Module 3. Developing Solution Space

Unit 3.1 Ideating in Sports

3.1.1 Introduction and Overview - The Fuel of Design Thinking and Innovation

The previous two chapters, empathy and problem definition, were centered on the problem space. Now, we go over to the solution space by thinking of revolutionary ideas on how to solve the previously defined problems. Problem statements and How Might We (HMW) questions are a good platform to start the ideation process. Ideation is not about coming up with the "right" idea, it is about generating the broadest range of possibilities in a judgement-free environment (Ideation, 2020). Ideation goes beyond basic brainstorming, there are a myriad of ideation techniques that help to generate ideas. Finally, after producing a variety of different ideas, these must be sorted and selected through a structured selection process.

Table 1
Cases - Ideation

Case	Name	Main Stakeholder	Short Description of Main Challenge
Case 11	Quantification of tactical football concepts	FC Barcelona (football)	Quantify tactical concepts and use AI to analyze it.
Case 12	Tinker Hatfield	Nike (basketball)	Design shoe that enhances athletes' performance.
Case 13	Authentic merchandise in the NFL	NFL (American football)	Start selling authentic player jerseys to fans.
Case 10	Nintendo Wii	Nintendo (non-sports)	Turn sports into a fun and easy entertaining experience.

3.1.2 Cases

Case 11: Quantification of Tactical Football Concepts

Context and Challenge

In 2018, video analysts at FC Barcelona spent most of their time cutting videos and not doing actual analyses. Barça Innovation Hub (BIHUB) set the challenge to change this. Together with the sports analytics team, BIHUB started a new innovation project with the goal of finding ways to automate the manual video-editing work through machine learning algorithms and thus, free up more time for analysts to conduct valuable

qualitative analyses. In order to achieve this, another objective was to transform tactical concepts from coaches and analysts into a more quantitative framework. Therefore, tactical concepts first needed to be identified, defined and then modelled into algorithms which would classify different game situations in the videos automatically. An example of such a tactical concept is that of “transition”. A transition means a game situation where the ball is passed from a team's area to the area of the opponent. A transition can be measured in time. However, it is not trivial to measure this time, as the term is only loosely defined. It is an abstract concept which is understood and interpreted differently by different coaches based on their own experiences, views and criteria.
So, the challenge of the innovation project team was to first identify different tactical concepts (such as transition), derive commonly accepted definitions, and then develop a data science-based model to quantify the concepts.

Innovation Process

In order to ideate possible solutions, BIHUB and the sports analytics department decided to set up a 5-year roadmap and a multidisciplinary team to cover a great variety of expertise as the project touched many different disciplines and areas. The innovation team was put together of a recent graduate in data science, a statistician with a more traditional view on how to manage datasets, a PhD candidate who took more the view of a footballer and bridged the two fields of football and analytics, and another PhD candidate on computer vision systems. Especially during the initial phase of data collection, this internal core team was supported by third party providers and other collaborators like the MIT. The overall project has been planned for 5 years (2018-2023) and has been split in many sub-projects. Due to the size and multidisciplinary character of the project, the project team set up a basic framework to bridge the gaps of the different disciplines and avoid confrontations in the team. This framework has been based on the common understanding that the “coach is king” and that everyone works for the coach who has the last word always. Albert Mundet in an interview said that something that is common in sports is that a hierarchy exists and coaches are at the top of it, and that is how they decided to frame it (Mundet, 2020)
The innovation team took a very user-centric approach by integrating the perspective of the users since the beginning. During the first year, the team mainly worked together with game analysts and coaches. With the help and inputs of these two end-users, the team could identify the main tactical concepts that coaches were using on a regular basis. These concepts have been defined as the main building blocks which basically are the expressions that coaches use to describe tactical concepts such as transition, a pass that overcomes a line, space control, space creation, etc. The team spent a whole year collecting insights to better understand these different tactical concepts from a data science, computer vision, statistics and football perspective. Thereby, they determined that the solution should be designed from a mathematical perspective as well as a football perspective to bridge the gap between the intuitive way of how coaches interpret tactical concepts and the quantitative way of science.

