> Mass Distribution

A conceptual framework for
imagining futures of retail

SPACE10

EXPLORING EMERGENT FUTURES

DISTRIBUTED EVERYTHING

ROYAL COLLEGE OF ART

FAB CITY

Exploring Emergent Futures is a Platform (pathway) on the Design Products programme at the Royal College of Art in London. It sees itself as a lab for rethinking what and how we make, in light of what we now know and hope for. As such the Platform challenges designers to ask and respond to big meta-questions relating to where humanity is heading and how do we want to live. Their method is to explore possible futures and responding with tangible outcomes.

The Platform is led by Senior Tutor **James Tooze** (designer and researcher) and Tutor **Tomas Diez** (urbanist and researcher). During the project the students were also tutored by **Gavin Pryke** - Senior Program Director London, UK for Luma Institute. **Jonathan Chapman** - Professor of Sustainable Design, Director of Design Research, Brighton University and **Cameron Tonkinwise** - Director of Design Studies at the School of Design at Carnegie Mellon University.

Platform students are **Jack Herring, Katrine Hesseldahl, Florence Melrose, Tolu Odusanya, Victor Strimfors, Panagiotis Velentzas** and **Alex Bygrave**.

SPACE10 is a Copenhagen-based future-living lab. It's purpose is to explore and design innovative and responsible business models for the future. It's mission is to enable a better, more meaningful and sustainable life for the many people. Space10 is proudly supported by Inter IKEA Systems, and serves as a non-commercial interface for IKEA Concept Innovation.

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› Introduction & Context

We are living at a time of great change, where the convergence of technological advantages are putting humanity in a state of transition to new socio-economic paradigms. Over the last few decades digital revolutions in communications and computation have dramatically disrupted the entire economic and production ecosystems; globalisation has been only possible thanks to the real time communication and logistics management of digital tools and infrastructure. The digital revolution is reshaping how we interact with each other, how we eat, sleep and live, how goods are bought and sold, how products are designed and manufactured, what gets produced and who gets to be involved. While these tools have optimised the production chain within industry, and improved the efficiency of markets, they (alongside population growth) have created massive social and environmental consequences, which are now becoming more and more evident.

With a third digital revolution, this time in fabrication, the industrial model of manufacturing is entering a significant paradigm shift. We are also in the midst of an industrial revolution (industry 4.0) where the integration of automation, large-scale use of data and digital technologies is transforming most industries. Alongside this there is a democratising of knowledge, plans and means of production: the information to produce a product (or 3D printer) can be distributed and replicated at zero or marginal cost and can then be produced on demand by or close to the end user using digitally enabled tools (3D printers and CNC machines, etc). The technologies, systems and associated mindset of this production model is on the march.

There are literally thousands of designers and makers in the 1000+ Fab Labs, universities, start-ups and beyond that not only believe that the manufacturing of custom products can happen close to where products are wanted but are building this reality. There is now unprecedented access to new tools, platforms, and creative forces to enable people to shape the world around them. Through the exponential rise in the number and spread of Fab Labs and open fabrication spaces people are increasingly able to access laser cutters and 3D printers as well as flexible manufacturing tools such as CNC routers, waterjet cutters and other medium scale industrial tools. Alongside this, advances
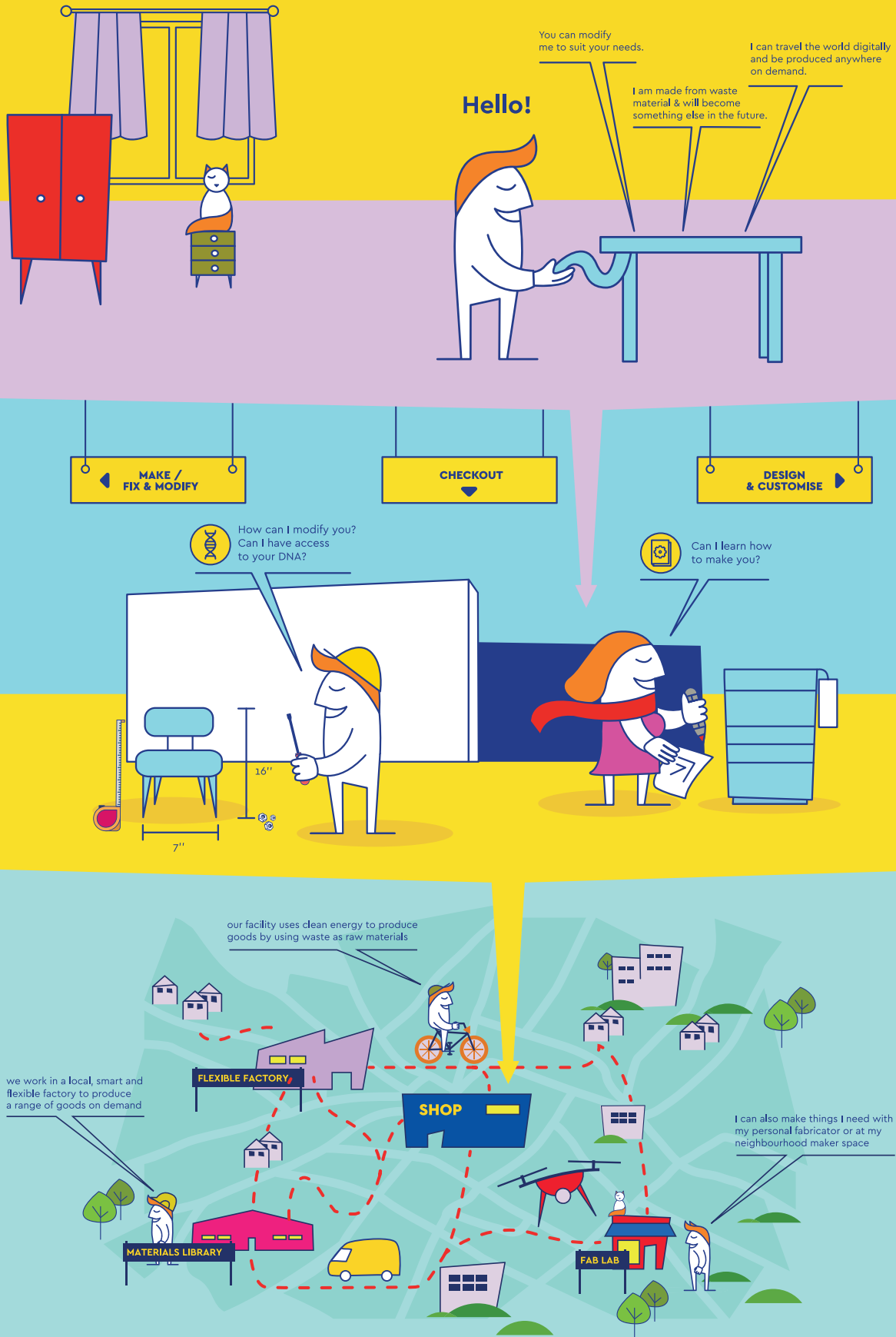
Figure 1

are being made in artificial Intelligence algorithms that are capable of optimising logistics and decision making for design and manufacture. Blockchains are enabling product and material tracking, new relationships in supply chains through smart contracts as well as alternative economies to flourish. These advances together indicate wholly new ways to organise and manage production that have the potential to disrupt the incumbent model of mass production and global distribution.

