

# High-Frequency Trading: Deception and Consequences\*

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This commentary is based on the work of Cooper, Davis, and Van Vliet (2016) and the commentary focuses on what problem high-frequency trading poses. It lists key literature on high-frequency trading that is missing and points out that the poker analogy to defend deception in financial markets is weak and misleading. The article elaborates on the negative impact created by spoofing and quote stuffing, the two typical deceptive practices used by high-frequency traders. The recent regulations regarding high-frequency trading, in response to the “Flash Crash” of 2010, are preventive, computerized and more effective. They reflect ethical requirements to maintain fair and stable financial markets.

*Keywords:* high-frequency trading, deception, volatility, instability, ethics, regulation

## Introduction

High-frequency trading provides an increasingly significant portion of daily trading volumes in US equity markets. Executed orders submitted by high-frequency firms made up 35% of equity trades in the US in 2005, high-frequency trades increased to 56% in 2010, and they rose further to 70% in 2012 (Kauffman, Liu, & Ma, 2015). However, the cancelled orders related to the trades are not known. Although the dominance of high-frequency trading in equity trading has been the increasing concern by certain market participants, only the “Flash Crash” on the New York Stock Exchange on May 6, 2010 started to unveil the impact that high-frequency trading has exerted to other investors and to the market as a whole (Commodity Futures Trading Commission [CFTC] & Securities and Exchange Commission [SEC], 2010; SEC, 2013).

The ecology of ambiguity, liquidity, volatility, uncertainty, and complexity caused by high-frequency trading in equity markets and other financial markets deserves serious studies. The “Flash Crash” has forced securities regulators and market participants in developed markets to assess the instability impact that high-frequency trading has created. The booming literature on high-frequency trading shows the emerging interest of academic researchers. Studies of ethics of high-frequency trading join the effort. Among them is “The Mysterious Ethics of High-Frequency Trading”, recently published in *Business Ethics Quarterly* by Cooper et al. (2016), which draws attention of the authors of this article. For convenience of discussion without loss of generality, this article focuses on the stock market except that financial markets are explicitly expressed.

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The key questions asked by Cooper et al. (2016, p. 3) are:

- (1) What problem does high-frequency trading in general, or some of its practices in particular, pose?
- (2) Will enforcement of a rule, like U.S. SEC Rule 240.10b-5, fix the problem, if there is one, without creating problems at least equally bad?
- (3) How should financial markets be redesigned to fix the problem (assuming that there is one and broad rule against deception, like U.S. SEC Rule 240.10b-5 is not the way to fix it)?

This article will focus on how Cooper et al. (2016) addressed Question 1 and how the more complete picture of reality looks like as we provide literature accordingly. We will discuss Question 2 and present the recent regulatory development since the global financial crisis in 2008 and the “Flash Crash” in 2010. Our conclusion on Question 3 is that Cooper et al. (2016) did not have a realistic proposal in the so-called “effective market” since they avoid looking at the consequences that high-frequency trading creates to other investors and the market.

First and most essential to Cooper et al. (2016) was how they address Question 1, which we believe, is a realistic question. Surprisingly though, we do not find a single section in Cooper et al. (2016) that is in line with Question 1. Rather, Cooper et al. (2016, p. 5) used one single order (limit or marketable order submission and cancellation) to argue for high-frequency traders which often submit and quickly cancel large numbers of orders. They select only proponents’ research to demonstrate how high-frequency trading improves market quality. We include some missing key literature on high-frequency trading and some recent research developments in Section 2 to provide a more complete and realistic picture to readers.

Cooper et al. (2016, pp. 10-13) spent an entire section, entitled *Two Forms of Deception*, to defend spoofing and other deceptive practices used by high-frequency traders as a necessary evolution in financial markets. However, Cooper et al. (2016, p. 15) mentioned that “a common criticism of high-frequency traders is that they only provide liquidity during normal markets and that, during extreme events, they tend to withdraw that liquidity”. Their true argument is still for high-frequency trading by praising how fast it helps the Dow to climb back to the level at which it was before the “Flash Crash” on May 6, 2010. They use a morality argument to avoid the fact that high-frequency trading amplified the systemic risk during the fast drop of the Dow on that day (CFTC & SEC, 2010; Kirilenko, Kyle, Samadi, & Tuzun, 2014). The true intention of Cooper et al. (2016, p. 13) was to “treat many deceptive practices of high-frequency traders as we treat bluffing in poker”. This may be the essence of their main argument of the entire paper. We will point out that the poker analogy in financial markets is weak and misleading in Section 3.

