HYBRID
Playful
Experiences

Playing between Material and Digital

GAME RESEARCH LAB

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HYBRID **Playful** *Experiences*
Playing between Material and Digital
Hybridex Project, Final Report

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Some of the future's most important product innovations will be made at the borderline of **physical and immaterial** *realities. New technologies enable development where immaterial products become materialized in novel ways, while material products and environment will be augmented with digital services. In this evolution immaterial, digital services will form multifaceted value networks with material products. The creative and playful design solutions and user cultures will form the basis for the utilization of these novel potentials in design of innovative and engaging* **experiences***.*

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INTRODUCTION

Some of the future's most important product innovations will be made at the borderline of physical and immaterial realities. New technologies enable development where immaterial products become materialized in novel ways, while material products and environment will be augmented with digital services. In this evolution immaterial, digital services will form multifaceted value networks with material products. The creative and playful design solutions and user cultures will form the basis for the utilization of these novel potentials in design of innovative and engaging experiences.

This report presents the results of Hybrid Experiences (Hybridex) research project. Hybridex project (2012 – 2014) was a strategic opening focused on the emerging field of hybrid entertainment: products and services that combine digital and material elements in designing playful experiences. The aim of Hybridex was to inaugurate research that would produce new knowledge about the user experience of existing and future playful hybrid services and products – about their design space, possibilities, and different dimensions.

Hybridex was funded by the Finnish Funding Agency for Innovation (Tekes) and the University of Tampere. The research team consisted of Annakaisa Kultima (project manager), Heikki Tyni, Timo Nummenmaa, Kati Alha, Ville Kankainen, Jouni Peltokangas, and Professor Frans Mäyrä. Additional contributors were Olli Sotamaa, Jussi Holopainen, Anu Seisto, and Kati Heljakka. The project steering board consisted of various experts on the relevant fields: Markus Montola (Grey Area/Boomlagoon), Kati Heljakka (Tactic oy), Anu Seisto (VTT), Susanna Kaitera (Tekes), and Riku Suomela (Nokia/Lume Games). The completion of this report was supported by the Hybrid Social Play project that continues the work in hybrid play studies.

How to read this report

This report is divided into seven chapters. This chapter acts as an introduction to the contents of the report and the project itself, beginning with an introduction for the emergence of the field of playful hybrids. The first three main chapters deal with catalysts, cases, and patterns, themed areas which contain the central results of the research project, presented in an easily palatable way. The

same thematic division is used for the Hybridex Deck of Cards, which summarizes these three chapters in a playful form for practical dissemination. The fourth chapter introduces the concept of MurMur Moderators, the main result of the constructive research of the project. The fifth, and final, chapter consists of the research articles written during the project.

The emerging field of playful hybrids

The study of hybrid, playful designs and experiences is rooted in multiple important developments and traditions of thought. Digitalization started to have a deepening impact on how the future of production and human interaction was perceived particularly during the 1980s and 1990s. The initial explorations of digital–material interface suggested dual directions. First, the technological enthusiasm of digital apologists such as Nicholas Negroponte (1996) claimed that true value of media, in particular, is in its contents rather than material existence, and that all media will eventually be digitalized. The unwieldy atoms slow and encumber us, whereas unlocking the full potential of digital bits will be the direction where "intelligence lives" (Negroponte, 1996). Second, it started becoming increasingly clear that our being in the world is deeply informed and shaped by the technologies we adopt and engage within our daily lives. Donna Haraway wrote her "Cyborg Manifesto" (1991) to promote deeper understanding of how our ontology (fundamental way of existing) is increasingly informed by the intermixing of material and biological, as well as technological and immaterial dimensions of social reality. Developed further by Bruno Latour and others, the field of science and technology studies in particular have been influential in emphasizing the interrelations between material things and semiotics, or concepts and socio–cultural meanings. Living in a web of relationships, both humans and material objects play various roles and influence each other in increasingly complex, dynamic environments.

In the research fields related to games and play, materiality and the role of design have gained new and expanded prominence during the last decade. This development has related both to how games as particular kinds of play objects have been perceived, and to the expanding significance of games and play studies to other fields and applications. For example, the "Platform Studies" as promoted by Nick Montfort and Ian Bogost (2009) among several others, aims to focus on the close reading of the materiality of video gaming culture in order to understand the material basis that intermixing hardware and software systems have for cultural, computational expression. In completely another tradition of research, concepts like 'tangible bits' have been used in experimental HCI studies to direct attention and experiment with the different ways in which digital information and capabilities can be embedded into everyday objects and physical environments (see e.g. Ishii & Ullmer, 1997).

Material affordances combined with digitally empowered functionalities open up powerful, new directions for design that are only now starting to unravel. Within this research project, it is particularly the playful, hybrid experiences and design experiments that are at the focus of attention. Playfulness

is a natural accompaniment to dynamic, living material objects, as experimentation and exploration are among the key components of play. Playful experiences in themselves can take many forms, some pleasurable and fun and some otherwise emotionally engaging. It is this potential of enhancing products and services with characteristics that invite users to playful interactions, as well as providing them with touch and feel of tangible materiality, that has driven researchers and developers to explore the rich potentials of this area (cf. Arrasvuori et al., 2011).

Since the combination of tactile and material design with novel functionalities is capable of providing engaging experiences, it is not surprising that entertainment industries have been at the forefront of experimenting with the opportunities of hybrid, material–digital products and services. This research report will showcase some of these developments, ranging from toys that come alive with the augmented capabilities of contemporary mobile 'app ecosystem' to touchscreen games that are designed to intimately link together with collectible gaming figurines. The benefits from such combinations are multiple: digital games and play will gain tactile and tangible characteristics that enhance the usability and ease of manipulation with characteristics that are familiar from e.g. traditional board games and physical toys. On the other hand, the dynamic and "smart" capabilities of computer software, sensors and networks provide in principle limitless opportunities for transforming the mute, physical object into something that can sense, react and invite to rich, playful interactions.

It is obvious that the development of embedding digital with physical is just starting. The miniaturization of electronics and new, flexible manufacturing processes constantly evolve and help to make the hybrid fusion of digital–physical elements increasingly seamless. It is becoming difficult to detect miniature chips, power sources and printed circuitry embedded in various, seemingly common, everyday objects. It is this, constantly advancing frontier of playful hybrid products, environments and associated services that has provided stimulus for research and experimentation carried out in Hybridex project. Combining the perspectives of hybrid design, hybrid user culture and hybrid user value, the research has involved explorations into user experiences that emerge at the borderlines of physical and immaterial realities. The complex value networks that link these developments to their contexts of production, consumption and appreciation are just starting to appear.

Hybridex research project: research areas

Hybridex research project was conceived after identifying the emergence of a wave of new products and technologies which, rather than distancing themselves from material aspects by moving towards immaterial, seemed to embrace the physical user experience as a valuable dimension worth combining with the digital. Seeing this development as a potential upcoming trend for game and toy industries, Hybridex aimed to understand the size, significance and future of the hybrid entertainment field through exploring equally the roots of the phenomenon, what kind of hybrid products were currently on the market, and why these products seemed to be emerging in such numbers. Central areas of interest have been play products that incorporate smart devices into physical toys and

proprietary play products that use a variety of features, such as online connectivity and 3D printing, to introduce new modes of play into traditional forms of toy and game play.

Hybridex research was divided into 5 approaches for examining the area of hybrid experiences:

1. Cases - The products and services of hybrid play
2. Interviews - The innovators and pioneers of hybrid play
3. Models - The patterns and configuring models of hybridity
4. Workshops - The creation of new hybrid play concepts
5. Prototyping - Constructive exploration of hybrid experiences

These different approaches have contributed in triangulation through different sources of information.

Cases

The explorative phase of Hybridex consisted of a collection of case studies that were conducted over the entire span of the project. A compiled list of hybrid products that were currently or previously available on the market was created resulting into an index of over 150 hybrid products. Selected cases were examined more closely through various information sources and by testing out the product, if possible. The selected cases were analysed for their core functionalities, contributing to the other research areas, such as dimensions for hybrid experience design and to our constructive research. Adding to the product cases, relevant phenomena and models were highlighted, such as manufacturing and distribution methods relevant to the hybrid products field. As a final set, approximately sixty interesting cases were selected as representatives of the different facets of the current hybrid entertainment field. These cases were then turned into the Hybridex Deck of Cards as a quick and comprehensible way to showcase and present the field of research.

Serving as a growing knowledge base for the research team, the product case studies have informed equally all the other research stages, including theoretical studies, design workshops, and our own design practices in the constructive phase of the project. Among others, this has meant: guiding the design of our own hybrid prototype, the MurMur Moderators; being able to define design dimensions of hybrid play products (Tyni et al., 2013) and building shared vocabulary relating to hybrid products (Kankainen & Tyni, 2014).

Interviews

During the span of the Hybridex project, eight expert interviews were conducted. Six of the interviews featured developers working specifically in the hybrid products field, while two featured "traditional" game developers with a markedly opposing view towards working in the hybrid field. The interviews

were semi-structured with questions focusing on developer background, inspiring products, attitudes toward hybrid products currently on offer, and the strengths, possibilities, and possible threats for the hybrid field. The results of the study are presented in the working paper "Emergence of the Industry of Playful Hybrids – The Developers' Perspective" (Tyni & Kultima, 2016) focusing on the developers' view on the hybrid entertainment field. The interview study presents an exploration of the state of the hybrid play products industry, during 2012-2014, and covers the focal points of hybrids as an emerging field.

Models

Grounded in the case studies, theoretical research was launched with the article "Dimensions of Hybrid in Playful Products" (Tyni et al., 2013), which aimed to identify the central design dimensions in hybrid play experiences and capture them in a design dimension model. A short paper called "Understanding Smart Device Tabletop Games" (Kankainen & Tyni, 2014) highlighted one of the more prominent hybrid play product categories, hybrid board games, and the special role of smart devices within the design of these games during recent years. Additionally, we grew to understand that to compensate the disappearance of the physical game copy, toy and game industries sought to slow down this process of de-materialization by introducing alternative forms of material products. This was manifested equally in toy replicas of in-game items, games that incorporate toy lines in their design, and many others instances – all products that could be sold in physical retail stores and thus worked as a tool for re-materialization. Taking this observation as a cue, an article called "Material Culture and Angry Birds" (Tyni & Sotamaa, 2014) was written to describe the general materiality still surrounding digital games, and which approached the subject matter by dividing the field of material culture into proposed areas of research.

Workshops

During the span of the project the research team organized multiple concept workshops. Vision workshops were conducted both internally and in conjunction with certain events and collaborations. These included, first, an international research seminar organized by University of Tampere Game Research Lab, second, a collaboration workshop with the EU funded COST Action FP1104 network, and third, a special hybrid product workshop (game jam) held as a part of the Utrecht Game Research Summer School. Participants of the vision workshops came up with new concepts and design directions derived from their field of expertise. In the case of COST network, the workshops involved an interesting mix of professionals from the hybrid print industries, participants of the international research seminar consisted of esteemed play and game researchers, while the Utrecht Game Research Summer School participants were a mixture of master's degree and PhD students with multidisciplinary backgrounds. The results of these workshops informed the project in various ways: they expanded the understanding of the design domain of hybrid experiences, mixed various fields together, and resulted in multitude of design ideas.

Prototypes

In order to deepen understanding on the different facets of hybrid experiences, prototyping was deemed an important part of Hybridex research. The constructive phase of the project started out with the creation of a character called Hybbi, designed as a narrative and research tool that could be used to demonstrate the design dimensions in the hybrid products design and to provoke certain kind of ideation processes in the workshops. The team further utilized ideas conceived from the vision workshops and selected to go forward with a concept of interactive seats. The concept of MurMur Moderators was born from an amalgam of several ideas from various workshops, as a set of seats that would playfully moderate conversations between people sitting on them. Through the experiences with MurMur Moderators prototypes, adult playfulness became one of the key areas of Hybridex (Kultima et al., 2015). See chapter 4 for detailed description of the MurMur Moderators.

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Catalysts
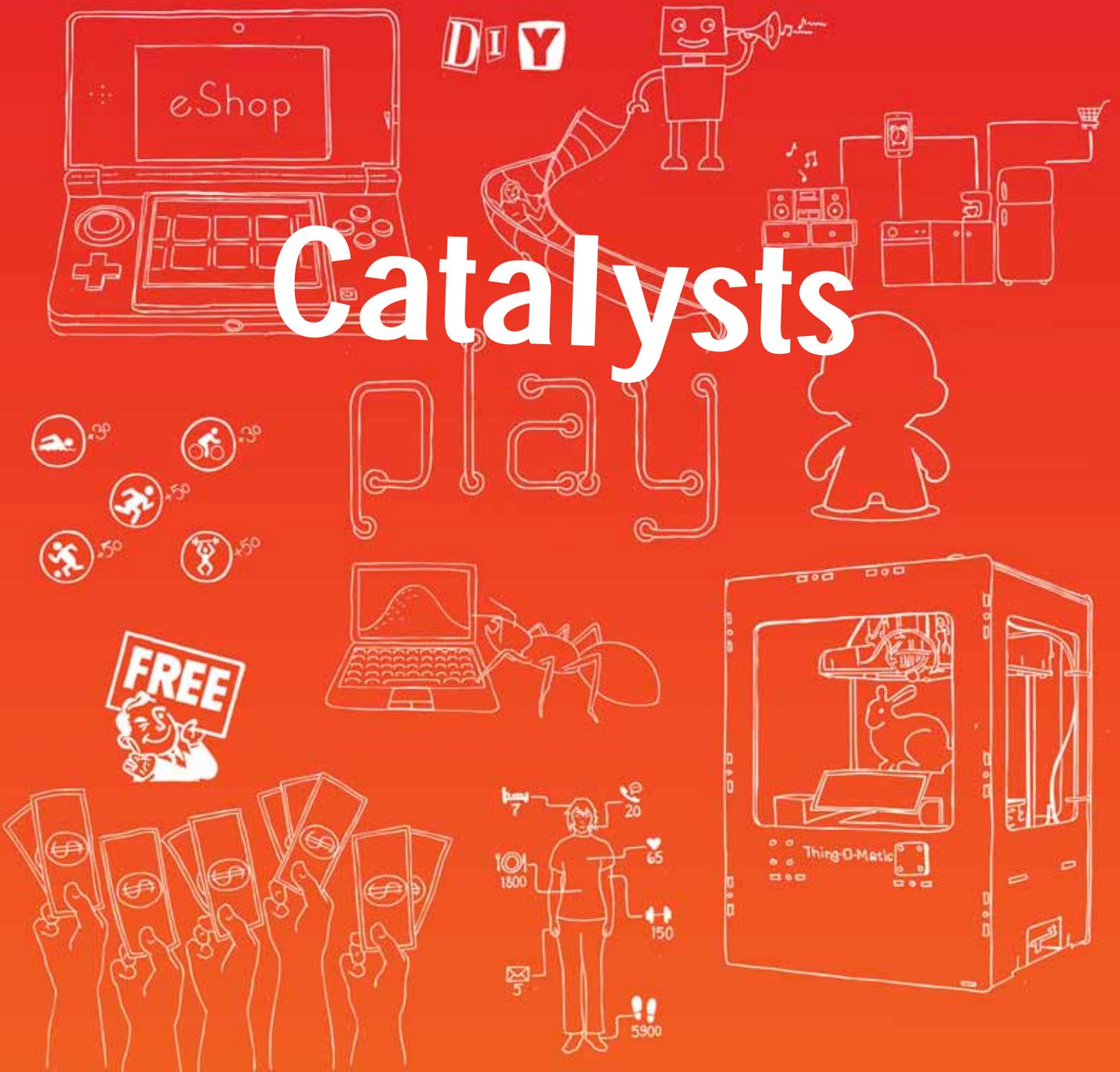
1 CATALYSTS

We have identified a series of phenomena affecting the field of hybrid playful experiences as catalysts for change. Such technology related catalysts as 3D printing technologies, miniaturization of technology, development of consumer grade sensor technology, and the Internet of Things have been pivotal forces behind the new wave of hybridity. Games and game-related catalysts, such as the service paradigm, the rising average age of consumers and 'adult play', gamification, free-to-play business models, and the phenomenon of designer toys have also had a big impact on the current trends of playful hybrid products. In addition, catalysts from the user cultures such as crowdfunding models, quantified self, and DIY culture have had an impact on the field of hybrid play.

These catalysts were also visible in the different industry conferences and fairs during 2013. We visited IFA Berlin 2013, Maker Faire Rome 2013, Spielenwaren Messe 2013 (Nuremberg Toy Fair), and Game Developers Conference 2013 to see how trends of hybrid play align with other trends of the toy, games and digital consumer products industries contributing to the industry of playful hybrids.

1.1 Collection of catalysts for playful hybrids

Technology related catalysts

3D Printing
The time period of when the Hybridex project took place (2012-2014) was heavily characterized by relatively fast technological advancements on a number of fields, many of which are still ongoing. One such technological area, loaded with techno-economical expectations, has been 3D printing. 3D printing refers to the act of printing a 3D model as a physical 3D object. A 3D printer is used to print physical objects. 3D printers vary in size and scale and use different technologies to print the objects out of various materials. As a curious example, it is possible for instance to print lifelike coral reefs out of sand with a very large 3D printer. On a consumer scale, a small printer can print plastic objects such as toy figurines or useful everyday objects. 3D printing technology is

expected to revolutionize material production, providing access for a wider audience to create and modify physical realities.

Miniaturization of technology

Another technological trend contributing to playful products and services is the miniaturization of technology, the phenomenon of technology becoming increasingly compact. This is related to Moore's law, a forecast envisioning that the amount of transistors on a chip will double every two years. The miniaturization of technology has enabled the development of smaller computers, compact smart devices, and embedding processor technology in everyday objects. The possibility to add digital technologies and connectivity to various physical objects is further accelerating the ubiquitous society and providing further possibilities for hybrid play.

Sensor technology

Recent years have also seen rapid innovation processes among consumer-grade sensor technologies. Sensor technology enables electronic devices the ability to sense the world and gather contextual data. While different types of sensors are widely used in many everyday objects, the development and miniaturization in sensor technology also enables the creation of increasingly advanced and compact devices. Sensors are able to sense for instance capacitance, temperature, luminance, sound level and acceleration. Smartphones and tablet computers, in particular, represent consumer-grade technology that incorporates a host of different sensors; something that conveniently makes advanced and easily programmable sensor technology available for developers everywhere. Many toys and hybrid products now harness this kind of sensor technology in collecting data and introducing "smart" usability in product experiences; a smart device may, for example, be placed in a plush toy to create an experience of a "sensing" smart toy.