Now is a time where the repercussions of consumer abundance, and the limits of our industrial system, are not only becoming apparent but an imperative for change. As we reach the physical limits of the extractive and linear models that have been the norm for the previous industrial revolutions, we have a newfound obligation to mitigate the consequences of mass production and consumption and create situations where abundance and sustainability are interwoven. The Circular Economy is a reimagining of industrial and societal practice where material resources are not disposed of at the end of a product's use life but kept in cycles and spirals of continual reuse. This industrial scale resourcefulness will require material recapture, reprocessing and remanufacture infrastructure coupled with product repair, interoperability and design for disassembly.

All of which would result in a highly distributed ecosystem of stakeholders interacting to maximise the value and mitigate the consequences of material use.

In the transition to a Circular Economy and as production becomes flexible, distributed and accessible; where manufacturing gets closer to the end of the supply chain, industry is facing the need to redefine business as usual. Empowered citizens and open innovation can start a new chapter in defining the future of industries and corporations. Social production might be a new way for citizens to interact among each other, to connect with companies, and to sustain life in cities and beyond. We might see a future in which flexible and automated factories powered by clean energy are situated in neighbourhoods to produce on demand what citizens need, using locally sourced materials, and tools provided by companies like IKEA. This is a vision where citizens co-design with companies using modular or parameterized designs and goods are produced using a broad spectrum of technologies and in particular digitally driven production tools. In this future cities will become a complementary ecosystem for local production of things, food and energy, and citizens will be able to exchange values embedded in products, in a distributed way. What roles could a global company play in this future?

> Project Outline

It was in the context of highly distributed production, material circularity, open design, hyper customisation and low impact products and production that **SPACE10** and the **Exploring Emergent Futures** Platform (EEF) at the Royal College of Art, London, joined forces to explore a future of retail. The project was titled **Mass Distribution**, as a counterpoint to mass production and mass consumption, where the distribution of production tools gives rise to the distribution of access, agency, responsibility and management in the design and production of the things a society uses.

The project asked designers to explore: what could the future look like when almost anyone could design and make almost anything, anytime and anywhere? How would customers play a role in designing, making and remaking products to their liking? What would retail stores be like if they are no longer places to sell mass produced items but rather new linkages between supply and demand? What would the future look like if things could be made when wanted, close to customers and be low impact? What could new retail experiences be like in a "digital" and "circular" economy?

As part of the collaboration, EEF was challenged to develop a **conceptual framework** to act as a catalyst in imagining futures of retail in the context of highly distributed manufacturing in a circular economy. The framework was developed through dialogue and workshops with EEF students and tutors and influenced by the students individual responses to the overarching context of Mass Distribution. This conceptual framework forms the basis for developing future scenarios and concepts and was tested at SPACE10 in a workshop with IKEA teams and local designers. In December 2016, EEF Design Products students presented original insights and exhibit their personal projects at SPACE10. The SPACE10 community were invited to a special SPACE Talk called "From customers to collaborators and custodians"

Link to speakers **>** https://www.space10.io/program/space-talk-from-customers-to-collaborators-and-custodians

Link to talks **>** https://medium.com/@space10/from-customers-to-collaborators-and-custodians-key-takeaways-from-an-evening-on-a-future-of-retail-5e9cb684617#.lnvnlqne0

Figure 2

Figure 3

> Conceptual Framework

The **Mass Distribution Conceptual Framework** was created as a result of a workshop with EEF students at the RCA.

During the workshop common threads from the student's research and thinking were discussed and synthesised, resulting in a matrix of **5 major shifts** for the near future and **5 directions for the future of retail stores**. At the intersection of each, new propositions can be created by looking through 4 areas of change: people, objects, spaces and city.
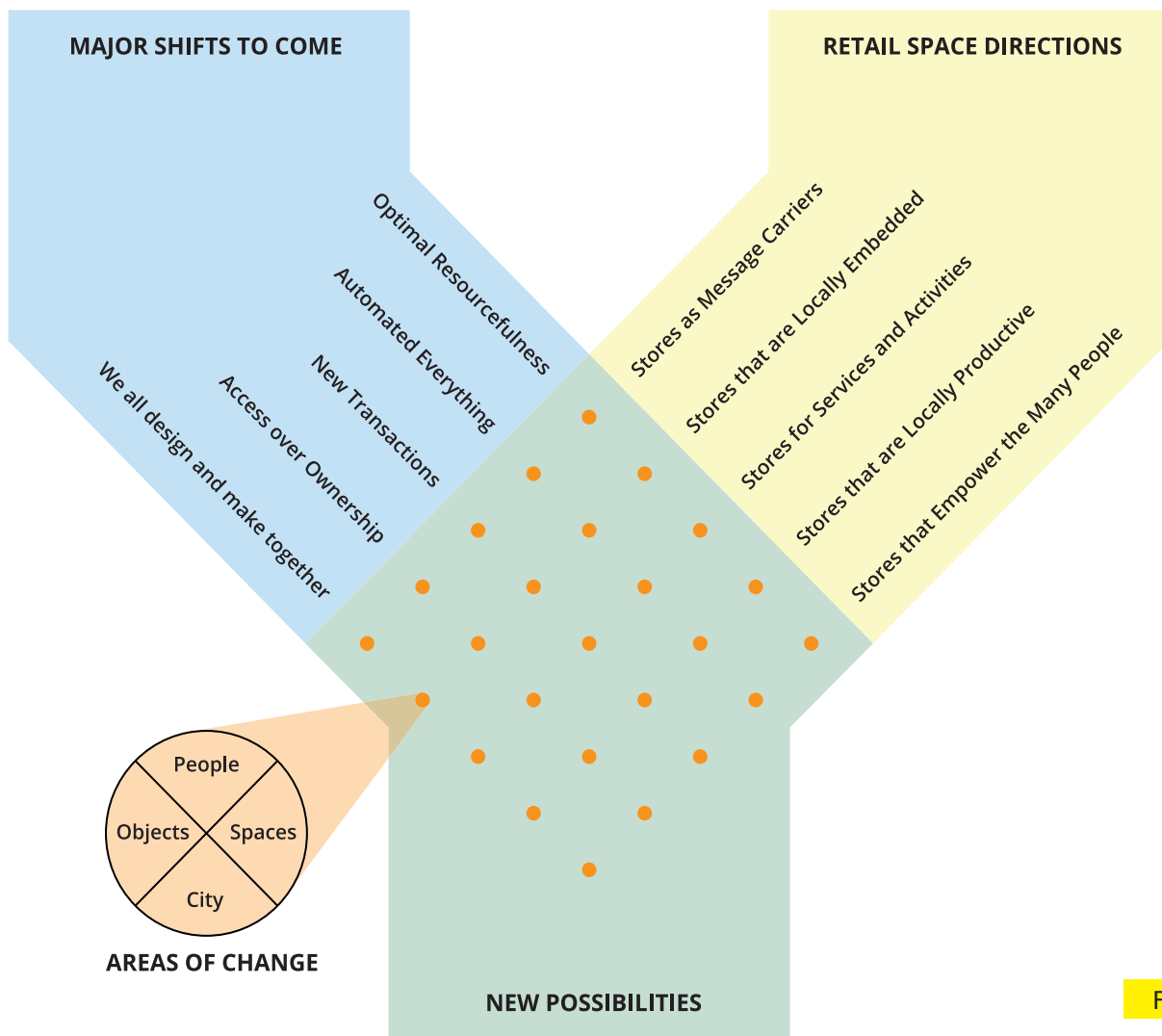
MAJOR SHIFTS TO COME