In an iterative process of ideation, the team designed different ideas about how data-specific, abstract concepts could look like and created various visualizations of them. In weekly meetings, the project team plus other staff from the club, such as coaches or analysts, came together and dedicated the first 15 minutes to ideate new ideas. Although they do not use a specific methodology, usually one person shares an idea followed by a short discussion in the team. While the output of this discussion can simply be knowledge, sometimes it can lead to next project sprints.
The weekly meetings also serve to present MVPs (Minimum Viable Product) to the end-users and get their feedback. Based on the user feedback, new ideas have been developed, either adaptions of existing concepts or completely new concepts. After modelling the basic building blocks based on the coaches' expressions, the innovation team started to ideate and build new concepts which had not been used by coaches before. For the first time in the history of sports analytics in football, it would be possible to quantify an abstract concept called “expected position value”. The goal of this metric is to help the team to get into a better positioning by measuring and giving each player a value according to how well he/she is taking decisions on the pitch. The value aggregates individual players' positioning to a whole, which helps to explain how individual players can contribute to moving the team into a better positioning.
To conclude, while the first step of the project has consisted of identifying and quantifying abstract tactical concepts that coaches use on a regular basis, the second step is about coming up and adding new tactical concepts and KPIs to quantify vaguely defined terms like “this player has taken really good decisions”.

Case 12: Tinker Hatfield

Context and Challenge

In his high school days, Tinker Hatfield was a successful track star, which allowed him to join the University of Oregon track team led by a man called Bill Bowerman (more about Bill Bowerman can be read in **Case 15**). Unfortunately, or maybe unfortunately, his career as a track star was hampered by a severe ankle injury. I say maybe unfortunately because that was when Tinker Hatfield, an architecture student with great drawing skills, started doing some work for Bill Bowerman who was experimenting with new tracking shoes for his athletes. Soon, Tinker Hatfield realized that his architectural skills actually could be applied to shoe design (Dadich, 2017).
In 1981, Hatfield joined Nike as a corporate architect; however, within a short time he actually became the lead designer. As Bowerman, Hatfield has this understanding that a shoe should not only provide a comfortable experience for the athletes but also enhance their performance and help to win the game. Hatfield even has the knowledge and experience of an athlete who lost his career due to an accident, so he knew the importance of designing shoes to prevent such accidents. Tinker Hatfield said that he never used to think about design, he always focused on the athletes – he thought that as a designer, the

ultimate goal should be to solve others problems, not becoming self-expressive. He explained that he always wanted to do that for the best athletes everywhere.
Today, Tinker Hatfield is not only Nike's game changing shoe designer and innovation architect but has also become the footwear industry's most accomplished visionary (Nick de Paula, 2017). For the last 39 years, Nike's Chief Design Officer has been innovating around the look and feel of Nike shoes and designed legendary athletic shoe models like the Air Max, Huarache or the Air Jordan.

Figure 1. Tinker Hatfield.

Source: Abstract: The Art of Design [Online Image]. Retrieved October 2020 from https://sneakers-magazine.com/watch-nike-designer-tinker-hatfield-in-new-documentary-on-netflix/ screenshot by author.

Innovation Process

From an ideation standpoint, Tinker Hatfield has generated many ideas for innovative sneaker designs by looking at industries, contexts or objects that are unrelated to sports. He has used cross-connections and the re-combination of ideas to influence the way in which Nike designs new shoes, solves problems for athletes and makes consumers feel about their shoes. Tinker Hatfield says: “I think if you just stay in your studio that is not a good foundation for your idea. Just get out there and experience life. That gives you a library in your head to then translate into unique, new design work.” (Dadich, 2017). The following examples of Tinker Hatfield's shoe designs illustrate these ideation techniques.

Air Max 1: in the mid-1980s, Tinker Hatfield designed the Air Max 1 running shoe as one of his very first projects at Nike. It was the first shoe with visible "airbags" from the outside of the shoe. Hatfield had this idea after visiting the Centre Georges Pompidou in Paris. The Centre Georges Pompidou is a high-technology building from the 1970s with an "inside-out" architecture where visitors can see the "guts" of the building like the structural system, mechanical system and circulation exposed on the outside of the building. While many people were shocked or outraged by the avant-garde structure, Tinker Hatfield was deeply inspired by the innovative and controversial inside-out construction as well as by the bright colors of the tubing the architects used to shake people up even more. And that is how Hatfield ended up showing the insides of the Air Max 1 as the first shoe that ever showed its "guts" (43einhalb, 2018).

Figure 2. Centre Pompidou Paris as inspiration for Air Max 1

Source: Centre Pompidou [Online Image]. Inexhibit. Retrieved October 2020 from https://www.inexhibit.com/mymuseum/centre-pompidou-paris/ screenshot by author.