Internet of Things

One of the largest technological trends of recent years is the Internet of Things, the concept of connected things forming a network through which they can communicate. Any object or entity can be a thing in an Internet of Things if it can be assigned a unique identity and it can communicate with other things through a network. For example, a smartwatch containing various sensors might both inform the user's health habits based on sensor data and at the same time incorporate related data from other connected household appliances, clothes or bedding to achieve better context sensitivity. Internet of Things provides new design opportunities for playful experiences as inanimate objects can share information and act independently from the users.
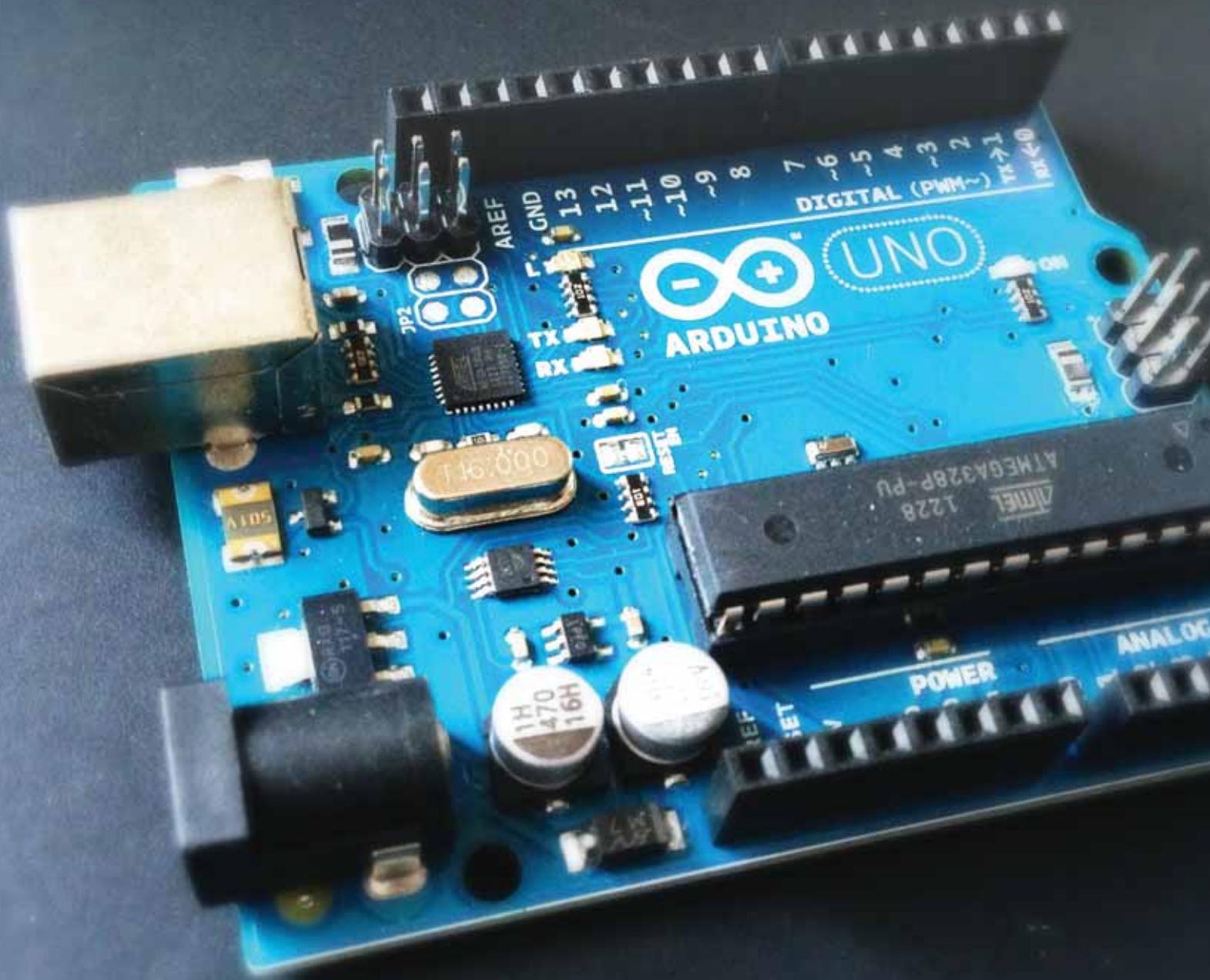
DIGITAL (PWM~)

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TX
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ARDUINO UNO

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ATMEL
1228

POWER
ANALOG

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16H

470
16H

Games and game-related catalysts

Service paradigm

The field of playful hybrid products and services draws evenly from toys and games industries. While many of the technology related catalysts, listed above, are equally relevant for games, there are some catalysts within the field of digital games that rise to a specific importance. One such catalyst, configuring game industry for change, has been the concept of the service paradigm. Service paradigm refers to information-intensive and interactive goods that are continually upgraded and consequently phase out of their status as products, metamorphosing into evolving services. There are many game culture examples of the service paradigm, including persistent game worlds (such as World of Warcraft) and free-to-play games with microtransactions and content updates. This transition is not limited to software based products (such as utility programs and digital games) either; almost any product can be fitted with software and fashioned as a license-based service now, starting from plush toys and ranging all the way to John Deere tractors.

Adult play

For the past decades, the average age of the consumers of both digital entertainment and games has been rising. Even though it is still common to think that games are in the sphere of children's play, the average age of digital game players in most developed countries is closer to 30. There is a rising interest, both in the play products industry and in academia, to the wide-ranging area of adult play, including but not limited to such phenomena as sports and social aspects of game playing, pastime hobbies, culture of high-end collectibles, and fascination on toy-like gadgets. All in all, the term 'adult play' has a lot of varying connotations; in part this signals that there is a lot of research to be conducted in the area.

Gamification

One trend expanding the sphere of play and especially the sphere of adult play is that of gamification. Gamification refers to varying methods of engaging users with gameful and playful mechanics, and in this way directing their actions towards preferred patterns of behavior. Gamification techniques can be used for instance to reduce the adoption threshold of new technologies or guiding the usage of new services. Gamification can be used within the sphere of playful products or services, such as games, but is usually connected to non-playful or utility products and services and their design. Among others, relevant areas of application can be found in office environments and education, where the method is used for measuring progression and engaging users. Another example are playful apps that encourage users to exercise, for instance through displaying an evolving, playful avatar.

Ludic Society

A wider phenomenon of expanding playful sphere is the transformation of the entire society into a Ludic Society. Ludic Society is a theoretical concept coined for a variety of emerging developments that seem to lead towards society and culture where play and playfulness are more common and acceptable than what has been before. Such a society will have games and play as its dominant cultural form, rather than linear text, for example. In a Ludic Society, it makes sense to simulate complex problems with games, and engage with systems and information in playful ways. The phenomenon of the Ludic Society contributes to the social acceptance of playful products and services making it easier to engage users in playful activities, be it within digital or material platforms. As games literacy will become more common, and the required level of technical skills is lowered through easy to use tools such as Game Maker, Stencyl, or Construct 2 and their descendants, most people will be able to design digital play as well as to engage in its various forms.

Free-to-play

Looking at the game industry from a business standpoint, one of the most prevalent trends of recent years has been the emergence of free-to-play games. Free-to-play refers to a larger category of games that are playable at no cost, and are instead monetized in other ways, such as by selling game boosts and speed-ups, virtual content, premium game features, or connected physical products. While the model is now very widely used among digital game design, it has been criticized for breaking games into segregated tiers divided by money and for focusing on monetization design over meaningful gameplay. The model is prevalent among all types of gaming, taking different forms depending on the genre. Besides digital games, free-to-play model has also been utilized in conjunction with hybrid play products. The digital game component of a hybrid product might for example be free-to-play, while new areas and characters could be unlocked by buying physical toys – a strategy used for example in Angry Birds Go! (Rovio, 2013).

Designer toys

One consequence of the evolving culture of adult play is the overall willingness to spend increasing amounts of money on highly specialized play and entertainment products. Among other things this has led to the popularization of collectible and premium grade toys, one example of which are designer toys. Designer toys are 'artistic toys', typically made from ABS plastic or vinyl and often produced in limited editions, from as few as 10 to several thousand pieces. Designers often have background in graphic design or illustration and connections to graffiti art, evident in the mash-up aesthetic of the scene. Having first appeared in the 1990s, designer toys are a continuing niche success, gaining increasing attention from high profile trade conventions such as Comic Con. Having an "adult feel", designer toys often give rise to communities of adult collectors who exchange toy related information, pictures, etc. As people buy stock toys, repaint them, and sell them online – often for thousands of dollars – the line between consumer and artist is blurred to the point of the two being indistinguishable. Overall, designer toys contribute to the adoption of toys as collectibles,
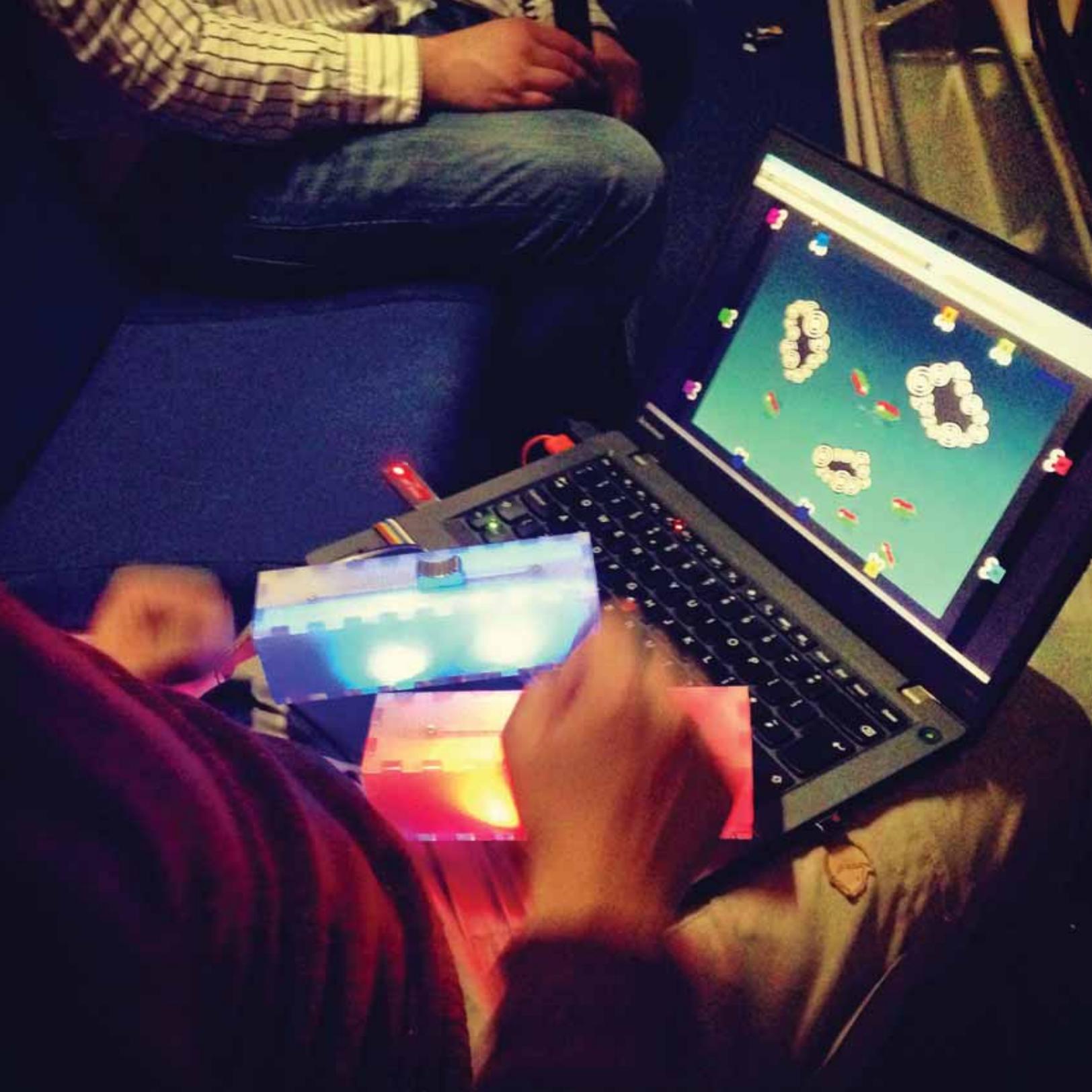
premium products or art objects worth a larger investment – something that has a clear parallel with more expensive hybrid play products.

Social catalysts

In addition to the previously described catalysts, configuring catalysts can also be based on people and the efforts and activities of individuals. The impact of individuals has particularly increased due to the emergence of social networks, Web 2.0 technologies, and the resulting participatory culture. In this process the line between production and audience has become increasingly blurred as ordinary individuals start blogs and host YouTube channels followed by millions, or start environmental projects to save the oceans that outdo even government efforts.

Crowdsourcing

One catalyst contributing to the social change is crowdsourcing. Crowdsourcing refers to the process of obtaining services, ideas or content by seeking small contributions from a large group of people, typically from an online community. The process is often utilized in cases where there is a large amount of tedious work which cannot be automatized to computers. The term is sometimes considered to be an umbrella term for other, similar activities, such as crowdfunding where a person or an entity asks for small donations from a large pool of online donors in order to fund a project. Crowdfunding has emerged as an alternative financing mechanism to fund risky or niche products and often targets early adopters.

DIY culture

Contributing to the phenomenon of increased user agency, web, as a collaborative medium, has also enabled the increased exchange of know-how related to various skills, professions and crafting. This has led to the re-emergence of a wider DIY culture. The concept of DIY (do-it-yourself) refers to the larger movement of creating goods and services by yourself, as opposed to simply buying them ready-made. DIY culture stands in opposition both to the consumer society and the incompetence it creates. The term can refer to a variety of practices, including home improvement and repair, fashion, crafts, music or other creative works. During recent years DIY culture has been revitalized by affordable consumer-grade processors, sensors and motors allowing various forms of amateur innovations and prominently displayed in 'maker culture' (Maker Faires, Make magazine, Craft magazines etc.). On the other hand, there is now an increasing number of sites and services selling user-made products, Etsy.com being perhaps the largest of these. Notably, many of these service providers are using emerging technologies such as 3D printing to produce their goods.

Quantified self

Yet another social catalyst trend is the emerging habit of single individuals to gather data about the various aspects of their everyday life. Quantified self is a term used for technology supported tracking and analysis of personal data with the goal of an increased understanding of the self. Devices used for this purpose are often wearable computers that utilize sensor technology to collect personal data. For example, a smartwatch can collect data on the heart rate, location, speed and body temperature. The data could then be visualized through an application on a smartphone or combined and synthesized with data coming from other sources to achieve more complex results.

1.2 Hybridity at fairs and conferences in 2013

During the Hybridex project, the research team visited fairs and conferences related to the main research areas: toys, games, consumer electronics, maker movement, and game industry. The function of this fieldwork was two-fold. First, a review of relevant industry areas showcasing the latest innovations of each respective field helped identify the catalysts, cases, and patterns of hybrid playful experiences. Second, to evaluate the state of the industry it was important to examine how informed of the relevant phenomena each field was. As by nature hybrid products and experiences exist between different domains, it is expected that conferences and trade fairs with particular histories and traditions each look at these new product categories from their own corner. In the following, we reflect on each industry sector's stance on the emerging hybridity.

IFA Berlin 2013

First held in 1924, IFA (Internationale Funkausstellung Berlin) is one of the leading, largest consumer electronics fairs in the world with over a quarter million annual visitors (Messe Berlin, 2016). It is one of the major trade fairs for international consumer electronics companies such as Sony, Samsung, and LG to showcase and announce new products. There are regularly over 1000 exhibitors at the fair, and the fair is largely open to public (for a fee). Showcased products include a wide range from smart device technology (phones, tablets, accessories, devices controlled with smart devices, etc.) to display and audio technology (TVs, home theaters, computers, computer components, cameras, etc.) to pretty much every conceivable home appliance (fridges, coffee makers, blenders, etc.) to the somewhat obscure such as Segway clones and Oculus Rift showcases.

While not a dedicated hybrid products event, IFA is nevertheless an important site for the 'hardware renaissance' movement. This refers to the emerging phenomenon of smaller companies starting to manufacture quicker and more specialized product runs due to the cheapening manufacturing costs in both China and the west, and the popularization of e-commerce and crowdfunding, to name only some of the enablers.

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In the 2013 event, some of the more visible phenomena included various kinds of gesture-based controllers, akin to Microsoft Kinect and Leap Motion. These controllers were used by many TV manufacturers, for example, as integrated solutions for controlling TVs. At the same time, many of these products supported and even included games that could be controlled by "drawing" in the air, similar to other touch and gesture based devices such as smartphones. Another popular category at IFA was different kinds of 'smart home' technology set-ups, focused on controlling various aspects of a home (such as heating, lighting, refrigerators, sauna, locks, and surveillance) via smart devices. This kind of development emphasizes advancements both in ubiquitous computing and in 'Internet of Things' where the connectedness of virtually every device allows both robust cooperation between these devices and aggregation of data.

The convergence of different functions into smart devices was a very popular feature among the manufacturers. For example, one could use an LG smartphone to diagnose problems in home appliances by the same manufacturer. When prompted, a malfunctioning device sends an error signal to the phone detailing what is wrong and what to do (offering customer service chats and numbers etc.). An emphasized feature of Sony's Xperia Z1 smartphone was its ability to communicate with supported Sony TVs in order to allow immediate streaming from phone to TV. Utilizing image recognition, the phone could also scan book covers, wine bottle labels, record labels and famous landmarks, and draw associated information from historical and geographical data, online databases, reviews, and retailers for the user. The entertainment features of Z1 included an AR app to project 3D dinosaurs onto flat surfaces without the use of AR markers.

While the photographing features of smartphones are generally getting better all the time, a lot of this development now results from utilizing smartphones' computing and online features to allow functionality beyond the means of standalone cameras. A highlighted feature in this regard was Xperia Z1's ability to record 60 pictures before and after shooting a still photograph, letting user to choose the perfect shot. On display there were also a lot of accessories for utilizing various forms of digital technology with recording capabilities – smart devices, regular video cameras, etc. – in physical hobbies and activities. Examples included devices rigged to bikes, snowboards, and surfboards, highlighting the trend of recording every aspect of one's life and instantly sharing it socially.

One of the big fair highlights were the various smartwatches by both major manufacturers such as Samsung, Sony, and LG and smaller enterprises such as ZeBracelet. A smartwatch maintains a connection to user's smartphone, harnessing sensor data from the phone and for example vibrating when a call is coming through. The user can then answer the call by pushing a button in the watch and for example drive a car with both hands on the wheel when talking. This way smartwatches remove the need to take out one's phone to read for example a tweet or a text message. The inclusion of NFC technology allows interaction options (for example swiping the watch near a Coke machine to pay). These functionalities represent some of the central first wave functionalities in smartwatches, while conveniently highlight other catalysts presented in this report such as advancements in sensor technology, service paradigm, and quantified self.