RETAIL SPACE DIRECTIONS

Optimal Resourcefulness

Automated Everything

New Transactions

Access over Ownership

We all design and make together

Stores as Message Carriers

Stores that are Locally Embedded

Stores for Services and Activities

Stores that are Locally Productive

Stores that Empower the Many People

People

Objects | Spaces

City

AREAS OF CHANGE

NEW POSSIBILITIES

Figure 4

People > attitudes, behaviours, practices, demographics, ways of organising, abilities, capabilities, opportunities, needs, desires, demands, expectations, cultures…
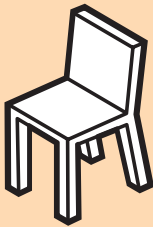
Objects > functions, aesthetics, cultural values, lifespan, materials, finishes, modularity, customisation, repairability, recyclability, provenance, affordances, price point…
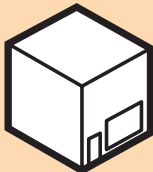
Spaces > location, size, customer experience, facilities, roles of staff, type of stock, core offering, role in the supply chain, connection to digital services...
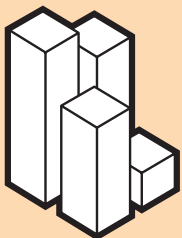
City / Neighbourhood > location, geography (physical and social), demographics, economics, cultural make-up/mix, infrastructure, history, politics, community spirit, institutions, resources…

Figure 5

> Optimal Resourcefulness

What if all materials were treated as precious resources? if instead of being consumers we thought of ourselves as custodians? What if materials could be tracked and be available in a transparent ledger that allows them to be resources for infinite production in neighbourhoods and cities? What if those materials come from urban mining practices? Blockchain technologies are proposing a new revolution on the information economy, and we are just at the beginning of it. As wasted materials become resources for re-production, we need to envision how new forms of information distribution can help supply chains to involve more complex dynamics, in which collection, distribution and processing are re-located in the urban environment, opening new forms of behaviour in retail spaces.

Figure 6 | RSA - Great Recovery - www.greatrecovery.org.uk

> Automated Everything

What if flexible factories exist in our neighbourhoods with their production line changing many times a day based on custom demand coming from local people? Artificial Intelligence and Robotic Fabrication seem to make a perfect match to re-locate production closer to consumption. Flexible factories (or Industry 4.0) are in the agenda of large manufacturers and governments; new infrastructure will populate our urban environments, making possible to produce closer to where things are consumed. A top level layer of algorithms could make this process more informed, and for sure will bring challenges around the future of labour of humans in an automated society.
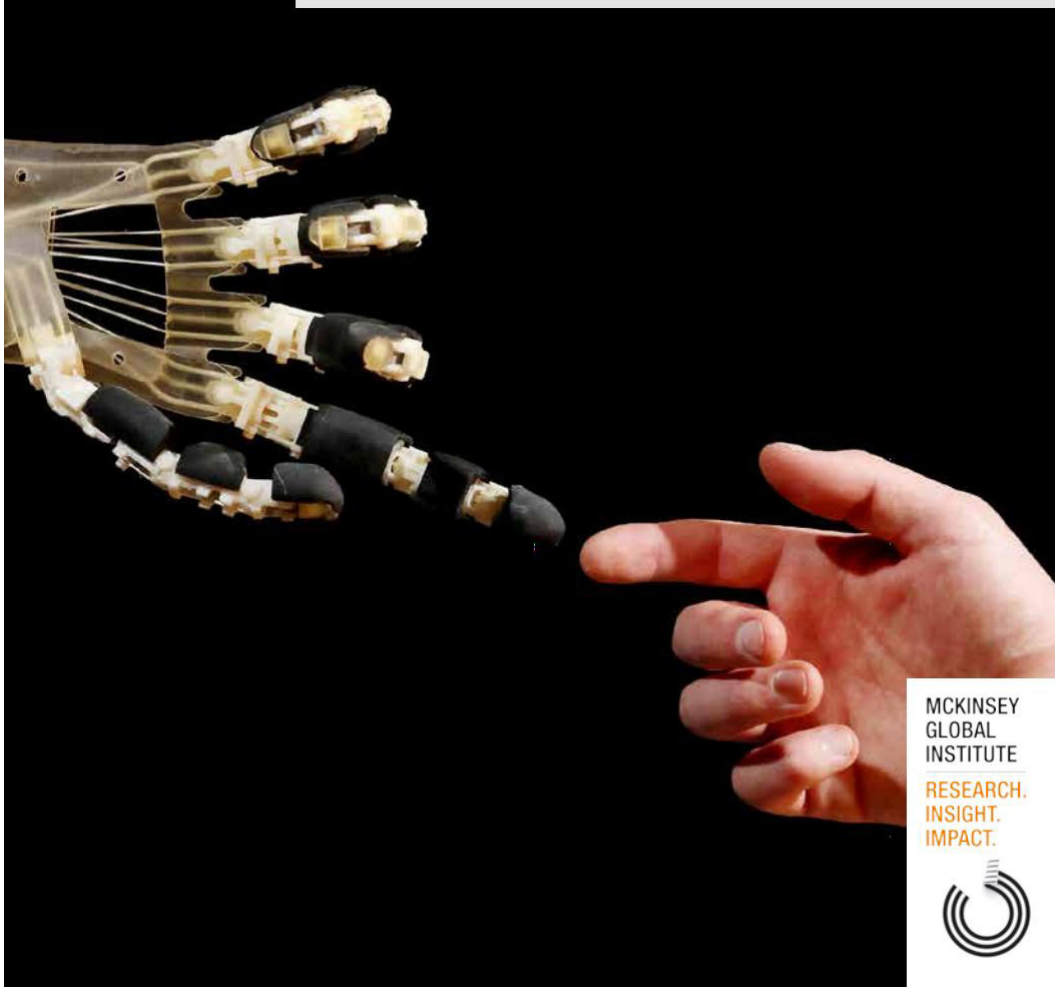
Figure 7