Figure 3. Air Max 1

Source: Air Max 1 [Online Image]. Nike. Retrieved October 2020 from https://www.highsnobiety.com/p/nike-air-max-1-history/ screenshot by author.

Huarache: what inspired Hatfield for the Huarache, a shoe from the 1990s, was waterskiing. While he was in the water waiting to get pulled out, he was looking down to his neoprene boots which really nicely fitted around his feet and ankles. Back in the studio, he started sketching neoprene-based shoes that conform to different shapes of feet due to the characteristics of neoprene. So, the Huarache was the very first popular sneaker that had its sole made out of neoprene, adapting to different shapes of feet. Thus, the idea for the shoe design of the Huarache was drawn from the field of waterskiing (DePaula, 2012).

Figure 4. Neoprene waterskiing booties as inspiration for huarache.

Source: Neoprene waterskiing booties [Online Image]. Sneakerfreaker.com. Retrieved October 2020 from https://www.sneakerfreaker.com/features/five-of-our-favourite-tinker-hatfield-inspirations screenshot by author.

Figure 5. Huarache

Source: Huarache [Online Image]. Nike. Retrieved October 2020 from https://solecollector.com/news/2016/01/alternate-sneaker-lacing-history screenshot by author.

Air Jordan: In the 1970s/1980s, there was a trend that superstar basketball players got signature sneakers that then became central to urban fashion. That is how Nike created the Air Jordan Brand with Michael Jordan. Michael Jordan was on the brink to leave Nike when Tinker Hatfield presented him with a new shoe design that would better protect his ankles and enhance his performance. The Air Jordan 3 was born and "the Jordan brand became larger than life." Tinker Hatfield was the lead designer of the Air Jordans 3 to 15 and later on the models 20 and 23 as well. Tinker Hatfield and Michael Jordan built a product that sustained over time and catered to the athletes on the highest level to a point where they could still play in the same shoe 30 years later.
For the Air Jordan 5 (1990) Hatfield got inspired by an element of the classic American fighter jets from World War II: the iconic shark teeth painted on the nose of the jets. In Abstract Tinker Hatfield says: "I was watching him play one day, he was floating around the edges of the game, like a fighter pilot in the World War II movie" (Dadich, 2017). At some point, Tinker Hatfield made the connection between Michael Jordan's mindset and game style and the World War II airplanes what made him integrate the shark teeth element on the leather wrapped midsole of the Air Jordan 5.

Figure 6. World War II fighter jets as inspiration for Air Jordan 5

Source: World War II fighter jets [Online Image]. Sneakerfreaker.com. Retrieved October 2020 from https://www.sneakerfreaker.com/features/five-of-our-favourite-tinker-hatfield-inspirations screenshot by author.

Figure 7. Air Jordan 5

Source: Air Jordan 5 [Online Image]. Sneakerfreaker.com. Retrieved October 2020 from https://www.sneakerfreaker.com/features/five-of-our-favourite-tinker-hatfield-inspirations screenshot by author.

The model Air Jordan 14 (1998) was directly linked to Michael Jordan and his affinity for motor sports and luxury sports cars. The design was inspired by the high performance of Michael Jordan's favorite sports car brand “Ferrari”. The sleek and low-to-the-ground silhouette truly looked like a sports car on the foot.

Figure 8. Ferrari as inspiration for Air Jordan 14

Source: Ferrari logo [Online Image]. Sneakerfreaker.com. Retrieved October 2020 from https://www.sneakerfreaker.com/features/five-of-our-favourite-tinker-hatfield-inspirations screenshot by author.

Figure 9. Air Jordan 14

Source: Air Jordan 14 [Online Image]. Sneakerfreaker.com. Retrieved October 2020 from https://www.sneakerfreaker.com/features/five-of-our-favourite-tinker-hatfield-inspirations screenshot by author.

Then, the Air Jordan 15 was the first model that somehow got negative reviews and Tinker Hatfield decided to take a break. However, in 2005, Hatfield came out of the Jordan retirement again and set out to remember the past two decades with the Air Jordan 20. For this model, Michael Jordan himself served as inspiration for the shoe design. Tinker Hatfield had the idea to tell Michael Jordan's life by embedding 200 icons which depict moments from Michael Jordan's childhood and his sports career. It turned out to be the best storytelling product Nike has ever done by traversing Michael Jordan's story and the legacy behind the Air Jordan empire (Standing the Test of Time, 2020).

