

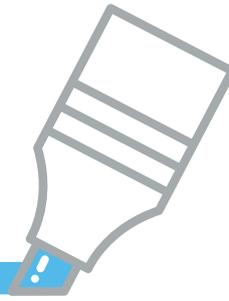


Art & Finance Report 2017

5th edition

Section 5

Art and technology



HIGHLIGHTS

- **Technology is increasingly playing a key role in the evolution of the art market:** Art-technology startups (ArtTechs) are building new digital business models aimed at enabling and supporting traditional art businesses, rather than replacing them. Technological innovations are aimed at increasing trust and transparency, but also supporting data-driven valuation methodology, building social capital, and transforming the backbone of the art market ecosystem.
- **Online art sales continue to grow:** Despite a challenging year for the global art market in 2016, with global auction sales falling by 19 percent⁹⁷ in 2016, the online art market continued to show resilience and further growth. According to the “Hiscox Online Art Trade Report 2017,” online art market sales reached an estimated US\$3.75 billion in 2016, up 15 percent from 2015. This gave the online art market an estimated 8.4 percent share of the overall art market, up from 7.4 percent in 2015.
- **Traditional art businesses responding to the online challenge:** The lion’s share of online art market growth between 2011 and 2014 was recorded by online-only platforms, boosted by significant venture capital funding and first-to-market advantages. However, growth has picked up among the traditional auction houses in the last two years. Sotheby’s expanded its online business (online bidding and online-only auctions) to US\$155 million, an increase of 19 percent in 2016, and Christie’s increased its online activities (bidding and online-only auctions) by 34 percent from US\$162 million in 2015 to US\$217 million in 2016.
- **Auction and dealer markets converging online:** Increasing competition is already forcing online art platforms to embrace new strategies to expand their business and diversify their income streams. Among the auction aggregators, Invaluable has ventured into the gallery and dealer space by allowing visitors to buy directly from galleries through fixed-price offers. Artsy, a platform predominantly targeting galleries, has held several online auctions in partnership with Phillips and Heritage over the last 12 months, and it raised a further US\$50 million in July 2017 to expand its auction business.
- **Improved data and analytics infrastructure in the art market:** A number of existing and new players are pushing for further developments, new data, and new analytical tools for the art market, and we are starting to see the emergence of a new and improved industry as it relates to data and analytics. This is an important development and it could contribute toward improving the transparency, valuation accuracy, and risk management of art-related wealth.
- **Blockchain could revolutionize the art industry:** The art industry is one of the world’s most opaque business sectors, with a multitude of middlemen between the creator and the consumers of art. Blockchain could revolutionize the art industry by resolving questions of provenance, and improving transparency, copyright, and ownership issues. Seeing the potential, art startups are already building real-world applications based on blockchain.

The lion's share of online art market growth between 2011 and 2014 was recorded by online-only platforms, boosted by significant **venture capital funding** and first-to-market **advantages**.



Phillip Ashley Klein
U.S. Art & Finance
Coordinator
Deloitte Consulting
LLP

Kevin Ye
Consultant
Deloitte Consulting
LLP

A digital art world

The intersection of art, wealth, and technology

While the fine art industry is often viewed as old-guard and slow to change, technology is quickly taking a front seat in its evolution. Today's consumers expect convenience, personalization, and contextual transparency, and the industry is looking to technology to deliver that experience. From art-technology startups (ArtTechs) to traditional incumbents, players are starting to look toward digital business models as a way to win in the contemporary art world.

In a series of recent discussions with industry luminaries, they provided their perspectives on the intersection of art, wealth and technology. From auction houses to startups to wealth managers, numerous leaders representing different aspects of the industry expressed their thoughts: how is technology evolving in the art market? What technologies are changing how art is viewed, purchased, and analyzed? What will the future hold?

Transparent valuation methodologies are increasing transaction comfort and investment opportunities

Traditionally, valuation has been considered more of an art than a science. While historical data points and comparatives are employed, much of the final result lies in the experience of professional appraisers and advisers. The influencing factors (and how they drive an artwork's value) are not always obvious or made clear to art collectors, and this can create friction and market inefficiencies.

A handful of industry pioneers are seeking to improve the valuation process through a more structured and transparent methodology. Christopher E. Vroom, CEO of CollectorIQ, Inc. is one of those spearheading the charge. He explains that “by aggregating nearly 100 million distinct attributes covering over \$100 billion in art sales, we’re able to assess the value impact of a wide range of selling choices such as auction house or location, time of year and the like while assessing the contribution to value of both primary and secondary object characteristics. Ultimately, structuring data is the key to understanding value.” The immediate goal is not necessarily to create a pin-perfect algorithm-based valuation, as this challenge may be too great given the subjective nature of art and the social capital element that drives the underlying value. However, increased transparency into the different components and weighting that determine value could instill more trust in the process, bringing increased comfort to buyers and sellers alike.

The development of more quantitative, transparent methods for valuations has a positive impact for financial services, particularly wealth managers. A key obstacle that high-net-worth clients face is the lack of sophisticated data and sufficient reporting that enables an investment-oriented evaluation. Art collectors are more commonly seeking the same level of sophistication from their auction house as from their investment bank. As pricing becomes more transparent and high-net-worth consumers get more comfortable with transactions, demand for art-related wealth management services should grow. As it relates to art-secured lending and financing, these algorithmic valuation methodologies could remove human bias / error and enable banks / financial

institutions to better evaluate and monitor their risk pools, driving increased loan volume on more favorable terms.

The establishment and adoption of these valuation methods can also open the door for advanced financial instruments, increasing exposure to art market economics and serving as a barometer for investment choices. Although art indices currently exist, they are not without their criticisms; they are often limited by the quality and availability of data.

Real-time algorithmic valuations could enable a more sophisticated, accurate, and timely index that satisfies the needs of investors. These same algorithms could also potentially drive the development of art exchange traded funds (ETFs), which would provide a financial instrument through which investors can gain exposure to market economics.

Social media as a builder of social capital and platform for art industry professionals

Social media is influencing the creation of art, serving as both subject matter and marketing channel. With exhibits such as *Rain Room*⁹⁸ and *Infinity Mirrors*⁹⁹ drawing massive crowds seeking that perfect photo to post online, the social media “friendliness” of a piece can make a considerable difference to the branding and performance of an artist, gallery, or museum.

Beyond just influencing the types of works created, social media is also serving as a low cost distribution channel for artists. In many ways, it is disintermediating the artist-gallery paradigm by allowing these creatives to showcase their work directly to millions of potential buyers. Joshua Campbell, a Sotheby's Institute of Art alumnus and co-founder of Canvas

The development of more quantitative, transparent methods for valuations has a positive impact for financial services, particularly wealth managers.

Collective—a social art-recognition platform and marketing tool for art venues—believes that galleries are realizing social media is the best way to target the middle market, and a lot of the focus is now shifting toward these buyers. “Middle market transactions might not have headliner prices, but the sheer scale and quantity of this market is starting to have a lot of appeal for sellers,” said Campbell. Perhaps the most popular platform currently used is Instagram, often viewed as the social media of choice for the art community.

⁹⁸ *Rain Room* is an immersive environment piece created by Hannes Koch and Florian Ortkrass of Pandom International in 2012

⁹⁹ *Infinity Mirrors* refers to a number of Yayoi Kusama's infinity mirror installations that have been made available to the public throughout the course of her artistic career

While it may be surprising to those who believe that the profile of an “insider” would suggest a slow or reluctant adoption of social media (due to their typical demographic), current observations suggest the opposite, with a significant number of active art collectors using the app on a consistent basis.

Dan Desmond, of Morgan Stanley’s Blue Rider Group, emphasizes the criticality of this development and its importance for wealth managers and financial services professionals who are looking to be well informed on what is happening in contemporary art. To truly develop deep and meaningful relationships with art collectors, it is not enough to merely understand the financial metrics and data of art, but to share an interest in the work itself and the community of artists, curators, scholars, and dealers that are the core of the community. Social media can provide a convenient and valuable channel for advisers to do just that, offering a window into shows happening all over the world.

Technology is transforming “the backbone” of the art ecosystem

From collection management to security to transportation, these ancillary services act as the backbone of the industry, ensuring art is exactly where it needs to be, when it needs to be there, and arriving in the same condition in which it left. While these services are acknowledged as crucial, how they are evolving through technology can frequently be overshadowed by more high-profile industry developments.

Adam Fields, CEO of ARTA, highlights that while the industry is often generalized as antiquated and resistant to change, logistics and other ancillary services that enable the daily operations for fine art can be considered even more old-fashioned. For example, electronic payment processing and currency conversion, capabilities that are taken for granted in most other industries, can be considered relatively new developments that many art shippers and service-providers are starting to adopt. Having found success with

directly connecting high quality shippers with customers, ARTA is now turning to APIs that can connect seller and buyer systems directly, bypassing the manual pen-and-paper processes that are typically required to complete a transaction.

Technology is also starting to address the challenges of provenance, tracking, and security, all of which are major risks and concerns. For example, the idea of a unique, reliable, and tamper-proof tracker for artwork can have many positive applications: simplified collection management, enhanced security monitoring, improved provenance accuracy, and monitored condition management. With technology like this, institutions and buyers can eliminate many steps that are currently being used to establish provenance and authenticity, and these benefits can ultimately translate into cost savings and improved confidence in the shipping and storage process.

A handful of firms are working on solutions to this problem, including Steven and Anne Halliwell (founders of ID4Arts and managing directors of the Art collectors Fund), who believe that technology using RFID transponders could be the solution. These developments will also likely have important implications for wealth management services as the issues of provenance, tracking, and security are solved.