> New Transactions

What if we could carry other types of value in the transactions we make every day? Cryptocurrencies could allow anyone to make their own money; to support local produce, for communities, interest groups or to encourage new behaviours and trade. The upcoming re-collapse of the financial system is powering new forms of value exchange. Bitcoin has revolutionised the way we understand money, and will affect largely the future of our economy. We can add new layers of complexity to materials as value carriers, and use them as currency, in the same we could do with trash or energy. When so much value is distributed and embedded in our everyday life we need to have new forms of exchange and interaction at the retail scale

APPLICATIONS

It's true to say that anything that can be written in code, can run in the Ethereum network. Some of the predicted application fields for Ethereum include:
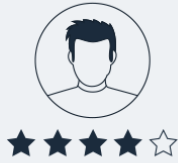
Reputation Systems

Registering Contracts

Messaging Systems

Individual Currencies
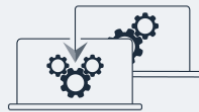
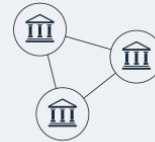**Property Management**

Online Voting

Social Networking

Finance

Trading Computer Resources (CPU time, HD space)

Decentralized Governance

THE MOST EXCITING APPLICATIONS OF ETHEREUM ARE PROBABLY THE ONES THAT WE HAVE NOT EVEN THOUGHT OF.

Vitalik Buterin, Creator of Ethereum.

Figure 8 | Ether & Ethereum - https://www.ethereum.org/

> Access over Ownership

The rise of the collaborative economy, made famous by platforms such as AirBnB and Uber, allow asset owners who were previously outside of a market to become service providers, and in doing so disrupt established businesses. These platforms can simplify transactions for users but in the process they centralise power and control in the hands of the platform operator. New trends in consumption patterns are moving towards a need to access products for specific time-spans, rather than owning something forever or treating products as disposable. We need to envision new forms of accessibility to production means, what collaborative production scenarios might look like? Are Uber style retail spaces the only option for collaborative production? and if so who will own the materials, infrastructure and information?

STREETBANK IN NUMBERS

THE TIMES "One of the 50 websites you can't live without"

£30
The value of the average thing shared

£1,500,000
The value of everything added on Streetbank so far

184 tons
Saved from landfill in 2014

1,500
people are meeting through Streetbank every month

£22,000
The amount saved per month

81
The number of countries where Streetbank has members
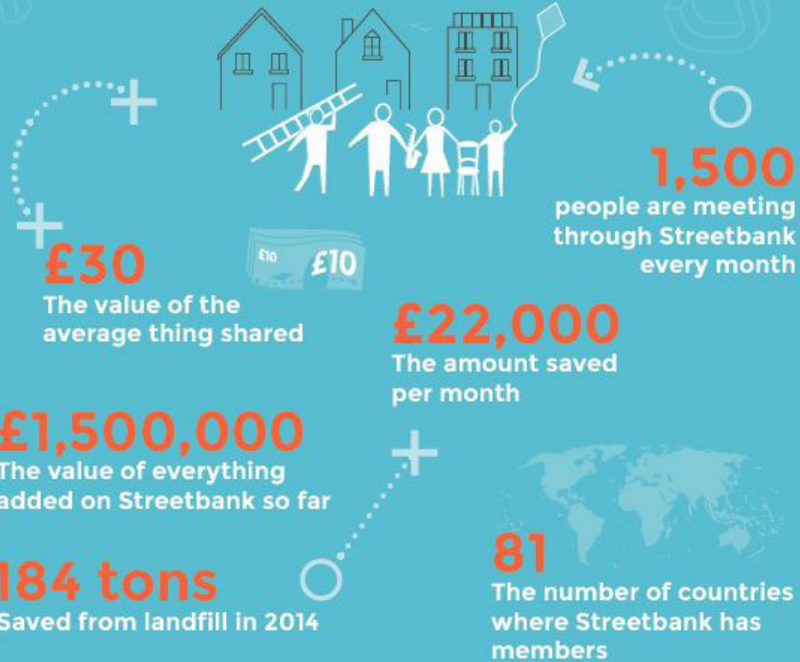
streetbank

Streetbank allows you to enjoy all the things within 1000 yards that your neighbours are willing to share.

Figure 9 & 10 | www.streetbank.com

> We All Design & *Make Together*

Over the last 100 years successive shifts in design and manufacturing have democratised access to well designed and produced goods. We now live at a time when the democratisation is happening at the design stage. Large own brand manufacturers are creating products as platforms allowing customers to customise non standard products. What will happen when customers are allowed more freedom to create, to modify and to become part of the assembly line, reducing and optimising costs, and developing a different relationship with the people they serve. We are already seeing the implementation of open source designs and open fabrication spaces in viable businesses, the consumer-designer-producer is already here and on the rise. Retail in a new form may be consist of: social making, crowd-sourced designing, flexible supply chains and experience based relations

Figure 11 & 12 | **Kniterate** - www.kniterate.com

> Directions for Future Retail Spaces

Stores as message carriers > Using the retail space in its entirety to communicate new values, approaches or ways of doing - beyond messages in the store to the store as a message / messages. The need to tell new stories was often discussed during the project, the circular economy is for the most part a paradigm shift and will require people to have new expectations from the things they use, the companies that provide these and for themselves. In the near future of retail there is a role for the whole store to play in telling new stories and contributing to positive change.

Stores that are locally embedded > Retail stores / spaces that connect to other local infrastructure in reciprocal and complementary ways. A store as a local resource or facility. In considering the unification of hyper-local production and retail it will be inevitable that stores will have a role to play in where they are situated. The question for this future is the degree to which they add value to their local area as well as leverage and support local infrastructure.

Stores for service and activities > With the possibility of services replacing the need to own products and new product offerings that allow customers (as participants and collaborators)

to shape or reshape them, we will see stores reshaped and retooled to facilitate this. Arising from two directions, this future combines the rise in interest in making, customising, modifying and repairing products with the product as service logic of the Circular Economy (producers / retailers retain ownership to better manage recycling / repair). If stores sell the experience of making something or play a greater role in the maintenance of the products they lease we will see new types of stores.

Stores that are locally productive > With the rise of digital fabrication and drives for locally produced food and other goods how mights stores change to producers and what might be produced? The current industrial revolution is being driven by automation, one vision is for mega factories full of robots churning out products with only a few people about to manage and maintain them. But there are other futures to imagine: ones where small scale and flexible automated tools are used to make highly custom products on demand, ones where automation (and other digital technologies) can enable small scale operators to increase their productivity, cooperate together and

Stores that empower the many people > Retailers such as IKEA have democratised access to well designed goods, how might they democratise access for people to respond to their own needs creatively as designers?

Figure 13

Figure 14

> Using the Framework / workshop

The conceptual framework is a mechanism to spark new possibilities, specifically by helping to generate ideas about what is possible at the intersection between major societal and technological shifts and future directions for retail spaces. It is intended to act as a catalyst for discussion and concept generation for not only new types of retail experience but to also new roles for retail spaces, new relationships with local communities, new ways to create value, new ways to create products and new types of products. The framework was envisaged as primarily a tool for teams to use and for running workshops. To test it, it was used for short sprint workshop at SPACE10, outlined below.