Maker Faire Rome 2013

Maker Faires are open events for people interested in the maker culture, bringing together commercial exhibitors, hobbyists, inventors, engineers, arts, craft, and education. They are conventions for all kinds of DIY culture, organized by Make magazine and its affiliates. Maker Faire resembles a combination of a science fair and a handcrafts fair, where exhibitors with commercial interests happily blend with garage tinkerers crafting things for fun or common good. The event is open for the audience, which typically consists of people of all ages, families and students being some of the largest attendee groups.

Having started out from the San Francisco Bay Area in 2006, Maker Faires are now held at various locations around the world. In 2014, a total of 131 Maker Faires were around the globe. The main US events in San Francisco in 2013 and New York in 2014 gathered audiences of 130,000 and 85,000, respectively (Make: Help Center, 2016). In Europe, the event started out with various "Mini Maker Faires", but in 2013 already three full-sized events were organized in the UK, Germany, and Italy.

The first European edition of the faire that was aimed at a larger European audience, Maker Faire Rome, attracted many different kinds of exhibitors in 2013. With 200 exhibitors and 8000 square meters of exhibition space, Maker Faire Rome 2013 gathered an audience of more than 30,000 visitors (Maker Faire Rome, 2016). 3D Printing services and robotics projects were somewhat dominating the setting, while traditional handicrafts and jewelry makers were less represented. As one of the highlights, Intel introduced their entry to the maker community aimed microcontrollers with their arduino compatible Galileo board. During the event, Intel provided select makers with Galileo boards to get the ball rolling with the new product.

Among the projects presented at the fair, the Hybridex project showcased the initial MurMur Moderators prototype. The booth next to the MurMur prototype featured led-light-enhanced smart clothing (utilizing the Lily Pad). In close vicinity, a project about sleep improvement featured the Breathing Pillow, a design that mimics the breathing of a sleeping person using both sound and movement. Another project on display was Shopper, a prototype of a robotic shopping assistant. Shopper acts as an automatically moving basket which follows its owner and is capable of carrying heavy items. Compared to IFA, Maker Faire Rome 2013 manifested much more playful projects. Examples of the playful projects were for instance IROMEC, which featured a furry robot prototype which autistic children can engage with and Drum Duino, a system which creates music by drumming physical objects connected to it.

While Maker Faire Rome is a celebration of DIY culture, it also featured projects by commercial companies of various sizes, supporting a larger ecosystem of makers. OSVehicle, for instance, presented the world's first open source car and the first universal chassis Tabby at the event. Many 3D printing technologies were present at the event, including a printer from FabLab Maastricht

capable of printing Nutella and a printer by the WASProject which uses clay as filament. Even large scale projects, such as printing replacement sections for coral reefs had a presence at the fair (Clark, 2013). The focus on 3D printing was not limited to the printers themselves, but also on methods of creating print material through recycling, and there was even a 3d Print Exhibition.

Spielwarenmesse 2013 (Nuremberg International Toy Fair)

Launched in 1949, Nuremberg International Toy Fair (Spielwarenmesse) is an annual toy fair, and one of the largest in the world (Spielwarenmesse, 2016). It is a trade fair, open only for the representatives of the toy trade and focused on selling manufacturers' products to both large and small retailers. The fair also aims to give retailers information on what to buy, i.e. what are the up-and-coming toy trends of the next few seasons. In 2013 the twelve halls of the Nuremberg exhibition center were filled with both traditional toys (stuffed animals, model train kits, wooden cars, etc.) and integrated solutions such as smart device controlled robots and helicopters. In conjunction with Spielwarenmesse, Global Toy Conference was also held in the same premises with presentations on trade topics such as how to best spread one's retail business in online space.

The special theme of the 2013 fair was 'Toys 3.0', which was highlighted in a various ways. A special Toys 3.0 product showcase was set up in the main lobby hall of the exhibition center. Existing and upcoming products, such as Disney Infinity and Furby 2012 were showcased. This showcase area highlighted words such as "Hybrids", "Augmented reality" and "Appcessories" on the stand walls, categorizing different sub-sectors of Toys 3.0 as seen by the Spielwarenmesse staff. Many manufacturers at the show were displaying children's tablets and on a general level there was a significant buzz surrounding these devices. A few children's tablets were also featured at the lobby.

Although highlighted at the lobby, the Toys 3.0 theme was not particularly visible at the twelve fair halls themselves. Some of the larger manufacturers, such as Mattel, were showcasing hybrid products at their reserve-only tours. One of the introduced hybrid products by Mattel was the Barbie Digital Makeover Mirror, which utilized a tablet device as a "beauty mirror". The user could then choose different makeup and "put it on" via an accompanied toy. The app would then augment the user's face with makeup, even following her movements through object and face recognition. The showcased products from the lobby made a return in their respective stands, too. In Jumbo's iPieces players used little toy fishing rods to "fish" from a tablet screen depicting a pond. Cartamundi's Olfacio featured an app and a set of collectable cards. The cards were scented and each displayed an imaginary, fantastical plant. The app would then create an illusion of "smelling" the odor from the cards and cross-breeding new plants on the screen according to this.

Spielwarenmesse highlighted smaller Asian manufacturers at two halls. Among the more noticeable trends were the many Lego-like building blocks – a result of Lego's expired patent on the interlocking brick mechanism and its subsequent failure in some countries to protect its brick design
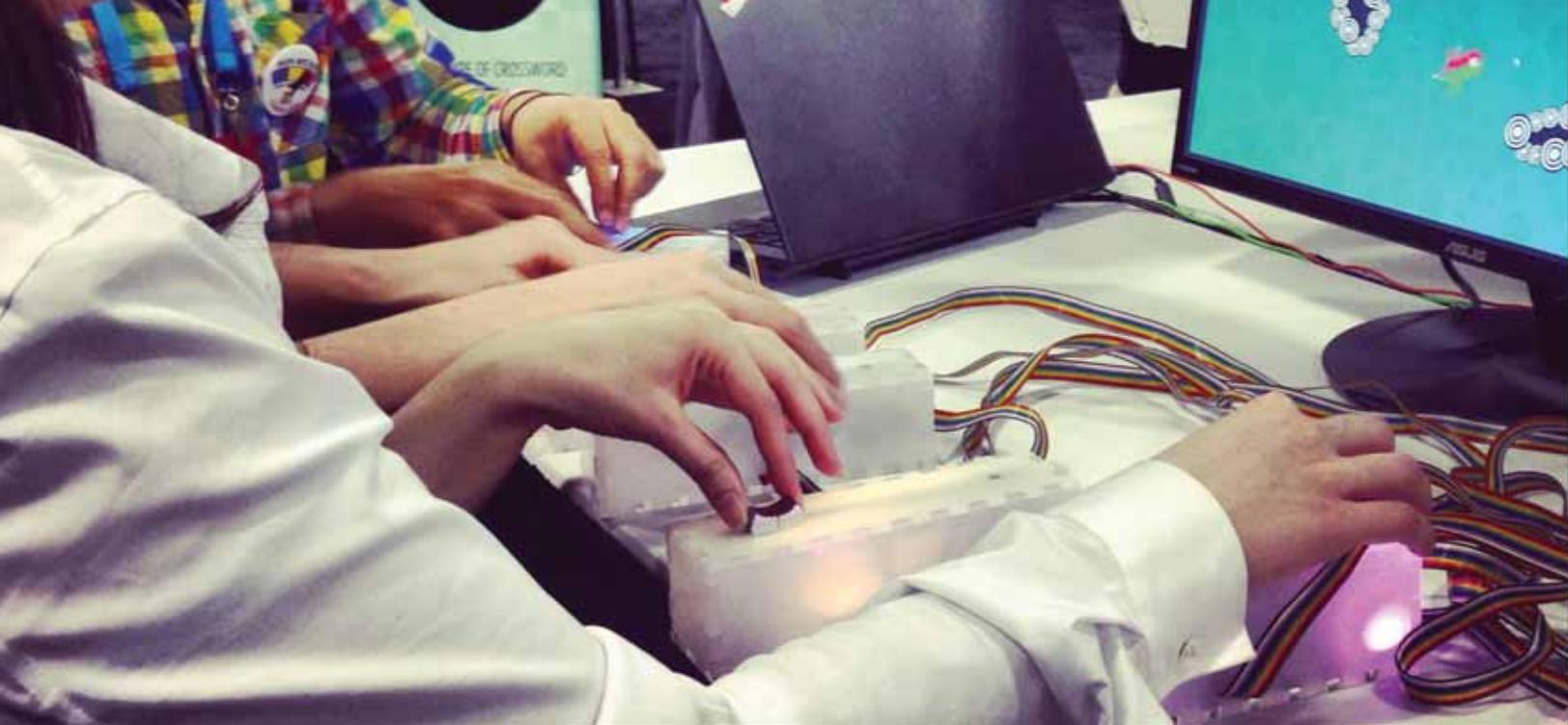
through trademarks. Fittingly, one of the more eye-catching products in the Asia halls was Gigo Future Car. A user would first build one of a few possible toy vehicles out of Lego-like building blocks and could then remote control the toy vehicle with an app, navigating an AR city. Another hybrid product on display utilized a smart device as a screen of a moving train, the App Train. The user would then sit dolls by the window as scenery raced by, making this in its simplicity an interesting example of hybrid products at the fair.

Overall, there was also a wide variety of playful protection cases for smart devices (shaped after popular characters etc.) highlighting, along with the children's tablets, how strongly smart devices are being pushed into children's domain.

Among all the industry conferences and fairs, Spielwarenmesse 2013 was the one showcasing hybrid products most visibly. This is arguably a direct result from a need in the global toy industry to address the threat of digital-only entertainment taking over children's play time completely. While it is precisely this kind of pressure that drives the innovation process for new kinds of toy experiences, it remains to be seen whether the increased adoption of digital design elements serves the traditional toy industry in keeping a hold of its core audience.

Game Developers Conference 2013

The Game Developers Conference (GDC) is the world's largest industry conference for game developers (Game Developers Conference, 2016). GDC is produced by UBM Tech Game Network and it is held annually in San Francisco, attracting over 24 000 visitors each year. GDC is an industry conference with a relatively high attendance fee making it less open for the public. The week-long event consists of over 400 conference sessions including tutorials, lectures, and roundtables by industry professionals on game-related topics such as programming, design, audio, production, business and management, and visual arts. There is also an exhibition area, various networking events, and awards shows such as the Independent Games Festival and the Game Developers Choice Awards. UBM Tech Game Network hosts sister conferences around the globe, including Game Developers Conference Europe and Game Developers Conference China.

GDC consists of a main track and summits with changing topics each year. GDC 2013 Summits were Free to Play Design & Business Summit, Game Narrative Summit, GDC Education Summit, Independent Games Summit, Localization Summit, and Smartphone & Tablet Games Summit. The topics of the summits and talks give an overview on the high-end of contemporary digital play. In comparison, the summits for the GDC 2015 included AI Summit, Community Management Summit, eSports Summit, Free to Play Summit, Game Narrative Summit, GDC Education Summit, Independent Games Summit, and Smartphone & Tablet Games Summit, highlighting the relevant areas of interest. None of these main areas has been devoted to hybrid playful experiences.

One of the overarching trends of the past two decades at the games industry has been digital distribution and the ease of publishing games on digital market stores. Striving to sidestep the role of the retailer in the value chain, the game industry has been paying less attention to material products and their inclusion to the user experience. At the GDC 2013, out of the total of over 400 presentations, only a handful was concentrating on the hybrid field. Sessions directly addressing the issues of hybrid playful experiences were about Skylanders (2011, Activision) and Mechatars (2011, iloveRobots), providing insight on how the developers of those products coped with issues of material production. Hybrid themes were almost nonexistent compared to the Spielenwarenmesse 2013 or Maker Faire Rome 2013.

Following how the event has developed after 2013 in terms of covering the topic of hybridity; In 2015 GDC, it stayed marginal: the extensive program that featured numerous technology, design and education talks had very little to say about the hybrid field, notwithstanding the small exception of the Disney Infinity 2.0 postmortem. Outside the traditional sessions, however, GDC featured the Alt.Ctrl.GDC exhibition that showcased game projects from 2014 and 2015 with an emphasis on alternative input methods. There were various projects and playful experiences moving between material and digital present at the exhibition, ranging from custom created slider controllers and text adventure printers. Notably, there has been more interest within the indie communities to expand the sphere of playful experiences through the combination of material and digital crafting: DIY electronics and micro computers have expanded the environment for fostering the creation of new, experimental forms of game play. Overall, it seems that the trend of hybrid playful experiences has been more readily present at the Maker Faire and Nuremberg Toy Fair, as well as at IFA, but seems to arrive more slowly to digital games industry communities.

1.3 The industry of playful hybrids

Whether used in children's toys, gadgets aimed at adults, or digital games moving beyond their traditional boundaries, elements that we can classify as hybrid can be encountered all over the entertainment industry. As a consequence of the technological, economical, and cultural shifts in the material production environment, there have emerged various large and small companies using hybridity as a design element. These companies are scattered all over the traditional toy and game industries, and while some identify themselves with those sectors, others think of themselves as a new area of industry. Indeed, there are enough of these companies now – specifically moving between material and digital – as to argue for the existence of a burgeoning sector called hybrid play products industry. This industry is roughly characterized by two central areas: the established million–selling franchises controlled by large international publishers – Activision, Disney and Nintendo in games, Hasbro and Mattel in toys, with Lego efficiently moving between the two sides – and a wide field of numerous indie developers working all over the world. As a general characterization, the sector of small developers is doing most of the innovation process for new hybrid designs, aided by the popularity of crowdfunding platforms and the cheapening production costs of Chinese

factories. Large publishers, on the other hand, wait for sustainable designs to emerge from this field.

Large publishers and established franchises

For years, traditional game industry has been characterized by a movement towards digital distribution. For platform holders and large publishers digital distribution is beneficial as it is very cost efficient, cutting material production costs and removing physical retail stores and distributors entirely from the value chain. Meanwhile, small game developers have embraced digital distribution as a democratizing tool for getting their games published. Given such an environment, it is understandable that game industry, as a whole, has been less interested in moving back towards material production.

From another perspective, digital distribution has pushed many game retail chains to look for new physical products to sell. In this sense, the interests of game retailers are aligned with those of traditional toy industry: material play products are a core product category for both, while the de-materialization of play industries threatens the livelihood of the sector. Projected against this background, the emergence of game-toy hybrids, and their continued success, has been welcomed as a rejuvenation shot for retail stores in both game and toy industries. Of the larger hybrid product lines, the defining example has been the Skylanders series (Activision, 2011-). A fusion of a digital console game and a toy line, Skylanders: Spyro's Adventure (2011) was developed by Toys for Bob after which Activision, one of the world's largest game publishers (Call of Duty, World of Warcraft), picked it up for publication. A surprise hit for many game industry analysts, Skylanders soon became a billion-dollar phenomenon, with both children and adults engaging in collecting characters. The first game has been followed by yearly sequels, coupled with new toy lines and, as a result, the franchise has generated over two billion dollars' worth of sales so far, making the series one of the biggest earners for its publisher.

Since its launch, Skylanders has inspired major competitors from equally big entertainment companies, such as Disney and Nintendo. The Disney Infinity series (Disney, 2013-) is a relatively close imitation of Skylanders with RFID tags and an activation portal, that has been able to leverage the rich Disney roster of characters while focusing more on user generated content typical for Web 2.0. Nintendo's Amiibo toys (2014), on the other hand, are not attached to a particular game but instead function in varied ways with existing and upcoming Nintendo games. Adding to the 'toys-to-life' genre, Lego introduced its own game-toy hybrid line, Lego Dimensions, in the fall of 2015. Dimensions leverages Lego's numerous licences combining characters from LEGO Lord of the Rings, LEGO Batman, The LEGO Movie, and so on, and has been well received.

The largest toy manufacturers, Hasbro and Mattel, have already a long history with different forms of toys-to-life genre, such as Baby Born dolls and the various VHS board games of the 1980s. The companies have been very interested in developing modern hybrid products, too, leveraging their existing brands such as Barbie. While neither Hasbro nor Mattel has been able to generate a hit

on the scale of Skylanders, both have published numerous hybrid products such as Barbie Digital Makeover Mirror (an app-toy based on AR technology) and hybridized versions of Hasbro's board games. For Hasbro and Mattel, who have a large repertoire of smaller hybrid products and who operate around the world, it is also possible to hybridize play products selectively. Board games for example can benefit from digital add-ons, while not necessarily requiring them, thus making it possible to sell augmenting apps for physical games in markets that have higher smartphone penetration.

Smaller hybrid studios

Besides the few larger companies operating in the hybrid field, there now exists a fertile field of smaller hybrid design studios. The gradual emergence of this game-toy hybrid field is explained by a number of contributing catalysts, such as DIY culture, progressing microchip and sensor technology, 3D printing, and crowdfunding, all of which have various consequences. As technology gets smaller, cheaper, and more powerful, it is possible to fit it into a wider variety of products. A large part of this development is due to Chinese production becoming available for western developers. It is now relatively easy to order small production runs from China to test out design ideas or manufacture products in a smaller scale, for example for small, specific audiences. At the same time, the quality of Chinese production has continued to rise. In turn, this development has forced western manufacturers to open up, making production more efficient and lowering the price of technology. Additionally, Internet as a collaborative medium has made assets and know-how for development more accessible than ever before. Further, crowdfunding platforms such as Kickstarter and Indiegogo have made it easy for entrepreneurs to test out their ideas and find in a relatively instinctive and unforced way whether or not there exists a market for their product (Tyni & Kultima, 2016).

Due to this development, it is now easier than ever to launch a play product start-up studio. Many of these small developers have adopted a business model that is fully dependent on this new techno-economic production environment, basing their product for example on serving niche audience needs in a scale that no large company would find profitable enough to bankroll. Moving to specific business models, Makielab offers an online service where users can customize their own virtual doll, after which the doll can be ordered as a 3D printed physical toy from Makielab. Little Printer by BERG is a miniature printer that prints subscribed content on receipt paper, including puzzles, news, pictures – and its own face. Sifteo (acquired by 3D Robotics in 2014) creates smart play cubes that interact with each other when placed adjacent to one another. In many cases, small hybrid companies drive the innovation process, while larger manufacturers wait aside to see what works and what does not. As an example, French design studio Les Editions Volumiques developed a capacitive technology that allowed using physical play pieces on an iPad. The studio showcased the technology with a couple of more eccentric design experiments, after which Hasbro licensed it for their zAPPed line of augmented board games.

Overall, while it is not a new observation that small companies drive experimentation and innovation, access to production has been eased. And while large corporations are still quite easily able to run over small companies, the start-up level has more and more chances to introduce completely new kinds of innovations. In the future the intersecting game and toy industries, coupled with additional third party actors and a larger value system, can give birth to even more products and services that belong to the 'hybrid playful industries'. Whether the smaller studios will be overrun by the bigger and more established actors remains open.

In the next chapter, we go through example cases of existing hybrid products, services and concepts before we arrive to the patterns in the chapter 3.