The next frontier in trust and transparency: primary market data

It is widely regarded that one of the most impactful industry developments has been data transparency. While negotiating power and access to art have traditionally been reserved for insiders, improved access and analysis of data has made it easier for a variety of stakeholders to venture into the art world. Secondary market data is readily available, and the understanding of fine art movements and financials has improved drastically as a result, giving art collectors more confidence to engage in transactions.

Conversely, a significant percentage of the global market value lies in the primary market, and the data on these transactions is not readily available or understood. Shedding light on this data could have enormous implications, as it provides the last major piece for a complete picture. As Pip Deely of Wolfram Ventures suggests, “What it’s going to take to see this change happen is for the holders of primary market data to understand the value of sharing their data.” Art insiders inherently want to amass as much primary sales data as possible because they understand the value that this information asymmetry has in both influence and negotiating power. However, Deely believes dealers are starting to understand that their data is not going to stay private forever and it’s in their best interest to tell richer stories and better justify their prices.

Although the issue of primary market data opacity is very much alive, the need for transparency is becoming more and more compelling. There is no doubt that technology will play a critical role in unlocking this part of the market, and it will be exciting to see what the future holds.

Technology is here to enable and support businesses, not replace them

While technology may invariably change how business is done, it does not necessarily mean that traditional jobs are at risk. Instead, incumbents will likely have to evolve to adapt to the technology. Those who are willing to transform can learn to engage the market in more compelling ways. For example, an art appraiser can embrace data-driven algorithms and marry them with the traditional appraisal process to provide a more compelling value proposition for a specific price point. They can also play a role in the development and fine-tuning of the algorithms.

The major role of technology within the industry will likely be to reduce friction, improve access, and instill confidence in the underlying processes. Margins for certain businesses and players may suffer as technology eliminates information

asymmetries and lowers the barriers for market entry; however, it is important to recognize that the same technology provides opportunity, as it enables more accessibility and comfort in transactions. As Hugo Liu of Artsy articulates: “You shouldn’t look at ‘ArtTech’ as threatening your slice of the pie. You should see it as a way to grow the entire pie overall.” The firms that can adopt and adapt will likely be able to tap into a more expansive market than they have ever seen before.

The nucleus of the market adopting technology innovation will continue to expand as prices become more transparent and demand better matches supply. However, there is broad agreement that the art industry has an intangible quality that can never be replaced or co-opted by technology. Much of the personal satisfaction and appeal can be derived from the “romance” of the in-person experience, and it’s not expected that any of these elements will ever be phased out entirely. Technology can go far in improving the access and convenience of art, but the nuances surrounding the experience of art may never vanish.

While technology may invariably change how business is done, it does not necessarily mean that traditional jobs are at risk. Instead, incumbents will likely have to evolve to adapt to the technology.

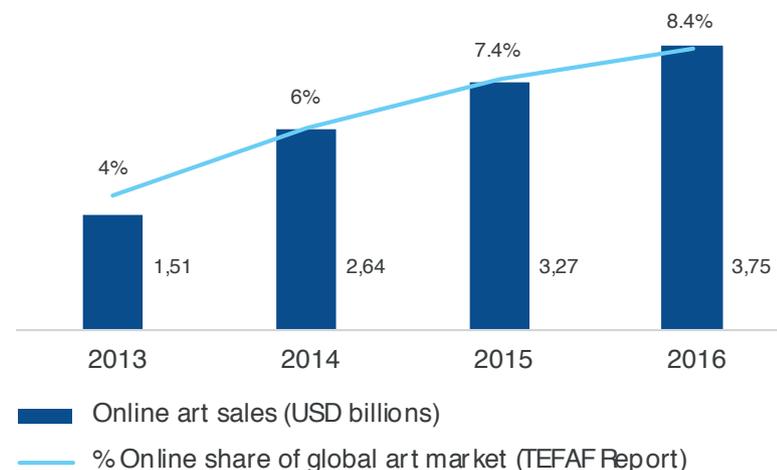
Trends

Online art market continues to grow, but competition intensifies

Despite a challenging year for the global art market in 2016, with global auction sales falling by 19 percent¹⁰⁰ in 2016, the online art market continued to show resilience and further growth.

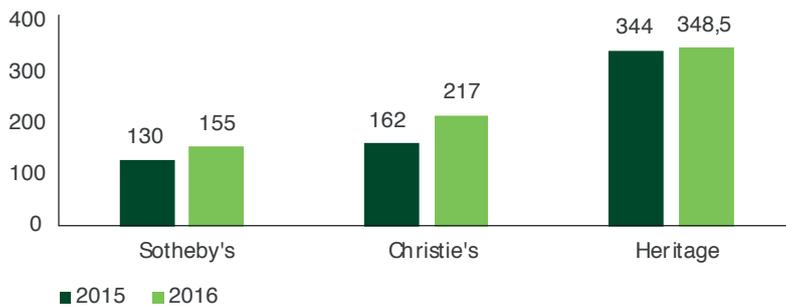
According to the “Hiscox Online Art Trade Report 2017,” online art market sales reached an estimated US\$3.75 billion in 2016, up 15 percent from 2015. This gave the online art market an estimated 8.4 percent share of the overall art market, up from 7.4 percent¹ in 2015. Tefaf reported in 2017 that more than US\$1 billion of art and antique dealer sales in 2016 were taking place online, which accounted for approximately 4 percent of the overall dealer market.

Figure 53. Online Sales 2013 - 2016 (\$US billion)



Source: “Hiscox Online Art Trade Report 2017”

Figure 54. Traditional Art Auction Houses: Online Sales in \$US Million



Source: "Hiscox Online Art Trade Report 2017"

Despite the global decline in auction sales, Sotheby's expanded its online business (online bidding and online-only auctions) to US\$155 million, i.e., an increase of 19 percent in 2016, and Christie's increased its online activities (bidding and online-only auctions) by 34 percent from US\$162 million in 2015 to US\$217 million in 2016. Online-only auctions saw particularly strong growth at Christie's, with an 84 percent jump in sales last year. Heritage Auction reported that 41 percent of its auction sales were now conducted online, with US\$348.5 million in sales reported in 2016 (up 1.3 percent).

While the lion's share of online art market growth between 2011 and 2014 was recorded by online-only platforms, boosted by significant venture capital funding and first-to-market advantages, growth has picked up in the last two years among the traditional auction houses, which are rapidly investing and adapting to the digital age.

The failure of the high-profile online auction house Auctionata (announced in January 2017), casts doubt upon the ability of new online-only players to grow fast enough and become profitable in an increasingly congested marketplace. On the other hand, the growth in online-only auction sales from traditional auction houses such as Christie's suggests that the power balance might be shifting back to the incumbent art-market players.

The "Hiscox Online Art Trade Report 2017" reported that the majority of online art platforms expected to see more industry consolidation. Among the online art platforms surveyed, 71 percent said they expected more consolidation to occur. 48 percent of companies surveyed felt that "horizontal mergers" (companies operating in the same space such as Paddle8 and Auctionata) will be the most common, while 53 percent believe "vertical mergers" are more likely, i.e., companies operating in different parts of the value chain. There is also evidence that online art business models are converging toward a one-stop shop template. Increasing competition is already forcing online art platforms to embrace new strategies to expand their business and diversify their income streams. Among the auction aggregators, Invaluable has ventured into the gallery and dealer space by allowing visitors to buy directly from galleries through fixed-price offers. Artsy, a platform predominantly targeting galleries, has held several online auctions in partnership with Phillips and Heritage over the last 12 months, and raised a further US\$50 million¹⁰¹ to expand the auction business. These trends suggest we could see more consolidation in the industry over the coming years.

¹⁰¹ The round of financing was raised in July 2017 from 56 investors led by Avenir Growth Capital

The "Hiscox Online Art Trade Report 2017" reported that the majority of online art platforms expected to see more industry consolidation.

Art data & analytics providers

Table 5.

Products	AMA/Art Analytics	Artfacts.net	artnet	Artprice
Art price database	Art Analytics do not own any price database itself.	ArtFacts.Net compares exhibition careers and auction trends using data provided by Mutualart.com	artnet has a database of auction records dating back to 1985. The database contains over 11 million color-illustrated fine art, design, and decorative art auction results with complete lot descriptions.	Artprice.com covers 30 million prices and indices for 630,000 artists. The data comes from 6,300 partner auction houses and covers auctions from 1962 to the present day.
Art price indices			A new family of art price indices launched in autumn 2017, showing the representative prices of art market sectors and artists. These indices help users to track the evolution of prices.	Artprice produces price indices per artists as part of their artist analytics service.
Primary art market analysis	AMA covers extensively all art market news including fairs, biennials, events, museum and gallery exhibitions.	ArtFacts.Net is the leading provider of data and analytics related to exhibition information. ArtFacts.Net produces a set of rankings for artists, galleries and art fairs. The Artist Ranking is an indicator of the cultural value of an artist career. It is calculated by quantifying the exhibition success of an artist, acting as an important counterbalance to the formation of prices in the art market.		

Source : Deloitte Luxembourg & ArtTactic Art & Finance Report 2017

Although the majority of the financing has gone into e-commerce-related art businesses, we are also seeing more activity in the art services and art infrastructure space. In this section, we have highlighted a number of new and recently launched initiatives in the art and technology space, which may have a real impact on the Art & Finance market in the future, and many of the key issues discussed in this report.