> IF THESE THEN WHAT? Workshop

Participants - SPACE10 staff, IKEA staff, RCA students, and invited guests

Equipment needed - Standard stuff (tables to work at, pens, paper, post-it notes, etc) Prior to the workshop - All participants had a good knowledge of the subject areas (see reference materials), most were designers or involved in concept development.

Teams - for this workshop there were 5 team made up of 3 to 4 people (with a mix of participants) with each focussed on one of the 5 major shifts.

Duration - 4 ½ hours (plus breaks) Outcomes of the workshop: Teams were asked to 1) imagine prototypes / pop up stores or trials that could be run to test a new retail experience 2) select one to develop into a proposal and 3) communicate their concept for others to understand.

> Running the workshop:

Context / outline - 20 mins) Introduction to the framework and the workshop (by James & Tomas) covering the overarching context, the purpose and use of the framework. The workshop asks participants to answer the question of **IF** (a major shift is happening and stores are acting in one or more of the potential directions) **THEN WHAT** can be expected or imagined in the 4 areas of change? What potential opportunities or challenges can be envisioned for: people to have new experiences, new kinds of objects or ways to create objects, new types of spaces or

roles of spaces, new services, new locations or configurations for spaces and new connections for spaces to have within the neighbourhoods they are located.

Introductions - 20 mins) Participants introduce themselves to their teams; their roles, background and interests relating to the subject matter.

Generate ideas - 60 mins) Teams create 5 mini briefs using their given major shift combined with each of the 5 future retail directions. These are worked through in turn and ideas are discussed using the 4 areas of change to seed new possibilities. Use post-its and paper to record / develop ideas.

Feedback - 20 mins) Taking their 3 strongest concept each team gives short / compact pitches to the others.

Develop - 60 mins) Teams choose 1 concept to develop into a proposal for a prototype / pop up store or trial that could be run to test a new retail experience.

Communication - 60 mins) Teams create illustrations or other material communicate their concept for others to understand.

Exhibit - 20 mins) Illustrations / communication materials are put up on wall around the workshop venue for other teams to look at. The work needs to speak for itself which is important in order to capture the idea in the fullest or most concise for future use.

Pitch & feedback session - 40 mins) Teams take it in turns to present back to the others in the style of a short pitch and feedback is given using the Rose, Thorn, Bud method used by Luma Institute (www. luma-institute.com). This method asks for each participant to identify one positive, one negative and one new addition or insight.

After the workshop - The purpose of generating new concepts should not be purely academic or as an exercise, the intention in developing the framework is to create ideas to test and strategies to test them. In developing it with SPACE10 and running it with IKEA we hope that some of the ideas can feed into future concepts or be developed and tested in their own right.

Figure 15

Figure 16

> Outputs from the Workshop

Optimal Resourcefulness

Group's vision > They imagined that cities would contain communities of production, where a mixed economy of products can be made using neighbouring communal facilities and where designing and making are normal everyday communal activities. They looked at this future change through the lenses of stores being locally embedded, locally productive and that empower the many people. The concept posits that the ever-increasing densities of cities will bring together high concentrations of people with broad skillsets that can form interdependent cooperatives. This type of production would be enabled by a system of digital tools and platforms that allow everyone within the community to participate in designing, customising, making and repairing. This system would also act as a task allocation platform (like www.taskrabbit.co.uk) where supply and demand are dynamically met. Members of the community both post the items they want making as well as share their skillsets and interests, thereby offering jobs through a dynamic market to those who are willing and able to fulfil them.

It is imagined that this communal approach to production would enable intergenerational and interdisciplinary skill sharing. This type of production ecosystem would encourage human interaction (acting as a counterbalance in the digital age) would inevitably encourage the concept of communal sharing, which would then result in logistical reductions in comparison to how products are made today. If these types of community production systems existed across many cities it would remove much competition between those cities and allow for mutually beneficial collaborative development, in production technologies, the facilitation platform and in the design of goods and services. Through the use of digital fabrication technologies and design tools would result in the potential for customisation from standard design types as well as bring about a higher emotional connection between the user and objects.

An example of how this might manifest was imagined in the form of a tower block optimised for making bread and pizza. It would have a rooftop farm and a ground floor communal area housing a workshop space, kitchen restaurant and shop with residential space in the floors between. By having a maker-space within the neighbourhood would allow all of the tools/objects used to be fabricated, repaired and upgraded locally.

How to test > It was imagined that this concept could be first tested by running an interactive workshop within a mocked-up new retail environment. This prototype store would allow consumers to 1) participate in the manufacture and fabrication of products if they wished, where they are guided through the fabrication of each component to make a finished product or 2) customise an existing product through a digital platform for themselves to make or to offer to others to fabricate. The journeys taken by the customers would serve to test assumptions about people's willingness and desire to engage in design and fabrication for material goods as well as validating if this establishes an emotional connection.

Figure 17

Automated Everything

Group's vision > It was imagined that in the near(ish) future IKEA has become a personalised automated shopping experience. The group's focus was on new experiences of retail offered by distributed production and at the heart of this are local, hi-tech, flexible and adaptive stores which only display products relevant to who is visiting. Underfloor robotic storage would be used to automatically select and display relevant products, the internal architecture of the store would adapt to suit the products currently on display. Big data, gathered from social media, live shopping habits and news are used to adapt the in-store stock so that it is always relevant to the local community. As customers enter the store they are directed toward a specific area, which by analysing online activity has adapted to display specially curated items that best match what the customer might be looking for. When purchases are made a product is then delivered to a specified address from a satellite (outside the city) automated storage facility and made to within custom parameters en-route in driverless micro factories. There is no longer any need for huge storage within stores, the out of town giant blue box is a thing of the past.

How to test > The group imagined that this experience can be tested as a pop-up installation. From the customer's perspective the store would be an automated magical experience. However, for the pop-up this would be a mechanical turk - an illusion, managed by people behind the scenes. The purpose of this store would be to gauge people's reaction to the concept of adaptable transformable personalised small inner-city stores.
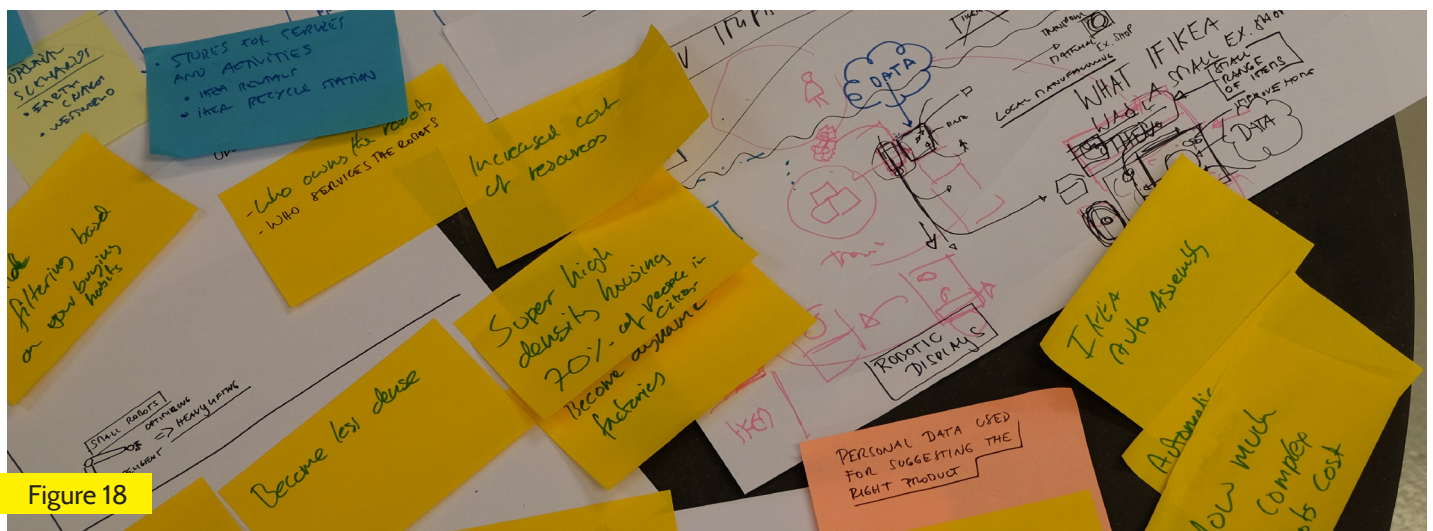

