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Andrea Lagna & Marc Lenglet

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The dark side of liquidity: shedding light on dark pools' marketing and market-making

Andrea Lagna ^a and Marc Lenglet ^b

^aSchool of Business and Economics, Loughborough University, Loughborough, UK; ^bStrategy and Entrepreneurship Department, NEOMA Business School, Mont-Saint-Aignan, France

ABSTRACT

In this article, we explore the case of dark pools of liquidity, which are trading venues that do not display order books and other trading-related data. We argue that, in a context where liquidity remains essentially invisible, dark-pool providers use visual advertisements that iconically represent liquid markets. In so doing, they defuse the idea that dark liquidity is harmful to market efficiency and fair pricing. We use Barthesian and Greimasian semiotics to study how a major bank advertised its dark-liquidity services through iconic visual signs. We contribute to economic sociology and social studies of finance by foregrounding the role of visual advertising in the construction of liquid markets. To do so, we draw on insights from market studies and visual culture.

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Salesperson: I just had a chat with a client of mine ... they have an interest in routing some part of their flows to all kinds of dark pools but do not know much about them. Would you come with me and meet them to give a quick sketch?

Compliance officer: No problem, as long as they do not want any stats or too many details ... you know it is still grey out there.
(Dialogue about dark pools between a salesperson and a compliance officer, Paris, 2008)

Dark pools of liquidity (or dark pools) are electronic markets where professional investors can trade financial securities invisibly and anonymously. Dark pools help investors hide their market movements from competing traders by not displaying pre-trade information such as prices, quantities and the number of available orders. However, by preventing pre-trade information from being visible to all market participants, dark pools may pose a threat to the informational efficiency of financial markets and the fair pricing of securities (Fama 1970; The Trade 2009). This paradox characterizing dark pools raises an important question: how do providers of dark liquidity succeed in convincing investors that trading in the dark is safe?

We address this question by focusing on European financial markets in the 2007–2010 period. We argue that during these years dark-pool providers constructed a narrative according to which using dark pools is not different from trading in transparent venues that display pre-trade information, such as regulated stock exchanges. The 2007–2010 triennium is a crucial period in European financial history and represents an ideal setting for investigating dark markets. On 1 November 2007, European member states implemented a new regulatory package known as the Markets in Financial Instruments Directive (MiFID), bringing about pivotal changes to the organization of European financial markets (Quaglia 2010). Above all, MiFID created the conditions for the emergence of alternative trading systems competing with traditional stock exchanges. Dark pools of liquidity

emerged in Europe as part and parcel of this historical shift away from traditional exchanges.¹ Given that European investors were not well informed about dark pools when MiFID was introduced, financial intermediaries willing to sell dark-liquidity services had to persuade investors that they would benefit from trading in the dark. Thus, they publicized the counterintuitive idea of dark trading being safe.

In particular, dark-liquidity providers relied on visual advertising to inform professional investors about the benefits of dark markets. In a context where ignorance – that is, not knowing whether a market venue really offers certain benefits – functions as a strategic feature (McGoey 2012), dark-pool providers tried to persuade investors through “iconic” (Peirce 1931) visual signs that resemble liquidity, informational efficiency and fair pricing. We therefore suggest that dark pools represent a critical case where to study how the production of liquidity in financial markets is the result of both market-making *and* marketing. Market-making is the process through which actors construct a financial market – for instance, by developing the infrastructure for pricing and trading securities.² Marketing is instead the promotion of (financial) services through techniques of persuasion including visual advertising. In the context of dark pools, both notions of market-making and marketing conflate in a specific device: the advertisement (or advert) aimed at market professionals.

Our paper is organized as follows. First, we provide a primer on dark pools in the European market context to facilitate the reader’s comprehension of this complex topic. Second, we review existing research on market liquidity in economic sociology and the social studies of finance. We contribute to this research agenda by putting forward the importance of studying the visual representation of market liquidity – in our case, dark pool’s visual advertising. In this regard, we introduce ideas and concepts from the academic fields of market studies and visual culture. Third, we develop a semiotics-based analytical apparatus by drawing on Roland Barthes and Algirdas Greimas. This semiotic framework is geared towards capturing the visual techniques of persuasion in dark-pool advertising. Then, in the fourth section, we show how dark-pool providers supplemented market-making with marketing by deploying an ideal-typical representation of market liquidity. Here, we study two exemplary advertisements that a major bank used to publicize two of its dark-liquidity services in 2007 and 2008. Finally, in the concluding section, we discuss our results and put them into perspective for future research on visual persuasion in financial markets.

A primer on dark markets in Europe

Dark pools emerged in the United States during the 1980s and 1990s, as part of a growing ecosystem of alternative trading platforms challenging traditional exchanges such as NYSE and Nasdaq (Patterson 2012). Because of structural differences between American and European markets, dark pools only appeared in Europe with the 2007 implementation of MiFID. MiFID brought competition to the financial markets industry and enabled the emergence of alternative trading systems known as multilateral trading facilities – that is the European legal name for electronic platforms matching buy and sell orders outside of traditional stock exchanges. MiFID also introduced the category of systematic internalisers, which are investment firms that systematically match client orders internally and against their own books (Banks 2014, 12–13). Besides increasing competition among new market venues and traditional exchanges, MiFID harmonized the set of rules concerning the

¹Dark pools emerged while the financial crisis of 2007–2008 unfolded. The crisis originated in the United States and had nothing to do with the implementation of MiFID. However, it contributed to the rising of uncertainty on European financial markets concomitantly with the structural changes brought by the directive. Furthermore, the 2007–2008 financial crisis exposed significant weaknesses in the functioning of financial markets in the United States and Europe. European policymakers tried to address such weaknesses when they began to discuss a revised version of MiFid (MiFID II) and the Market in Financial Instruments Regulation (MiFIR). The European Commission adopted MiFID II and MiFIR in June 2014. Both regulations became applicable as of January 2018 and introduced caps on the volume of trades that can be executed through dark pools (Hadfield 2017).