Art market data, research, and new analytical tools

Many of the art data analytics companies have existed for more than 15 years and have developed analytical tools to offer both quantitative and qualitative analysis aimed at improving the understanding of risk and performance in the art market. The following table illustrates some of these companies:

ArtTactic	Mutualart	Pi-eX
<p>ArtTactic has developed a proprietary auction price and price forecasting database for around 1,300 modern and contemporary artists. This data can be accessed via bespoke projects and reports.</p>	<p>With price analysis, auction results and event listings for over 300,000 artists, the MutualArt database offers an objective and extensive view of the global art market.</p>	<p>"Pi-eX has a clean and exhaustive database of fine art auction sales results since 2007 from the top three auction houses. The data includes withdrawn, unsold and guarantee information."</p>
<p>ArtTactic artist reports map the characteristics and structure of the primary market for an artist using a mix of gallery, exhibition, museum, media, social media and collector sentiment data.</p>	<p>MutualArt does not offer an index based on auction prices, however they do offer their subscribers the MutualArt Index, which uses a comprehensive proprietary algorithm to rank artists. MutualArt's extensive primary market data is featured in their subscriber newsletter, where they highlight key exhibitions, and is a primary source for their mobile app, which uses geo-location to alert users to nearby exhibitions of their favourite artists. This data is also used in the MutualArt Index (as described above).</p>	<p>Pi-eX believes that the disparate nature of fine art and the relatively low level of transactions do not allow for the construction of accurate price indices. To obtain better benchmarking, Pi-eX developed a buyer/seller behavioral analysis, switching the focus from the artwork to the collectors.</p>



Products	AMA/Art Analytics	Artfacts.net	artnet	Artprice
Risk analysis		ArtFacts.Net offers dynamic career charts for over 500,000 artists. This unique career trend analysis can be used to make informed decisions about the likelihood of an artist to become historical and offers vital information when estimating risk value.	artnet can use its new art indices to calculate market volatility and correlation with other asset classes.	Artprice regular market reports inform about historic trends and market risks. Artprice artist analytics allows users to compare the performance of the market with other asset classes.
Valuation / Analysis of single art works	Art Analytics produces on-demand artwork valuation and analyses. These very detailed (up to 50+ pages) reports focuses only on the valuation and market research. Art Analytics does not provide any type of forensic or artistic analyse.			Artprice offers an estimate service called Arpricing. This is not an appraisal, but will provide an estimated range of the work's current value based on the detailed auction results for at least two comparable artworks.
Artist reports	Art Analytics produces numerous artist reports for AMA's readership as well as for third-party medias. It also produces on-demand artists reports for art market professionals.	"ArtFacts.Net provides reports on individual artists breaking down their exhibition and primary art market performance data over time. This includes global and local artist rankings, peer artist comparisons, exhibition type and location. ArtFacts.Net also creates customised ranks on artists according to gender, artistic movement, country and fair participation, among others."	Reports to track an artist's auction market performance and trends over time, or against any other from artnet's database of over 130,000 artists.	Analytics to track an artist's auction market performance and trends.
Art market & sector reports	AMA produces specific event-related reports (auction, fairs, etc.). Art Analytics produces macro-level reports for specific sectors: tribal art, bought ins, etc.	ArtFacts.Net has been contributing data to the Art Basel Art Market Report since 2017.	Art market analysis on various collecting categories and regional sectors based on its comprehensive database. The in-depth analysis shows the evolution of market and includes experts' insights into the rational behind changes. artnet publishes yearly auction reports on the Chinese art market and in partnership with art fairs.	Artprice publishes the annual global auction report, as well as half-year reports on the global auction market. It also publishes special reports on the contemporary art auction market, as well as regional reports on Asia.

Source : Deloitte Luxembourg & ArtTactic Art & Finance Report 2017

ArtTactic	Mutualart	Pi-eX
<p>ArtTactic produces bespoke risk analysis and due-diligence reports on individual artist markets. ArtTactic is also using its Artforecaster platform to crowd-source for forward looking data, which is then imbedded in market risk analysis and expected loss scenarios.</p>		<p>Pi-eX standard methodology provides clear indicators of liquidity, performance and volatility for specific artists, locations, auction houses, price ranges, etc.</p>
<p>ArtTactic offers this as a bespoke service and sits within the family of artist research reports. These reports would analyse the value of a single art work in the context of the overall market for the artist, and analysis around current value and future (12-months) value are provided.</p>	<p>MutualArt's art experts have over 30 years of experience in art appraisal and authentication, assisting private collectors, corporations, insurance companies and legal professionals to value artworks. Their experts are members of International Fine Art Appraisers (IFAA) and have worked for leading art auction houses including Sotheby's and Christie's.</p>	<p>The performance of single artworks can be viewed in comparison to other relevant artworks sold or bought by collectors of the same artist, at the same auction, in the same location, etc.</p>
<p>ArtTactic produces monthly artists reports on important Post-War and Contemporary artists. It also offers bespoke artist reports on any artist, and provides a holistic look at the market using a mix of primary market, auction market, media/social media and collector sentiment data.</p>	<p>MutualArt provides subscribers with detailed auction performance analyses including: value and volume of lots offered and sold, performance against estimate, relative value compared to related artists and price band comparisons. They also provide links to exhibitions (past and upcoming), articles and other information about the artist.</p>	<p>Pi-eX artist reports focus on analyzing the behavioral trends of art buyers and sellers for that particular artist. Data standardization and visualization allow for easy understanding and comparison.</p>
<p>ArtTactic produces weekly, monthly, quarterly and annual market reports on different developed and emerging art markets, with specific focus on Modern and Contemporary Art. In 2017, ArtTactic launched a new set of market reports on Old Masters and Impressionist & Modern Art. ArtTactic is also partner in several research projects such as the annual Hiscox Online Art Trade Report, Deloitte Art & Finance Report and the South Asian Art Market Report.</p>	<p>MutualArt produces seasonal auction summaries; sale week summaries (i.e. post-Frieze week sales); individual artist spotlights and collecting guides.</p>	<p>Pi-eX market and sector reports focus on analyzing the behavioral trends of art buyers and sellers for that particular market or sector. Data standardization and visualization allow for easy understanding and comparison.</p>



artnet's new Insights platform

Based on artnet's database of auction results, the newly launched artnet Insights platform allows users to understand an artist's market performance, with reports that can be filtered by medium, artwork series, and more. The platform makes use of artificial intelligence powered by a new virtual device (please see the contribution on [page 220](#)).



Pi-eX develops analytical and financial tools

Over the past four years, Pi-eX has focused on building analytical and financial tools that help fine art collectors better understand and manage risk and volatility in the fine art market. While developing the first derivative instrument based on fine art, Pi-eX built a proprietary database of auction sales results and developed a systematic methodology for analyzing liquidity, performance, volatility, and hedges against volatility. Please see the contribution on [page 226](#).



A new initiative to foster the role of science in the world of the art market and cultural heritage: The Seracini Foundation

Award winning scientist and art diagnostician, Maurizio Seracini, has secured funding and is expected to open in 2018 in Luxembourg the Seracini Foundation, a non-profit organization dedicated to furthering the role of applied science and technology to conservation, preservation, discovery and dissemination of Cultural Heritage and to authentication for the art market.

The Foundation will set-up a world class lab and will use its findings to educate the general public as well as train the next generation of art researchers and scientists. Additionally, it will develop an online database of over 3,500 scientific studies making it available to scholars and art professionals worldwide and further develop the "Clinical Chart for Art", establishing international certified standards for the scientific study and authentication of art.



ArtTactic launches new art market tracking and market confidence tools

Over the last 12 months, ArtTactic has expanded its in-depth art market coverage and market tracking tools. This includes a weekly, monthly, and quarterly auction tracking barometer (RawFacts), as well as regular in-depth analyses and reports on specific artists and collecting segments such as the old masters, modern and impressionist art, and post-war and contemporary art. Data and analysis covering regional art markets in Africa, the Middle East, and South Asia are also provided. Furthermore, ArtTactic continues to monitor the role of financial guarantees at auction, and with more than 5,000 individuals surveyed on a weekly basis, and constant monitoring of changes in buyers' taste, preferences, and sentiment. Please see the contribution on [page 222](#).

Although the majority of the financing has gone into e-commerce-related art businesses, we are also seeing more activity in the art services and art infrastructure space.

New infrastructure developments

1. Art valuation

ValueMyStuff: having been acquired by the now-defunct Auctionata in 2015, but subsequently bought back by the founder Patrick van der Vorst in 2017, ValueMyStuff (VMS) will now exclusively focus on expanding its valuation business and capabilities. With mobile traffic accounting for 38 percent of its business dealings, fresh efforts to redevelop the website and launch a new app at the end of the year are aimed at increasing mobile conversions. ValueMyStuff has also been developing software for their website over the last five years, amassing over 500,000 clients and performing over 1.2 million valuations to date. From October this year, this software will be ready to be shared with third-party businesses as a white-label service. This would, for example, allow auction houses to outsource their online valuations, and focus their valuation efforts only on objects that they would consider for a sale. VMS is moving from simply providing valuations to integrating their valuation expertise and software platform into existing art-related businesses. In doing so, it hopes to increase effectiveness, reduce costs, and allow these businesses to focus on their strengths.

ArtForecaster: the market prediction and valuation gamification platform launched by ArtTactic in 2014, has tested its first crowd-based valuation, risk, and market analysis service with a number of art-secured lenders and insurance companies over the last 12 months. ArtForecaster is unique in that it offers users the opportunity to identify specific groups of forecasters with particular skills based on their past forecaster performance. This unique data has been

used to generate crowd-based market valuations (current and expected value in 12 months), as well as developing scenarios to assess the probability of downside risk over a 12-month period. The current shift in accounting regulations around art-secured lending (*discussed on page 164*), in which forward-looking data is prioritized over historical data for risk management purposes, means that new types of data and models will be required, and this is an area that Artforecaster is currently addressing.