Figure 10. Michael Jordan as inspiration for Air Jordan 20.

Source: AP Photo. Michael Jordan [Online Image]. Bild. Retrieved October 2020 from https://www.bild.de/sport/mehr-sport/basketball/nba-legende-michael-jordan-die-schatten-seite-des-genies-70407736.bild.html screenshot by author.

Figure 11. Air Jordan 20

Source: Air Jordan 20 [Online Image]. Fight Club. Retrieved October 2020 from https://www.flightclub.com/air-jordan-20-og-white-varsity-red-black-010119 screenshot by author.

The Air Jordan brand managed to achieve what no other basketball footwear brand ever has. Today, the Jordan brand alone is worth multi-billion dollars. Apart from the greatness of Michael Jordan, Tinker Hatfield was the driving force behind the Jordan brand's lasting legacy. He broke through the paradigm of how athletic footwear was designed and redefined what it meant working with athletes by constantly trying to solve problems for them.

Case 13: Authentic Merchandise in the NFL

Context and Challenge

In 1981, Norm Charney, the owner of Athletic Supply, a sports retail company in Dallas, had the idea to sell authentic jerseys to the public. Back then, selling authentic merchandise was still not a common practice as nobody thought consumers would be interested in buying game quality jerseys. However, Norm Charney was convinced that there would be a market and real business from jersey sales. Charney's idea and conviction was based on the following: his sporting goods store fed equipment to the Dallas Cowboys, an American football team in the National Football League (NFL), and every year they refurbished the Cowboys' helmets and displayed them in the store. People would come in the store and marvel at the new helmet designs. This observation led Charney to think about putting jerseys on display as well. And soon after, he had the idea of also selling them. However, after first initial sales he was hold back by the NFL because he did not have the authority to sell authentic NFL jerseys. Subsequently, Charney went to New York and met with the NFL league officials who granted him a license to sell authentic NFL merchandise. Within 4 years, Charney's sports goods business was selling tens of thousands of authentic NFL jerseys and had become the largest direct marketing sports company in the United States with an exclusive license to sell NFL merchandise (Layden, 2016).
In hindsight, after already having granted the license to Charney, the NFL realized the missed opportunity. However, they had to wait for Charney's license to run out in order to start distributing authentic merchandise themselves.

Innovation Process

Prior to Charney's visit to New York, the NFL had already tested a few ideas around selling authentic merchandise. However, they had not evaluated these ideas in a structured process, which hindered the innovation process to unfold. Also, when Charney presented his idea to the committee, the NFL did not recognize the idea. They did not want to go through any sort of user empathy, prototyping or testing in order to evaluate the potential

of the idea. Instead, they simply assumed that consumers would not be willing to buy authentic merchandise. They rejected a million-dollar idea out of their personal view.

Case 14: Nintendo Wii (non-sports)

Context and Challenge

For many years, the video game industry was characterized by fierce competition, taking place in five-year cycles based on a superior technology performance. In each successive cycle, consoles allowed for games with better graphic design and more realistic action (Hagiu, 2011).

The Japanese game manufacturer Nintendo took over the video game market in 1983 and controlled 90% of the gaming market in 1989. However, its dominance did not last long and in the early 1990s Sega, another Japanese company, dethroned Nintendo. Then in 1995, Sony launched the PlayStation and gave third-party developers a wide access to software libraries and development tools, so it would be easier for game developers to write games for them than for the competing systems of Nintendo and Sega. Furthermore, PlayStation used CD-ROMs whereas Nintendo continued with ROM cartridges. Since the cartridge format was more expensive and Nintendo charged higher royalties, Nintendo attracted less support from third-party developers. Soon, Sony established itself as the industry leader. However, in 2001, a new player entered the console market: Microsoft. In 2006, many industry watchers were expecting the battle to take place between Sony's PlayStation 3 and Microsoft's Xbox 360. Nintendo merely acted as a follower in the console business. Radical change was needed as the competition already had too much advantage in the technological arena. And that is what Nintendo did (O´Gorman, 2018).