²We use market-making in the wider sense of building financial markets. Hence, we do not intend to refer solely to the professional figure of the market-maker, namely the broker-dealer who guarantees to buy and sell securities at all times in order to keep markets liquid.

transparency of pre-trade and post-trade information. As part of this harmonization process, regulators provided several pre-trade transparency waivers that encouraged financial actors to launch dark pools of liquidity as innovative trading services offering anonymity and invisibility (Petrescu and Wedow 2017, 13). Financial firms began to advertise their dark-liquidity services in this context.

How precisely do dark pools create anonymity and invisibility for investors? They do so by not displaying the order book, which is a pivotal device of contemporary financial markets. Traditional exchanges and alternative trading venues other than dark pools use order books to record and display essential information on each listed instrument. An order book is a list of buy and sell orders for specific securities that have not yet been executed. It also shows the number of shares being bid or offered at each price level and who is behind those buy and sell orders (MacKenzie 2018a). Most exchange venues make order books accessible on computer screens, thereby providing participants with a simple representation of the levels of available liquidity – a dimension which is absent in the case of dark pools. Surely, the practice of not displaying liquidity existed for many years in financial markets and was often executed through manual mechanisms. For example, traders kept big orders in their pockets and executed them throughout the day to limit market impact (Hautcoeur and Riva 2012; MacKenzie 2015). Modern-day dark pools deploy instead sophisticated technologies in line with the electronic and algorithmic transformation of financial markets (Lin 2014; Patterson 2012). Current estimates suggest that dark trading accounts for over 8% of total equity value in Europe, against 16% in the United States (Rosenblatt Securities 2018a, 2018b).³

Dark pools have always been controversial since their emergence. Initially, institutional investors such as pension funds and mutual funds were attracted to dark pools because they could trade large amounts of securities without being anticipated by other investors.⁴ The need for institutional investors to hide their market strategies further increased with the growth of high-frequency trading in the late 2000s. High-frequency traders use powerful computers and algorithms to spot price movements quickly and execute many orders at fractions of a second – often front-running other investors (MacKenzie 2018b). Thus, it is possible to say that “dark pools have grown in response to investors’ demands for protection against information leakage in a rapidly changing trading environment” (Petrescu and Wedow 2017, 7).

However, it has soon become clear that some dark pools gave high-frequency traders access to privileged information about “who is trading what” – a notorious story which best-seller author Lewis (2014) has popularized in the book *Flash Boys*. The presence of high-frequency traders in dark pools defeats the potential benefits that pension funds and mutual funds might derive from trading in the dark (Arnuk and Saluzzi 2012). Big banks such as Deutsche Bank, Barclays and Credit Suisse have all reached multi-million settlements with the United States Securities and Exchange Commission for alleged misconducts in their own dark pools (Michaels 2018). These settlements provide ammunition to the argument against dark trading and regulators are trying to bring dark pools back to their original role of protecting institutional investors (Mamudi and Massa 2017).

Now that we have gained a better understanding of what dark pools are and the European market context in which financial firms advertised their dark-liquidity services, we turn to a discussion of how scholars in economic sociology and the social studies of finance have dealt with the issue of liquidity in financial markets. We do so with a view to developing a contribution at the intersection of economic sociology, social studies of finance, market studies and visual culture.

³Investors use dark pools to trade company shares. However, several dark pools also offer dark-trading services for corporate bonds (Mooney 2015).

⁴For instance, if pension fund ABC wanted to buy 100,000 shares of company XYZ, other investors would surely notice such large order by a pension fund and rush to buy XYZ shares. Such action would move price upwards and ABC would end up buying part of those 100,000 shares at a higher price than expected. By executing the buy order through a dark pool, ABC is instead able to reduce the market impact of its trade (Banks 2014, 6).

Towards a visualization of liquid markets

Researchers in economic sociology and the social studies of finance have done a great deal to study market liquidity as a social and cognitive phenomenon. In their seminal work on the social structure of liquidity, Carruthers and Stinchcombe (1999, 353) described a liquid market as a context in which “standardized products can be bought and sold continuously at a price that everyone in the market can know, and [where] products are not normally sold at a price that diverges substantially from the market price.”⁵ Based on such definition, Carruthers and Stinchcombe (1999, 354) examined how market actors come “to share a deep conviction that the ‘equivalent’ commodities in a large flow of (say) financial instruments are really all the same” (Carruthers and Stinchcombe 1999, 354). In other words, Carruthers and Stinchcombe studied market liquidity from the vantage point of sociology of knowledge, investigating how market participants create liquidity by knowing that the assets they trade are standardized and exchangeable.

Carruthers and Stinchcombe initiated a stream of research on the social structure of liquidity and successively other scholars in economic sociology and social studies of finance enriched their work. For example, Pitluck (2011) has shown how professional investors often strive to find liquidity in the stock market and are forced to send smaller orders to different brokers who execute them slowly. Furthermore, MacKenzie et al. (2012) have studied the fact that investors have different access to market information and price discovery. MacKenzie and colleagues refer to the case of high-frequency traders who gain an informational advantage over other investors by locating their computers closer to exchanges’ matching engines. As a result, “traders at a large distance from matching engines are permanently doomed to learn ‘what the price is’ much more slowly than those who co-locate” (MacKenzie et al. 2012, 288).