2. Blockchain

smArtchain: smArtchain is a recently launched not-for-profit initiative at blockchainhub.net, which showcases art projects and art startups using blockchain technology. The aim is to draw attention to case studies involving the use of blockchain, smart contracts, DAOs, and ICOs by artists and the art industry alike. Please see the contribution on *page 232*.

ArtTracktive: Deloitte Luxembourg has developed a technological alternative to the paper trail that normally proves the provenance and movements of an artwork. The firm's blockchain development team revealed the application during the ICT spring summit in Luxembourg in May 2016. The Deloitte ArtTracktive proof-of-concept provides a distributed ledger for tracking the provenance and whereabouts of works of fine art. The blockchain-based application manages the interactions between all parties involved, from the artist or the owner of the piece of art, through freight forwarders, customs, art galleries, museums, and all the way to potential buyers.

3. Tagging and authenticity

Tagsmart: Tagsmart uses DNA tagging technology to identify artworks alongside a unique system for issuing secure certificates of authenticity. These services are fully integrated with a provenance record that enables artists to verify the authenticity of their artworks and create an accredited ownership history over time. With over 15,000 artwork records stored on its platform, Tagsmart has tagged more than 5,000 artworks in its first year. It is now also providing its API to online platforms including ArtRepublic (launched in August 2017), enabling end-users to instantly request secure certificates of authenticity, and establish provenance records for works sold via their website. Tagsmart recently announced its next-generation range of products and services, including location security for artist studios and a new method for establishing proof of ownership. Tagsmart is also working with leading material scientists at the University of Surrey in the development of highly secure, uncopyable materials to work alongside their existing synthetic DNA solutions, as well as exploring other forms of tagging, including limited-edition books.

4. Art collection management: new vs. incumbent providers

The last 10 years have seen significant activity in the art collection management industry. Artbinder raised US\$3.17 million in Series A funding in July 2014, and other new providers, such as Collectrium (founded in 2009) and ArtCloud (founded in 2012), joined the traditional market of existing providers such as Artsystems (1989), ArtLogic (formally incorporated in 1999), and Artbase (set up in 1993). Christie's reported the US\$16 million purchase^[1] of Collectrium in 2015, signaling that the art industry was increasingly seeing art collection management as an attractive customer service tool, and a potential platform on which to integrate other services (such as valuation, insurance, and shipping, as well as a potential platform for buying and selling). It is clear from this year's survey findings that consolidated wealth reporting incorporating art and collectible wealth is a key priority for both clients and wealth managers, particularly as the wealth management industry is increasingly moving toward a holistic wealth

management model. This represents an opportunity for existing art collection management providers to collaborate more closely with the wealth management industry in developing solutions that addresses their concerns regarding client confidentiality and discretion. However, with the landscape currently fragmented between new and incumbent providers with different legacy systems and solutions, it is still not clear whether technology will be the dominant competitive factor, or whether the ability to provide tailored solutions will suit the wealth industry better.

**ArtTracktive:
Deloitte
Luxembourg
has developed
a technological
alternative to the
paper trail that
normally proves the
provenance and
movements of an
artwork.**

5. Technology and logistics

Arta: the company connects high-quality shippers with customers, and seeks to address the inefficient, fragmented and opaque high-end art shipping and logistics market. The service aims to streamline the process by creating a one-stop shop for fine art shipping. ARTA allows customers to find the best shipping option by tapping into a network of selected art transporters, compare pricing, transact and pay online (which streamlines the invoicing process), and manage an entire logistics operation. It is essentially a Kayak or Expedia for fine art shipping. The company is also working on developing APIs to connect seller and buyer systems directly, bypassing the manual pen-and-paper processes that are typically required to complete a transaction.

Artrunners: this is an online comparison and contracting service striving to be the new benchmark in specialized art logistics services such as crating, packing, transport, and installation, anywhere in the world. The service is currently in a live beta version, and aims to give other art lovers, collectors, and art professionals a simple and efficient solution, enabling them to choose from a diversity of service providers and make informed decisions. Artrunners tackles the complexity of art logistics using its proprietary technology so that users can save time. It has developed a proprietary algorithm that matches your shipping requirements with the specific capabilities of each of its service providers. There is also a strong community element, whereby community member reviews enhance transparency and satisfaction for customers and service providers alike.



Fabian Bocart
Vice President of
Analytics
artnet

artnet Insights

case study

Pablo Picasso

Established in 1989, artnet is dedicated to bringing transparency to the art world with a range of products that ensure easy access to the latest art market information and news online. More than ever, the world of Art & Finance would benefit considerably from an accurate, quantifiable, and reliable metric to assess art as an asset. **artnet Insights** comes as the latest development in the field of analytics for Art & Finance.

Pablo Picasso is one of the most liquid artists at auction, and thus a prime candidate for any serious art investor. Over the last 12 months, global auction sales for Picasso works totaled US\$401 million—2,675 lots were offered, with 77 percent successfully sold. According to the trend of the artnet Picasso price index, the sale price of his paintings saw a decrease in 2016, but increased by 38 percent during the first half of 2017. The total sales volume in 2016 had dropped sharply from its peak level of US\$572.5 million in 2015. Picasso works are now back on the rise again, and look set to make a strong recovery in 2017.

Market-wise, Christie's New York has had the largest market share of Picasso's auction market history over the last three years, totaling US\$610.5 million and accounting for 38.36 percent of the total sales value—followed by Sotheby's London (23.98 percent), and Sotheby's New York (19.08 percent). With the data pulled from artnet Insights, prospective investors can either choose the right partner for an auction sale or select from a list of over 200 galleries for a private sale.

artnet Insights

These types of analyses are highly sought-after on the art market. Based on artnet's database of auction results, the newly launched artnet Insights platform allows users to understand an artist's market performance, with reports that enable them to filter by medium, artwork series, and more. Covering a total of over 103,000 artists, it provides an up-to-date price index for any given artist, which can be used to compute the estimated potential return on investment.

The tool also allows for data to be downloaded directly in CSV—a format that is compatible with most data analysis software packages, including Microsoft Excel. This new approach allows dealers, money managers, hedge fund managers, and private bankers to use artnet's indices to easily obtain an indicative update on the value of their stock or their client's collection without the risk of sharing confidential information. Naturally, all other traditional metrics are readily available as well, including total auction sales, number of lots offered, sell-through rate, and volume. Auction volumes can be filtered by medium, such as paintings, works on paper, photographs, sculpture, and design, allowing users to directly focus on the medium of interest to them.

artnet has also employed another new development in the field of art data analysis: artificial intelligence powered by a new virtual device—a groundbreaking addition to the field of art data analysis. This tool will analyze a set of works produced by an artist: an algorithmically generated group of works that are variations on a theme or otherwise resemble one another. For each series, a price index is generated to identify different trends among the various groupings by the same artist. For example, the algorithm automatically differentiates and analyzes Pablo Picasso's male portraits and then indicates the performance of that specific series.

artnet Insights has also introduced a much-needed metric in the art world: market shares of auction houses per artist. At a glance, users can identify which auction houses occupy the top positions in consigning works by a given artist, which can help determine the right partner for an auction sale. Similarly, this option gives auction houses the capability to identify their strengths and weaknesses in the market for any artist.

Figure 55. artnet Insights





Anders Petterson
Founder
ArtTactic Ltd

ArtTactic: Market sentiment analysis— understanding the risk associated with market fashions and tastes in the contemporary art market

The ArtTactic Art Market Confidence Survey was launched in May 2005, and covers a range of art markets and specific **artists. This unique dataset covers changes in market sentiment** and confidence among key experts and stakeholders in the market. The survey findings are made available every six months and are based on a sample of 120-130 key international collectors, curators, auction houses, dealers, and art advisers. **The relationship between the short-term and long-term confidence indicators tell us something about how fashion, one of the greatest risks in the contemporary art market, can be better monitored, analyzed, and understood.**

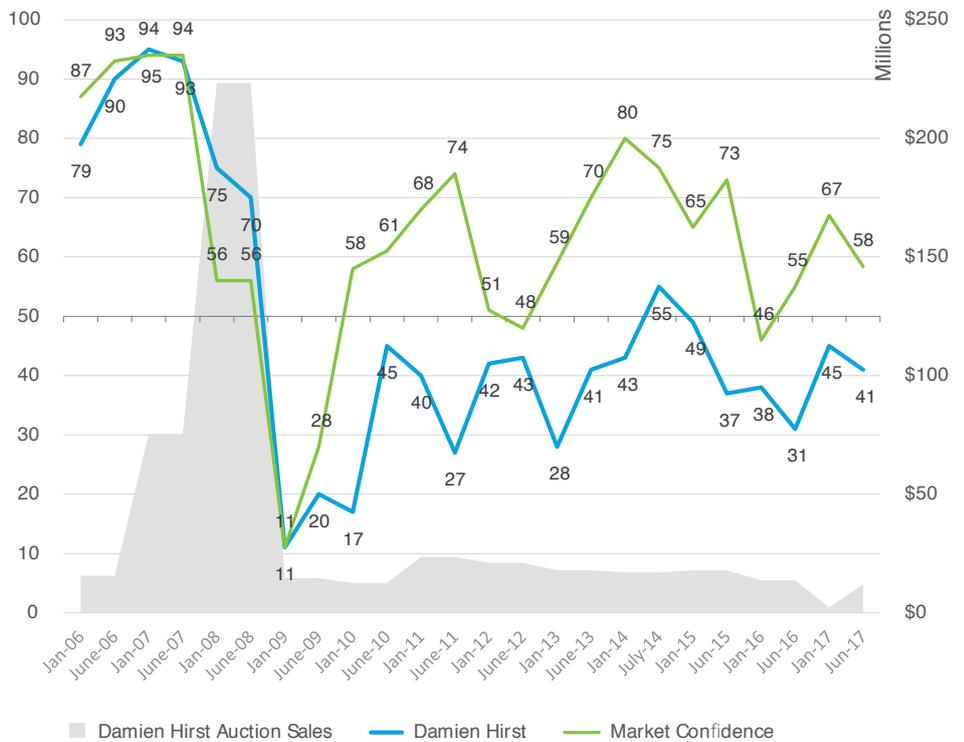
In the following brief example, we take a closer look at how this data has been utilized in the context of the market for a specific artist: namely, Damien Hirst.