Cooper et al. (2016, p. 15) treated iceberg orders placed by low frequency traders and spoofing orders sent and cancelled by high-frequency traders as they treat deception. Their logic dictates that spoofing should be allowed because iceberg orders are. The sender of iceberg orders has no intention to induce other investors to trade in the direction he desires. Rather, he intends to reduce the exposure of his large order to the market to reduce the risk of being front-run by other traders, particularly high-frequency traders. Thus, sending iceberg orders can help to protect a large order. It is intended to avoid inducement of other traders to trade. This action is neither aggressive nor predatory. Spoofing is intended to induce other traders to trade in a rush in the direction desired by the spoofing high-frequency trader. Iceberg orders are not manipulative. Spoofing is obviously deception-based and manipulative. We will examine spoofing in greater detail in Section 4. Cooper et al. (2016, p. 16) recognized that quote stuffing should be prohibited. However, Cooper et al. (2016, p. 17) rolled back, to a certain degree, the earlier statement on the prohibition of quote stuffing. They suggested to “control” rather than “prohibit” quote stuffing. In Note 17 in their paper, they recommended the maximum

message-to-fill ratio of 50:1. The recommendation is in line with the maximum order-to-trade ratio proposed by the European Commission in 2001 (Dalko & Wang, 2016). A detailed analysis is presented in Section 4 of the negative impact to other investors and the exchanges that quote stuffing creates.

Cooper et al. (2016, p. 7) believed that if a high-frequency trading firm uses prudent strategies in trading according to the three criteria framework proposed by Cooper, Ong, and Van Vliet (2015), an effective market is promoted. The three criteria may help a high frequency trading firm become better managed. They do not have self-regulatory functions against any deceptive or manipulative trading strategy. Thus, they will demonstrate little positive impact on other investors, either high or low frequency traders. Subsequently, they will not prevent any negative impact that the firm may bring to other investors and the market as a whole. Therefore, the “effective market” proposed by Cooper et al. (2016, pp. 16-17) would not be justified by the protection of investors and maintenance of market stability. Their purpose does not stop here. Their true purpose, we believe, is to fend off any regulatory attempts to protect investors and maintain market stability by regulating certain deceptive tactics used by some high-frequency traders. They use the ineffectiveness of legal enforcement to argue for the abandonment of securities regulation. They claim that regulations create more problems than the targeted issues, but they do not list what problems have been created by enforcing the U.S. SEC Rule 240.10b-5 (Cooper et al., 2016, p. 3). They argued that “transparency is a better response than flat prohibition as a way to protect against the bad effects on society of deception in high-frequency trading” (p. 18). Transparency is important, but transparency alone is not sufficient to prevent deceptive practices in high-frequency trading. We will discuss the recent regulatory development in the US and European Union (EU) in Section 5. Section 6 concludes our discussion.

### **Does High-Frequency Trading Improve Market Quality?**

Many academic studies support the view that, all else equal, high-frequency trading makes markets more liquid, reduces transaction costs, and dampens volatility (Brogaard, 2010, pp. 4-5; Jovanovic & Menkveld, 2010, p. 2; Hendershott, Jones, & Menkveld, 2011, p. 3; Hendershott & Riordan, 2013, p. 1003; Fabozzi, Focardi, & Jonas, 2011, pp. 29-35; Cooper et al., 2016, p. 5).

The researchers in the studies cited by Cooper et al. (2016, p. 5) were mainly proponents of high-frequency trading as liquidity providers. The studies not cited by Cooper et al. (2016) showed a different picture that high-frequency trading paints. This article starts by looking at the nature of high-frequency trading.