Inspired by social and cognitive approaches to liquidity, our study explores the visual representation of liquid markets by focusing particularly on visual advertising. We do so for two reasons. First, addressing the visual dimension of liquidity – in our case, visual adverts – is crucial to understand dark pools and their paradoxical nature of non-transparent but supposedly efficient and safe markets. Second, and more generally, we contend that the realm of financial visualization deserves greater scholarly attention (Pryke 2010). As several researchers have already noted, visual practices and technologies play a key role in today’s highly digitalized financial markets.⁶ For instance, Knorr Cetina and Bruegger (2002) studied how foreign-exchange traders are captured by on-screen visualizations connecting them to global markets. Beunza and Stark (2004, 390) pointed out how Bloomberg workstations “select, modify and present data in ways that shape what the trader sees.” Pryke (2010) examined how financial organizations rely on visual innovation to make better sense of market flows. Both Zaloom (2006) and Arnoldi (2006) touched upon market visualization in their analyses of derivatives markets. More recently, Arjalies and Bansal (2018) have dealt with how asset managers use visual devices to inscribe environmental, social and governance criteria in their investment practices. Höllerer, Jancsary, and Grafström (2018) have instead examined how visual artifacts shaped journalistic narratives about the 2008 global financial crisis. Thus, the time is ripe for exploring market liquidity in its manifold visual manifestations.

To investigate dark pools of liquidity and their visual advertising, we draw on insights from two fields: market studies and visual culture. Market studies provide a fascinating research agenda

⁵To put it differently, market liquidity is the degree to which a market – e.g. a stock market – allows assets to be bought and sold without significantly pushing asset prices upward or downward. Accordingly, a liquid asset is one which investors can easily buy or sell without influencing the price of that asset dramatically. For example, an investor who wants to buy a large amount of shares at a certain price might struggle to find other investors willing to sell all those shares at that price level. In this case, we would say that the market is not liquid enough for all those shares to be traded at that specific price. Most likely, the investor would need to buy part of those shares at a higher price. Liquidity is measured in terms of: immediacy (the extent to which a trade can be executed at the current time); breadth (the cost of executing a trade); depth (the number of shares that can be bought or sold at a given price level); resiliency (the degree to which the share price returns to its previous level once trade is completed) (Banks 2014, 60–63).

⁶We focus on studies about the visualization of financial markets. However, the growing importance of visual practices and technologies goes beyond the realm of finance (Boxenbaum et al. 2018; Meyer et al. 2013).

on the marketing practices shaping socio-economic relations (Araujo, Finch, and Kjellberg 2014; Cochoy, Trompette, and Araujo 2016; Cochoy, Deville, and McFall 2017). Particularly interesting for our purposes are the stream of research on marketing performativity and Cochoy's (2008) concept of "qualculation." First, by building on Callon's (1998) interpretation of performativity – and in line with work on this topic in the social studies of finance (MacKenzie 2006; MacKenzie and Millo 2003) – scholars such as Cochoy (1998), Araujo (2007) and Kjellberg and Helgesson (2007) have studied how marketing activities contribute to creating the realities they represent. Although we do not deal with the performativity debate directly, our analysis of dark pools' visual advertising supports the view that marketing practices and devices play a strategic role in modern-day financial markets. Second, Cochoy's (2008) notion of qualculation describes how in many situations people use quality-based rational judgements to complement standard price-based calculation. In our study of dark pools' advertising, we contend that visual adverts functioned as marketing artifacts enhancing market-making as a typically price-oriented process. To put it differently, dark pools' visual adverts aimed at influencing investors' attitude towards dark markets by activating their quality-based perception of dark liquidity – especially in the absence of a visible order book.

Concerning visual culture, scholars in this field have explored at length how vision, visuality and visualization dominate modern life (Berger 1972; Hall 1997; Jay 1993; Mitchell 1986; Stephens 1998; Sturken and Cartwright 2009). Berger (1972, 7) famously claimed that "seeing comes before words," while Jay (1993) coined the term "ocularcentrism" to describe how the visual saturates our social interaction. The field of visual culture offers creative ideas to study how the visual dimension is fundamental to the construction of market liquidity. Crucially, from the visual culture tradition, we adopt semiotics as a prominent approach to conduct visual analysis. In the next section, we introduce our semiotics-based framework, the aim of which is to capture the signs of selected advertisements and their structures of signification.

A semiotics-based analytical framework

Methodology

Two caveats must be noted before introducing our analytical tools and then proceeding to the actual semiotic study of the selected advertisements.

First, scholars have often criticized semiotics as a method for conducting visual analysis. In this regard, McFall (2004) has pointed out several limitations of semiotics in her study about advertising. The most critical issue concerns the creation of meaning as a process that is not inherent to the visual signs of an image, but negotiated across a range of sites and embedded in social relations (Hodge and Kress 1988). In our semiotic study, we examine the "site of image" and not the "site of audiencing" or the "site of production" (Rose 2001, 16–28). Indeed, as Floch (2001, 6) argued: "like a word, an advertising concept [...] constitutes only the small, visible tip of an iceberg of meaning, while its plot, roles, décor and stage setting are not always apparent [...]". We are interested in isolating the signs of dark pool's adverts, rather than analyzing how investors interpret such signs or how advertising agencies create them by interacting with dark-pool providers as clients. In the long-standing debate on which site of analysis is more relevant (Van Leeuwen and Jewitt 2006), we maintain that examining the site of image through a semiotic approach is a powerful way to deconstruct an image and detect how it functions vis-à-vis wider systems of signification (Mick 1986; Roberts 2013). Studying the site of audiencing and the site of production is an important exercise that nonetheless lies beyond the scope of this work. We will outline several avenues for future research on the site of audiencing and the site of production in the concluding section.

Second, investment firms place their adverts in specialized newspapers and magazines such as *The Trade*, *Automated Trader* and *Institutional Investor*. Within all of these publications, *The Trade* is particularly relevant to our study. This magazine contains articles on issues relevant to investment

managers, together with adverts produced by market venues, data vendors, investment banks and brokerage companies. In 2007, *The Trade* began organizing *TradeTech*, an annual fair where brokerage companies, data vendors, investment managers and regulators could gather and share ideas. MiFID gave its impetus to the event, as it required substantial technological changes and investments from market participants.