Short-term market confidence

Short-term confidence in the Damien Hirst market experienced a substantial drop in 2008, ahead of and after the ground-breaking single-artist auction at Sotheby's in September 2008. This sale raised £111 million over two days, in the midst of the outbreak of the financial crisis. Although the auctions were a financial success, the market's interpretation of the events was very different, with confidence falling 25 percent leading up to the event, and a further 85 percent after the auction had happened. Although confidence has recovered from its lowest ebbs, the market has remained in limbo since 2010, with a lack of consensus as to where the market will be heading next. In the most recent reading from June 2017, the confidence indicator came in at 41 (a reading below 50 signals that there is more negative than positive sentiment in the market), down from 45 in January 2017. This could imply that Hirst's long-anticipated and highly publicized exhibition in Venice has had little positive short-term impact on the market's perception of where the market is going next.

Figure 56. ArtTactic Damien Hirst Confidence Indicator 2006 - June 2017

Damien Hirst Market vs. Overall Market Confidence



Source: ArtTactic

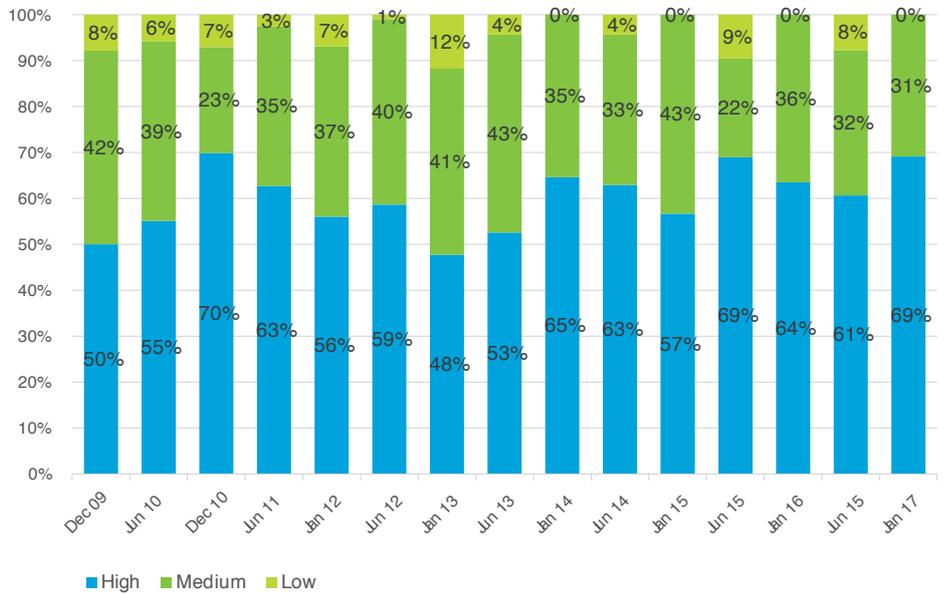
Although confidence has recovered from its lowest ebbs, the market has remained in limbo since 2010, with a lack of consensus as to where the market will be heading next.

Long-term market confidence

In addition to measuring experts' perceptions regarding short-term confidence (next six months), the confidence survey also looks at respondents' perceptions about their long-term outlook. Despite negative short-term sentiment, the market has remained more confident about Damien Hirst's long-term importance. Based on the recent survey findings, 40 percent of market experts believe the artist will be of high importance and a further 43 percent believe the artist will be of medium importance in ten years' time, which suggests that the majority think the artist's market will survive and play an important role in the future. Accordingly, only 17 percent believe that the market will be of low importance.

Figure 57. ArtTactic Hirst Market Survey March 2017

Question: How important do you believe Damien Hirst's Market will be in 10 year's time?



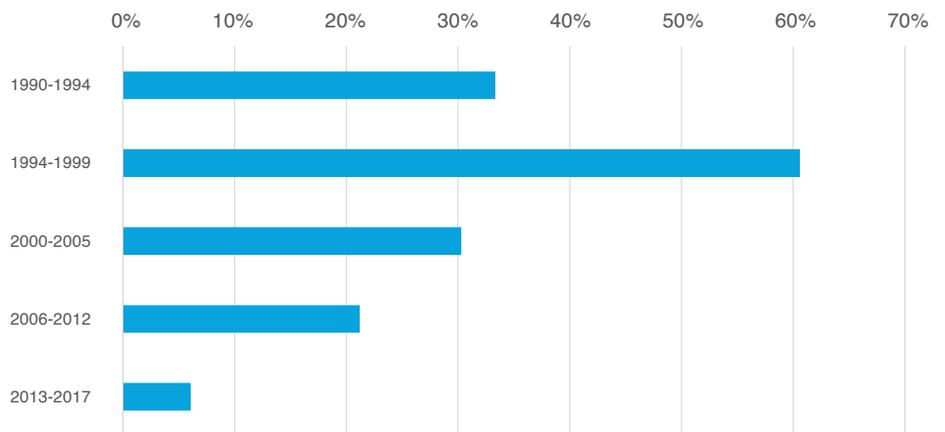
Source: ArtTactic

Confidence in object-specific characteristics

Overall short-term and long-term confidence can help us to understand the market's perception of a particular artist in broad terms. This, in turn, may give an indication as to where the market and prices could be heading next, and to what extent this trend is sustainable. However, the confidence survey also aims to extract more granular details regarding perceptions of the artist's specific oeuvre. The analytical tools, see *Figures 58 & 59*, depict the market's perception of the period and series of works believed to be of the greatest importance at the time of the survey.

Figure 58. ArtTactic Hirst Market Survey March 2017

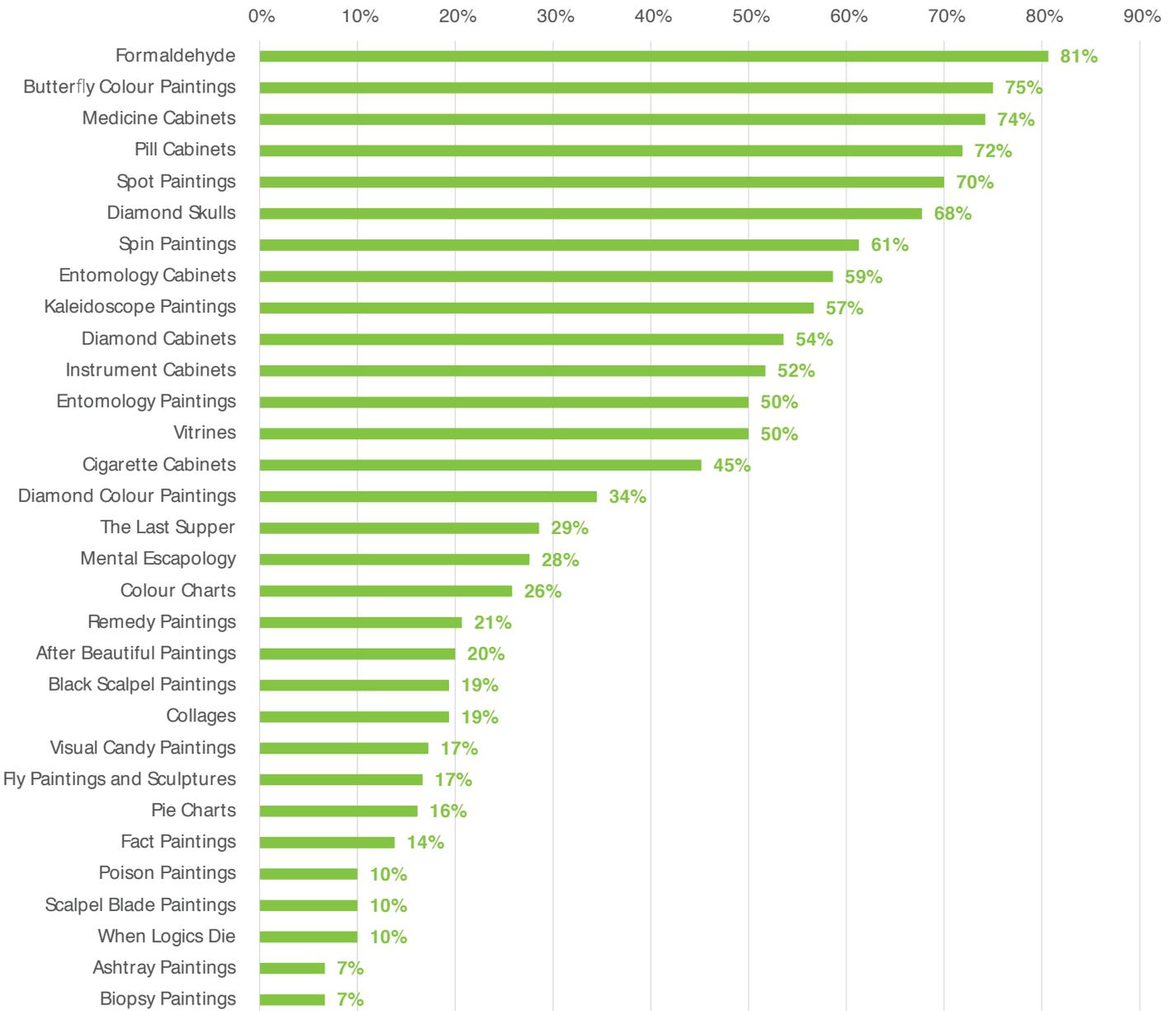
Question: Which period(s) do you consider to be his most important?



