a retailer or private seller. At least one online database exists where wine can be searched for details about its provenance and established authenticity.

Members of the wine community have taken it upon themselves to resist wine fraud. Additional attempts to derail counterfeiters occur online via wine media websites, forums and threads. The online presence of the wine community is alive and well, as users read wine news, exchange recommendations, and seek advice. Leaders in the industry, as well as wine-specific media, may report on counterfeit discoveries, cellar theft, and other issues that concern collectors. There is a wine fraud specific website to report wine fraud news, offer insights and advice on wine fraud, and educate members on the issue. Collectors have also sought legal solutions and have taken active measures against wine fraud.

The Kurniawan Fraud

Nearly thirty years after the sale of the counterfeit Jefferson bottles, a recent wine fraud event prompted interest in wine fraud and further highlighted the relevance of expertise in wine authentication. A young connoisseur with supposedly wealthy Indonesian roots, Rudy Kurniawan stepped onto the collector wine scene in the early 2000's, where he quickly established himself among high society wine connoisseurs (Hellman 2017). Kurniawan's nickname, "Dr. Conti," originated from his preference for DRC wine. Domaine de la Romanée-Conti is among the most distinguished and sought-after wine producers in the Burgundy region of France. The domaine is designated Grand Cru, the highest appellation of Burgundy wines. As a small producer of exceptional quality with world-renowned status, DRC wine is extremely rare. The scarcity of DRC wine shapes its value, and at auction DRC wine often sets records. Kurniawan was well-known among wine connoisseurs for his impeccable taste, lavish dinner encounters, spending fortunes at auction houses, and selling bottles from his private collection (*Sour Grapes* 2016). He was also a mystery—little was known about the origins of his wealth and history, but the story he told is that he came from a wealthy family, and his monthly wine expenditure was at one point a million dollars per month.

The unraveling of Rudy's operation entailed multiple levels of investigations, involving connoisseurs and billionaire collectors, wine professionals, private investigators, auctioneers, and vintners. A federal investigation revealed an operation that involved creating recipes from lesser quality and cheap wines to mimic authentic tastes, using old bottles and printed labels to forge rare wines.

The Kurniawan events resulted in the first time that anyone was prosecuted for wine fraud in the United States, and the uncovering of the affair was a shock to the wine community.

The Kurniawan case exposed wine fraud as a serious problem for the fine wine industry. The case also revealed a specialist expertise in wine fraud. Several experts testified for the prosecution in the case. The prevalence of fraud and increased publicity of counterfeit schemes in the fine and rare wine industry created a need for wine authentication. Wine authentication is subjective, just as subjectivity permeates the wine market in general. The following section considers subjectivity and objectivity in wine.

WINE, SUBJECTIVITY AND SCIENCE

Sociologists and historians have problematized notions of objective knowledge, drawn attention to how it is developed and established, and examined objective knowledge at different times and places and in varied cultural contexts (Shapin 2016, 436). Such approaches to objectivity and subjectivity complicate expert judgments about wine. Subjectivity permeates the wine market. The relationship between experts and the subjective and objective categories have been chronicled in the development of enology, or the study of wine.

In “A Taste of Science: Making the Subjective Objective in the California Wine World,” Steven Shapin (2016) examines this relationship through research that occurred in mid twentieth century California enology. Shapin determines that knowledge produced in this arena resulted in ‘objectified subjectivities,’ whereby the objectivities are themselves forms of subjectivity. The article focuses on the language that experts, connoisseurs, and consumers use to describe the sensory experiences of drinking wine as well as the science involved in identifying taste and odors. In documenting research led by enologist Maynard Amarine at the University of California Davis, the article demonstrates the role of subjective judgment and the marketplace in modern science. This section summarizes Shapin’s research in this area, and the following section connects these themes and sociological approach to expert judgments in wine fraud.