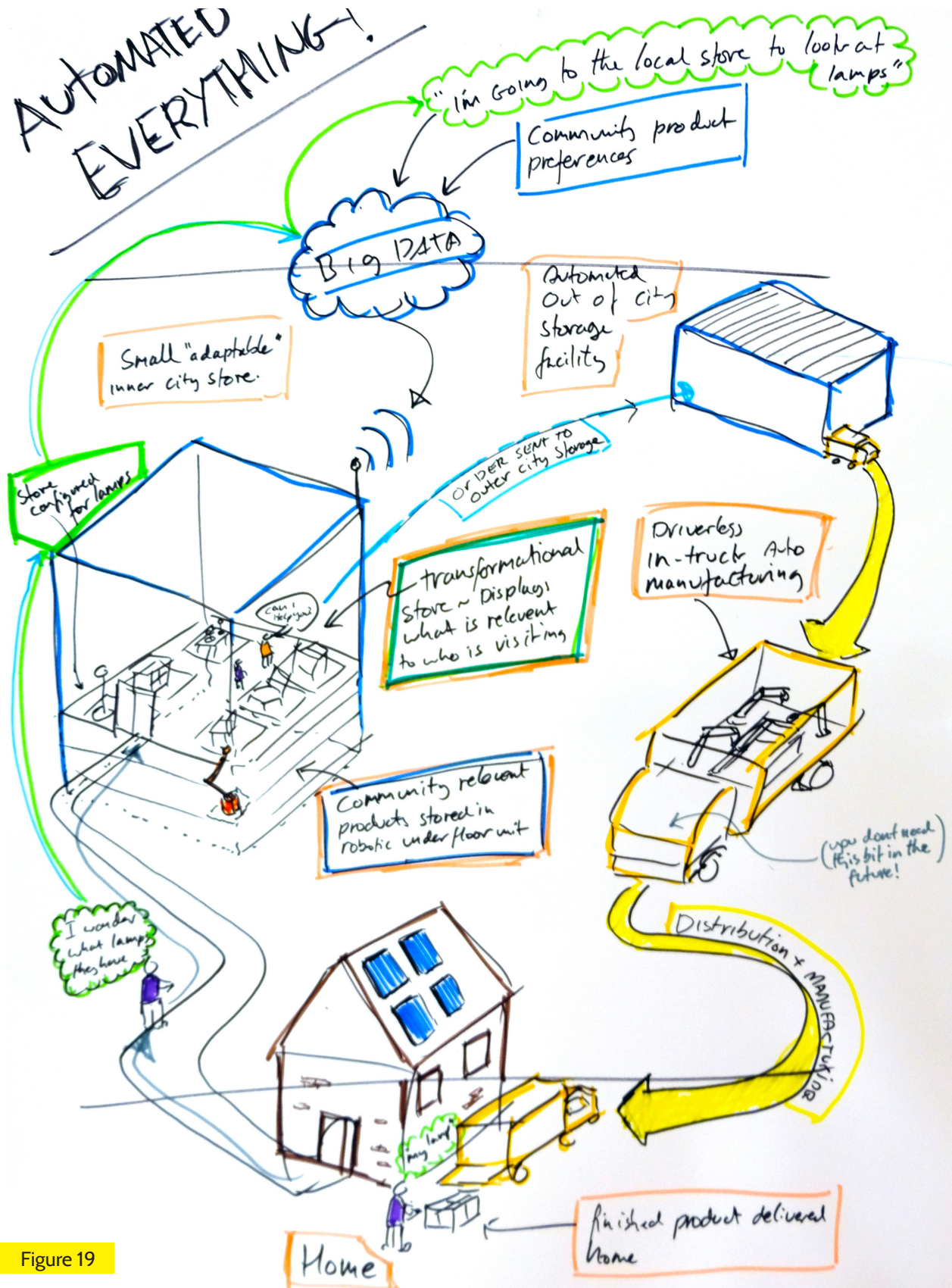Figure 18

AUTOMATED EVERYTHING!

"I'm Going to the local store to look at lamps"

Community product preferences

Small "adaptable" inner city store.

Big DATA

Automated Out of city storage facility

Store configured for lamps

transformational Store ~ Displays what is relevant to who is visiting

Order sent to outer city storage

Driverless In-truck Auto manufacturing

Can I Help you?

Community relevant products stored in robotic under floor unit

(you don't need this bit in the future!)

I wonder what lamps they have

Distribution + MANUFACTURING

finished product delivered home

Home

New Transactions

Group's vision > Their concept was centred on the recyclability and short lifespan of many plastic products and packaging. They imagined a system where customers could earn tradable points (using a cryptocurrency) by feeding plastic waste back into a productive system. Using barcodes that appear on most plastic packaging, information regarding the material properties / plastic type could embedded allowing for identification and sorting.

This scenario is based on the development on 1) an mobile application that acts as digital wallet for a user's points, 2) a digital platform to manage the data and transactions; holding materials and product data and being used by companies/orgs that are trading plastic waste with 'collectors' and 3) re-vending machines that collectors can feed plastic packaging into, for it to scan and then add credit to a collector's wallet 4) certified retailers that use this recyclable material in new products and also offer goods that can be purchased using a collector's points.

Further into the future a next step could be to move on to home collection; where a domestic smart bin with a barcode reader could automatically sort waste into appropriate streams, enabling the process

to be untaken at home and allowing collectors to more easily earn points from a range of materials.