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Cases

2 CASES

Hybridex was centered on examining the intersecting roles of material and digital in varying playful experiences. Initially, it seemed that there were very few cases of existing products, but during the project timeline many new cases emerged. Some of the cases were introduced by existing actors, such as the toy industry giants Mattel and Hasbro, whereas some were by emerging start-ups utilizing the opening possibilities for small scale material production, often with the support of crowdfunding. By analysing products and product lines such as Skylanders, Mechatars, YetYet, HappiTaps, Makies, Apptivity, Appmates, EyePet, Furby, Invizimals, iPieces, Life of George, Mega Bloks World of Warcraft, Moshi Monsters, Parrot AR Drone, Sifteo Playcubes, and Sphero, to name only a few, we formed an understanding of the field of hybrid playful products and services. In total, we identified and listed over 150 hybrid products, services, and product lines during the duration of the project, between fall 2012 – fall 2014. The products were then compiled into categories which are introduced below via a smaller set of example cases.

2.1 Types of playful hybrids

Augmented reality play

Augmented reality (AR) games utilizing material accessories such as fiducial markers have been a trend in the playful products and services for a long time already. There exists a large number of AR concepts and research prototypes; these, however, were deliberately not highlighted in the Hybridex case study. On a commercial level, successful AR products are still a rarity.

The Eye of Judgment (2008), SONY

> The Eye of Judgment is an augmented reality based card battle game for the PS3. In it, players try to conquer a 3x3 grid playfield by strategically deploying various creature and spell cards on the physical game mat. The spell cards each display a fiducial marker. The PS Eye camera peripheral records the view and displays an AR view of the game on the TV screen, which substitutes the cards with associated virtual creatures.

Invizimals (2009), NOVARAMA

Invizimals is an augmented reality collectible creature game for the PlayStation Portable. It involves players catching various virtual creatures from real-world environments via the PSP camera and a physical "trap", a square-shaped device used as a fiducial marker. After collecting the creatures, players raise, level up and battle with them. Invizimal has been relatively well received among gamers, the series has sold over one and half million copies (Zaled, 2013) over its lifetime.

Barbie Digital Makeover Mirror (2013), MATTEL

Barbie Digital Makeover Mirror is an augmented reality app toy. An iPad is first slid into an accompanied "vanity frame". Using an applicator wand and a special app the user can then apply virtual makeup on herself. Utilizing the tablet camera and AR, the app projects user's image on the screen with the virtual makeup on. Thanks to facial-tracking technology makeup "stays on" even if the user moves her head. Barbie Digital Makeover Mirror is an advancement of a long line of vanity toys, such as the styling head products by Just Play (see e.g. Barbie Styling Head, 2013; Monster High Styling Head, 2014).

Advanced figure play

Miniaturization of technology and advancements in sensor technology are both long-term catalysts that have provided increased design opportunities for traditional figure play for years already. Battery-based action figures that make sounds have been around since the 1980s. In Redbeard's Pirate Quest (Zowie, 1999) users could control a PC pirate adventure game in real-time by manipulating a USB connected toy ship and its crew (Isaacs, 1999). Yet, only with the recent game-toy hybrid lines, beginning with Skylanders (2011), was hybrid figure play popularized in a way that had significant mass-appeal. Skylanders both became a billion dollar earner for its publisher and solidified hybrid figure play as a 'toys-to-life' genre. Despite several competitors having emerged since the introduction of Skylanders, majority of hybrid figurines are still mere toy statues (i.e. they do not have articulated limbs). As such, there is a lot of room for innovation in the genre, with increasingly "smart", animated, and life-like toys that exist between digital and material realities.

Skylanders: Spyro's Adventure (2011), TOYS FOR BOB

Skylanders is a fusion of a digital console game and a toy line. The RFID equipped toys are placed on a "Portal of Power" peripheral which instantly activates a matching interactive character in the game. The original game features 32 fantasy characters (the starter pack comes with three figures) and to conquer all the game locations player needs at least one from each of the eight elements represented in the game. New characters can be bought separately or in three-a-pack combos. Player progress

is saved in the toys and they can also be used with newer games in the series. However, each main game in the series – launched yearly – has introduced new functionalities to the series, necessitating players to buy new games and portals in order to use their old characters with them. Counting the characters and their variants from all the games, 348 Skylanders have been released by the end of February 2016 (Portal characters, 2016).

Disney Infinity (2013), AVALANCHE SOFTWARE

Disney Infinity is a line of toys that can be transported into a digital game of the same name. Players place up to three character figurines on a special pedestal to activate their digital equivalents in the game, and are also able to use physical add-on discs on the portal to enhance game sessions in different ways. Popular Disney characters from classic Disney films, Pixar movies, and for example Star Wars constitute distinct play-sets, each containing a campaign of their own. While characters can only be used in their own campaigns, the game features a mode called Toy Box where players are able to create their own game experiences and unlock new objects.

Amiibo (2014), NINTENDO

While using similar NFC technology embedded in toys, Nintendo's Amiibo figurines are not tied to one particular game, but are rather compatible with all major Nintendo releases. The figures depict popular Nintendo characters and scanning them with the associated NFC reader unlocks bonus functionalities in the supported games. In Super Smash Bros Wii U (Nintendo, 2014), for example, each figurine lets the player train an especially powerful version of the same character, and in Hyrule Warriors (Nintendo, 2014) scanning the characters that are featured in the game gives the player special items.

Lego Dimensions (2015), WB GAMES

Lego Dimensions copies the familiar form of Skylanders, Disney Infinity, and the Amiibo, but features figurines that look and work like regular Lego figures, making them first articulated toys in 'toys-to-life' genre. Additionally, the Dimensions portal supports up to six figurines (compared to 2-3 in the competing games) and the figurines are completely platform and version agnostic, meaning that players need not to worry whether new toys can be used with old portals. Dimensions features "Legofied" characters from several franchises licensed by Lego, including Lord of the Rings, DC Comics, Ghostbusters, and the Portal games.

Play on digital board

Of all the hybridization possibilities offered by recent technology, the tablet computer, with its resemblance and easy appropriation as a game board, has in particular interested designers to create hybrid game experiences. Hybrid tabletop gaming with a smart device can be understood at least in five different ways: smart device as a game board, smart device as a tabletop game pawn, smart device as a gameplay accessory for a tabletop game, smart device as a tabletop game helper, and smart device overseeing play (Kankainen & Tyni, 2014), in addition to a few peripheral cases. Innovations such as conductive ink have allowed physical game board to sense the location of game pawns on them (Alexander, 2014). If needed, electronics such as batteries and RFID tags can be printed into game boards or cards.

Balloon paperApp (2012), LES EDITIONS VOLUMIQUES

The Balloon paperApp combines a papercraft hot air balloon with an iPad app. Appearing to float on the iPad, the "flight" of the balloon can be directed by finger swipes acting as bursts of wind. The player controls the direction of the wind and tries to hit tags on the ground by landing on them. The illusion of the paper craft floating is achieved by the app displaying a virtual shadow cast by the balloon and changing from large to small depending on the altitude of the balloon.

Olfacio (2012), CARTAMUNDI

Cartamundi's Olfacio is a playful project for iPad that "smells" special scented plant cards. The user places one card at a time on the tablet screen. Cards, which in reality use embedded touch recognition patterns to interact with the tablet computer, depict fantastical plants, which are recognized by the app. The app then creates a virtual hybrid, a new combination plant out of any two plant cards.

The Game Changer (2012), IDENTITY GAMES

The Game Changer is an appcessory board game that uses an electronic, triptych-like game board to which a tablet computer is attached to create a larger, hybrid game board. There are multiple game-specific "skins" that go on the board, while the game app can be downloaded freely online. The integrated app tracks progress, keeps score, provides instructions, asks questions, and assigns tasks. The supported games feature interactive animations and sounds.

Spellshot (2012), HASBRO

Spellshot is an appcessory board game. Each player controls an elemental wizard figurine which is moved around on a tablet screen similar to board games. Capacitive pads in the bases of the figurines let the tablet recognize the figurines. Among other things, players can cast different types of spells by drawing runic shapes on the tablet.

World of Yo-Ho (2015), IELLO

> World of Yo-Ho is a hybrid board game in which smartphones are used as play pawns. Players move their smartphones, depicting animated pirate ships, on a large gridded play mat. The position of the phones is sensed via accelerometers, allowing the software to match the animated graphics with the art of the play mat. As players only see what's immediately around them, the feature acts as a novel implementation of 'fog of war'.

App controlled toys

Another popular category of emerging hybrid products are remote controlled products where the traditional radio control mechanism is replaced by a smart device application. App controlled devices range from cheap toys aimed at children to more expensive, programmable 'smart toys' and gadgets with more adult appeal. As such, they actively blur the line between child and adult users. For example, quadcopters and drones, now popular among different age groups, come in significantly varying price tiers. While the cheapest drones present an affordable route to gadget play, others can cost up to thousands of dollars, often fulfilling more serious functions. Flying drones are used for example in film productions to shoot aerial footage, whereas public sector uses them to survey the condition of construction structures such as bridges.

Parrot AR.Drone 2.0 (2012), PARROT

> The Parrot AR.Drone is a radio controlled, flying quadrotor helicopter. The 30 cm long drone is designed to be controlled with iOS and Android devices. Through a built-in HD camera, the user can see and record on the smart device whatever the Drone sees. The Drone can also recognize 3D stages, is compatible with augmented reality flying games, and has an ultrasound altimeter that lets it hover.

Sphero (2011), SPHERO

> Sphero is a robotic, programmable ball, remote-controlled via a smartphone. Able to move on its own via built-in motors, Sphero can host many kinds of games. Examples include a version of golf where the ball is hit with the smartphone acting as a golf club and AstroBall where players fly through rings seen on smartphone by twisting, tilting, and turning Sphero. In Sphero MacroLab users can create easy, repeatable programs and macros for Sphero.

Romo the Robot (2013), ROMOTIVE

>Romo is a small robot that uses a smartphone for a face. The face has a variety of expressions and emotional states. Romo moves around with tank-like treads and can also tilt its "head" to better look up and down. The face can be touched for a host of reactions, including tickling. Romo can also be remote-controlled with an additional smart device, while a special Lab mode allows the creation of new behaviors.

Sensor play

The increased availability of cheap sensor technology and cheap programmable controller boards for processing the information from them has provided new design opportunities for products that measure user activity and the environment. Many projects which could previously only have been accomplished within a professional or military setting are now something that can be built by anyone. Through easy to use microcontrollers such as the Arduino, or small programmable computers such as the Raspberry Pi, sensors and actuators can be controlled and configured to interact with users and the environment. Sensors that sense pressure, infrared light, capacitive touch, acceleration, orientation, sound, or temperature can easily be utilized in such projects. These developments also open up opportunities for more user engagement and user-led modifications, bringing some of the benefits associated with digital products to physical artifacts.

As sensor equipped smartphones are used so widely in hybrid play products, sensor technology is now a core part of the industry. Many hybrid play products bring together data from several sensors to build user experience that considers how a product is being held, whether it falls or is brought close to other sensors, what is the noise level around it, and so on. (See for example "Smart Toys" and "Playful Smart Device Covers", below). Some hybrid products, such as programmable game balls that can measure the movement of the object, use sensor technology as a standout feature and a selling point. The inclusion of sensors into these objects can create new modes of play or a new way to analyze the performance of a player.

94Fifty Smart Sensor Basketball (2013), 94FIFTY

>94Fifty Basketball set consists of a special sensor-equipped basketball and an accompanied app. Indistinguishable from a regular basketball, the position and movement of the ball can be tracked with the app. This way the set can be used for measuring and analyzing play in real-time, providing feedback on such statistics as throw arcs and ball handling.

Hackaball (2015), HACKABALL

Hackaball is a programmable ball equipped with gyro and accelerometer sensors. It is specifically designed to encourage children to easily program games for it. The games can then be controlled via associated iOS app. The ball senses throwing, falling, shaking, kicking etc. The ball can also vibrate and change color.

Smart toys

Traditional play objects such as plush toys, toy guns, and play cubes, too, are affected by the emergence of new technologies and phenomena like the service paradigm and the free-to-play model. Through utilizing digital components toys can become more modifiable and updatable. While this category is called smart toys, it could also be called 'connected toys'; using an online connection or a smartphone as an element of the product experience allows users to modify and rejuvenate their experiences – something that was impossible, or very limited, with electronic toys. A shared characteristic between most smart toys is that they can be updated, ideally providing prolonged usage. This, subsequently, can be seen turning the toys into evolving services.

Furby 3.0 (2012), HASBRO

Furby is a talking, electronic toy that has an evolving personality. Furby also "learns" to speak by listening to human speech, while answering to a host of voice commands. The furry toy can move its robotic eyes and ears and dance in a subdued manner. It also fashions an accompanying app which can be used to "feed" the toy by flicking different edibles towards it from a smart device. When Furby speaks and another one is nearby, it can discern the "Furbish" language and respond.

Hasbro Lazer Tag (2012), HASBRO

Hasbro Lazer Tag combines a classic toy gun with a smartphone used as a targeting system. The top of the plastic gun features a slot for the smart device which, when loaded with the Lazer Tag app, provides the player with an augmented HUD view from the smartphone camera. The camera view displays virtual enemies and "bullet trajectories", as well as other information in the real-world surroundings.

Sifteo Play Cubes (2011), SIFTEO

Sifteo cubes are motion-aware, 1.5-inch blocks with full-color clickable screens that can be interacted with by shaking, tilting, rotating and placing the cubes adjacent to one another. Cubes host a range of games designed to encourage development of spatial reasoning, strategy, collaboration, and pattern recognition. Users are also encouraged to create their own games and applications for the cubes.

Playful smart device covers

Most homes with children and smart devices are faced with the problem of children being very interested in these devices and how to adequately protect them from being broken in the process. The first answer to rectify the situation were child-friendly protection cases, coming often in exciting colors and shapes. This, however, was soon complemented by plush toys in which the device could be placed and that could utilize the smart device capabilities in the play experience. There are now a host of different kinds of 'slip-in' plush toys available that come alive when a smart device is placed inside them. Typically, these slip-in smart toys harness the sensor technology of the smart devices, for example recognizing speech or when the toy is picked up. Such products can be also suitable for more adult audiences, following the trend of designer toys.

YetYet (2012), TOTOYA CREATURES

YetYet is an 'appcessory' that combines a plush toy character with an app. User first inserts a tablet or a phone into the plushie. Visible through two openings in the doll, the app displays an animated face and selected play functions. User can change the creature's color, make it repeat voices with effects, and play with its eyes. The toy also reacts to turning motions thanks to smart device accelerometers.

Ubooly (2014), UBOOLY Inc.

Funded through a crowdfunding campaign, Ubooly is a plush creature that comes alive when a smart device is placed inside it. Users first buy the Ubooly plushie and then download the free app. Ubooly can tell jokes and stories, make conversation, and even recognizing users pitch. Similar to Furby, two Uboolies can recognize each other and have a conversation. In Ubooly Lab parents can customize Ubooly to teach their child new languages, math, and ocean biology, among other things. Ubooly can download new content periodically over Wi-Fi. Content packs are available as in-app purchases.

Printable play

In terms of new printing technologies, 3D printing generates perhaps the most curiosity in both commercial and academic circles. At the same time, there are a host of other printing techniques

that could be utilized with new forms of technology and playful experiences. Mattel experimented already in 1996 with Barbie Fashion Designer on how to utilize printable cloth in dressing up dolls. Recently, the paper industry in particular has been keen to find out how traditional paper printing could be developed into new and viable directions. For example, it is now possible to print all kinds of technology including RFID tags, batteries and speakers directly into paper and cardboard. In an age when everything is becoming digital, traditional paper, too, can be re-framed in marketable ways that leverage the haptic experience associated with it. Commercial interest in using 3D printing to produce new kinds of play products has resulted in new possibilities for business, such as custom made doll and figure products. Traditional printing can also be adapted into playful forms, as exemplified by Little Printer.

Makie Dolls (2012), MAKIELAB

Makies are 3D printed dolls. User customizes the doll (facial features, skin color, etc.) in MakieLab web service, after which the doll is printed and shipped to the user. The dolls can also be fitted with electronics, such as Lilypad Arduino sets, Bluetooth, and RFID tags for further tinkering. Additional clothes and accessories, as well as a community for customization tips are also available through the service.

FigurePrints: World of Warcraft (2007), FIGUREPRINTS

FigurePrints provides 3D printed models of World of Warcraft characters based on player avatars. Player first outfits her game character with any gear she currently possesses and poses the character in a way she wants. FigurePrints may tweak the angle and position of the weapons and armor to make more aesthetically pleasing final statue. The character is then 3D printed as a statue or a bust, fine-tuned, and mailed to the customer.

Little Printer (2013), BERG

Little Printer is a mini-sized, online connected printer that prints on receipt-sized paper. Among other things, it can print black and white pictures, shopping lists, and puzzles such as Sudoku. An associated service lets users to subscribe to different kinds of content, such as regularly released puzzles, news, and how-to's. Little Printer is an open platform and anyone can apply to create content for it.

Other playful hybrids

There are also various other products that present notable cases in combining material experiences with digital. Some interesting products are born in the re-examination and re-invention of conventional products. For example, the classic Polaroid camera can be enhanced with digital technology and online capabilities. This kind of process might lead into unexpected concepts, such as a service enabled, smart chair. Arguably, one of the factors common for many of these re-inventions is trying to find new affordances and value through playful connectivity and digital enhancements. As such, the field of hybrid products is tightly connected to the future and the burgeoning possibilities of the Internet of Things.

Polaroid Socialmatic Camera (2014), POLAROID

An upgrade to the classic Polaroid camera, Polaroid Socialmatic camera takes digital photographs that the user can instantly soft-edit on the 4.5-inch camera touchscreen. The pictures can be posted to different social media platforms straight from the camera, while the camera – of course – can print the pictures as 2x3-inch physical copies. The 14-megapixel digital camera comes equipped with an Android based operating system.

Sparkle Bench (2012), NUNOERIN

The NunoErin collection of interactive furniture includes tables, benches and other seats. One of these is the Sparkle Bench. The surface of the Sparkle Bench sports a layer of lights reminiscent of pixel graphic. The lights on the bench light up from the touched position in luminous colors. Touching the bench is an evocative experience and the interactive lights encourage users to playful and positive mood. Users can for example "draw" simple pictures into the bench surface.

MurMur Moderators (2013), HYBRIDEX

MurMurs are playful interactive seats that function as toys and ambient elements in professional environments, such as workplace recreational areas. Covered with different colors of moss-like "fur", each MurMur has its own fairytale-like personality and a backstory. The seats react to different actions (when somebody sits on them, stands up to leave, touches their ears or sways on the seat) with unique cartoony voices.

Physical and material in games and early hybrid play

Hybrid playful experiences, as a phenomenon emerging from the melding of the digital and physical sides of games, already have a long and multi-faceted history. While some have suggested that digital games are moving towards an entirely digital form via digital distribution, several scholars have drawn attention to how digital games are deeply rooted into materiality and material production (Maxwell & Miller, 2012; Apperley & Jayemane, 2012; Peteri et al., 2013; Sotamaa, 2014).