#### **Liquidity Provider or Consumer**

Most high-frequency trading strategies engage in intraday speculation and finish a trading day with no or negligible shareholding. Naturally, the most important precondition for high-frequency trading to enter a stock and exit from it in seconds or minutes is extant large liquidity. This basic nature of high-frequency trading is also reported by researchers (Biais & Foucault, 2014; Brogaard, Hendershott, & Riordan, 2014). Furthermore, high-frequency traders prefer not only liquid stocks but also low-priced ones (Brogaard, 2010; Gai, Yao, & Ye, 2013; Jones, 2013; Brogaard et al., 2014). The preference of stocks of large liquidity and low price shows that high-frequency trading is the liquidity consumer at the beginning and closure of its trading activities. Some high-frequency trading strategies may provide liquidity at certain times of market tranquility. Often the liquidity generated is provided by other traders who are induced by high-frequency trading. This is particularly true when the high-frequency trading strategies aim for momentum ignition (Biais & Foucault, 2014). Even a proponent of this aspect shows that high-frequency traders consume nearly the same amount of liquidity as the liquidity they provide (Brogaard, 2010).

Equity markets frequently encounter stressful times. The behaviour of high-frequency traders in such times is very different than in peaceful times. Several studies find that high-frequency traders withdraw from the market when turmoil emerges, they compete away liquidity from slower traders, or the fierce competition involving high-frequency traders causes liquidity providers to withdraw from the market (Biais, Foucault, & Moinas, 2011; Madhavan, 2012; Kirilenko et al., 2014).

### **Volatility Damper or Amplifier**

High-frequency traders generate a large number of trades within very short time durations (Gomber, Arndt, Lutat, & Uhle, 2011). Those trades frequently accompany an even larger number of order submissions and cancellations. This is true when the high-frequency trading strategies involve spoofing and other order-based deceptive tactics. After the trading strategies are completed by high-frequency traders, very likely there is price reversal. To that end, high-frequency trading causes the frequency of price reversal and other volatility risks to increase substantially (Partington, Philip, & Kwan, 2015). The volatility increase happens not only in the short-term (Boehmer, Fong, & Wu, 2015), but also the long-term (Zhang, 2010).

During stressful times, high-frequency trading exacerbates market volatility substantially in a short time period (Kirilenko et al., 2014). Also during stressful times, high-frequency traders compete fiercely for liquidity, which leads to liquidity dry-up and dramatic price volatility in a short time period. The “Flash Crash” in 2010 was evidenced by market wide price volatility with large magnitudes on the scale of minutes. High-frequency trading was found to be a main factor in amplifying the market panic and fast recovery (CFTC & SEC, 2010; Kirilenko et al., 2014). Therefore, the market quality deteriorates and instability emerges when high-frequency trading intensifies (Hanson & Hall, 2012; Gai et al., 2013).

The proponents for high-frequency trading argue that it improves the market quality in general. However, the data used by these researchers are provided by US exchanges. They do not include the broker identifications. Some of the proponents use a proxy for the activity of high-frequency traders by using data on submitted orders which may or may not be executed. Others use National Association of Securities Dealers Automated Quotations (NSDAQ) data that exclude brokers-dealers who are important high-frequency traders (Biais & Foucault, 2014; Partington et al., 2015). These researchers do not look into the reality that many of the high-frequency trading strategies are manipulative or deceptive and the ratio of order to trade for submitted orders is large. The liquidity generated by high-frequency traders may not be provided by them directly, but by induced other traders who are likely low frequency traders (Easley, Lopez de Prado, & O’Hara, 2010; Biais & Woolley, 2011; Biais & Foucault, 2014). These researchers used market quality metrics developed prior to the prevalence of high-frequency trading. Therefore, their conclusions that high-frequency trading improves market quality are questionable (Partington et al., 2015). Evidently, Cooper et al. (2016, p. 5) demonstrated selection bias by citing certain literature that favors high-frequency trading.

In summary, the more complete picture of liquidity provision and consumption by high-frequency traders is their adverse selection behavior. Worse, high-frequency trading does not supply liquidity but takes it when liquidity is in shortage. On the other end, high-frequency trading provides substantial liquidity when liquidity is not needed (Partington et al., 2015). High-frequency trading causes a reduction in transaction costs relative to the era preceding decimalization. However, the US equity markets are more volatile in general today than before decimalization. High-frequency trading has contributed to intraday volatility, to say the least.