How to test > In many countries where bottle recycling is the norm people often get back a deposit when they return these to a store. To test this concept it would be possible to prototype a re-vending machine with a barcode scanner capable of taking a wider range of packaging and validate if people would be keen to use it. Some work would be needed to be done to test the viability of the economics for such a system but with new laws in place that favour recycled or reused packaging it may well be feasible.
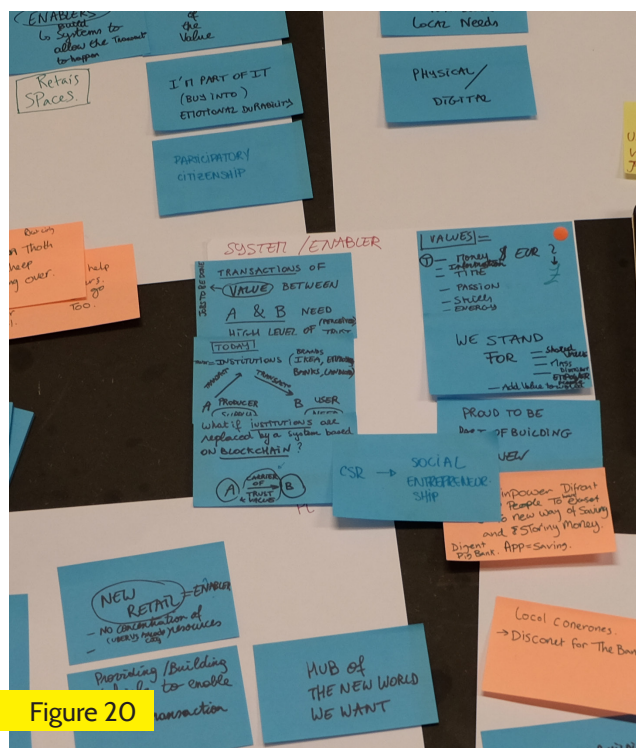

Figure 20

We all design and make together

The group's vision > Retail spaces were reimagined as filters for the city; taking in materials and products that are considered waste or unwanted and transforming them into desirable and useful goods. These future factories are both a store and production facility; acting as places where the community can bring their old stuff and get new products in return. These hyper efficient facilities will maximise the value of all materials, where everything that enters will be used again in some way, either by renovation, repair, reprocessing or recycling. Meaning that in the case of furniture, this could result in recondition items, customised or mash-up objects, pieces broken down into parts, the creation of composite material products or passing on materials to recyclers. This means that what is produced is highly dependent on what the inputs are and the facility/ies would need to be highly flexible and responsive.

How to test > Much of these activities happen already across businesses small and large, the challenge is to workout how this capacity can be integrated into particular types of stores that specialise in certain products or material groups. Experimentation needs to be made to trial how such a store would function, as well as what the customer experience would be. This can be done by taking existing initiatives (reuse and repair), adding flexible production technologies and putting this into the context of high street retail.

Access over Ownership

Group's vision > Recognising that what users find valuable in a product differs depending on whether they own it or have access to it. Criteria such as function, symbolic status, emotional attachment and style are really important for owners of products. However, when users access products via subscriptions, criteria such as the core values of the brand they are subscribing from, the ease with which they can get what they need when they need it and the relationship they have with the vendor are key.

By asking the question: how can a retailer become an agent for the continuous recycling of material? This group developed a concept based on the work of RCA students (Kat and Victor) where for landlords and tenants use a subscription model for furniture that enables tenants to create their own spaces without the need of removing bulky furniture each time a tenancy changes. This concept is imagined to also encourage the circulation of second hand furniture.

Concept - Landlords rent standard packages of furniture for their properties from a provider over a certain period of time (10 years for example). Tenants rent the furnished apartments from the landlord and the furniture subscription is paid for through their rent. When the tenants move into their apartment, basic furniture for living functionally is already there. In addition they get given an amount of "points" which they can spend with the same provider for additional products to make the apartment fit their specific taste and needs. The extra furniture is then included in the subscription the landlord holds. When buying these products, tenants can log on to the company's website and choose from a range of new or used products. The second hand products would cost less "points" than new products, incentivising the continued use of material in products (rather than recycling them). The website would ideally connect users that were geographically close and connected to the same subscription scheme.