Components such as the chipsets needed to construct play devices and cloud servers, for example, are deeply rooted in mining the required minerals. Kittler (1995) has even pointed out that computer software by its nature is tied to materiality, by necessity, through electrical current switches.

The importance of the material and cultural elements surrounding games has also been discussed through the concept of 'paratext' (Genette, 1997; Consalvo, 2007). Paratext refers to everything surrounding media content outside the actual content – in the case of digital games the game box, manual, ads, strategy guides, previews and reviews, forum discussion, and so on. The concept draws attention to how the meanings associated with a game and the game experience are also importantly shaped (sometimes intentionally but always unintentionally) by these surrounding (or paratextual) elements. Additionally, Toivonen and Sotamaa (2011) have highlighted the everyday meanings players attach to the material manifestations of digital games and how people can still have deep appreciation towards game boxes, cover art, and collector's edition figurines in a time when digital games are turning to digital-only distribution. Game cartridges, discs, and boxes can operate as important carriers and mediators that provide game cultural value that surpasses the passing gaming instances (Tyni & Sotamaa, 2014). According to Kultima and Stenros (2010) the holistic experience covering the material and temporal aspects of the game play experience should be taken into account in game design.

While the physical elements that come with a game have always been a big part of the meaning making associated with a game experience, hybrid game products such as Skylanders now utilize this transmedial melding of the two worlds in a very deliberate manner in their design and marketing. Further, there are several different ways to construct historical trajectories and developmental directions within the context of these products and services. For instance hybrid tabletop games have a long history with various media, often the most potent media technology on offer at the time (Kankainen & Tyni, 2014). Similarly, the conceptual origins of Skylanders and Disney Infinity can be easily traced to earlier products very deliberately combining toy play with a digital game, such as R.O.B. the Robot (Nintendo, 1985), Barbie Fashion Designer (Mattel, 1996), Redbeard's Pirate Quest (Zowie, 1999), and Tamagotchi (Bandai, 1997).

R.O.B (1985) NINTENDO

> R.O.B. was a robot toy accessory for the Nintendo Entertainment System (NES). The 24 cm tall robot received commands via optical flashes from the TV screen which it detected through its eyes. R.O.B. had a very short lifespan, with support for only two games comprising the "Robot Series", Gyromite and Stack-Up, both of which involved R.O.B. moving around plastic discs. R.O.B. draws comparisons to many current hybrid products including games like Skylanders (in combining a physical toy with a digital game), robot toys such as Romo the Robot, and Osmo (Tangible Play, 2014), a smart device application which uses object recognition to oversee pre-programmed games played in front of it.

Barbie Fashion Designer (1996) MATTEL

Barbie Fashion Designer was a PC game that let users design their own Barbie clothes. Users could choose from a set number of clothing templates, including vacation, party and wedding outfits. Each of the categories included a number of clothing pieces that could be combined and decorated differently. As a stand-out feature, the dresses could be printed on printable fabric that came with the game. Barbie Fashion Designer brought in the power of DIY (Do it yourself), which is surfacing also in the new inventions, the fascination of printable fabrics and the 'born digital' are also features of the current wave of new products and services.

Tamagotchi (1996) BANDAI

The now famous Tamagotchi was a virtual pet game-toy in which player takes care and raises a tamagotchi through several life phases. The creature develops differently depending on the care the player provides, with better care resulting in a happier, healthier adult creature. The interface of the original toy consisted of three buttons, an LCD screen, and an internal speaker, while the newer models have introduced many new features. The idea of Tamagotchi has been copied in many different ways; having a mobile companion and the nurturing relationship between a human user and a technological counterpart play a role also in many modern hybrid playful products.
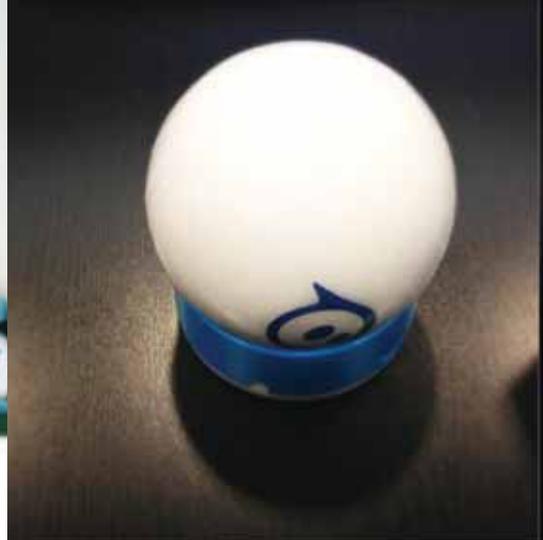
2.2 Company-driven hybrids vs. customer-driven hybrid experiences

In this section two special brand cases are introduced in order to give the reader a better understanding of the different possibilities hybridity offers for the design of play products. Lego is highlighted as an example of a modern toy company that, on a closer look, reveals itself working deeply on both physical and digital realms while leveraging this position in turning modern Lego play into a hybrid phenomenon. On the other hand, modern doll play – with photoplay, online communities, and 3D printed toys – provides another example direction of the hybrid experience: customers themselves taking material products into the digital realm and using contemporary tools to enhance play. Instead of fighting to retain a distance to users, many developers embrace this with an open-ended design philosophy. A prime example of this is the Makie doll, a truly unified hybrid toy that brings together many key areas typical for hybrid entertainment economies, including 3D printing, user customization, embedded electronics, and Web 2.0 services. These two examples, Lego and doll play 2.0, represent two different approaches to the same phenomenon: playful hybrid experiences.

World of Lego

During recent years, Lego has established itself both as one of the leading toy manufacturers expanding their brands towards hybrid experiences and as a dividend explorer within the category of hybrid toys. Charting Lego's journey chronologically from their first expansion into digital play, this chapter illustrates how a traditional toy company with lots of resources has tried to develop a digital strategy over the years and how that digital strategy has gradually transformed into a strategy that can be called hybrid, as Lego finally launched its own 'toys-to-life' toy-game-hybrid, Lego Dimensions, in the fall of 2015. This outcome – hybridization instead of digitalization – is no doubt explained by Lego's long history as perhaps the most popular toy line in the world and its subsequently massive investments in material production. Further, it is also a result of Lego experimenting with other kinds of material production outside of its core competency, the Lego construction bricks, including the Bionicle action toys, and the Lego Studios theme that allowed users to create special 'brickfilms'.

Beginning: computerization in toys and games

Lego started first to develop programmable toys in the 1980s. First programmable Lego products were released in 1986, and in 1988 Lego started to develop an "intelligent brick" which would allow users to bring Lego constructions alive with computer programming. Mindstorms, the construction theme build around this programmable RCX brick, and an associated programming interface, Robotics Invention System, were launched in 1998. The RCX brick has a built-in battery, a number of connection sockets, and acts as a central building block, around which users build programmed

constructions such as robots or vehicles. Since 1998, three later iterations have been released: Mindstorms NXT in 2006, Mindstorms NXT 2.0 in 2009, and Mindstorms EV3 in 2013. EV3 runs on Linux and can be controlled with its own remote controller or via a smart device. Mindstorms sets have been popular in programming and robotics education all over the world, with numerous contests for the builders.

Mindstorms was preceded by one year with the launch of the first Lego software aimed at consumers, Lego Island (1997). Lego Island, like the other Lego computer games that would start to emerge fairly regularly after this, featured characters and worlds modeled after corresponding Lego toys. Other games of this early period include titles like Lego Chess (1998), Lego Racers (1999), Lego Soccer Mania (2002), and Lego Knights Kingdom (2004). During this period (1997-2004, after which Lego games have been mostly handled by an outsourced company, TT Games), Lego released altogether 23 computer games. The early games were all based on Lego's own IPs and characters, with a change coming in 2001 when Lego released its first licensed game, Lego Creator: Harry Potter, as a part of its wider shift in market strategy focused on licensed properties.

Transmedia narratives

In 2000, Lego launched a new theme called Lego Studios. The sets guided users with different stages of movie making and allowed them to make stop-motion movies using the bricks. Steven Spielberg MovieMaker Set contained a video camera, video editing software, and a host of 'lego-fied' movie props such as collapsible towers, a mechanical dinosaur foot, and studio lights. The included software allowed editing the films and the ability to add various sound and video clips in them. While the theme was discontinued in 2002, it has been credited for the emergence of a whole subculture formed around these stop-motion brickfilms.

At the same time with the launch of Studios, in 2000, Lego Launched a new easy-to-build, snap-together line of action figures called Bionicle. The figures were modular but, compared to regular Lego, consisted of much fewer and more specified parts custom made for the line. Bionicle was launched during a ten-year downturn for Lego, a time period that called drastic strategical changes, and soon became a huge hit, eventually rising to be the number one product for Lego in 2003. As a new kind of product for Lego, Bionicle faced internal skepticism from company traditionalists for its war-like appearance. The line was a significant turnaround for Lego: instead of an open-ended toy with no set story, it was heavily story-centered and marketed as if it was an upcoming movie. An associated web page was advertised in every single Bionicle product, while each physical purchase yielded points to use in a Bionicle online game. Bionicle also spawned five console game iterations. The line was replaced in 2010 with a new, similar line called Hero Factory. Hero Factory figures came with activation codes to unlock game points for the digital game. These points – that could also be earned by playing the game, albeit slower – could be used to upgrade the Heroes' weapons and abilities, reflecting the free-to-play model. Users could also create custom Heroes on the site and use them in the game.

Apparel & Accessories

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Building Accessories

Buildings

Customized Items

Exclusives

Games

Girls

Hard to Find Items

Home

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Digital designing and material production

The early Lego computer games had features for content created with virtual bricks (see e.g. Lego Creator, 1998). In 2004 Lego launched Lego Digital Designer (LDD), a design software where users can design their own creations out of virtual Lego bricks. LDD allows users to save the designs for their own purposes or share them in an associated online service. For some years, LDD allowed users also to order the sets they had created as physical copies from the Lego Shop (using only a limited selection of the in-production bricks), but this feature was discontinued in 2012. The digital designer is still open, however, and can nowadays be used for example with other compatible products, such as Lego Mindstorms and Lego Ideas.

Launched in 2008, Lego Ideas is a website that allows users to submit design proposals to be turned into real-world sets. Once a proposal reaches 10,000 supporters it is reviewed by the Ideas team. To this date, twelve sets have been produced, including Minecraft Microworld (based on the hit game), DeLorean time machine (from Back to the Future movies) and Research Institute (a set showcasing female scientists). Some sets that have reached 10,000 votes have been rejected on the basis of infringing intellectual properties, including The Legend of Zelda and Shaun of the Dead.

Recent computer games

Since 2005, all major Lego games have been developed by TT Games. Starting with Lego Star Wars: The Video Game (2005), the games developed by TT Games are a series of adventure games, mainly aimed at younger players, featuring digital counterparts of the familiar Lego toy figures, locations, vehicles, and worlds. Notably, games employ the constructional form of the toys to great effect in their writing, design, and lighthearted humor (Mäyrä, 2015). A car crashing into a wall for example will break down into Lego pieces and can be constructed again. Majority of the games are based on existing third party licenses such as Star Wars, Lord of the Rings, and Indiana Jones, but in recent years Lego has started to develop games based on in-house intellectual properties. Lego has also started to leverage its dual position in both toy and games industries, looking for ways how to tie the two halves together. Lego City Police "High Speed Chase", a construction set in the City theme, allowed buyers to unlock exclusive content in a console game, Lego City Undercover (2013). The set also included an exclusive minifigure modeled after the protagonist of the game.

Moving into hybrid worlds

Released in 2011, Life of George was one of the first Lego products that could be called truly hybrid. Players first purchase the Life of George Lego set which includes an array of small Lego bricks and a special "green screen" play mat. The app provides the associated assembling game and the capturing software. Play consists of players trying to build displayed models, one at a time, as fast as possible. After finishing the requested model, the smartphone camera is used to capture

the model to "verify" the end result for time and accuracy.

Similar to Life of George, Lego Fusion is an app-toy hybrid that uses image recognition. Each Fusion set comes with 200 bricks and a special "capture" brick building plate. The free Fusions app features four types of games. In Town Master user builds a two-dimensional facade of a house on the base plate. The base plate allows the app first to recognize the shape and size of the facade, second to transfer the building into a virtual Lego town, and third to transform the facade into a three dimensional house. In Resort Designer players focus on decorating the interiors of the buildings, in Battle Towers players wage a tower-defense style battle, while Create & Race lets players to build a customized car for different types of race modes in the virtual world.

The latest addition to Lego's hybrid lineup is Lego Dimensions (2015). Similar to Skylanders and Disney Infinity, Lego Dimensions is a 'toys-to-life' game that combines physical toys with a dedicated console game. Dimensions combines different intellectual properties Lego has licensed for its toys during the years, including Lord of the Rings, DC Comics Heroes and Back to the Future with Lego's own IPs such as The LEGO Movie. Users first purchase a starter set that comes with Lego Dimensions game, three starter characters and bricks that allow them to build a special "gateway" pad. While looking like regular Lego figures, Dimensions Lego figures are equipped with NFC technology. Placing them on the similarly equipped toy pad (on which the "gateway" is built) transfers the characters in the game as playable, virtual versions. The toy pad supports up to six characters simultaneously. Unlike with Skylanders and Disney Infinity, the Dimensions characters are fully articulated toy figures, not mere statues. The game can be expanded with several types of expansion packs, adding new characters and areas to the game.

World of Blythe and friends

In addition to the latest technology utilized in hybrid play products, Hybridex was also focused on understanding the more traditional spheres of play such as doll play – now surrounded by digital environment of the modern society. On the surface doll play might appear to be relatively simple, but the centuries old phenomenon of 'toys with faces' is far from being one-dimensional. Such doll-icons as Barbie, born in 1959, are still at the center of pre-teen girl play communities, manifesting its pink and plastic world famously parodied by the 90s pop song Barbie Girl. Barbie, however, is not alone nor played only by girls and adolescents. Other 12 inch dolls, such as Skipper, Bratz, Monster High dolls, Momoko, Licca, Blythe, Pullip, Dal, and Teeyang as well as other 1/6 scale dolls are competing for the attention of kids and doll hobbyists around the globe. Larger dolls are still popular, too, such as the American Girl doll and New Born Babies. Smaller dolls accommodating dollhouses (1/12 scale) or figurines in hobbyist model trains (various scales) are scaling the hobby even further in terms of demographics and target audiences.

Dolls have been traditionally considered to be girlie play objects. As the beginning of the 1900s urbanization process had painted outdoors play unsafe for wealthier children, play was gradually moving indoors (Jenkins, 1998; Lauwaert, 2009). Girls of that time played with toys that "reflected new technologies that were revolutionizing the household and the lives of their mothers", toys which "demonstrated the workings of the girls' future work tools, the engineering of the household" (Friedman 1995 in Lauwaert, 2009). The toys for girls were mostly dolls and designed to train girls to become both "modern" housewives and nurturing mothers (Cross 1997 in Lauwaert, 2009). This is still evident in the toy industry's views towards dolls affected by the general attitude of the consumers.

While traditional doll play seems to be endlessly popular among children, many dolls now lead a different kind of life in the hands of adult hobbyists: as collectibles, design objects, and art pieces. And even though the producers of these dolls might not intend their products to end up as objects of hybrid play, users extend the lives of their dolls in various digital ways, not least through the creation of digital communities around their hobbies.

Photoplay and art with dolls

In 2000, Chronicle Books published a book titled This is Blythe by NY photographer Gina Garan. The book presented a selection of skillfully set up photos of Kenner's classic Blythe doll. (Blythopia. com, 2015). The book was an important catalyst in popularizing a new form of doll play: stylishly arranged dolls with 'chic' clothing photographed in carefully picked locations (e.g. often outside). This form of play can be conceptualized as 'photoplay' (cf. Heljakka, 2013).

Blythe is a 12 inch tall doll, created in a 1/6 scale compared to the human body – similar to that of Barbie. The most noticeable feature of the doll is its head, which is disproportionately large compared to the body. A unique functionality of Blythe is its specific eye mechanic: the doll's eyes change color and direction when the string hanging from the back of the head is pulled. The original Blythe doll was created by designer Allison Katzman in 1972 and sold by the toy company Kenner. However, Blythe's oversized head and color changing eyes did not go over well with the young audience, and the four original dolls were sold only for a short period. The eye mechanism has nowadays an important role in Blythe photoplay.

Utilizing the sudden popularity of Blythe as an example of photoplay, the Japanese company Takara began manufacturing new editions of Blythe in 2001. The dolls became immediately a huge success in Japan. In 2005, US based Ashton Drake began producing replicas too. While Takara's Neo Blythes were loosely based on the 1972 originals, Ashton Drake attempted to produce exact replicas.

Gina Garan received her first doll as a gift a few years prior to the publication of This is Blythe, and simply started to better her photography skills with the doll. This ended up in hundreds of pictures,

with the doll travelling around the world to be photographed by Garan (Blythopia.com, 2015). Today photoplay is a major part of the Blythe hobby. "For most Blythe fans, it's not so much about playing with the dolls but more about photographing them" (Qureshi, 2012). Julieanne Kay, a business owner from Manchester with six Blythe dolls, describes her hobby: "The first time I saw Blythe, I thought she'd just be amazing to photograph. I've always been very into my photography, and Blythe is very endearing and very photogenic. It's quite a creative process, thinking of how to photograph them and set the scene" (Qureshi, 2012). There is also a very sizeable Blythe Flickr community where fans share ideas and set each other Blythe related photography challenges (Qureshi, 2012). There are also numerous artists and photography exhibitions around the Blythe, among them a Finnish toy photographer Kati Heljakka (Virtanen, 2013.)

The kind of photoplay associated with Blythe extends to other toys and action figures, too. Photographer Rémi Nöel has photoplayed his Batman figurine, taking him around the world to be photographed in various, often somber situations, in a 'noir' black-and-white style (Trendacosta, 2014). In addition, photoplay is popular with miniature models used in art photos and urban installations. British model-maker and photographer Slinkachu has become famous for his miniature sized installations, constructed utilizing tiny human models used in hobby-trains. He assembles (and leaves) his mini-sized arrangements into public locations, such as busy street corners, where for example a tiny, world-weary, old man quietly sits in a boat floating in a puddle, fishing, seemingly just wanting life to be a little less hasty. The major theme running through most of Slinkachu's installations is the frailty of these small lives, in many ways similar to ours (Campbell, 2016).

Poseable toys

Some editions of the Blythe doll features bendable knees and arms, but within the hobbyist community it is also typical to change the default doll body to a more "posable" body, such as the Japanese Azone Pure Neemo doll's body which can be attached to a Blythe head with small alterations. Posable toys afford more versatile opportunities for photoplay. A category of ball-jointed dolls (BJD) represents an answer to the demands of advanced doll play. These dolls are articulated with ball and socket joints making the arms and legs easy to manipulate to preferred poses. In contemporary usage when referring to modern dolls, this term usually refers to modern Asian ball-jointed dolls. They are predominantly produced in Japan, South Korea, and China and are also growingly popular in the west.