We have examined forty-nine issues of *The Trade* published in the period 2006–2016 and the satellite publication *The TradeTech Daily*, which is the official daily newspaper published each year during the TradeTech event. In so doing, we built a database of all the adverts related to dark-pool services. The first element worth noting is the attempt of all dark-pool providers to sell their execution venues as safe, transparent, liquid, efficient and providing fair pricing. However, we have noticed considerable heterogeneity across all these adverts, to the extent that some advertisements are more creative than others in conveying the message. How then have we identified which adverts should be analyzed in depth? To make a choice, we have used three criteria. To begin with, adverts should be creative, meaningful and their signs should foster an interpretive exercise. In other words, adverts should give us the feeling that there is an elaborate message to be grasped – one which would not necessarily be obvious at first sight. Second, adverts should come in series. They should reproduce a pattern and make use of techniques helping the reader to recognize them. Finally, adverts should extol the properties of both electronic services and dark trading. Through these three criteria, we have selected Lighthouse and Aqua/Arid as cases for our in-depth semiotic analysis. *The TradeTech Daily* consistently published these two adverts in 2007 (4 issues containing the advertisement for Aqua/Arid) and in 2008 (4 issues containing the advertisement for Lighthouse). Hence, both adverts were published during the pivotal 2007–2010 period.

Barthesian and Greimasian semiotics

Let us now introduce our analytical tools that draw on Barthes and Greimas, two authoritative scholars who developed distinct approaches to semiotics (Cian 2012).⁷ We use both Barthesian and Greimasian ways of analyzing and deciphering processes of signification in advertisements (Kobayashi, Jackson, and Sam 2017).

Barthes distinguishes three distinct elements constitutive of the message conveyed by a text or an image: the linguistic message, the non-coded iconic message and the coded iconic message.⁸ The linguistic message – usually supported by captions and product labels – is both denotational and connotational. Denotational refers to the description of the material aspect of the sign, while connotational goes beyond denotation to draw on cultural codes (Olivotti 2016). The linguistic message performs the two functions of relay and anchorage. Relay indicates that the text and image are complementary in a way that both produce the meaning of the advertisement – for instance, as it happens in comic strips. The anchorage function fixes instead the multiple signifieds the reader could think of when seeing an image and its signifiers (the part of the sign that does the referring). In this regard, the text directs the reader's attention at one specific meaning. Concerning the non-coded and coded iconic messages, these two elements share the same substance, namely the image. Yet, the non-coded iconic message is denoted, whereas the coded iconic message is connoted. In other words, the coded iconic message symbolizes several culturally-learned meanings.

Although Greimas did not engage with the language of advertising as directly as Barthes did (Floch 2001), his research also provides relevant operational concepts for the analysis of visual advertising as well as consumer identity (Bardhi, Ostberg, and Bengtsson 2010). Greimas was interested in the deep structures of meaning that underlie narrative forms. In his work, he highlighted the need to develop a visual semiotics by stating that the role of the iconization process – that is, “a procedure of

⁷See Sebeok (2001) for an introduction to semiotics as an academic discipline. See Beasley and Danesi (2002) for an overview on semiotics of advertising.

⁸Barthes drew primarily on the Saussurean tradition of semiotics. For his understanding of semiotics, see Barthes (1957, 1964a, 1964b).

veridictory persuasion” – is “not far removed from the ‘rhetoric of the image’” of Barthes (Greimas 1989, 635). The constructed image, Greimas contends, is a “signifying object” and as such “is of the order of a semiotic system” (Ibid., 636–637). To be revealed to the observer, this system requires “an examination of the semiotic process – that is of the ‘visual texts’ – by which it realizes itself” (Ibid., 637). To make sense of such processes, Greimas developed the so-called semiotic square (Greimas and Courtés 1976; Greimas and Rastier 1968), a tool through which we can formalize the relations between signs. Here, so-called disjunction, conjunction and complementarity allow for reconstructing the narrative that is embedded in a given image. Specifically, the semiotic square helps us code and organize the constitutive elements of the message displayed in the narrative, which can be of any type. In other words, the semiotic square is a relational tool that is based on the idea of oppositions (Greimas and Ricoeur 1989). As we will show below, by articulating the fundamental oppositions that frame a given discourse, the semiotic square guides us through the process of mapping an advertisement and how its logical structures of signification develop.

Creating the icon: Lighthouse and Aqua/Arid

Both Barthes and Greimas provide appropriate tools for examining the systems of signification that are embedded in adverts. Our aim is to capture three intertwined elements, namely: what signifiers the advertisement includes; what signifieds the signifiers refer to; and what structure of signification the advertisement generates. In doing so, we demonstrate that the two adverts for Lighthouse and Aqua/Arid produce an iconic visualization of safe liquidity. According to Peirce (1931, 168–169), iconic are those signs that resemble the objects they represent and “excite analogous sensations in the mind.”

We apply the Barthesian concepts of non-coded message, coded message and linguistic message to Lighthouse. Successively, we use Greimas’ semiotic square to analyze Aqua/Arid. The advert for Lighthouse presents an elaborate ensemble of signs. In this case, a Barthesian framework is an appropriate choice because it is geared towards interpreting specific signs before capturing how they create a system of signification. The advert for Aqua/Arid contains less signs and is based on a stark visual contrast. Thus, we adopt a Greimasian framework that goes beyond the meaning of each sign to emphasize instead semiotic narratives through relations of opposition, contradiction and implications. Barthesian and Greimasian methods can be used synergistically (Cian 2012), whether one applies them to the same visual representation or different ones.

Lighthouse

Lighthouse was launched in early 2008 and then replaced by a new system in late 2009. A lighthouse produces light, that is a reference point for those in need of directions at sea, in the night or in turbulent waters. The lighthouse metaphor works on the idea of orienting those who are lost in the complexity of fragmented financial markets. The name therefore stands as a kind of contract or guarantee for investors to find their way in the obscure complexity of electronic and algorithmic markets (Figure 1).