### **The Poker Analogy Is Weak and Misleading**

Financial markets involve millions of market participants. Financial trading is a serious business operation for most investors, particularly institutional investors who trade for their clients. Since leverage is frequently used, more profit and more loss are both probable. If the market moves against a leveraged portfolio, the loss can be greater than the initial capital. Thus, the risk can become large. In extreme cases, the loss turns potentially unlimited when certain trading strategies go wrong. A poker game is played by four players in general. The purpose of the game is mainly entertainment. Even if gambling is the purpose of a poker game, no player bets with other people's money. The potential loss is limited to the player, and no leverage is involved.

Poker is a competitive game—every player has random access to the cards and nobody can influence the outcome consistently. For example, 100 games in a row by pure skill if no material deception or manipulation is involved. Deception in poker has no serious consequences, such as a financial crisis. Therefore, deception in a poker game is not considered unbearable by the deceived players. Financial markets involve numerous investors and billions to trillions of US dollars in transactions on any trading day. Financial markets are not always competitive. Rather, deception in various forms, with some extending to market manipulation, exists in the market all the time (Allen & Gale, 1992; Zhou & Mei, 2003; Khwaja & Mian, 2005; Aggarwal & Wu, 2006; Klein, Dalko, & Wang, 2012). Frequently, financial markets are monopolistic regarding certain instruments or time horizons (Dalko, Klein, Sethi, & Wang, 2016). Some strategic investors can influence their trading outcome to the extent that substantial profits are made at the loss of numerous other investors. Since deception-based market manipulation has serious financial consequences, occasionally it can and has led to a financial crisis (Carvajal & Elliot, 2009).

Therefore, using poker as the analogy to financial markets regarding deception by Cooper et al. (2016, pp. 2-11) did not have solid footing. Subsequently, the argument made by the three authors regarding whether deception in the financial market should not be regulated is weak and misleading.

### **Two Deception-Based Tactics Used by High-Frequency Traders**

Cooper et al. (2016, p. 9) used one limit order submission and cancellation to discuss the concept of deception. This discussion is insufficient to address the deception issue of high-frequency trading, because a primary characteristic of high-frequency trading is the high ratio of order cancellation to execution (Gai et al., 2013; Biais & Foucault, 2014). When the quantity difference is very great, the meaning of deception is dramatically different. Since high-frequency trading mainly engages in intraday speculation, it generates a large number of trades within very short time periods (Gomber et al., 2011). Carrying the advantage in order processing speed, high-frequency traders focus on frequent turnovers but thin profit per turnover. Thus, high-frequency traders do not need many trading strategies but few, such as volunteer market making, momentum ignition, and statistical arbitrage (Chlistalla, Speyer, Kaiser, & Mayer, 2011). All of these trading strategies may incur numerous order cancellations for each executed order. Some of the order cancellations are not planned ahead of order submission, and thus, they are not deceptive. Still many other cancellations are intentional, and thus, are manipulative or deceptive. Two deception-based tactics deserve careful examination: spoofing and quote stuffing.

### **Spooing**

Spooing is similar to fake trading made by human traders in the era prior to high-frequency trading. Spooing is a deceptive practice. It comes to existence and with a high success rate because high-frequency trading fires order submission and cancellation in nanoseconds, and the order of display by exchanges involves incomplete disclosure of order information (Klein et al., 2012; Lee, Eom, & Park, 2013). In spooing, a high-frequency trader targets order display in the limit order book that is updated frequently for the subscribing market participants. Hence, spooing is an order-based manipulation tactic because it involves no *bona fide* trade, but only order display manipulation. One high-frequency trading strategy, momentum ignition, involves spooing (SEC, 2010; Biais & Foucault, 2014). The main purpose of spooing is to accelerate price changes by inducing other investors to trade in the direction desired by the spooer. In a long example, the spooer submits large-limit buy orders just below the best bid so they can be displayed to the entire market. Since the exchange displays only the submitted orders, not the cancelled or executed orders, numerous investors see the newly arriving large buy orders only without knowing if these orders will be executed or not. Many of them rush to buy and bid the share price higher. As soon as the price increase takes place, the spooer cancels the spooing orders. Once the share price is lifted by the spooed investors above certain level, the spooer places sell orders. He trades against the spooed investors at a sure profit (Lee et al., 2013; Biais & Foucault, 2014; Martinez-Miranda, McBurney, & Howard, 2015). Spooing is purely a deceptive tactic. It causes unfair losses for some of the spooed investors. Thus, spooing is prohibited by Dodd-Frank Wall Street Reform and the Consumer Protection Act of 2010 (Kluchenek & Kahn, 2013).