In his time at the University of California, Davis, Maynard Amarine produced research on many topics in enology. Shapin focuses on Amarine’s research on the ‘sensory evaluation’ of wine (2016, 436). Amarine sought to introduce objective ways to talk about the properties of wine. This was a central task for establishing expertise in enology, but, as Shapin notes, research in this area was underpinned by commercial realities. At the same time, however, Amarine differentiated ordinary consumers from legitimate experts in their ability to distinguish wine

characteristics. An additional distinguishing feature of enology was a focus on the chemistry of wine and sensory physiology to understand how people experienced wine, further specifying scientific components of taste and smell. Because chemistry lagged in this area, there had been little contestation between the objective and subjective, or chemistry and connoisseurship.

Amarine's efforts to inject objectivity into enology resulted in the introduction of a systematic and academic method to assess wine quality and to describe its defining characteristics. This research took up categorical objective and subjective distinctions to separate consumer sensitivities, experiences, and preferences from expert, analytical, and objective modes of evaluation. However, "each category enfolded aspects of the other" (Shapin 2016, 444). Amarine developed principles for a descriptive language in order to objectify the sensory experience of wine, and part of this task was concerned with describing wine defects and odors. Amarine aspired to develop an analytical approach, but his principles did not incorporate advancements in the chemistry of wine odors.

Shapin describes two central developments that prompted the development of wine flavor chemistry (448). First, the growth of the food industry yielded quality control measures and new product development. Second, the military became concerned with flavor perceptions and chemistry. Analytical techniques, such as gas-liquid chromatography were advanced. The success that occurred in this field resulted in a new vocabulary to talk about wine properties. Amarine's successors further expanded descriptive language and invented the 'Wine Aroma Wheel.' In contrast to Amarine's approach, the wheel would be used by ordinary consumers. Shapin posits that the wheel is an 'intersubjectivity engine' that allows people to systematize their subjective sensory experience and to communicate that experience with others (450). It is also an 'objectivity engine' that standardizes experiences and facilitates training. Interestingly,

the wheel introduces a confidence in objectivity that incorporates foundational flavor chemistry but overreaches actual advancements in the discipline. In any case, the Aroma Wheel succeeded in offering a consistent descriptive language that both consumers and experts use to communicate characteristics of wine. As a result of its success, the wheel presented an analytic vocabulary that enabled consumers and connoisseurs to express judgment and transformed the wine market. Developments in enology satisfied a market demand by generating objective knowledge of subjective judgments (453).

Shapin's work demonstrates the relationship between objective and subjective categories in wine. Led by Amarine, enological research sought to objectify the subjective sensory experience of tasting wine. Developing a language to communicate wine characteristics was driven by efforts to establish legitimate enological expertise and influenced by advancements in chemical science. The descriptive language is characterized by 'objectified subjectivities' that now pervade the wine market through both consumer and expert judgments.

Much like early efforts to objectify the subjective experience of drinking wine, there are efforts by leading wine experts to objectify subjective judgments about wine authenticity. These developments have occurred in response to a market demand for wine authentication following several wine fraud revelations. While connoisseurs have used their expertise to detect fraudulent wines, recent approaches by wine experts aim to systematize the process. At the same time, wine chemistry is developing analytical techniques for wine authentication. Collector wine fraud raises special issues for objectivity in wine authentication. Because the science is less developed for rare and old wines, collectors rely upon subjective expert judgments about wine authenticity. Notions of objectivity and subjectivity in wine authentication raise interesting questions about the future of expertise in wine fraud.

WHO IS A WINE FRAUD EXPERT?

The prevalence of fraud and increased publicity of counterfeit schemes in the fine and rare wine industry created a need for wine authentication. Leaders in the wine industry have taken on this challenge, developing methods to evaluate wine. Consultants, who are hired to authenticate wine, will examine the bottle for specific indicators that the wine is authentic.