Source: ArtTactic

Figure 59. ArtTactic Hirst Market Survey March 2017

Question: Which series do you consider the most important?



Source: ArtTactic

Despite negative short-term sentiment, the market has remained more confident about Damien Hirst's long-term importance.



Christine Bourron
CEO
Pi-eX Ltd

Pi-eX: A new approach to art data analysis

Shifting the focus from the artwork to the collectors

At a time when Big Data has become a buzz phrase for many industries, providing new opportunities to analyze data and understand market trends, the art market continues to struggle with data. This was clearly demonstrated earlier this year when simply sizing the art market proved a challenge, as shown by the wide discrepancies between the 2017 TEFAF report and the 2017 Art Basel report.

The discrepancies not only highlighted the lack of transparency in the fine art market, but also the absence of widely established methodologies and analytical standards on the research side of the fine art industry.

Does this mean that the art market should remain forever a world where all that matters is emotions and feelings as opposed to quantitative, objective data and rational analysis? Not necessarily, but it clearly shows that art is a unique asset class that requires a new approach to data analysis and communication.

Over the past four years, Pi-eX has focused on building analytical and financial tools that help fine art collectors better understand and manage risk and volatility in the fine art market. In the process of developing the first derivative instrument

based on fine art, Pi-eX built a proprietary database of auction sales results and developed a systematic methodology for analyzing liquidity, performance, volatility, and volatility hedges. As in the traditional finance world, especially when dealing with risk assessment and management, Pi-eX uses a behavioral analysis approach to gain insightful information on the dynamics of the fine art market. By focusing on the behavioral trends of art buyers and sellers rather than specific artworks or styles, Pi-eX strives to provide valuable market-focused information to those interested in better understanding liquidity, performance and volatility in the fine art market.

Here is some of the rationale behind Pi-eX's new approach to art data analysis.

Why, in the era of Big Data, is the fine art market still struggling with data?

Various elements contribute to this struggle: a lack of trade transparency, lack of industry standards, the multiple distribution channels, and—of course—the unique nature of the trade of fine art in which each item is unique and non fungible, making it extremely difficult to truly compare like for like. Even the same exact item sold at different times after belonging to different collectors can hardly be used as a point of comparison.

Is Big Data analytics the solution for the fine art market?

While it would be easy today to browse through millions of art sales records, the reality of analyzing art data is often very similar to comparing apples to oranges. In fact, when looking at the historical trends for a particular artwork, the researcher rarely finds more than three or four relevant data points. We can therefore forget any correlation or regression analysis, variance calculation, Sharpe Ratio, etc. With only three dots, it is often challenging to discern any historical trends. As for predictions of the future based on these historical trends, one might as well resort to Paul Klee's creative definition that "a line is a dot that went on a walk."

Recognizing and accepting that art is a particular asset class, for which standard analytical solutions do not perfectly apply, is an important step. In this regard, we at Pi-eX strongly believe that the solution for fine art does not reside in Big Data, but rather in Smart Data.

What is Smart Data?

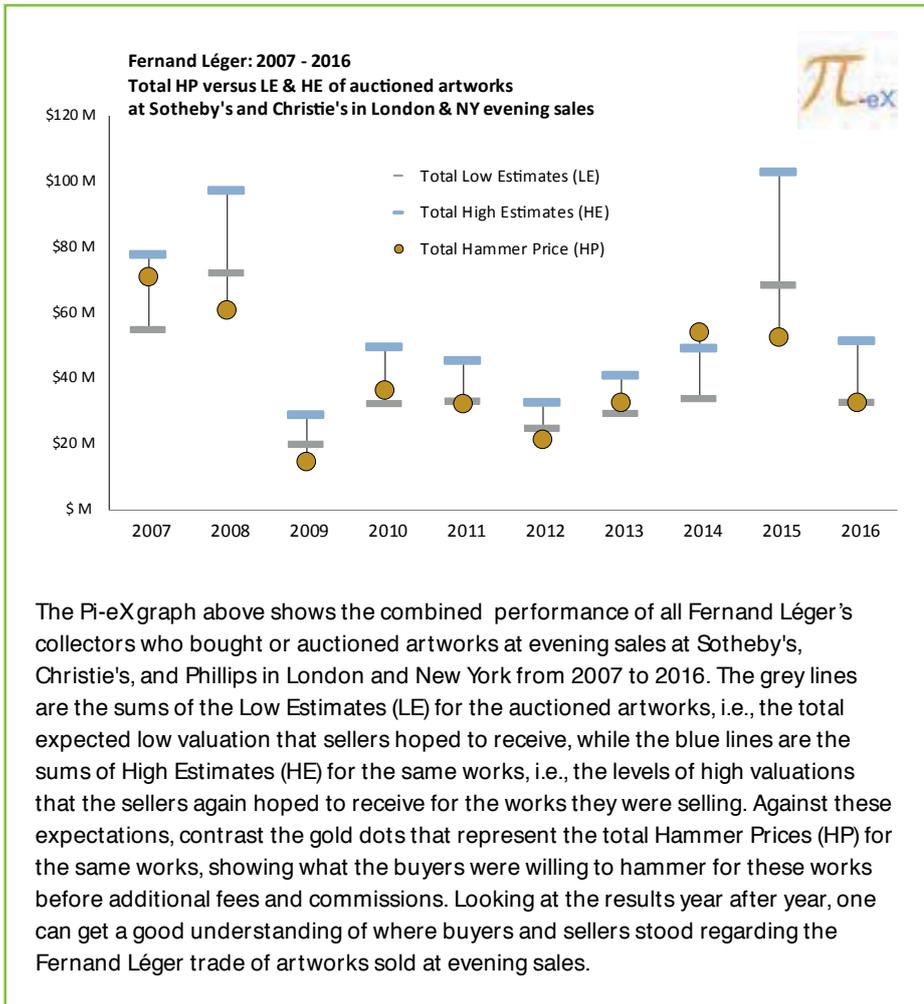
Smart Data is about finding creative ways to deal with the unique challenges presented by the fine art market. A Smart Data analysis starts by recognizing that any analysis can only be based on a small dataset. Consequently, it is not meaningful to look at the data exclusively through averages or indices, as any type of aggregation could be disproportionately influenced by the fate of just a single artwork and thereby minimize the importance of others. The other important thing to recognize is that the small dataset cannot easily be extended by adding

multiple comparable items. By mixing too many loosely related items, one may lose track of the particularities of the original analysis. Does this mean that no data analysis can be done? Not at all, but it certainly means that the analysis should always link back to specific works of art to allow the reader to see and understand the impact of every single artwork involved in the analysis.

While it would be easy today to browse through millions of art sales records, the reality of analyzing art data is often very similar to comparing apples to oranges.

Shifting from an artwork-focused analysis to a collector-focused analysis

In a Smart Data analysis, one way to overcome the challenge of a small data set at the artwork level is to switch the focus from the artwork to the collectors. Specifically, rather than trying to analyze repeat sales for one particular artwork, the focus should be on the collectors of artworks, thus analyzing behavioral trends between sellers and buyers. While data for collectors' behaviors is not available across all art distribution channels, there is one channel where there is a profusion of data: public auction sales. In fact, this channel offers all the prerequisites for systematic behavioral analysis of art buyers and sellers.



The Pi-eXgraph above shows the combined performance of all Fernand Léger's collectors who bought or auctioned artworks at evening sales at Sotheby's, Christie's, and Phillips in London and New York from 2007 to 2016. The grey lines are the sums of the Low Estimates (LE) for the auctioned artworks, i.e., the total expected low valuation that sellers hoped to receive, while the blue lines are the sums of High Estimates (HE) for the same works, i.e., the levels of high valuations that the sellers again hoped to receive for the works they were selling. Against these expectations, contrast the gold dots that represent the total Hammer Prices (HP) for the same works, showing what the buyers were willing to hammer for these works before additional fees and commissions. Looking at the results year after year, one can get a good understanding of where buyers and sellers stood regarding the Fernand Léger trade of artworks sold at evening sales.