Cooper et al. (2016, p. 16) stated, "A trading strategy must have a good intention or even that the orders it sends must add good information". Does the spooing trader have a good intention to send numerous large orders and quickly cancel them? His real intention is to induce other traders to jump in the same direction expected by him so the price increases/decreases to the level he can profitably close the position he established earlier. The information he sends out is ambiguous or deceptive. It provides no good information to other investors.

### **Quote Stuffing**

Quote stuffing is another deceptive tactic. In practice, a high-frequency trader submits an extraordinarily large number of orders followed by immediate cancellation. Subsequently, flash-like submission and cancellation of those orders generate congestion, causing order submissions by other investors to be delayed. The purpose of quote stuffing is to slow down the processing of the exchange and create a "traffic jam" to other investors' order turnover (Biais & Foucault, 2014; Egginton, B. F. Van Ness, & R. A. Van Ness, 2014). Eventually, quote stuffing slows down the price changes of the targeted instrument on the victimized exchange, thus creating arbitrage opportunities for the quote stuffer (Biais & Woolley, 2011; Egginton et al., 2014).

In the process of quote stuffing, other investors can be misinformed as to which exchange has the most liquidity or best pricing. The high-frequency trading strategy that employs quote stuffing is both deceptive and predatory. It generates more pollution and waste in message traffic. According to the second criterion of the "effective market" proposed by Cooper et al. (2016, p. 16), "The trading strategy should not block price discovery", and quote stuffing does the opposite, because it reduces the probability and causes delays for other investors' orders to be filled. It affects the majority of US listed stocks and operation of large exchanges (Gai et al., 2013). It is correlated with short-term volatility, decreased liquidity, and higher trading cost. It is detrimental to market quality (Egginton et al., 2014; Partington et al., 2015). It is illegal, as the Dodd-Frank Act prohibits bidding or offering with the intent to cancel the bid and offer before execution (Gai et al., 2013).

### **Deception-Based High-Frequency Trading Needs to Be Regulated**

Cooper et al. (2016, p. 3) concluded that it is a mistake to treat mere deception, or even mere intentional deception, as misconduct in a financial market. We disagree deception in financial markets that it is not the same as deception in an entertainment game, such as poker. Deception-based trading strategies can lead to substantial loss to some investors who made trading decisions on deceiving order display with high-frequency trading in the background. The intentional deception by high-frequency traders needs to be regulated, as it is a financial misconduct if not considered as crime. Financial regulations seek fair markets because fairness is the basic ethical requirement of financial markets (Boatright, 2010). In other words, regulators aim to protect investors from unfair loss in addition to maintaining the market stability. Certain high-frequency trading practices are manipulative, hence unethical, which is equivalent to being illegal in financial regulations. The recent Dodd-Frank Act of 2010 has declared spoofing and other deceptive tactics employed by high-frequency traders as illegal. Regulators have completed a number of prosecutions under the Act (Rossi, Deis, Roche, & Przywara, 2015; Sokol, 2016).

Cooper et al. (2016) used SEC Rule 240.10b-5 and US CFTC Final Rule 180.1 as their regulatory basis when arguing for deception in high-frequency trading. A number of researchers and legal scholars have complained about the difficulty in prosecuting market manipulation, which is *de facto* intentional deception. The reasons are multiple. One is that regulators target the misbehaving trader. Another is that conviction requires proof of sinister or bad intent, which turns out to be the sole factor responsible for low prosecution success rate. Thus, market manipulation as crime is virtually un-prosecutable under the current legislature (Fishel & Ross, 1991; Markham, 1991; Kyle & Viswanathan, 2008). From October 1, 2004 to September 30, 2008, the total number of complaints citing market manipulation is 3,503, while the prosecutions total is 161. The ratio is 4.60%. This ratio shows the low prosecution rate of market manipulation in the US. Japan has an even lower prosecution rate. From July 1, 1998 to June 30, 2008, complaints citing trade-based manipulation are 11,514. Among them, 25 are filed for prosecution. The ratio is 0.22%. These two ratios demonstrate how ineffective legal enforcement is when dealing with market manipulation, which is equivalent to intentional deception (Klein et al., 2012).