Katriina Heljakka (2013) has written about toys with faces. The popularity of Blythe as an object for photoplay might be partly explained by the doll allowing its gaze to be directed, providing more affordances for advanced photoplay. The same kind of advanced gaze mechanism is available in some action figures too: Star Wars DX-07 Luke Skywalker by Hot Toys features a removable hair plate and a handle inside the head for fine tuning the direction of the doll's eyes. This could be argued to indicate that action figure manufacturers, too, recognize the importance of providing fans with more possibilities for posing and photographing their figurines.

Adult play

The doll hobby has been examined also in connection to cosplay and has similarities to such marginal phenomena as Lolita fashion. In cosplay hobby, popular anime, or game characters are brought to life by aficionados dressing up in recognizable costumes. While an important part of the hobby is the actual creation of the costume, public performances, competitions, and photographing are also central elements for the community. Lolita fashion, then again is a subculture of street fashion, where young women dress up in doll-like costumes, hairstyles, and makeup, in pursuing a characteristic style.

In her book Wandering Dolls Katrien Jacobs (2001) reports an ethnography of East-Asian doll hobbyists who also doll up themselves. Even though many doll hobbyists do not tie any sexual undertones to their hobby, there is a continuum from the craft-oriented and photography-driven hobby to the more widely known 'adult play' of private bedrooms. Then again, as sexual adult play has become so widely accepted and commercialized in the 21st century, the asexual doll-hobby subculture of adults can sometimes appear more strange and perverse as dolls are so strongly perceived as play objects for adolescents.

The adult doll-hobby is in many levels defined by various cultural frames and historical trajectories. Jacobs (2001) points out that Asian religious beliefs, such as Shinto in Japan, are a more natural context for the doll hobby. In Shinto, spiritual existence is not tied to a single abstract "being", but instead can be found in rocks, animals, people and nature. Such animistic tone is stronger in various indigenous religious systems and beliefs around the world. In some religions doll play is tied to rituals such as the tradition of Navratri in Hinduism. Within the celebrations of Navratri, the festival of nine nights, dolls become gods worshipped at home shrines. All in all, the adult doll and figurine hobby goes back centuries, if not milleniums, with different cultural backgrounds and undertones.

Digital communities

The modern 12 inch doll-hobby scene is uniting east and west. Online marketplaces, forums, blogs, and other forms of digital communities have been important for the growth of the phenomenon of Blythe and alike. The Internet has united scattered niche communities into a thriving, global hobby scene of doll fans. Globalization and e-commerce have been large catalysts in providing access to products and materials which one might not have been able to get hands on in traditional ways. International online stores give western doll hobbyists an access also to Japanese and Korean products that would not have been accessible otherwise.

YouTube and social media platforms such as Facebook and Flickr provide good platforms for doll fans to express their hobby to others. It is also very easy to find a lot of how-to and tutorial videos on various aspects of the hobby. People who have connected online might later travel to hobbyist get-togethers, such as the annual Blythecon (BlytheCon UK, 2016) for the Blythe hobbyists. These

Blythe Lips

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provide physical meeting places for the hobbyists and crafters, allowing sharing, buying, selling, and trading dolls and their parts etc. in a more traditional way.

Material crafting and repurposing of objects

In addition to the new ways of social sharing, photoplay integrates other areas of hobbyist activity into doll hobby. Yet another big part of the doll hobby is customization and the collectible culture. While some collectors like to keep their dolls in mint condition, most play with their dolls and many customize their dolls' clothing and features. Customization can range from new make-up and rerooted hair to carved eye sockets and new eye chips. Takara has catered to this growing trend by releasing several dolls with minimal accessories and a cheaper price tag, called Prima Dollies. Besides clothing there are several items that one can purchase for dolls – similar to the dollhouse hobby.

Hobbyists use online marketplaces such as eBay and Etsy.com to sell their self-crafted objects and to provide customization services. Sometimes dolls are photographed in specially crafted dioramas. One interesting aspect of crafting is how items originally produced for other purposes might be sold as 'repurposed'. Examples include a 1/6 scale magnetic paper-clip holder reappropriated as a sink, miniature versions of designer chairs which can be sold as a decoration for a doll diorama, or other objects originally created for decorative purposes.

The popularity of Blythe dolls and the increasing needs of the hobbyists have also created a market for fake Blythes and clones. Examples include the so called "Factory Blythes", Icy Dolls, Blyhs, CCE (Color Changing Eyes) and Basaak dolls. All of these are very similar to the original Blythe, but are sold with a much lower price in order to provide affordable practice pieces for customization, as well an easier access to the doll play hobby. The legal status of the clone products are not always so clear.

Dolls born in digital

As early as 1890, Thomas Edison created dolls with interactive features: dolls with recordings of nursery rhymes inside. Even though the product did not become a success at the time, it can be considered as one of the first entertainment records (Cowen, 2015). Prior to the digital era, there has been several products with mechanical interactivity or sound features. This trajectory is still visible in modern interactive toys, for example in such talking toys as Furby and Baby Alive by Hasbro.

Some traditional toy manufacturers provide services for customizing their products. For instance, with American Girl there was a customization service where their customers were able to order American Girl dolls with a customized head mold, skin tone, hair, and clothing. The doll was created online and the assembled product was then shipped home. In a way, the dolls were 'born digital'.

London based MakieLab has taken this kind of customization service even further. Their dolls, Makies, are fully customizable, 3D printed dolls that the user creates online, similar to an avatar in a digital game. The doll's facial features are created in MakieLab's web service, after which the doll is printed and shipped. Through the service, additional clothes and accessories are also available. This way, Makies can truly be considered 'born digital'.

The lowering costs of 3D printing probes new innovations within the field of customizable toys. Users are able to create as many virtual Makies as they want and then order the creations they like as 3D printed dolls. The associated online service can then be used to shop from a wide variety of additional doll clothes and accessories. Makies support more extensive customizing, too, as the doll's head can be fitted with electronics, such as Lilypad Arduino sets, Bluetooth, and RFID tags for further tinkering. While the price tag of roughly 80 € is not necessarily too high for children, high-end collectible toys are often embraced by adult aficionados. This kind of business model strongly relies on the community, as the users are encouraged to create custom content and share design tips and photos.

Utilizing the potential of new technologies such as 3D printing, sensor technology and miniaturised computers, the life of toys and dolls can now be digitally expanded. This development provides new directions both for toy manufacturers to offer new kinds of experiences and game developers to expand the experience into traditional avenues of play in new ways. However, there are many different ways to approach this, neither is it always about manufacturers and developers trying to create hybrid experiences. The digitalization of the society has made experiences in the virtual almost as real as the ones within the material world. The spheres of physical objects and digital environments are getting closer to each other. The ultimate goal is not to create "true" hybrid experiences, but to enable different kinds of experiences within these fields.

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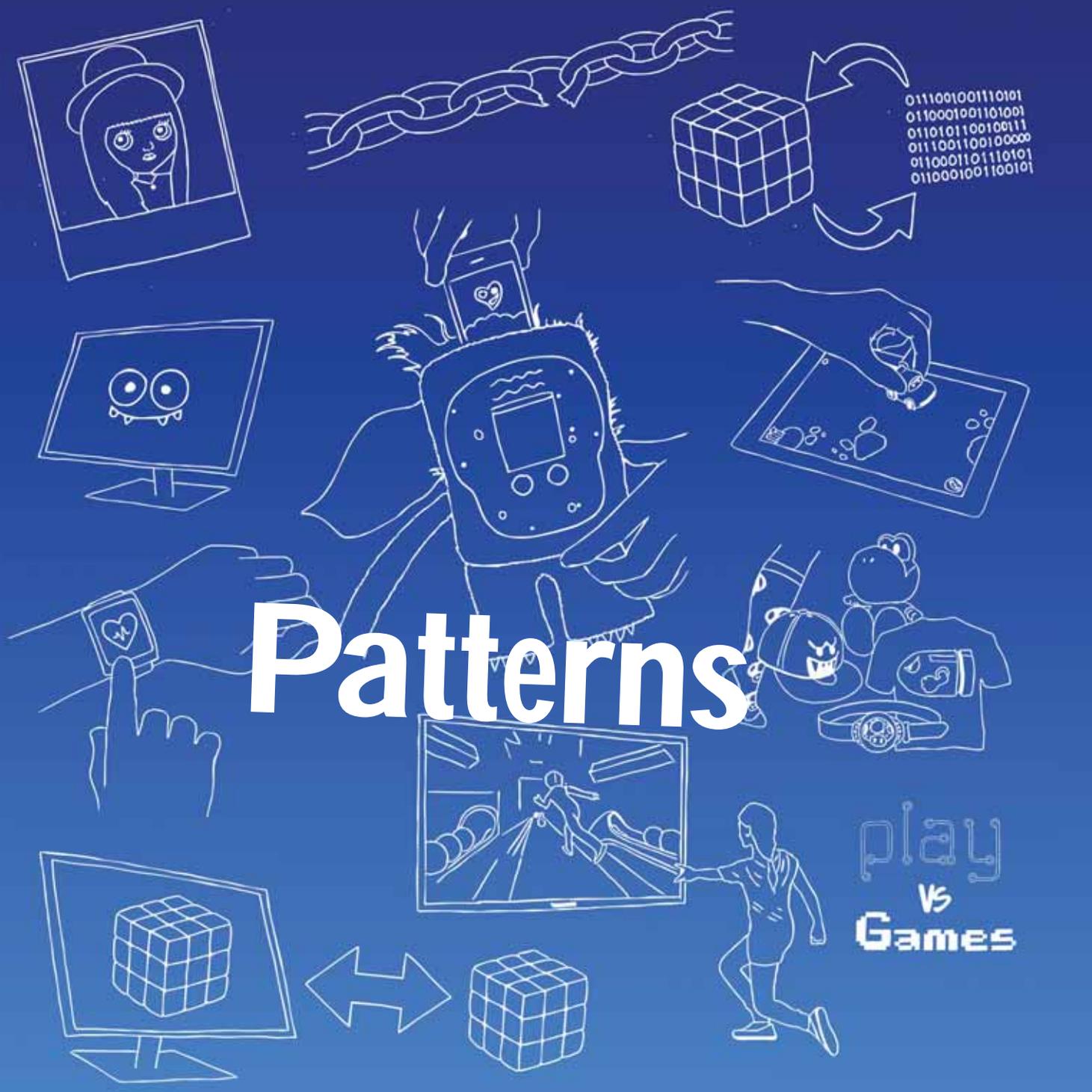
Patterns

3 PATTERNS

There is no single way for crafting hybrid experiences. Some hybrid play products are essentially traditional toys with some kind of digital add-on feature, whereas others fashion complicated services with customization and free-to-play components. Some products use digitality separately from material components, while in others the two halves are tightly integrated (Tyni et al., 2013). As such, there is a wide space of possibilities for combining different design features within hybrid products. Analyzing the case examples (see chapter 2) listed during the Hybridex project, various design sensibilities, or patterns, are emerging. Those patterns are presented in this chapter; they are meant to outline the variety of the possibilities that exist in the hybrid design space and to act as an easily palatable guide to the inner workings of hybrid products and services.

3.1 Collection of patterns for playful hybrids

Synchronized/asynchronized hybrid play

In many hybrid products the digital experience and the material experience are sequenced: they take turns. The user might first hold the physical toy and then move her attention completely to the accompanying digital environment, like in Skylanders. The same can hold true the other way around: you start by creating your plaything in a digital environment and then bring it to life in the material domain, as with the 3D printed Makie dolls. Some hybrid product experiences are much more integrated and digital and physical components are at play simultaneously. For example in Spellshot (Hasbro, 2012) players move physical pawns on a tablet acting as a game board which provides special effects and rules during the play. From design perspective, it might be useful to identify in what way synchronicity and asynchronicity are manifested in a particular product and what it would mean to make design changes based on this axis. For example, one can either slow down or increase the rhythm and intensity of the play experience through this design dimension. (Tyni et al., 2013).

Dependent/independent hybrid play

Hybrid play products often enable separate digital and material play. On the other hand, some have been purposefully created so that digital and material sides of the product are co-dependent of each other. For example, the Makie doll starts out as a digitally created avatar. User can concentrate simply on customizing avatars and just ignore the rest. On the other hand, when the user has designed and received her doll, she does not necessarily need the associated service at all. With Little Printer, on the contrary, the physical machine is highly dependent on the digital service and the content and updates it receives through it. This balance is not always symmetrical, however: sometimes the material product can be conceived as a standalone product and the digital part only as its enhancement – and the other way around. As a result, the digital half and the material half of the product can often be evaluated separately, based on the criteria of dependency. (Tyni et al., 2013).

Open/closed hybrid play

Hybrid play products that combine material and digital aspects in their design can be analyzed from the perspective of what kind of play, open or closed, they support. Whereas 'open play' refers to toy-like design where the product supports free and unstructured play, 'closed play' denotes a more structured, game-like form. Introducing digital features into a traditional toy, for example, often pushes the toy into a more game-like state, i.e. play based on rules. This is a very important design axis; in some contexts leaving room for free play might mean leaving room for creativity. As an example, while it might be tempting to integrate story content into an action figure in form of advanced features such as an audible voice, this might limit the free-play potential of the toy to only one character voice. Those board games which choose to use a tablet computer as a game board choose also to limit themselves to a comparatively small area of play. And by supervising game rules, these games might also rob players of the possibility to negotiate house rules if needed. As a result, designers of hybrid play should evaluate whether their decisions take away or add from the experience they are augmenting.

De-materialization and re-materialization

De-materialization refers to the cultural phenomenon of goods such as music, books, and games gradually turning entirely digital. Re-materialization on the other hand refers to cultural phenomena where digital products and services start to re-introduce physical aspects into their design. (Heljakka, 2012). As an example, while many digital games have already for years offered players downloadable content (DLC) with which to extend and expand the experience, Skylanders essentially brought this habit into a physical realm by using character toys as 'physical DLC' that can be used to unlock new areas in the game. Similarly, FigurePrints offers World of Warcraft players the chance to turn their digital in-game characters into physical statues, while MakieLab lets users order their avatar files as 3D printed dolls. In a global online culture where so many things are offered in a digital

form to everyone everywhere, often for free, both consumers and producers are trying to come up with new ways for individuals to differentiate themselves from the others. In some cases material experience has become such a means, a re-materialized premium feature amidst all the digitality.

Born digital

Born digital refers to products starting their life in a digital form and often later getting a material form. Being born digital means the product can harness the best parts of digital products such as easy customization in the initial phase. On the other hand, the physical object originating from that digital file can then take advantage of this customization, for example if there is a need to order spares or additional parts or if another iteration of the object needs to be made. For instance, users can order additional accessories for Makie dolls that fit precisely even though each user-made doll is unique. Similarly, 3D printing is now often used for custom-fitted screws and other small construction material used in various kinds of precision work, and it is very useful to be able to print slightly altered versions of those materials when needed.

Digital anthropomorphism

One recurring design feature in hybrid products is using digitality somehow to make inanimate objects more human-like or alive. For example, many 'smart toys' are created by using a smart device as the face of a toy (such as YetYet and Romo; see chapter 2), while Little Printer prints its own face in the end of each printing session. The printed face occasionally uses glasses and even has slow hair growth. MurMur seats (Nummenmaa et al., 2014), on the other hand, are embedded with audio and sensor technology to give the seats the ability to speak with custom-fitted voices, sense touch, and make comments upon it. Each seat has its own backstory. All of these features combine to give an impression of distinct personalities, which has proven to be evocative for the users.

Photoplay

'Photoplay' refers to the collector toy hobby practice of posing toys in a playful manner, for example in public spaces or in carefully orchestrated lighting (Heljakka, 2013). The practice is popular among collectible dolls surrounded by an active adult hobbyist scene, such as the one around the Blythe dolls. Hobbyists often customize figurines, pose and photograph them in a presentable way and share the photographs of their work on the Internet. This is sometimes done in order to sell customized dolls to hobbyist users. Photoplaying digital communities stage competitions, for example "take a picture of your doll each day, for a year, always with different clothing". Some dolls offer better opportunities for photoplay in different ways, such as with more flexible limbs that allow for better posability and through the ability to direct the dolls line of sight via a gaze mechanism. The same kind of advanced gaze mechanism is available in some action figures, too; thus more and more manufacturers recognize the importance of providing fans with more possibilities for posing

The Elf on the Shelf is Santa's very special scout that reports to him every night till Christmas. Welcome a new, lovely family addition!

lf already?

what your Elf has been up to lately!

and photographing. Besides dolls and figurines, photoplay is also used for artistic purposes like installations. Street artist Slinkachu for example uses train hobbyist miniatures to stage installations that aim for social commentary.

Digital games merchandising

Due to digital distribution, the traditional materialism surrounding digital games – the game box – has shifted into new forms, such as collector's edition boxes, collectible figurines and give-away promotional material surrounding big game launches. For instance, the small size of Angry Birds, as a downloadable mobile game, is compensated by the enormous merchandise phenomenon surrounding it. Other examples include physical, real-size objects from games, such as the pick-axe from Minecraft and the 5-foot long chainsword from Warhammer 40K. This development is partly due to the fact that earlier the game boxes sold in retail stores were a large part of advertising the game. If the game is primarily digitally distributed, the lack of advertising needs to be compensated somehow. In a networked society where virality is often the best means of marketing, grabbing consumer attention often calls for "marketing stunts", created to be as visible and shareable as possible. An example of such a stunt was the giant-sized mech robot erected at Berlin Central Station that was used to promote an upcoming Xbox game, Titanfall (Electronic Arts, 2014).

Tangible user interfaces

Tangible user interface (TUI) is an interface that allows a person to interact with digital information or a virtual system through the means of physical environment. One of the first 'toys-to-life' games, Redbeard's Pirate Quest (Zowie, 1999), had players move physical, USB-connected pirate toys on a pirate ship, for example manipulating cannons, while these movements could then be seen happening in a virtual form in the associated computer game. Since then TUI has become very common in hybrid toys, such as smart device tabletop games. For example, this could mean games played with physical game pawns on a tablet computer screen and games where smartphones are used as game pawns on a physical game board. TUI is popular among interactive art installations that are built around audience participation.

Mimetic interfaces

Mimetic interfaces are interfaces that, to control particular virtual system, mimic the command moves used in the real-world equivalent of that system (Juul, 2010). For example, some computer operating systems support gesture controls which allow user to swipe air to bring in new information on the screen or dismiss it, with the system animating these transitions in an intuitive way that corresponds to the speed and momentum of the hand movement. In a digital game that features a mimetic interface the physical activity that the player performs – e.g. swinging a controller – causes similar movements in the game activity seen on the screen. For example, Wii Sports (Nintendo, 2006), a tennis video game, is controlled by moving the controller as the racket in actual tennis

(i.e. the controller is a stand-in for the tennis racket handle). Further, in Guitar Hero (RedOctane, 2005) player strums a plastic guitar with the movements corresponding with those of an on-screen avatar, while in Dance Dance Revolution (Konami, 1998) player performs dance movements on a controller surface in front of a screen depicting a similarly dancing avatar.