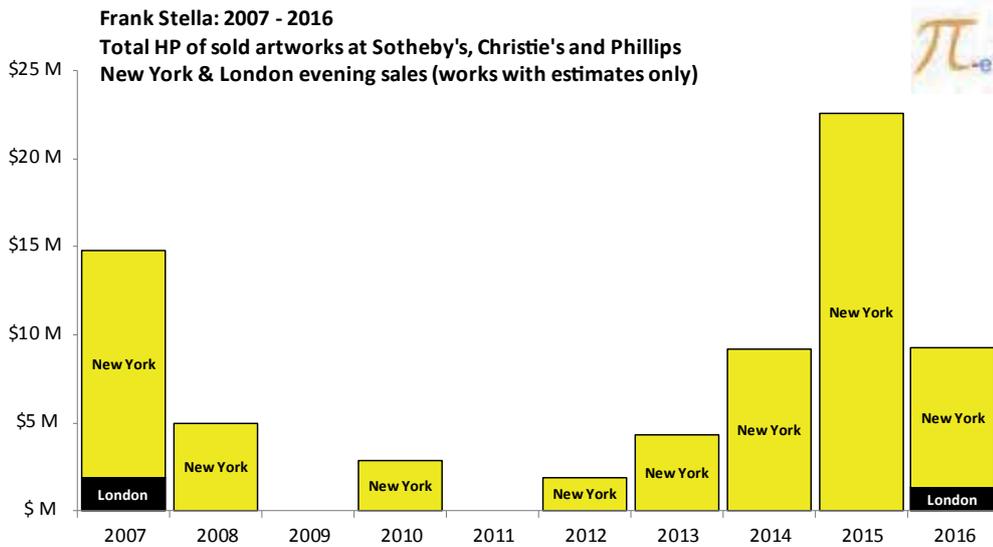
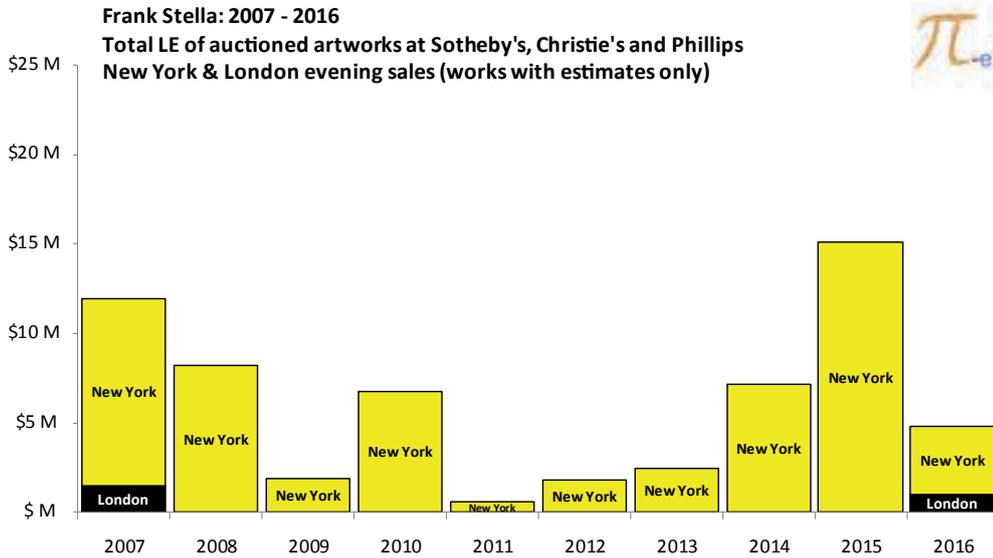
Source: Pi-eXLtd

Why is behavioral analysis relevant to the fine art market?

The value of a work of fine art goes far beyond its intrinsic value: the cost of the canvas, the oil, or the time spent by the artist creating the artwork represent a mere fraction of the price eventually paid. What mostly drives the value of an artwork is at which price sellers are willing to sell their works and buyers are willing to pay. In the end, the sale price of an artwork is a fragile equilibrium between the expectations of both sides. If no common ground is found between the two sides, the artwork does not reach the reserve price and it is unsold or "bought-in". Behavioral analysis of buyers and sellers deals with understanding this critical price point at which sellers and buyers may or may not meet. It is the analysis of where this price point has been historically and where it could be in the future.

How does behavioral analysis help with the small dataset challenge?

While historical sales for a particular artwork generate very little data, behavioral analysis of buyers and sellers can be based on abundant data across many years, different locations, and numerous artworks, especially when dealing with collectors buying at public auctions. Thanks to the annual regularity of public auction sales, one can systematically analyze year after year what collectors like to buy or sell, where they prefer to do so, how their tastes evolve, what their critical price points are, which artists they are confident in or not, etc.



As an example, the top Pi-eX chart shows the total sum of the Low Estimates (LE) chosen by sellers for Frank Stella's artworks auctioned at evening sales at Sotheby's, Christie's, and Phillips in London and New York from 2007 to 2016. An immediate conclusion is that sellers of Frank Stella artworks clearly prefer New York as a public auction trading place. The chart above shows the total sum of the Hammer Prices (HP) obtained from buyers for Frank Stella's artworks sold at evening sales at Sotheby's, Christie's, and Phillips in London and New York from 2007 to 2016. By comparing both charts, one can conclude that while sellers had a hard time obtaining the value they desired for their Frank Stella works from 2008 to 2012, 2013 to 2016 have been good years for sellers as they have generally obtained more value than their LE, especially in New York in 2015 and 2016.

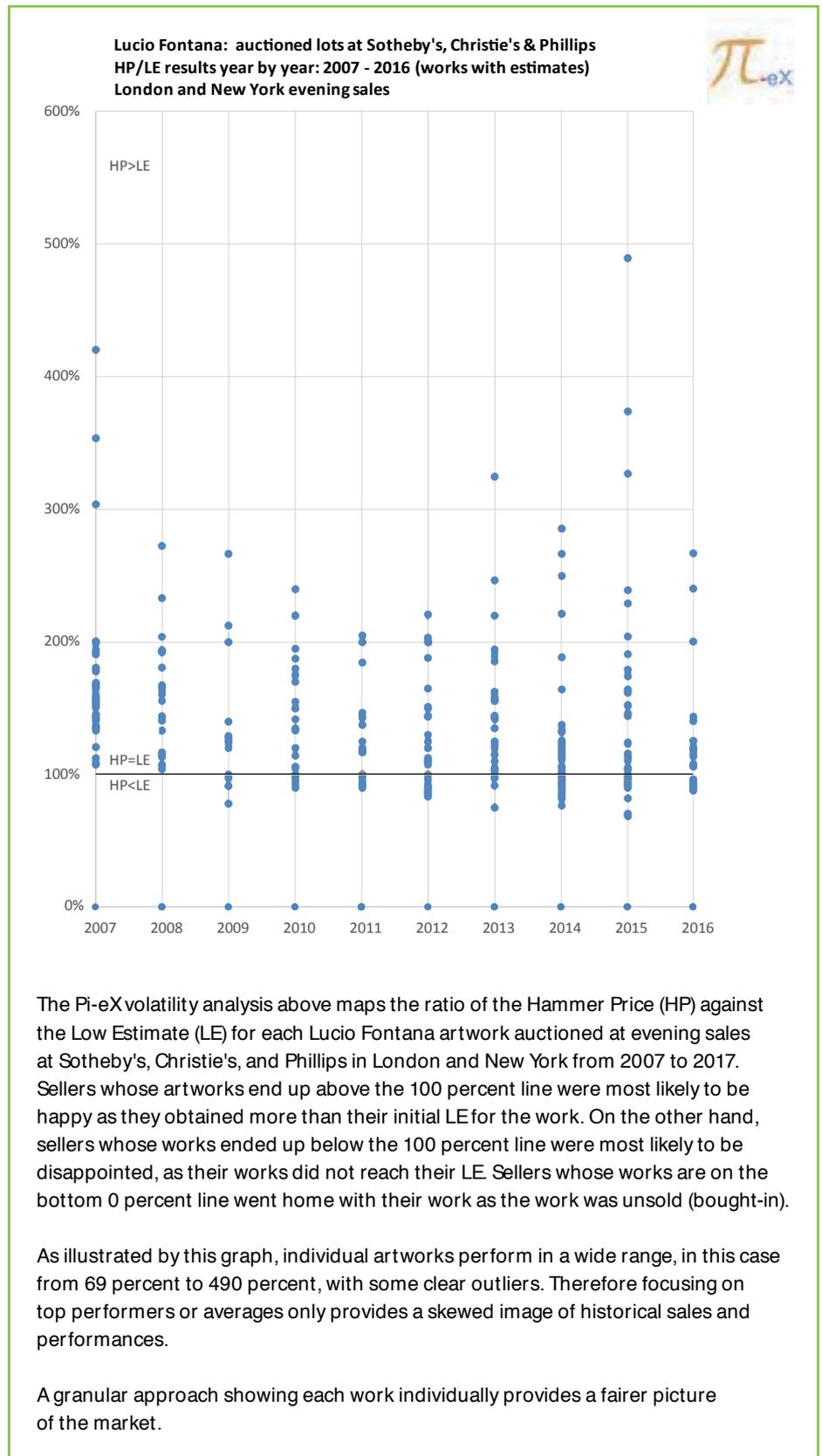
Source: Pi-eX Ltd

What else can be done to make data more relevant to the fine art market?

When looking at the behavioral analysis of art collectors, one should never forget that these collectors are buying unique artworks. Therefore, while there certainly are some trends that can be identified, there will always be a few outliers that will not and cannot fit the trends because they are so unique. How to identify and showcase these outliers is critical in a Smart Data analysis. A successful way to do so is through granularity and visuals.

1. Granularity

Instead of just producing indices or averages, a granular approach makes sure to always represent the various components of the market. Specifically, for art, the analysis should map specific artworks according to the criteria chosen for the analysis.