Industry expertise in wine fraud has emerged and is spearheaded by one leading wine consultant, Maureen Downey, who has been referred to as the world's foremost expert on wine fraud (Micallef 2018; Decanter 2014). She is the founder of Chai Consulting and WineFraud.com, "the first ever wine counterfeiting, wine fraud and wine authentication educational resource available in the world" (Anon n.d.). The online organization is a product of collaboration between various expert domains in the wine industry. In addition to offering wine authentication services, the organization maintains a membership-based online database of wine fraud evidence, coverage on recent reports of fraud, and educational resources to learn about authentication. Besides its online presence and authentication services, Downey's consultation services include wine fraud presentations and two levels of authentication training. Advanced certification in wine authentication is offered, which educates and trains students in a proprietary method of inspection, reporting and documenting proof of authenticity, and recording the authenticated bottle in an online database (Chai Consulting 2019). Downey's enterprise has laid claims to expertise in wine fraud and authentication, and other organizations are likely to follow. Such claims to expert knowledge call for empirical investigation, and future research may conduct experiments to examine the validity of wine authentication and to evaluate the effectiveness of education and training in wine fraud.

Expert wine consultants may be hired to authenticate wine. Key indicators that are evaluated include the bottle, the label, capsules and corks, and sediment. Establishing the provenance, or the origins and records of ownership of the wine, is crucial to appraising wine and determining authenticity. Wine authentication requires careful inspection of the wine's physical characteristics as well as its provenance. By looking at the wine, wine fraud experts claim the ability to identify whether it is authentic. Other wine authentication techniques have been developed in the wine sciences.

The past several decades demonstrated an interest in applying scientific techniques to wine authentication. Scientific studies of wine authentication invoke analytical models to verify the statements on the label, that is, the wine identity (Fauhl-Hassek 2009, 94). Wine identity has been defined by the relationship between labelling and authenticity. To examine the relationship, scientists have traditionally focused on the geographical origin or the composition, which includes illegal additions or other adulterations. Examining geographic origin relies on stable isotope analysis. Compositional analysis compares the concentration of specific natural compounds in the wine to previously established normal ranges, and analysis of anthocyanin profile, determining the concentration of specific acids, has been used to identify grape variety.

Advanced scientific techniques in chemometrics have been introduced and employed in recent years to assess wine authenticity (Versari et al. 2014). Much of the research in this area applies authentication techniques to wines produced for the consumer market, and many of the techniques were developed for quality control and compliance with regulations. In a review of techniques that have been successful in recent years, the authors focus on analysis of mineral elements, isotopic and metabolomic analysis, targeted and untargeted approaches, volatile compounds, and infrared spectroscopy.

Christoph, Herman, and Wachter (2015) review the contributions of stable isotope analysis to wine authentication in the European Union. Specific stable isotope ratios have been used to analyze different issues of adulteration, including ethanol, sugars, water, glycerol, carbon dioxide, geographic origin, and year of vintage. These techniques rely on databanks that contain data for authentic reference samples. The EU wine databank contains authentic samples collected since 1992 and adds more than 1400 samples annually. Among stable isotope ratio analysis, establishing geographic origin is the most complex challenge. For this purpose, the analysis must be based on authentic samples that are specific to origin and vintage. The authors propose increased implementation of stable isotope ratio to improve quality control.

Combined technologies have also been applied to wine authentication in a study by Wilkes et al. (2016). For this study, the researchers investigated whether combining techniques could determine whether a wine was made from Australian grapes, and if they could further determine the region of origin. They analyzed isotope ratios and strengthened the analysis by combining this technique with trace metal data and were able to determine correct classification at a rate of 94.7%. Adding geological data, they were further able to identify the region with an 85% accuracy rate. The authors propose utilizing multiple analytic techniques to offer more robust results when analyzing wine authenticity. Analysis of grape residual DNA has also been used to authenticate varietal wines (Siret et al. 2000). Applications of metabolomics to wine has also demonstrated potentials for analytic approaches to authentication of wine (Alañón, Perez-Coelle, and Marina 2015). Thus, a variety of techniques have been developed for the purpose of wine authentication.