Appcessories

An appcessory (app + accessory) is an accessory for smartphone combining a specially written app to perform a useful function. The term originates from the toy industry and points to the various physical accessories designed to enhance and complement related smartphone applications or, vice versa, to digital apps designed to complement physical products. The full value proposition involves both new hardware and new software. The term is used often with toy and game applications, such as with board games utilizing a smartphone component. Examples include toys that are moved on top of tablet screens, smartphones facilitating and enhancing board game play, and plush toys enhanced with a smartphone element. Like the smartphone, appcessory hardware itself is often also a platform: it supports new software thus allowing updates, patches, and expansions (Holtman, 2012).

Smartphone "slip-ins"

Since the early days of smart devices, users have tried to protect their phones and tablets from accidental falling and rough handling. This has led many manufacturers to design more and more attractive cases for different user segments. While some smart device covers are mere decorative cases, some are accompanied with a dedicated app adding interactive character aspect to the product. An emerging category of playful protection cases is smart devices cases doubling as toys and playful characters. Some of these "slip-ins" allow user to slide their device into a plush toy which then becomes a sound-and-interaction-enhanced smart toy. Some toys leave openings in the plushie, letting parts of the device screen remain visible for touch controls and visual input/output. A typical slip-in, YetYet (2012) by Totoya Creatures, looks like a cuddly yeti. User interacts with YetYet via touching its face (actually a smartphone), visible through an opening in the toy. Similar looking Ubooly (Ubooly, 2014) talks to the user, for example tells jokes and stories. Ubooly can also teach a user new languages and math. As typical "appcessories", smartphone slip-in toys can often download new content to allow updates, patches, and expansions.

Wearable technology

Wearable technology refers to technologies that are integrated into clothing or are otherwise worn by a person or an animal. Examples include smart watches that measure different metrics such as movement and heartbeat and smart clothing that measures life signs and automatically alerts help in a case of cardiac arrest. Although early wearable technology products and prototypes featured bulky computer systems or were alternatively limited in functionality, they have evolved into a point where

it is feasible to create sleek consumer products featuring computer chips and advanced electronics. Smart watches, such as the Apple Watch, Samsung's Gear series of watches, and Kickstarter funded Pebble watches are examples of recent consumer targeted products featuring advanced technology. Other examples of wearable technology include smart glasses such as the now discontinued Google Glass, shirts with sound-controlled LEDs, or FitBark, an activity and sleep monitor for dogs.

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MurMur

4 MURMUR MODERATORS

As we examined the field of hybrid catalysts, products, and patterns, a need for a concrete experimentation, which would reflect and combine some of the crucial properties of the field, arose. Prototyping was one of the key areas of the project, and the purpose of this experiment was both to explore the hybrid domain from a different perspective and to create and study something that we felt was still missing from the field.

The concept of MurMur Moderators was born from an amalgam of several ideas from various workshops. Adult Play was taken as the guiding principle for the experiment as it was seen as a rising but still underutilized phenomenon. Internet of Things was included in the concept as well as another clearly rising issue. Miniaturization of Technology and Sensors worked as the catalysts that allowed us to implement interactive technology inside the product relatively easily and cost-effectively. To further explore the DIY culture, the physical structure was also made from affordable and easy-to-find materials.

Soon after the design phase, the concept of the MurMur seats were accepted to Maker Faire Rome 2013 as an exhibition piece. An intense construction phase followed and a prototype was built. The result was a set of playful, interactive seats, the MurMur Moderators that function as toys and ambient elements in professional environments, such as workplace recreational areas. In the MurMur Moderators, the focus areas of 1) furniture as a service, 2) hybrid product design, 3) adult play, and 4) playful office design come together. The design objective for MurMur Moderators was that they would function as both primary (direct interaction) and secondary (ambient) playful objects creating and facilitating playful atmosphere through undirected play.

Concept

MurMur Moderators is a set of playful interactive seats combining sensor play, connectivity and digital anthropomorphism. The concept includes five furry seats, each of which takes the form of a fantastical creature with a distinct personality: the grumpy Mur, the goofy Mus, the mellow Muh, the sensitive Mut, and the shy Mum.

The MurMurs speak their own made-up language and they react to touch by laughing or greeting the user. Each seat has its own cartoony voice recorded by a voice actor, consisting of grunts, sighs, and nonsense words, with which the seats react to different user actions. When somebody sits on them, they greet the user in delight, and when the person leaves, they utter mournfully. When the ears of a MurMur are touched, the seat laughs. When in the same space, the seats can interact with each other by having random discussions and singing and bellowing together. If the seats are left alone for a while, they fall asleep and start dreaming of environments reflected by distinct soundscapes: Mur dreams of stormy weather, Mus of forests, Muh of nights, Mut of meadows, and Mum of the ocean.

The MurMur Moderators are also connected to the Internet. Each of the seats has their own Twitter account and they tweet in certain intervals according to their personality. Mus for instance tells jokes while Mur appears serious and wise. They also direct their tweets to each other and reply to other MurMurs' tweets.

Build

Aiming for affordable DIY design, the prototype seats were created using IKEA Alseda Stools covered with IKEA Hampen Rugs. The technology that brings MurMurs alive is a combination of several components: a Raspberry Pi single-board computer, an Arduino Mega microcontroller (Arduino UNO in the first iteration), an EasyAcc 12000mAh battery pack, and a ProCaster BeachBox speaker (Jabees Jmusic speaker in the first iteration). Several sensors were also used: in the first iteration, a simple push-button, a tilt sensor, and an RFID sensor. In the second iteration, custom made buttons were used, but the tilt sensor and RFID sensor were left out. In addition to these sensors, Arduino microcontrollers provide capacitive sensing capabilities. RFID tags were used with the RFID sensor.
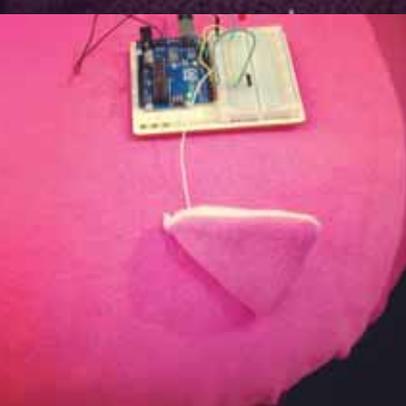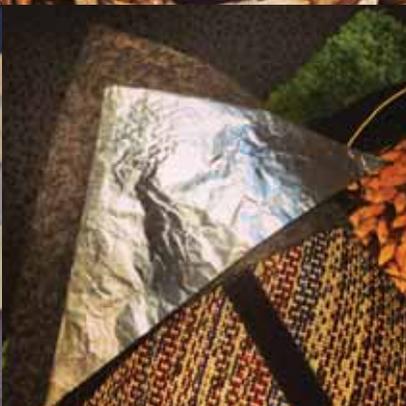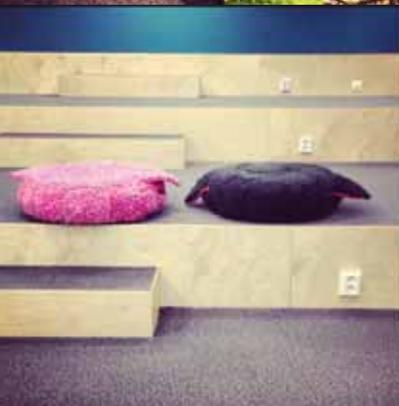
First iteration

Two prototype seats were first constructed by the research team using different kinds of sensors, Arduino and Raspberry Pi processors, and "hacked" IKEA furniture.

In the first iteration, all of the sensors were handled by the Arduino UNO. The Arduino UNO is well suited for handling sensors, consumes little power, and is easy to use when prototyping. To sense capacitive touch when users would touch the ears of a MurMur, we used tin foil that was connected to the UNO. A simple two state tilt switch placed inside the seat was used for tilt detection. A simple pushbutton was installed into the center of the top part of the seat to sense if the user was sitting on MurMur. The antenna of the RFID sensor was installed so that it was at the center of the top part of the seat, surrounding the pushbutton. The RFID tags were placed at the bottom of the seat, so that the sensor would meet the tags when stacking MurMurs.

The Raspberry Pi was chosen because it supports audio output and can communicate through WLAN using a small USB PICO WLAN adapter. The connection between the two devices is established through an I2C connection, leaving the USB connection of the Arduino free for debugging. To connect the Raspberry Pis to one another, we needed to set up our own wireless access point. Through the access point, each Raspberry Pi could communicate with each other as long as they were within the transmission range of the access point. MurMurs could thus be set up anywhere where the access point could be connected to a power outlet.

Having one device for handling sensors (the Arduino UNO) and another one for handling audio and client software (the Raspberry Pi) was essential for our prototyping purposes. We were able to tune sensors separately with the Arduino UNO and solve issues without having to restart the Raspberry Pi or even the client software. The Arduino also uses very little power while constantly monitoring sensors and only communicates information when necessary to the Raspberry Pi.

In order for MurMurs to have shared discussions and to sleep and wake up synchronously, they needed to be able to communicate with each other. With just two MurMurs, this could be accomplished by having the Raspberry Pis in the seats establish a direct connection between each other.

The physical form was also explored through prototyping. A couple of non-interactive prototypes were created in order to find a suitable form for the chairs. We wanted to make the seats suitable for an otherwise "serious" setting, so instead of tails and "Mickey Mouse" ears or visible eyes, we ended up with stylized creatures with the shape of a leaf. To heighten the sense of a design furniture instead of a children's toy, we also abandoned the material of fake fur and used hot-melt adhesive to glue pieces of rugs on the seats instead.
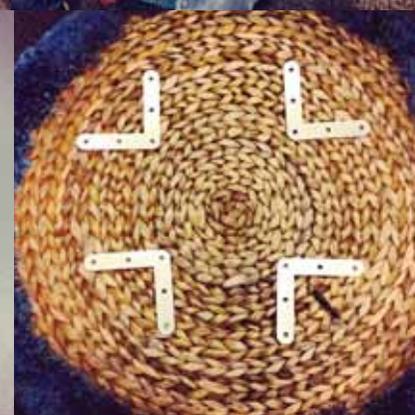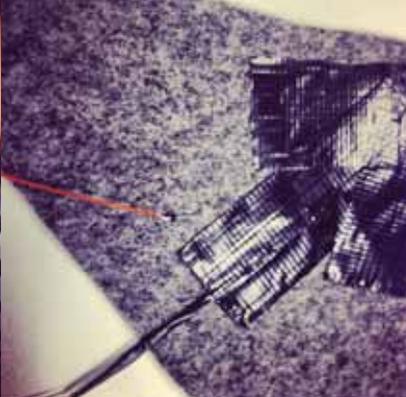
Second iteration

In the second iteration of the project the concept was taken further by building a set of five seats with added functionalities such as singing and tweeting.

While the first iteration round of the prototypes included two personalities, Mur and Mus, the second iteration round featured all five of them. In the first iteration, the seats greeted each other when they were stacked on top of each other and, when they were tilted upside down, they output a dizzy, or "sea-sick" sound. These two features were removed from the second iteration to streamline the concept.

The experiences from the first iteration brought a new feature as well: as many users tried to sway on the seat to elicit reactions out of them, a swaying interaction was implemented as a new rhythmic audio output for the second iteration. As the number of the seats rose from two to five across the iterations, two "group features" were added: singing together and bellowing together. Adding vibration to the seat as suggested in the feedback of the first iteration was experimented for the second iteration, but was not included in the end after the test sessions proved it unsatisfactory.

Based on the findings on the robustness of the first iteration, the design of both the hardware and software was changed to be more robust for the second iteration. While the first prototype seats worked generally well for research purposes and needed lengthier maintenance (lasting over 15 minutes) only a few times, they required smaller maintenance procedures of a few minutes more often. While the small maintenance procedures often consisted of simply restarting the Arduino microcontroller, such problems would be unacceptable in settings where the developers would not be constantly in the space where the seats are located.

In the second prototype, the wiring was redone with longer wires that enabled smarter routing inside the seat. This solved the issue with interference between wires. The handling of sensors was kept separate in case of problems. The components were kept attached to the inside surface, but now filling was added that held the battery and speaker in place. The speakers themselves were changed to bigger ones so that the volume could be louder without compromising the quality of the sound.

The new prototype featured five seats, so the network setup needed to be different. There was now a separate server software that ran on a pc. Each seat connects to the server pc, which hosted an access point. Starting MurMurs still works by connecting to them through SSH, but as the server runs on a separate computer, disconnections never caused trouble for the other seats.

Experiences with MurMur Moderators

The seats were tested and their use was studied in different environments including fairs, a research seminar, and the OASIS social space, located at the University of Tampere. Research on MurMur Moderators has been published in several academic articles (Kultima et al., 2015a; Kultima et al., 2015b; Nummenmaa et al., 2o14; Nummenmaa et al., 2015). In addition to receiving positive feedback from the fair visitors we gained extensive media exposure for the project (e.g. Clark, 2013; Savin, A. & Matson-Mäkelä, 2013).

Further, research based on and conducted with our own hybrid prototype has helped us to understand the design space in which the designers are working in as well as the central facets of hybrid products and their design, such as what makes them fun and what could be fruitful use contexts for hybrid products. One central finding from the study has been the discovery of the importance of the concept 'ambient play', pointing to the ambient nature and the consequent design affordances of interactive playful products embedded in social spaces. Second, the focus on adult play led us to the concepts of 'play affordances', 'play preferences' and the 'thresholds for play' specifically in adult play context (Kultima et al., 2015a). The design, use and reception of the seats have been covered in several articles (Kultima et al., 2015a; Kultima et al., 2015b; Nummenmaa et al., 2o15; Nummenmaa et al., 2014), with the results focusing on adult users' discovery of play features and discarded, risqué features, among others. Through the experiences of the MurMur Moderators prototypes, adult playfulness became one of the key areas of Hybridex (Kultima et al., 2015a). Finally, the seats have had a clear contribution in our understanding of the possibilities and the significance of the field of Internet of Things, and the design possibilities of playful applications within it in particular: The Playful Internet of Things.

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Hybridex Research
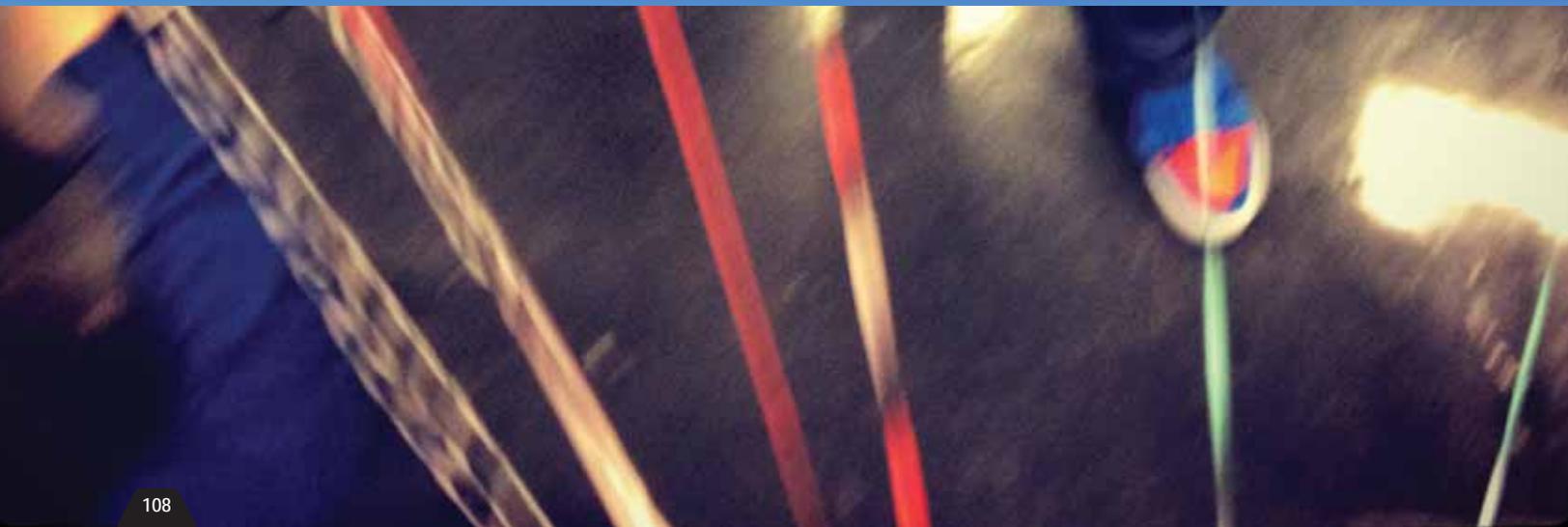
5 HYBRIDEX PUBLICATIONS

In the following the different research articles created during Hybridex are summarized. Majority of the articles have been published elsewhere in full-length, while some are still working papers.

2013

Dimensions of Hybrid in Playful Products
Heikki Tyni, Annakaisa Kultima & Frans Mäyrä

2014

Material Culture and Angry Birds
Heikki Tyni & Olli Sotamaa

Understanding Smart Device Tabletop Games
Ville Kankainen & Heikki Tyni

MurMur Moderators, the Talking Playful Seats
Timo Nummenmaa, Annakaisa Kultima, Heikki Tyni & Kati Alha

ToDiGRA Special Issue: Physical and Digital in Games and Play
Journal Special Issue (Eds.) Frans Mäyrä, Kati Heljakka & Anu Seisto

2015

Goofy Mus, Grumpy Mur and Dirty Muf: Talking, Playful Seats with Personalities

Annakaisa Kultima, Timo Nummenmaa, Heikki Tyni & Kati Alha

On the Interplay of Two Worlds - A Case Study on Gameplay Experiences of Blood Bowl -Board Game and Its Digital Versions

Ville Kankainen (Master's Thesis)

Need to Touch, Wonder of Discovery, and Social Capital: Experiences with Interactive Playful Seats

Timo Nummenmaa, Annakaisa Kultima, Heikki Tyni, Kati Alha & Jussi Holopainen

Working Papers

Talking Playful Seats in a Presentation Environment

Annakaisa Kultima, Timo Nummenmaa, Heikki Tyni, Kati Alha, Ville Kankainen & Frans Mäyrä

Hybrid Play Products Industry - The Developer's Perspective

Heikki Tyni & Annakaisa Kultima

Dimensions of Hybrid in Playful Products

Conference Paper / Theoretical Framework

Heikki Tyni, Annakaisa Kultima & Frans Mäyrä

Abstract

This article examines playful hybrid products located in the intersection of toys and games. By hybrid, we mean games and toys that utilize digital environments to provide added value to tactile, physical or material experiences. For the past couple of years a rise of a new wave of hybrid playful products has become a reality. Products like Skylanders (2011), Invizimals (2009) and Mechatars (2011) expand digital experiences into material realm, and material toys carry information and link to digital games and services.