A simple glance at the advert gives already a very good impression of the whole composition. We have a horizontal picture – between two black shades – in which a lighthouse illuminates a scenery composed of two islands, birds and a sailing boat, perhaps in the last miles of an estuary. The colours of the sky are grey and orange, suggesting we may face either dawn or twilight. The message is conveyed from the left to the right, from the problem to the solution. On the left, we find the event that provides the impetus. On the right, we get the solution as a final euphoria of the semiotic course.

Several captions support the linguistic message. These are placed in the upper left side, the bottom left and the bottom right side of the page. The linguistic message is also partly supported by the electronic quotation numbers, which are surreally projected as part of the lighthouse beam. At the level of denotation, the linguistic message tells us that the dark pool venue called Lighthouse, which helps



Figure 1. Advertisement of Lighthouse, The TradeTech, 2008.

us find our way in the dark. It also shows us how to contact (via email, telephone or website) the electronic trading team based in different geographic areas. Moreover, the octagonal logo is displayed in the modernized version, which was used between 2000 and 2008. Finally, the tiny caption at the bottom of the page (both left-hand and right-hand side) provides us with the legal disclaimer of the advert: it is said to have the only purpose of informing its audience and that it should not be seen as a suggestion to enter into any financial investment. At the same time, the bank reserves the right to enter into any transaction mentioned in the advert. The small caption also informs us that the bank is authorized by the then Financial Services Authority and is a member of the London Stock Exchange.

At the connotation level, there are several elements that we should pay attention to in the linguistic message. First, the name Lighthouse indicates a sense of guidance and safety in a context which otherwise is dark and unknown (we label this feature as *safety*). The expression “finding your way in the dark” reinforces this meaning. Second, the octagonal logo reflects an identity which is attuned to the digital era of electronic and algorithmic trading. It is interesting to note how the octagonal logo was created in 1961 as a modern, dynamic logo suggesting forward motion within the framework of control (Chase Alumni Association 2017; Chermayeff & Geismar & Haviv 2018).⁹ The idea came from the connection of water pipelines that were initially laid in the Lower Manhattan area in early 1800. In fact, the Bank of Manhattan Company – which merged with Chase National Bank in 1955 – was initially a water supply company in the area (Tett 2009). In this regard, there is an interesting parallel between the materiality of water supply pipelines and the present-day trading infrastructure made of cables, antennas and data warehouses (we label this aspect as *digital modernity*). This sense of digital modernity is further strengthened by the electronic quotation numbers in the beam. Third, the word “team” shows the presence of a dedicated group of experts helping clients with their trading needs. It implies the creation of a tight relation between client and seller which bounds both parts in a win-win situation. Moreover, this team of experts can help clients worldwide

⁹The octagonal logo could also be seen as an iconic message. We prefer to analyze it as part of the linguistic message.

– as illustrated by the different phone numbers and emails separated by geographical area – and also via a single global web site (we call this element *global community*). Finally, the caption at the bottom of the advert breaks this relationship of trust between client and seller by embedding such relation into legal language. It reminds the client that, after all, we are talking about money and financial markets. However, it is a fair deal to the extent that the dark-pool provider is a trustworthy seller recognized by the authorities (we define this feature as *fairness*).

The non-coded iconic message is supported by all visual signs in the picture. It has a denoted character to the extent which works at a first order of signification. In other words, visual signs in the advert simply refer to the bare reality of the objects that are signified. In the case of Lighthouse, the red and white lighthouse is on the dark cliff and illuminates the grey-orange clouded sky at twilight. The boat and the birds are following the trajectory of the light in the distance. In a surreal manner, the ray of light is projecting some numbers and percentages. The sea is grey and contrasts neatly with the lighthouse cliff. The non-coded iconic message supports the coded iconic message in a way that the two are practically inseparable, because the viewer reads them at the same time. Analytically speaking, however, we can differentiate the two iconic messages on the basis that the coded iconic message mainly draws on the viewer's reference system and ideology.

Thus, in the case of Lighthouse, the lighthouse is a sign of relief for the men at sea. It is the promise of firm grounds, some security against the uncertain conditions of the sea. The rocks supporting the lighthouse reinforce this sense of security. The dark pool venue is built on solid foundations from which it is possible to have a clear view of market liquidity (*safe and liquid markets*). The sky is cloudy, but the beam offers a positive contrast to such cloudy background. It brings light and the possibility to navigate in a context which is otherwise dark and unpredictable. Far from being unpredictable, the beam generates quotes – recalling a public order book as a symbol of informational efficiency and fair pricing – which can only be seen through the eyes of the Lighthouse's dark-pool infrastructure (*dark-pool transparency*). The boat is safely navigating – just like the seabirds are flying – under the guidance of the lighthouse. Both big and smaller investors are safe in their search of dark liquidity when using Lighthouse. Investors want a non-transparent but liquid market, so that they can execute their trades without being anticipated by competitors. At the same time, investors want a liquid market which is safe – in other words, transparent enough for them – so that they can trust it enough when trading. The sea is calm and flat, but we can assume that conditions can quickly change for the worst. However, the lighthouse will still be there, providing the right direction to navigators (*management of future risks and uncertainties*).

The linguistic message, the non-coded iconic message and the coded iconic message work simultaneously to produce a system of signifieds in which Lighthouse is seen as liquid, dark transparent (dark but still informationally efficient), technologically innovative and safe (providing fair pricing). The non-coded iconic message naturalizes this order, making Lighthouse look just like the system of denoted signifiers which are depicted in the image. Furthermore, the linguistic message anchors the chain of signifieds by guiding the viewer towards the preferred system of signifieds: you can find your way in the sea of dark liquidity thanks to Lighthouse and the expertise of its team (Table 1).