Source: Pi-eX Ltd

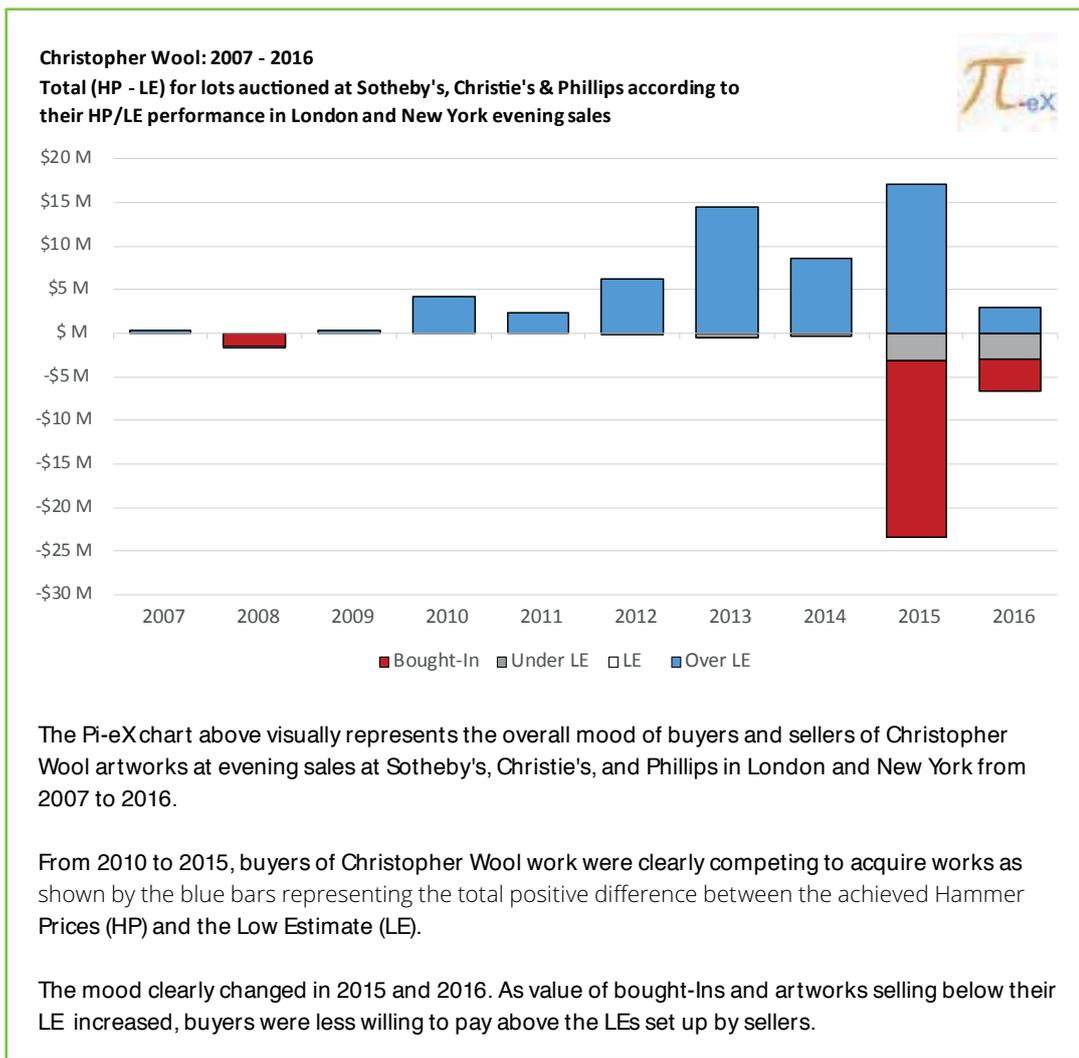
2. Visuals

While art is considered by many as an alternative investment opportunity, it certainly cannot be reduced to a number or an index. Along the same line, art analysis could not just be a ratio. It requires its own visual representation that talks both to the left and right parts of our brain.

Pi-eX was shortlisted for the Best Innovation in the Data category for the 2017 UK Financial Innovation Awards. The company was selected for the work it has done developing a new methodology to analyze trends and opportunities in fine art as described here.

Conclusion

Traditional analytical tools available to fine art collectors usually offer limited value-add to the risk assessment and investment decision process when buying art. As interest in art as an asset class has grown recently, a new analytical approach to the fine art market based on a Smart Data approach and the behavioral analysis of art buyers and sellers not only makes sense, but also offers a completely new perspective on the market, especially in regards to risk analysis and assessment during the investment decision process.



Source: Pi-eXLtd



Dr. Shermin Voshmgir
Founder
blockchainhub.net

blockchainhub.net is an information hub and think tank advocating blockchain, smart contracts and the decentralized web.

Blockchain Case studies in the art industry and beyond

We recently launched the smArtchain¹⁰² initiative at blockchainhub.net, where we showcase art projects and art startups using blockchain technology. Our aim is to draw attention to case studies involving the use of blockchain, smart contracts, DAOs, and ICOs by artists and the art industry alike. Furthermore, we have forged a partnership with Lensbased—Hito Steyerl’s class at Berlin University of the Arts—where we critically examine the role of blockchain in society. As blockchainhub.net, we are also collaborating with Propellor Film Tech Hub—a joint venture between the Berlinale Film Market and Rotterdam Film Festival.

Art-industry case studies

The art industry is one of the world’s most opaque business sectors, with a multitude of middlemen between the creators and the consumers of art. Each of these middlemen takes a cut of the revenue and passes along the rest, with the leftovers typically reaching the artists themselves months, if not years, later. Blockchain could help keep track of an artwork’s movements

without relying on cloudy and sometimes still paper-based systems of recording provenance. Blockchain could revolutionize the art industry by resolving questions of provenance, and improving transparency, copyright, and ownership issues. Seeing the potential, art startups are already building real-world applications based on blockchain.

Ascribe.io, for example, offers artists a platform for uploading their digital works, securing their attribution, and selling them. In 2015, the Museum of Applied Arts (MAK) in Vienna acquired several editions by the artist Harm van den Dorpel that had been authenticated by Ascribe. MAK also showcased an exhibition of the work of Valentin Fuhry, an artist and the cofounder of Cointemporary,¹⁰³ a scheme that exhibits works online that are available for purchase in bitcoin.

Blockai is a startup that seeks to democratize access to copyright protection, allowing artists to claim copyright on their work instantaneously and see where it is being used. Blockai also acts as a fraud deterrent. If someone tries to claim somebody else's work, there will be a permanent record of this on the blockchain.

Chainmark, on the other hand, is a startup that seeks to bridge the gap between physical art and blockchain. Combined with tagging technology, chainmark is a mixture of materials of varying colors that can be placed on the side of a painting. This produces a unique fingerprint that can then be hashed onto a blockchain. A missing chainmark could reveal that a work has been tampered with.

Grammy-award winning singer-songwriter Imogen Heap¹⁰⁴ has pioneered Mycelia, a think tank to empower a fair, sustainable, and vibrant music industry ecosystem. The startup Artlery¹⁰⁵ is attempting the same thing for physical art such as sculptures and paintings.

Earlier this year, music streaming company Spotify acquired blockchain startup Mediachain Labs,¹⁰⁶ an open-source platform that seeks to enable creators to attach information to projects and create a record on the bitcoin blockchain stored on the distributed file system, IPFS.

In the entertainment industry, SingularDTV¹⁰⁷ is working on a blockchain-based digital content management and distribution platform. The vision is to decentralize the entertainment industry so that creative individuals can profit from the films, videos, games, and art they help to make.

Blockchain as a creative tool

Blockchain is much more than a tool to make the art industry more efficient. Blockchain technology could also serve as a new creative medium for artists to use to push the boundaries of creation and society, as we can see with Plantoid and Terra0.

Terra0¹⁰⁸ is a self-owned forest. It is an ongoing art project by two students of Berlin University of the Arts, who are seeking to set up a prototype of a self-utilizing piece of land. A smart contract on the blockchain allows the forest to become an autonomous piece of land that manages itself in accordance with the rules established in the smart contract. With Terra0, the forest is able to sell licenses to log trees through automated processes. The forest thereby accumulates capital. A shift from valuation through third parties to self-utilization makes it possible for the forest to procure its real exchange value, and eventually buy and own itself. The augmented autonomous forest is then in a position to buy more ground and therefore to expand.

Another art project using smart contracts is Plantoid¹⁰⁹—the plant equivalent of an android. It is an autonomous blockchain-based lifeform that is able to reproduce itself through a smart contract. Plantoid is a hybrid creature that lives both in the physical world, as a mechanical contraption made up of recycled steel and electronics, and in the digital world, as a piece of software deployed on top of a blockchain-based network.

It is autonomous, self-sustainable, and capable of reproducing itself through a combination of blockchain-based code and human interactions. Contributions are made through the bitcoin blockchain, by simply sending funds to the Plantoid's bitcoin wallet. Once a Plantoid has proven its worth by accumulating a sufficient quantity of bitcoins, it will enter into the reproductive phase, initiating a procedure whereby the Plantoid will look for humans willing to help it in the process of reproducing itself—physically building another Plantoid in exchange for bitcoins.

ICOs, artist tokens, and crowd funding

Blockchain and smart contracts can also be used by artists to fund their projects through token sales, creating their own artist coins or using it as a crowdfunding or crowd-investing tool.

Tatiana Moroz pioneered this field in 2014 by issuing the first artist currency, Tatiana Coin, long before ICOs and token sales became a mainstream application. Owners of TCs could redeem them for members-only rewards including autographed memorabilia, advanced copies of music, merchandise, and access to exclusive events, and also custom music, house concerts or sponsorship opportunities. With Ethereum, token issuance and sales have become easier, and we are likely to see more artist coins emerge in the future.

Other References

<http://theartnewspaper.com/news/blockchain-how-the-revolutionary-technology-could-change-the-art-world/>

<http://financeandsociety.ed.ac.uk/article/view/1724/2238>

<http://www.coindesk.com/blockchain-technology-inspiring-art/>

¹⁰² <https://blockchainhub.net/smartchain>

¹⁰³ <https://cointemporary.com>

¹⁰⁴ <http://myceliaformusic.org/2016/05/14/imogen-heap-decentralising-the-music-industry-with-blockchain/>

¹⁰⁵ <https://artlery.com/>

¹⁰⁶ <http://www.coindesk.com/mediachain-blockchain-tech-next-spotify/> and <http://www.coindesk.com/spotify-acquires-blockchain-startup-mediachain/>

¹⁰⁷ <https://medium.com/@SingularDTV/anatomy-of-singular-dtv-vs-code-centrally-organized-distributed-entropy-cd7285d63549>

¹⁰⁸ <http://digital.udk-berlin.de/?students/kolling-paul/projects/ss16.terra0/>

¹⁰⁹ <http://okhaos.com/plantoids/>