This article aims to create a preliminary model for mapping hybrid dimensions. Our initial analysis paints a picture of a design space with varied degrees of hybridity. Comparing seven example cases lets us see how in some products the digital part of the experience is independent of the material side, while sometimes these sides are co-dependent. Further, in some cases the digital and material halves are intertwined to a synchronous experience, whereas in others they take turns.

The main axes for our model for hybrid playful products are dependency and synchronicity. We featured several examples drawn from our survey of hybrid, playful products and presented a preliminary analysis of them, applying dependency and synchronicity as the main analytical tools. The results indicate that there are many types of hybridity present in the current play products, something that the marketing of these toys has acknowledged. It is also apparent that it is sometimes hard to draw the line on what constitutes hybridity. This blurring of the historical phenomena such as motion based and AR games with the newly emerging hybrid products serves to showcase the crossing trajectories of several different product categories and turn the question to a different, perhaps more cultural direction: why is this hybrid products phenomenon happening now?

Material Culture and Angry Birds

Conference Paper / Case Study

Heikki Tyni & Olli Sotamaa

Abstract

This article examines different ways in which the research of material culture is relevant for digital games. While digital games are increasingly distributed in a completely digital form, materiality of digital games can now be discovered in new places. The new wave of hybrid playful products like Skylanders (Activision 2011) expands digital experiences into material realm (Tyni et al. 2013). In addition, empirical studies show that people can still have deep appreciation towards game boxes, cover art and collector's edition figurines in a time when digital games are turning to digital-only distribution (Toivonen & Sotamaa 2011). Study on materiality in general can be in many instances extrapolated on game culture, for example in considering questions of identity and how we relate to our physical belongings.

This article compiles a collection of different research areas relevant for the study of games and materiality. First, it goes over multiple strands of research on material culture. Second, a collection of different research approaches relevant for the study of games and materiality is compiled. Finally, the paper looks at Angry Birds (Rovio 2009) as a case study in order to better contextualize the different research approaches, at the same time illustrating the surprisingly material nature of this digital hit game.

Through the exploration of Angry Birds we try to exemplify how these perspectives can importantly inform our understanding of how the AB phenomenon is constructed, also in very material ways. Rovio's desire to highlight the Big Physical (giant plushies, the championship contest in an aeroplane etc.) seems to communicate that half of the appeal is still in the physical space, outside the screen and online networks. The diversity of Rovio's operations also effectively contests any simple conception of a modern game studio as mere software developer. The marketing logic of tying the physical toys into the larger ecosystem of hybrid media, composed of equally important elements of physical and digital components, is in the center of both the hybrid AB toys and the multimodal AB phenomenon as a whole. Rovio's three-fold strategy – digital games, animation and physical merchandising – helps to bring sustainability and predictability, as business is not at the mercy of the fluctuating economic situation of only one entertainment sector. It has to be acknowledged that a lot of the play experiences now available to us, are more or less hybrid experiences, combinations of physical and digital elements.

Understanding Smart Device Tabletop Games

Conference Paper / Theoretical Framework

Ville Kankainen & Heikki Tyni

Abstract

The aim of this short paper is to understand smart device tabletop games (SDTG) as a part of the larger phenomenon of hybrid tabletop games. The article briefly highlights the history of 'hybrid' tabletop games, goes over some of the recent studies focusing on them, and finally moves on to describe the types of smart device tabletop gaming experiences currently on offer. With this kind of loose categorization the article hopes to inspire tabletop game design in further harnessing the design space offered by smart devices. The process of creating a typology also helps movement towards understanding the nature of a wider hybrid gaming experience, not restricted merely to the delivery medium of the game.

Smart device as the game board is the most obvious category of SDTGs. Games in this category use the tablet computer as a game board in some way. Due to their smaller size, smartphones particularly can be used as game pawns themselves. Games taking this approach form the category of Smart device as a game pawn. Smart devices can also be used as different kinds of gameplay accessories for SDTGs. The variety in the category called Smart device as gameplay accessory for a tabletop game comes from how integral the smart device is for the gameplay of the game. In turn Smart device as a tabletop game helper -category refers to the way how, besides being a gameplay accessory, smart devices can be used outside the core gameplay to help streamline game sessions, for example during set-up. The exceedingly good quality of sensors, like HD-cameras and microphones, integrated in modern smart devices allow them to be used as self-standing game master overseeing play. This kind of games fall in the category of Smart device overseeing play. In addition to these categories there are Peripheral cases – instances of gameplay that resemble game play on tabletop games and are associated with smart device, yet falling out of our definition of SDTG. These encase All-digital tablet games with board game aesthetics and Smart device tabletop toys.

Among other things this kind of loose taxonomy implicates that in this new environment of ubiquitous technology the boundaries that define a "tabletop game" are fast becoming blurred. The designer isn't anymore tied merely to either on the material or digital world. In this new hybrid design space she can draw affordances from either or both of those according the need of the gameplay experience she wish to offer. As such, the article hopes to highlight the hybrid tabletop game experience as something that resides between the physical and digital elements, yet drawing experiential elements from both.

MurMur Moderators, the Talking Playful Seats

Conference Paper / Design Experiment

Timo Nummenmaa, Annakaisa Kultima, Heikki Tyni & Kati Alha

Abstract

In this article the the concept of MurMur Moderators, talking playful seats facilitating playful atmosphere and creativity at office environments is presented. The article describes the design and technological composition of our first prototype, and our experiences exposing the concept to audiences at two science fairs: Maker Faire in Italy (2013) and Valoa Pimeyteen in Finland (2014). This research has served as an informative pilot study, consequently directing our focus to the ways the accompanying narrative brings additional design value to the interactive seats. Our goal with the fairs was to investigate what are the preliminary audience reactions for the high level concept and how people interact with the initial prototype.

The MurMur seats are prototypes of playful, connected furniture, in which the different focus areas of hybrid product design, adult play and playful behavior in workplaces come together. The MurMur seat is an interactive seat that has its own made-up language and reacts to touch by laughing or greeting the user. The two prototype seats were constructed by the research team using different kinds of sensors, Arduino and Raspberry Pi processors, and 'hacked' IKEA furniture. The prototype brings together the concept of an interactive toy and interactive furniture.

The prototype introduces a host of interactive features that facilitate playful behavior, and these features were tested in two science fair settings. Of the interactions, tickling proved to be one of the most celebrated features. Our focus has also been to investigate the playfulness this kind of unfamiliar concept evokes in adult users and what role, if any, playfulness could have in an every-day environment such as the work office. The reactions and comments of the fair visitors have added to our understanding concerning the design space and were used for generating further ideas for ambient play and furniture-as-a-service, some of which carries on to future research and second prototype of the seat. The prototype has led us to shift our focus more heavily on the relation of primary vs. secondary interaction in playful products and especially to investigate more on the ambient nature of play.

ToDiGRA Special Issue:
Physical and Digital in Games and Play

Journal Special Issue

(Eds.) Frans Mäyrä, Kati Heljakka & Anu Seisto

Abstract

This special issue is a collection of papers which started their life as working papers, drawn from ongoing games research projects that were presented in the 2013 Game Studies spring seminar at the University of Tampere. Titled "Physical and Digital in Games and Play", this seminar aimed on one hand to highlight the unique characteristics both material and immaterial aspects hold in games and play, but also to bring digital and physical game studies into closer contact and dialogue with each other. Fifteen research papers were presented in the seminar, and afterwards a selection of seven articles, ranging from experimental work on playful, physical technologies to more specifically games related research areas, were chosen and expanded through the standard process of double-blind peer-reviews and editorial work to appear in this journal issue.

The first paper, by Stephanie de Smale, titled "Building Material: Exploring Playfulness of 3D Printers", investigates the playful dimensions of 3D printers and the evolving practices around them. The second article, by Paul Coulton, Dan Burnett, Adrian Gradinar, David Gullick and Emma Murphy, titled "Game Design in an Internet of Things", addresses the nature of game design in reference to the emerging Internet of Things. The third article, by Alison Gazzard, Mark Lochrie, Adrian Gradinar, Paul Coulton, Daniel Burnett and Daniel Kershaw, titled "From the Board to the Streets: A Case Study of Local Property Trader", describes a case of a mobile location based social media game, extending and combining features from previous concepts e.g. FourSquare social media mobile application and the traditional Monopoly board game. The fourth article, by Frederika Eilers, titled "SimCity and the Creative Class: Happiness, Place, and the Pursuit of Urban Planning", reports an experimental study on the SimCity game.

The fifth article, by Inger Ekman, titled "'That's Not a Secure Area' – Physical-Digital Sound Links in Commercial Locative Games", presents a detailed dissection of how sound is utilized in seven commercial locative games, based on first-hand play experiences. The sixth article, by Karl Bergström and Staffan Björk, titled "The Case for Computer-Augmented Games", discusses the benefits of using digital information and communication technologies to augment and facilitate traditional (non-digital) gameplay, rather than implementing games that rely completely on computers. The seventh article, by Marcus Carter, Mitchell Harrop and Martin Gibbs, titled "The Roll of the Dice in Warhammer 40,000", focuses on the many-sided experience of dice rolling and their role in W40K.

Goofy Mus, Grumpy Mur and Dirty Muf: Talking, Playful Seats with Personalities

Conference Paper / Design Experiment

Annakaisa Kultima, Timo Nummenmaa, Heikki Tyni & Kati Alha

Abstract

The article discusses the concept of MurMur Moderators, talking playful seats designed to facilitate playful atmosphere and creativity at office environments. The concept of MurMur Moderators consists of five different personalities, grumpy Mur, goofy Mus, mellow Muh, sensitive Mut and shy Mum. The article describes the experiences and reactions to two personalities, Mus and Mur. Further, a sixth personality, Muf, consisting of rejected, provocative features is detailed. Consequently, the paper discusses play preferences, affordances and thresholds in connection to adult play. These will be the focus of future research by the authors. The central design goal of the project was to explore adult play and the role of frivolous play activity in formal context. Even though games and play are traditionally perceived to belong to the domain of children, the sphere of adult play is relatively wide – yet under researched.

Both the audience reactions towards MurMur Moderators and their design process communicated us that people reacted differently to the two personalities. The different reactions and their influence on the willingness to play with the seats gave us an interesting starting point for future research on the threshold for play, play preferences and play affordances. Based on our experiences with the audience we crafted a hypothesis of the importance of personal identification and attachment to the narrative. For some users, the perceived affordance of play seems to play a crucial role in lowering the threshold for play.

The sixth personality, later named as "dirty Muf", was created as one of the first prototypes of MurMur. Unintentionally, the audio design of female pleasure sounds had strong sexual connotations when the seat was used, which was further emphasized by the shape and the color making the seat resemble a vagina shape when looked from above. Even though we initially rejected the functionalities drawing associations to sexual themes, "dirty Muf" provides an interesting addition to the MurMur Moderators as a research tool to provide further understanding of adult play.

On the Interplay of Two Worlds: A Case Study on Gameplay Experiences of Blood Bowl -Board Game and Its Digital Adaptations

Master's Thesis
Ville Kankainen

Abstract

Board gaming has a long history as a pastime, but with the development of digital technology it has moved on to a new era. Through advancing mobile technology, digitized board games have rapidly grown in numbers. Still the material aspect of board games builds up much of their attraction. What bearing do digital and material aspects have on the formation of board game experience?

Blood Bowl (1987) is a two player board game that resembles american football. The game is played on cardboard board with metallic or plastic miniatures. Since the original release there has been many official and unofficial digital adaptations of the game. This study examines what kind of features material and digital play of Blood Bowl have, and what kind of relations do they have with each other. The study also shortly considers what this kind comparison offers towards the design of hybrid board games in general.

For the study, nine people were interviewed using thematic interview. All the interviewees had experience on material Blood Bowl and at least some of its digital adaptations. A qualitative analysis of the data produced six categories describing Blood Bowl experiences. The categories are not mutually exclusive, indicating the overall nature of the game play experience which spans over different mediations of the game.

By filling different needs, playing both the material and digital versions of the game form an expanded game experience. Material play is experienced more as a social event, when digital play constitutes as filling empty time and substitutes material play. Still the social aspect is important for both styles of play, but with the digital adaptations happens more often outside of an actual game session.

On the perspective of hybrid board game design it would be advisable to take into account this expanded game experience. For example combining heightened accessibility of digital board games to the social event of playing a material board game could be advantageous for future hybrid board game design. This kind of approach would look into whole new design space of hybrid products instead of just borrowing features from material and digital domains.

Need to Touch, Wonder of Discovery, and Social Capital: Experiences with Interactive Playful Seats

Conference Paper / Design Experiment

Timo Nummenmaa, Annakaisa Kultima, Heikki Tyni, Kati Alha & Jussi Holopainen

Abstract

In this article findings from a design experiment of MurMur Moderators, talking playful seats facilitating playful atmosphere and creativity at office environments is presented. The article describes our two prototypes, and our experiences exposing the concept to audiences at two different types of environments. MurMurs are playful interactive seats that function as furniture, playthings and ambient elements in professional environments, such as workplace recreational areas or creative spaces designed for collaboration. MurMurs provide mainly an auditive experience for the users and each seat has its own cartoony voice recorded by a voice actor, consisting of grunts, sighs and nonsense words. The seats react to different actions, for example, when the ears of the MurMur are touched, the seat laughs, and when a person makes a swaying motion on the seat, the seat chants in rhythm. MurMurs also interact with each other by discussing in their own made-up language, and sometimes sing or bellow together. If the seats are left alone for a while, they fall asleep and start to dream of environments reflected by distinct soundscapes.

The article focuses on findings from a two-week observation period of the MurMurs placed in playful office environment. These findings are compared to previous findings from faire environments where preliminary audience reactions for the high level concept and how people interact with the prototype were investigated. Research data consisted of 9 days of video material from three cameras recorded during 14 April – 9 May, 2014 in an open social learning space called OASIS, located at the University of Tampere, School of Information Sciences. The actions of the people visiting OASIS who somehow interacted with the MurMur seats were timestamped and logged, and then analyzed by the research team. The data reveals reactions of curiosity and delight, but also irritation towards the seats. The collected data gives us insight on the seats as primary and secondary play objects and how users touch, discover and socialize.

The reactions and comments of the fair visitors, and the observations made of the users of the social office space, have added to our understanding concerning the design space. Overall, many observations have been made during our research which provide insight into primary and secondary play objects, ranging from the need to touch, to the wonderment of discovery, and also to the effect of social capital. An important topic that has also been identified is the ambient nature of play.

Talking Playful Seats in a Presentation Environment

Working Paper / Design Experiment

Annakaisa Kultima, Timo Nummenmaa, Heikki Tyni, Kati Alha, Ville Kankainen & Frans Mäyrä

Abstract

In this article the findings of a playful experiment run at an academic seminar setting is presented. The MurMur Moderators, a playful interactive furniture prototype, was utilized at the Game Research Lab Spring Seminar: Critical Evaluation of Game Studies in 2014 at the University of Tampere, Finland. Critical Evaluation of Game Studies was a two-day seminar in the series of Spring Seminars organized by Game Research Lab, University of Tampere. The nature of the seminars is conversational, including only brief presentations of the speakers and a longer slot reserved for discussion.

MurMurs are playful interactive seats that function as toys and ambient elements in professional environments, such as workplace recreational areas. Each MurMur takes the form of a fantastical creature with a distinct personality. The original concept fashions five different personalities (the grumpy Mur, the goofy Mus, the mellow Muh, the sensitive Mut, and the shy Mum). All of the original personalities have been realized as functional prototype versions. During the seminar presentations, five seats were used as ambient elements inside the conference rooms where the presentations were held. The experience was evaluated by observation, analysing seminar tweets and by conducting a small survey after the seminar.

The main data for this study comes from the survey that was sent to all participants of the event after the seminar. Additionally, all the Twitter tweets sent during the conference concerning MurMurs were recorded. The research team was also present in the conference, observing the interactions of the users and the general atmosphere. Within the survey responses opinions towards the seats varied from positive to negative and in-between. The ratio between positive and negative responses was very close to even, while the amount of responses deemed containing both positive and negative feedback or being ambivalent was about half of the positive or negative responses. It is interesting to note that there were no Twitter messages which were clearly negative or disapproving of the seats.

As the seats were objects that make sound and are clearly disruptive, we would have expected to have an even larger negative effect. However, the experiences of the participants varied from enthusiastically positive to strong negative feelings.

The Emergence of the Industry of Playful Hybrids – The Developers' Perspective

Heikki Tyni & Annakaisa Kultima

Abstract

This article presents findings of an interview study of developers' perspective on hybrid play products and services as an emerging industry sector. Recent years have seen the rise of a wide variety of play products that combine material and digital interaction elements in their design. Besides traditional game and toy companies creating these 'physical-digital' products, there are now many developers focused solely on hybrid play products. The emerging hybrid play products industry presents an interesting new entertainment sector with a wide array of new design and business opportunities. This article aims to present an informative first look on the hybrid play products industry.

The aim of this explorative study is to chart and understand industry development within the field of hybrid products and services in 2012-2014 when a large amount of new hybrid products and services were launched. The empirical ground for the study was twofold. First, we examined the field of existing products by cataloguing and describing over 150 hybrid products, both contemporary and historical. Second, a semi structured, thematic interview study was conducted between 2012-2014, consisting of eight expert interviews: six with developers working specifically in the hybrid products field, and two with "traditional" game developers with markedly opposing view towards working in the hybrid field.

The catalysts that have enabled the emergence of the hybrid play products industry include the smart device as a disruptive new platform for creating hybrid products, the emergence of new and cheaper processor, sensor and prototyping technologies, the service-oriented business environment, and the Chinese production facilities opening up for Western developers, among others. The contemporary 2012-2014 era on the other hand is identified as having been an experimentation phase for the emerging industry, characterized by the many companies trying to create sustainability through adopting a platform model for harnessing user-creativity and being in the cross-pressure of the larger toy and game industries. The future of the hybrid play products industry centers around finding the right way of using hybridity and creating longevity in the user experience. One of the central threats to the model is being fragmented into too many sectors, without being able to fully compete in none of them.

Some of the future's most important product innovations will be made at the borderline of physical and immaterial realities. New technologies enable development where immaterial products become materialized in novel ways, while material products and environment will be augmented with digital services. In this evolution immaterial, digital services will form multifaceted value networks with material products. The creative and playful design solutions and user cultures will form the basis for the utilization of these novel potentials in design of innovative and engaging experiences.

This report presents the results of Hybrid Experiences (Hybridex) research project. Hybridex project (2012 - 2014) was a strategic opening focused on the emerging field of hybrid entertainment: products and services that combine digital and material elements in designing playful experiences. The aim of Hybridex was to inaugurate research that would produce new knowledge about the user experience of existing and future playful hybrid services and products – about their design space, possibilities, and different dimensions.