Scientists have expressed a cautioned optimism about the future of wine authentication (Fauhl-Hassek 2009, 100; Versari et al. 2014, 9). Some of this caution is due to natural

variations in wine composition that are a product of genetics and the environment. Due to extensive variation in composition, databases may be misrepresentative of the wine or could lead to mistakes in the treatment of data. Versari et al. (2014) identify three specific challenges for future research in wine authentication. These include analyzing larger number of samples, studies in which pure authentic samples are analyzed with blended authentic samples, and further developing tools for data mining that include using a larger number of samples.

The technological advancements discussed here face several challenges in applicability to the old and rare wines. There is no databank containing authentic reference samples for very old wine and collecting an authentic sample would be extremely difficult. Another significant hurdle is that opening the bottle to collect a sample renders the wine unstorable and worthless (Fahrni, Fuller, and Southon 2015). To address this issue, the authors conducted a study to verify wine vintage by ^{14}C carbon dating vapors extracted from cork closures without removing liquid or exposing it to the atmosphere. Scientific authentication and traceability are more complex for old and rare wines. Because of significant challenges, the industry relies on wine consultants and connoisseurship to make judgments about wine authenticity based on subjective judgments and expertise.

The extent to which wine connoisseurs collaborate with wine scientists has yet to be determined. Wine fraud raises issues about expert knowledge. Wine authentication, fine wine forgery, and wine forensics draw fascinating parallels to a recent article published by Simon Cole (2010) about the controversial authenticity of a painting and disputed expert judgments regarding its authorship by Jackson Pollock. In this case, a painting that resembled one of Pollock's was purchased at a yard sale. A Jackson Pollock drip painting can fetch millions at auction. Connoisseurs at the International Foundation for Art Research denied authentication of

the painting based on criteria relating to provenance, physical characteristics, and the quality of the painting. A forensic examiner discovered a fingerprint on the painting that he matched to a fingerprint found at Pollock's studio. Still, the connoisseurs at the foundation denied authentication. Later, the forensic examiner was accused of having forged the fingerprint by another examiner who claims the ability to identify an artificial fingerprint. The story was represented in a magazine article as a dispute between connoisseurship and science.

At the forefront of these issues is the juxtaposition between art connoisseurship and forensic science (Cole 2010, 85). Cole contends that the concept of "connoisseurship" is not unfamiliar to fingerprint identification. The narrative that constructs a dichotomy between "subjective" judgments of art connoisseurs and "objective" conclusions by fingerprint examiners is uncharacteristic of fingerprint examination and forensic science. The expert judgments of both art connoisseurs and fingerprint examiners are underpinned by training and experience. Fingerprint evidence is probabilistic, not absolute, and it is based on notions of connoisseurship.

Although experts aim to represent their evaluations as objective analytical assessments, they have not been scientifically validated. While there are prospects for scientific wine authentication, wine science is unsettled by fine and rare wines. Databanks for old and rare wines have not yet been developed. Moreover, stable isotope analysis relies on samples that are specific to origin and vintage. Each wine that requires authentication would also require a specific reference sample. Such samples will be difficult to obtain because of the limited reference pool available. While wine producers may have access to authentic samples in their own cellars, they may or may not be interested in relinquishing their prized wines to science. The fundamental setback, characterized by the fine wine industry, is the inability to sample the wine inside the bottle. Opening the bottle and collecting a sample would render the wine

worthless. Instead, wine authentication relies on evaluations of provenance and physical assessment of the wine. As further scientific techniques are developed, wine fraud expertise will undoubtedly respond.

CONCLUSION

In 2013, Rudy Kurniawan, was sentenced to ten years in prison for wine fraud, having carried out an operation that involved creating recipes from lesser quality and cheap wines to mimic authentic tastes, using old bottles and printed labels to forge rare wines (Hellman 2017). Kurniawan sold millions of dollars in fake wine at auctions and in private sales for ten years before his fraud was unraveled. One calculation suggests that at least \$550 million of Kurniawan's counterfeit wines are still in circulation (Downey 2018). This case brought a lot of attention to collector wine fraud.