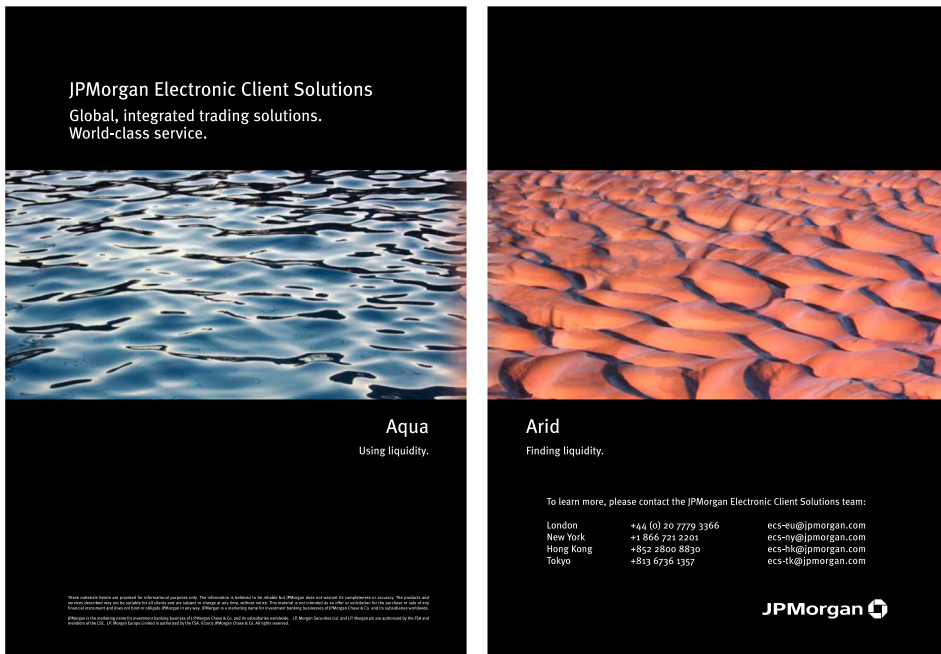
Aqua/Arid

Aqua/Arid was launched in 2006. Aqua – which still exists today – is a liquidity-seeking algorithm designed to stealthily trade large orders in liquid markets. Arid was its equivalent intended for illiquid securities such as small-cap stocks (Figure 2).

The Aqua/Arid advert is built on opposite notions: a double page showing a stretch of water on the left side and a stretch of sand on the right side. The focal length chosen – and the use of a black background – does not make it possible to determine whether large areas are represented (an ocean and a desert) or, on the contrary, if both sides of the picture belong to the same space – for instance, a beach shore where the two elements of sand and water meet. However, what is clear is the intention to suggest both difference (opposition) and repetition (conjunction) by having the reader collating a

Table 1. Summary of a Barthesian analysis of Lighthouse.

| | Signifiers | Signifieds | Functions |
|--------------------------|---|---|---|
| Linguistic message | Lighthouse title and tag line; octagonal logo; right-end caption; bottom caption | Safety; digital modernity; global community; fairness | Anchorage: linguistic message directs the receiver to the preferred system of signifieds (see coded iconic message) |
| Non-coded iconic message | Red and white lighthouse on solid cliff; lighthouse illuminates clouded sky; boat and birds move towards the lighthouse; ray projects numbers; grey sea | – | Based on denotation. It normalizes the coded iconic message: using the Lighthouse's dark-liquidity is comparable to navigating under the guidance of the lighthouse |
| Coded iconic message | | Safe and liquid markets; dark-pool transparency; ability to manage future risks and uncertainties | Based on connotation. It is normalized by the non-coded iconic message and anchored by the linguistic message |

**Figure 2.** Advertisement of Aqua/Arid, The TradeTech, 2007.

series of terms such as water/ocean (Aqua) and sand/desert (Arid). The conjunction is suggested by using the Latin words *aqua* (that which relates to water) and *arid* (from *aridus* and its alternative form *ardus*, which means dry, parched and spiritless). At the same time, the advert generates a micro tautogram – that is, a text in which all words start with the same letter – linking both sides of the image.

The Aqua/Arid advert builds on representations generating associations (liquidity/water, fragmentation/sand) and extolls the desired capacities. Specifically, an initial dysphoria caused by the need to use liquidity in order to make transactions finds its resolution in the euphoria of finding liquidity (water). The image of fragmentation is instead associated with sand, a material which often escapes from our hands. Those interpretive elements suggested by the image impersonate the proposal made by the liquidity-seeking algorithm. This is confirmed by the message “finding liquidity” which is displayed just under the image of sand and opening towards the contact details of the team in charge of helping the investor (i.e. the reader). Hence, from left to right, the company

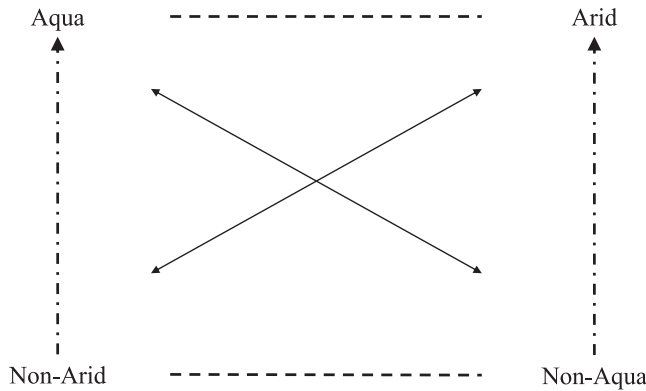


Figure 3. Basic opposition, contradictory relations and relations of implications in the Aqua/Arid advertisement.

builds a proposal that translates into the following narrative programme: in order to use liquidity – and to do so “globally”, with an “integrated trading solution” – the observer needs to contact the team in charge of selling the algorithmic tool. The programme appears in filigree, like a *mise en abyme* of the service provider having the ability to operate the transformation from one state of matter to the other.