How to test > It is proposed to trial the subscription model for a small number of products that landlords would often buy for furnished apartments (sofa, bed, chairs) in one neighborhood to begin with. Connect the users in the online community platform to see if they would actually use the opportunity of buying/ swapping from each other using the points.
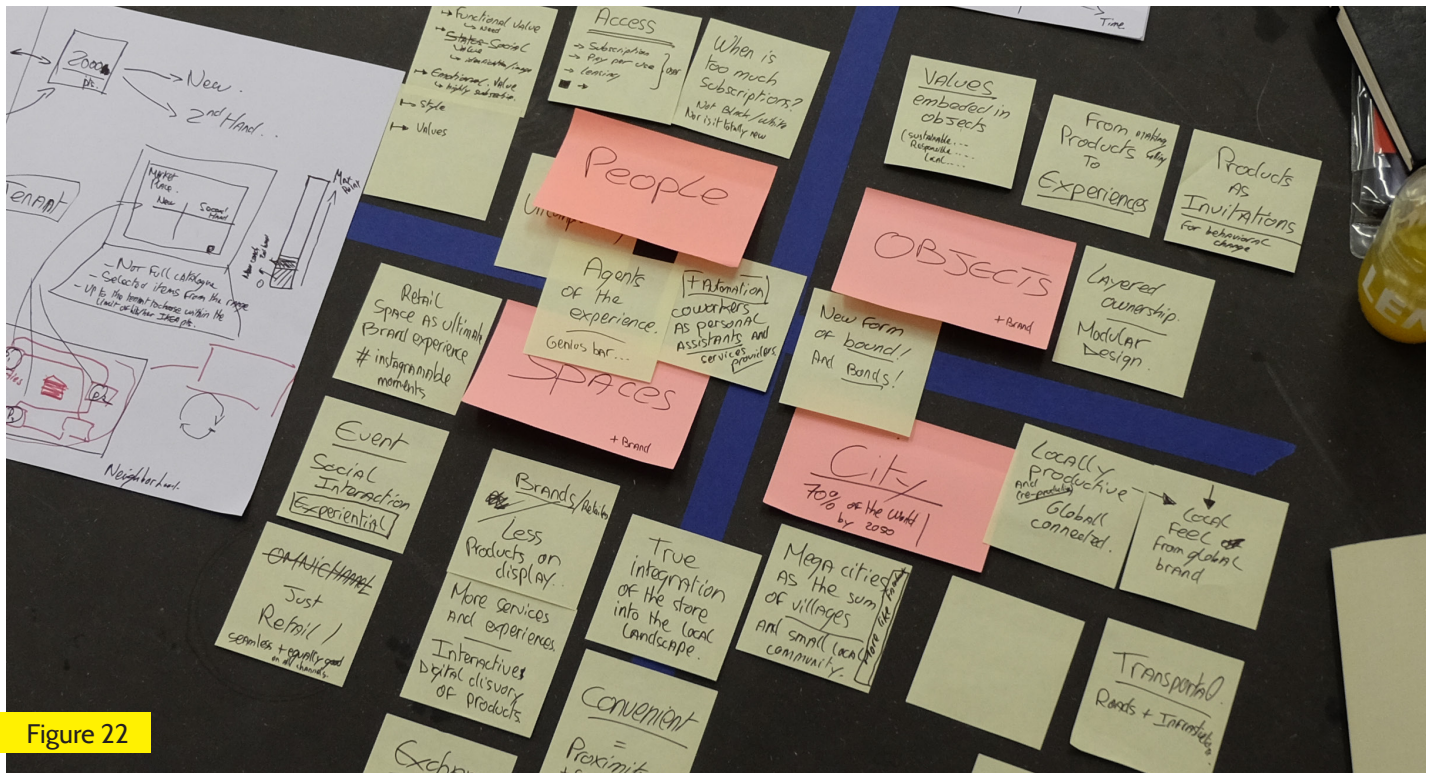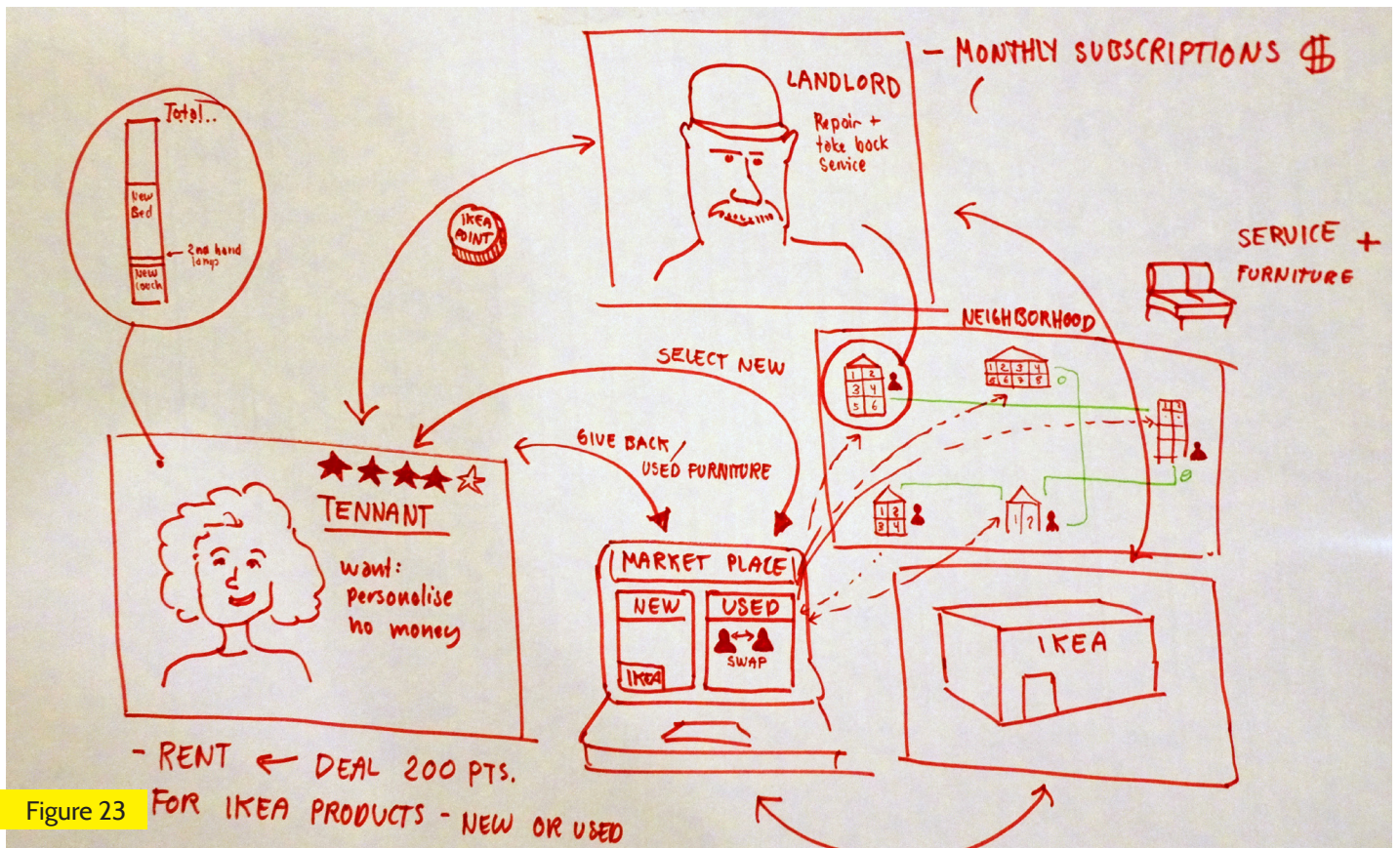
Figure 22

Figure 23

Figure 24

› RCA Student Projects

The collaboration between Exploring Emergent Futures (EEF) & SPACE10 challenged EEF students to respond in their personal areas of interest to the following questions:

Q1) Is it possible to change the consumption paradigm of our times by designing products that carry new values and messages?

Q2) In the future of retail is it possible and desirable to bring production on demand close to consumption, and indoing so, to make the customer part of the design and production process?

Q3) How might retail stores of the future look and work? how might they be prototyped in different contexts and what are the strategies and challenges for particular places?

In addition to tutorials throughout the project with EEF Platform tutors students participated in the following activities:

> 15th of October (RCA) Design Methods Workshop #1 with Gavin Pryke - Luma Institute.

> 17th of October (RCA) Project Launch Workshop with SPACE10 team.

> 22nd of October (RCA) Design Methods Workshop #2 with Gavin Pryke.

> 7th of November (RCA) Design Methods Workshop #3 with Gavin Pryke.

> 7th of November (RCA) Framework development workshop with James Tooze

> 22nd November (RCA) Roundtable discussion with Cameron Tonkinwise and invited experts for - **Transtion Design & Redistributed Manufacturing** as part of the Future Makespaces in Redistributed Manufacturing research project at the RCA
> 22nd November (RCA) Feedback session with SPACE10 team, Gavin Pryke and Jonathan Chapman.

> 23rd November (RCA) Tutorials with Cameron Tonkinwise.

> 6th of December (SPACE10) Student project exhibits and presenations.

› Figures

Fig 1 - illustration by Christina Biliouri

Fig 2 & 3 - photography courtesy of SPACE10

Fig 4 & 5 - illustrations by James Tooze

Fig 6 - www.thersa.org/globalassets/pdfs/reports/the-great-recovery---designing-for-a-circular-economy.pdf

Fig 7 - www.mckinsey.com/global-themes/digital-disruption/harnessing-automation-for-a-future-that-works

Fig 8 - www.genesis-mining.com/img/Version3/infographic/what-is-ethereum-004.png

Fig 9 - streetbankimages.s3.amazonaws.com/Welcome%20to%20Streetbank.JPG

Fig 10 - iomfoe.org/wordpress/wp-content/uploads/2016/05/streetbank-explained.jpg

Fig 11 & 12 - www.kickstarter.com/projects/kniterate/kniterate-the-digital-knitting-machine

Fig 13 to 24 - photography by James Tooze

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