The massive scale of the operation generated serious concerns for collectors who may have purchased Kurniawan's wines. The industry called upon consultants and experts who could authenticate old and rare wine. Consultants responded by claiming the ability to distinguish authentic wine from counterfeits. They further generated membership-based organizations, education and trainings in wine authentication techniques to legitimate expertise. These techniques rely on subjective evaluations of the physical characteristics of wine. At the same time, researchers are developing methods for scientific wine authentication. While such methods have demonstrated success in determining adulterations and classifications, identifying geographic origins and vintage are challenging. Old and rare wines create even more complexity for scientific authentication. Thus, authenticating old and rare wines frequently relies on the subjective judgments of expert connoisseurs.

Because there are significant issues for applying scientific wine authentication to fine and rare wine, judgments from wine fraud connoisseurs continue to be relied upon in the industry. How wine fraud expertise is applied in legal settings, and how experts in this field will interact

with scientific experts will continue to raise interesting questions about subjectivity and objectivity in collector wine fraud.

REFERENCES

- Alañón, M. E., M. S. Perez-Coelle, and M. L. Marina. 2015. "Wine Science in the Metabolomic Era." *TrAC - Trends in Analytical Chemistry* 75:1–20.
- Anon. n.d. "WineFraud.Com." Retrieved February 11, 2019 (<https://www.winefraud.com/>).
- Broadbent, Michael. 2006. "Red Burgundy." Pp. 215–72 in *Vintage Wine: Fifty Years of Tasting Over Three Centuries of Wine*. London: Websters International Publishers.
- Bull, Toby. 2016. "The Grape War of China: Wine Fraud and How Science Is Fighting Back." Pp. 41–56 in *Art Crime: Terrorists, Tomb Raiders, Forgers and Thieves*, edited by N. Charney. Palgrave Macmillan.
- Casey, William J. and Andrew G. Wagner. 2011. "Litigating a Case of Counterfeit Wine." Pp. 329–47 in *Wine in America: Law and Policy*, edited by R. Mendelson. Wolters Kluwer.
- Chai Consulting. 2019. "TCM Wine Authentication." Retrieved February 11, 2019 (<http://www.chaiconsulting.com/services/authentication-services/>).
- Christoph, Norbert, Armin Hermann, and Helmut Wachter. 2015. "25 Years Authentication of Wine with Stable Isotope Analysis in the European Union-Review and Outlook." *BIO Web of Conferences* 5.
- Cole, Simon A. 2010. "'Connoisseurship All the Way down: Art Authentication, Forgery, Fingerprint Identification, Expert Knowledge.'" *The Journal of Art Crime* 4:85–88.
- Dominé, André, Eckhard Supp, and Dunja Ulbricht. 2017. "A History of Enjoying Wine." in *Wine*, edited by A. Dominé. H.F.Ullman.
- Downey, Maureen. 2018. "\$550Mill of RK Wines in the Market - The Math." *WineFraud.Com*. Retrieved February 11, 2019 (<https://www.winefraud.com/winefraud-news/550mill-of-rk-wines-in-the-market-the-math/>).