Following Greimas and Rastier (1968), we can map the universe of possible opposite relations organizing the image by first identifying *contrary* elements (here, quite explicitly, Aqua and Arid). These elements offer a first opposition, from which it is possible to deduce a second set of relations, building on *contradictory* elements (Aqua \Leftrightarrow Non-Aqua/Arid \Leftrightarrow Non-Arid). Finally, relations of *implications* are also represented (Non-Arid \Rightarrow Aqua; Non-Aqua \Rightarrow Arid). These relations are represented in Figure 3.

A further stage would associate the features of Aqua/Arid to each of the considered positions – using concepts drawn from the context (here, the vocabulary of financial economics). The suggested meanings associated with Aqua/Arid would appear as in Figure 4.

Back to the image, we can add the two poles of the basic opposition displayed as in Figure 5.

A syntactic use of the semiotic square would suggest that the successive positions on the square allow for building a story. For instance, the narrative programme could read as such: liquidity is usually said to be available in markets (1. Aqua), but is not always easily identified because of market fragmentation (2. Arid); the dark-pool provider provides you with the tools necessary to consolidate

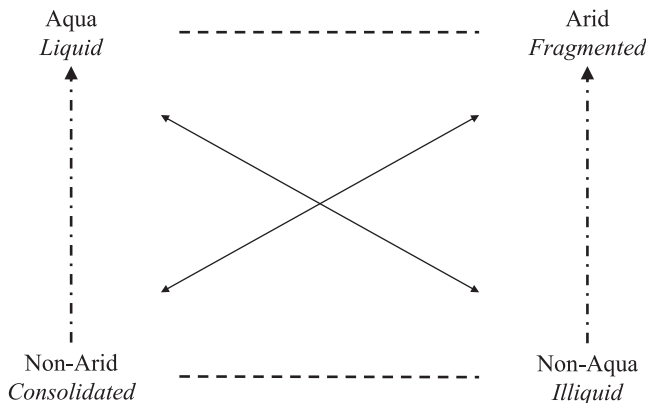


Figure 4. Associating the features of Aqua and Arid to the vocabulary of financial economics in the Aqua/Arid advertisement, first degree of association.

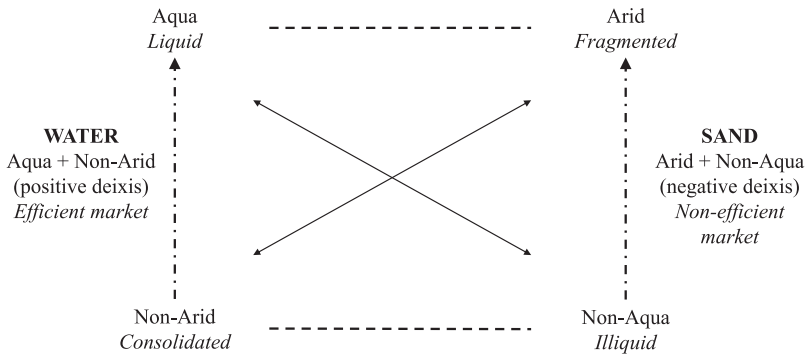


Figure 5. Associating the features of Aqua and Arid to the vocabulary of financial economics in the Aqua/Arid advertisement, second degree of association.

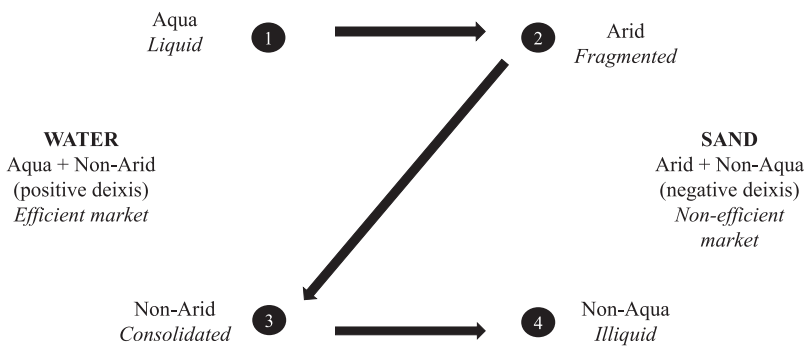


Figure 6. The narrative programme in the Aqua/Arid advertisement.

what is fragmented (3. Non-Arid – for illiquid stocks), or to make use of liquidity (4. Non-Aqua – for large orders) (Figure 6).

This narrative tactic can be read at the bottom of the advert, where the product appears explicitly as a solution to the problem identified, namely: using liquidity when trading large orders in liquid markets on the one hand, or trading illiquid securities on the other hand. Finally, the two metaterms – which are implied and represented on the left and the right sides of the square – can be seen as reinforcing the basic opposition revolving around the notions of liquidity/illiquidity and fragmentation/consolidation. Particularly, what underlines these complementary notions (Aqua + Non-Arid, Arid + Non-Aqua) is the efficient market hypothesis (Fama 1970), a theoretical construction that acts as a shared reference for the community of financiers.

A Greimasian analysis provides us with the ability to map the interpretive possibilities contained in a given image – a “precarious set of axial relations contingently arranged along a single paradigmatic plane” (Corso 2014, 72). Furthermore, the proposed representation allows to reduce to the syntactic level “a set of heterogeneous semiotic effects, traditionally considered as resulting from signifying *overdetermination*,” thereby reducing the “arbitrariness of description” (Petitot 1977, 423).

Discussion: main contribution and future research agenda

Dark pools of liquidity are a whole complementary world that lies in many different venues and exists in parallel to displayed liquidity. Dark pools belong to the unseen, but at the same time remain fully embedded in the ecology of electronic trading facilities constituting the global financial marketplace. The opening dialogue between a salesperson and a compliance officer in a Parisian trading

room shows how market participants visualized dark pools as “grey out there” in a period when dark trading was becoming popular in European financial markets but was not well understood yet.