Ineffectiveness of legal enforcement of deception-based misconduct does not imply that intentional deception in financial markets should not be regulated, in accordance with the claims of Cooper et al. (2016, p. 3). Rather, regulation needs to be improved to increase effectiveness. Simplicity of regulations is not necessarily the virtue to maintain fair and orderly markets. Effectiveness is the key. Effective regulations can be simple, but they can be complex depending on how complex market manipulation is. As financial markets have changed significantly when globalization, information, and communications technology and other societal aspects are fast evolving, high-frequency trading is the increasingly dominating trading style in financial markets, especially equity markets. It is not the high-frequency trading itself but how to use it that impacts the fairness and stability of the market (Angel & McCabe, 2013). Furthermore, it is not of concern how fast high-frequency trading executes trades. It is of serious concern that many high-frequency trading strategies deceive numerous traders (Partington et al., 2015). Large but slow traders lose certain freedom of competition because of high-frequency trading. This unfairness in profiting opportunities leads to financial unfairness (Shefrin & Statman, 1993; O'Hara, 2014). This is due to the unethical behavior of some high-frequency trading strategies. The Dodd-Frank Act of 2010 has taken the legal step on the intentional deception of high-frequency

trading. However, targeting the manipulators behind those deceptive tactics through the legal framework has proven financially costly and time consuming. Very likely, prosecutions consume various resources without achieving success in the end (Fishel & Ross, 1991; Markham, 1991; Klein et al., 2012). Therefore, the conventional legal approach, being *ex post*, cannot effectively fulfill the daily tasks of promotion of fairness and market stability.

The “Flash Crash” of May 6, 2010 is important in both the history of equity markets and regulatory improvement. It unveils the negative impact that high-frequency trading can create on other investors and the market stability. In response to the “Flash Crash”, regulators in major economies have proposed or enacted new regulations to curb high-frequency trading and mitigate deception-based consequences. The Securities and Exchange Commission enacted the Limit Up-Limit Down Regulation in 2012 (Dalko, 2016). The European Commission proposed two new regulations in 2011. They are the maximum order-to-trade ratio and minimum resting time of displayed orders. These two regulations directly target the deceptive practices of some high-frequency traders. Major European markets, for instance, Italy, France, and Germany, have enacted the proposed regulations (Dalko & Wang, 2016). Different from the conventional legal approach, these new regulations target trading activities regardless of the underlying traders. They are quantifiable, adjustable, and easy to implement and operate daily through regulated exchanges. The most important aspect is that they are preventive. That is, they can be computerized and deny deceptive practices before they can create misinformation. Thus, they have the potential of reducing the necessity of legal enforcement and financial cost. They may imply the future direction of financial regulations (Markham, 2014).

### Conclusion

Research on ethics in financial markets is rare, because financial regulations reflect ethical requirements (Boatright, 2010). However, the unethical behavior of major financial firms and deregulation since the 1980s both contribute to the 2007-2009 financial crisis (Nielsen, 2010). Thus, the crisis has an ethical dimension. Unethical scandals are revealed during boom, euphoria, and crisis time (Argandoña, 2012; Bogle, 2006; Kindleberger, 2000). The society pays more attention to post-crisis unethical cases, such as frauds of Bernard Madoff while ignoring them during pre-crisis time. Cooper et al. (2016) were among the few researchers who promote toleration of deception while calling for deregulation despite the fact that the last crisis has caused so many problems in unemployment, bankruptcy, crime, health hazards, and cultural demoralization (Nielsen, 2010; Klein et al., 2012). It may be too early to make ethical conclusions on high-frequency trading because of the scant available research. But instability caused by high-frequency trading, either deceptive or non-deceptive, is a more serious threat to the financial markets with increasing studies. Reflecting ethical concerns, new regulations against manipulative high-frequency trading strategies have been proposed or enacted in developed economies in North America and Western Europe in response to the “Flash Crash” and have been recently considered by developing economies in Asia (Ait-Sahalia & Saglam, 2013; Chakraborty & Merritt, 2016). These regulations may represent the new direction of regulation that is preventive, computerized and more effective in maintaining fair and stable financial markets (Markham, 2014).

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