- Fahrni, Simon M., Benjamin T. Fuller, and John R. Southon. 2015. "Angel's Share Combats Wine Fraud: 14C Dating of Wine without Opening the Bottle." *Analytical Chemistry* 87(17):8646–50.
- Fauhl-Hassek, C. 2009. "Trends in Wine Authentication." *Le Bulletin de L'OIV* 82(935-936–937):93–100.
- Fichot, Nicholas. 2010. "French Traders Sentenced for Mislabeling Wine." *Reuters*, February 17.
- George, Stuart and Noah Charney. 2015. "Excerpt from the Wine Forger's Handbook." *Journal of Art Crime* 14:101–8.
- Gittleson, Kim. 2014. "Wine Fraud: How Easy Is It to Fake a 50-Year-Old Bottle?" *BBC Business Reporter*, August 8.
- Godoy, Maria. 2016. "The Judgment of Paris: The Blind Taste Test That Decanted the Wine World." *NPR: All Things Considered*. Retrieved February 11, 2019 (<https://www.npr.org/sections/thesalt/2016/05/24/479163882/the-judgment-of-paris-the-blind-taste-test-that-decanted-the-wine-world>).
- Hellman, Peter. 2017. *In Vino Duplicitas: The Rise and Fall of a Wine Forger Extraordinaire*. New York: The Experiment.
- Holmberg, Lars. 2010. "Wine Fraud." *International Journal of Wine Research* 2(1):105–13.
- Lecat, Benoit, Joelle Brouard, and Claude Chapuis. 2017. "Fraud and Counterfeit Wines in France: An Overview and Perspectives." *British Food Journal* 119(1):84–104.
- Lukacs, Paul. 2012. *Inventing Wine: A New History of One of the World's Most Ancient Pleasures*. WW Norton & Company.
- McCoy, Elin. 2014. "Five Ways Wineries Fight Counterfeits." *Wine-Searcher*.
- Meltzer, Peter D. 2019. "Global Wine Auctions Exceed \$479 Million in 2018." *Wine Spectator*.

- Micallef, Joseph V. 2018. "What's In Your Cellar? Counterfeit Wines Are a Multi-Billion Dollar Problem." *Forbes*. Retrieved February 11, 2019
(<https://www.forbes.com/sites/joemicallef/2018/12/01/whats-in-your-cellar-counterfeit-wines-are-a-multi-billion-dollar-problem/#47884c61c836>).
- Mustacich, Suzanne. 2018. "Bordeaux Wine Firm Found Guilty of Fraud." *Wine Spectator*.
- Pfanner, Eric. 2012. "Fraud Charges Threaten Burgundy's Vaunted Reputation." *The New York Times*, June 18.
- Phillips, Rod. 2000. *A Short History of Wine*. Harper Collins.
- Robinson, Jancis. 2015a. "Authentication." *The Oxford Companion to Wine*.
- Robinson, Jancis. 2015b. "Counterfeit Wine." *Oxford Companion to Wine*.
- Robinson, Jancis. 2015c. "Provenance." *The Oxford Companion to Wine*.
- Shapin, Steven. 2016. "A Taste of Science: Making the Subjective Objective in the California Wine World." *Social Studies of Science* 46(3):436–60.
- Siret, R., J. M. Boursiquot, M. H. Merle, J. C. Cabanis, and P. This. 2000. "Toward the Authentication of Varietal Wines by the Analysis of Grape (*Vitis Vinifera* L.) Residual DNA in Must and Wine Using Microsatellite Markers." *Journal of Agriculture and Food Chemistry* 48(10):5035–40.
- Versari, Andrea, V. Felipe Laurie, Arianna Ricci, Luca Laghi, and Giuseppina P. Parpinello. 2014. "Progress in Authentication, Typification and Traceability of Grapes and Wines by Chemometric Approaches." *Food Research International* 60:2–18.
- Vins de Bordeaux. n.d. "Grand Cru Classes En 1855." Retrieved February 11, 2019
(<https://www.bordeaux.com/us/Our-Terroir/Classifications/Grand-Cru-Classes-en-1855>).
- Wallace, Benjamin. 2008. *The Billionaire's Vinegar: The Mystery of the World's Most*

Expensive Bottle of Wine. Crown Publishers.

Wilkes, Eric, Martin Day, Markus Herderich, and Dan Johnson. 2016. "In Vino Veritas- Investigating Technologies to Fight Wine Fraud." *Wine & Viticulture Journal* 31(2):36–38.

Woodard, Richard. 2018. "1945 Romanée Conti Sets New Record at Wine Auction." *Decanter*. Retrieved February 11, 2019 (<https://www.decanter.com/wine-news/1945-drc-wine-auction-record-403025/>).