In this article, we have studied a paradox that characterized the popularization of dark markets in Europe during the 2007–2010 period – following the implementation of MiFID. Investors may find dark pools useful to trade large blocks of securities without being anticipated by other traders. However, it is at the same time difficult for investors to know whether dark pools are safe given the absence of visible trading information. How did providers of dark liquidity manage this contradiction? We have argued that dark-pool providers constructed a narrative according to which dark markets are not different from their visible counterparts. The use of iconic visual advertising in the pages of specialized publications came to be a powerful way for dark-pool providers to persuade investors about the benefits of dark liquidity. Adverts showed the European investment world that dark trading is informationally efficient and offers fair pricing. We have supported our argument by demonstrating – through an in-depth semiotic study – how a major bank advertised its dark-liquidity services in European financial markets during the years 2007–2010.

Main contribution

We have contributed to the literature on market liquidity in economic sociology and social studies of finance. Researchers in these two cognate fields have done a great deal to investigate liquidity in financial markets as a socio-cognitive phenomenon. Inspired by this literature, we have put forward the relevance of delving into the visual dimension of market liquidity – in our specific case, visual advertising. A focus on visual representation is useful to study the paradoxical nature of dark markets. More generally, paying attention to the visual dimension can offer important insights into the growing role of visual practices and technologies in today’s digitalized financial markets (Pryke 2010).

To explore the visual representation of dark pools of liquidity, we have borrowed ideas and concepts from market studies and visual culture. We have taken from market studies the view that marketing practices such as visual adverts constitute markets (Araujo 2007; Cochoy 1998; Kjellberg and Helgesson 2007). Furthermore, we have drawn on Cochoy’s (2008) notion of *qualculation* to contend that iconic visual signs stimulate quality-based rational judgments as a complement to price-based calculation. From visual culture, we have borrowed the analytical tools of Barthesian and Greimasian semiotics to deconstruct adverts and interpret their signs.

Future research agenda

Having focused our semiotic study on the site of image, we encourage scholars to direct their research efforts also to the site of production and the site of audiencing. The site of production (how the image is made), the site of image (what the image looks like) and the site of audiencing (how the image is seen) are three key modes through which a visual representation can become meaningful (Rose 2001, 188). Hence, exploring these three dimensions would provide a comprehensive understanding of visual persuasion in dark markets.

Studying the site of production would allow scholars to gain insights into how advertising agencies develop their creative work and interact with financial firms as clients. Researchers could address several questions such as: when and where was the advert made? Who made it? What visualization techniques were deployed? What meaning did advertising agencies and financial firms intend to convey through visual signs? Examining the practices of advertising agencies at the organizational level is critical to understanding the socio-material environment (Leonardi, Nardi, and Kalinikos 2012) where adverts are produced. Accordingly, by investigating which financial firms are most active in advertising dark-liquidity services would offer important insights into the dark-pool sector and its market trends.

Besides the site of production, researchers should also consider the site of audiencing. In particular, they should focus on two intertwined aspects. First, how do investors perceive dark pools’

advertises? Although advertising agencies and financial firms “encode” (Hall 2005) images with a particular meaning during the production phase, audiences can interpret this meaning in many ways and may engage in qualculation (Cochoy 2008) differently. Thus, adverts can be more or less effective in communicating the message that advertising agencies and financial firms meant to convey. Second, how do adverts influence investors’ use of specific dark-liquidity services? Researchers could draw on Bardhi and Eckhardt’s (2017) notion of “liquid consumption” to assess investors’ level of attachment towards specific dark pools and the extent to which advertising is implicated in the development of brand loyalty. Examining investors’ use of dark trading from the vantage point of liquid consumption is a fascinating exercise in the context of modern-day financial markets. Here, the malleable, fluid and accelerated nature of digital data and algorithms is likely to entail a type of consumption that is liquid – namely, “ephemeral, access based and dematerialized” (Bardhi and Eckhardt 2017, 582).

Finally, scholars could also go beyond the three key sites of meaning creation. They could study how dark pools’ advertising strategies differ in intensity, format and market impact depending on the historically specific context in which they are deployed. For instance, despite using the iconic adverts of Lighthouse and Aqua/Arid during the 2007–2010 period, the bank failed to establish a leading position in European dark trading – a market which is currently dominated by UBS, Cboe Europe, Turquoise and ITG (Petrescu and Wedow 2017, 5). However, by using similar advertising strategies, the bank was successful in the United States where it operates one of the leading dark-liquidity services – ranking fifth after UBS, Credit Suisse, Morgan Stanley and Level ATS (Financial Industry Regulatory Authority 2018). The landscape of dark trading is constantly changing as a result of competition among market venues, technological innovation and regulatory intervention (Banks 2014). Exploring dark markets from the vantage point of visual representation is an opportunity to shed light on such a crucial facet of modern-day algorithmic finance.

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Notes on contributors

Andrea Lagna is an assistant professor at the School of Business and Economics, Loughborough University. He’s currently conducting research on the management of fintech innovations. He has previously published work on the governmental use of derivatives in *New Political Economy* and *Competition & Change*. His Twitter handle is @a_lagna.

Marc Lenglet is an associate professor in the Strategy and Entrepreneurship Department at NEOMA Business School (France). His research roots in the social studies of finance tradition, with a focus on compliance and regulation. He is the co-editor, with Isabelle Chambost and Yamina Tadjeddine, of *The Making of Finance. Perspectives from the Social Sciences* (Routledge, 2019).

ORCID

Andrea Lagna  <http://orcid.org/0000-0002-8990-1352>

Marc Lenglet  <http://orcid.org/0000-0002-7267-9425>

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