In 2006, Nintendo Wii was launched. Nintendo Wii implied a radical change in the focus of Nintendo's strategy and innovation approach away from technological leadership towards a more user-centric strategy. Instead of investing money in the screen, Nintendo started to invest in the game experience. The challenge they were confronting was to make the gaming experience easy and fun. More specifically, their “How Might We” question seemed to be “How Might We motivate people to play video games regardless of their age, gender or background.” Their user research showed that there was demand for games which integrated sports into the game play and turned physical activity into a more entertaining experience. This implied technological adaptions and changes in the game play that made the overall experience much more realistic and pleasant. Actually, compared to the two rivals Sony and Microsoft, Nintendo Wii was less advanced from a technological perspective. However, there was one critical feature which was new to the industry: wireless motion-sensing controllers. The appeal of the new Wii consoles reached far beyond hard-core gamers to casual and even non-gamers like women, seniors or young children. Nintendo marketed its categorical exception that was targeted to the untapped majority of the market as “active, social gaming in the living room” (MaRS Startup Toolkit, 2020).

Nintendo caught all the hype and early success in the new generation of gaming experience. One year after Nintendo Wii's launch in 2006, it was already outselling Sony's PlayStation. In 2008, Nintendo's share value quadrupled and its innovative motion-control-centric console was still outselling Sony's PlayStation as well as Microsoft's Xbox (Hagiu, 2011). Nintendo revolutionized the gaming experience with a disruptive strategy where new paradigms had been written.

Innovation Process

As outlined above, with Nintendo Wii, the company changed towards a more user-centric strategy, approach and organization. In terms of ideation, it borrowed ideas from the world of sports and redefined what a gaming experience could be like. Thus, the inspiration for this innovative, even disruptive idea came from a different, unrelated field to gaming. Nintendo took ideas from sports like the need for physical activity or exercising in groups, recombined them and adapted them to the new context of video gaming.

3.1.3 Analysis and Discussion

There is the false conception that ideas are developed from scratch. Innovation research shows that almost every idea comes from an inspiration. The more distant this source of inspiration is, the more novel and radical the idea. The example of **Tinker Hatfield** shows how the legendary Chief Design Officer at Nike brought brilliant ideas of athletic shoe designs to life by taking **inspiration and recombining ideas from other contexts**. For his iconic shoe designs like the Air Max, Huarache or Air Jordan, Tinker Hatfield got inspired by the architecture of Centre Pompidou in Paris, waterskiing and American fighter jets. Hatfield says that going out into the world and looking at other contexts, areas and things unrelated to the own industry creates an immense library of ideas in our heads (Dadich, 2017).

Nintendo Wii is also a great example of cross-industry inspiration. Nintendo borrowed ideas from the industry of sports, recombined them and adapted them to the new context of video gaming. There are many other examples of great innovators and entrepreneurs that used ideas from a different field and adapted them to a new context. For instance, **Antoni Gaudí**, one of the most famous and revolutionary architects of all times with pioneering buildings like Sagrada Familia, Park Güell, La Pedrera and many more, drew inspiration from nature. He created structural as well as ornamental designs like spiral stairways, tree-inspired columns or honeycomb gates by studying the body structure of animals or the design of flowers and plants.

Another example is the creative work of Chef **Ferran Adrià** who revolutionized haute cuisine with his restaurant “elBulli” and brought the experience of eating to a whole new level (Norton, Villanueva, & Wathieu, 2009). Adrià puts a great focus on the investigation and research process of new ideas and recipes. His unique approach to creativity consists

of deconstructing the familiar and reinventing it by recombining the individual pieces differently. Each year, his research team visits foreign countries and cultures, and for instance, interacts with designers from other industries to get insights from a more diverse setting, outside from their own cuisine.

All these examples show the importance of opening up our minds to other unrelated areas. Thereby, the source of inspiration can come from anywhere and anybody - from people inside or outside the organization. Moreover, in the ideation phase it is fundamental to recognize all kind of ideas - silly, crazy and impossible ones. The **NFL** is a good example that illustrates how the absence of these principles can lead to missed opportunities. The **NFL** failed to look beyond the boundaries of their own industry and did not recognize a good idea that came from outside the organization. They did not thoroughly consider and test the idea of selling authentic merchandise and then had to wait for the license to run out to start selling merchandise themselves.

An environment of trust and psychological safety where outside-the-box ideas are heard is fundamental to give people the confidence to be creative and share ideas. The more ideas and the more diverse ideas, the higher the probability of success. In order to come up with many and many diverse ideas it is important to work in **diverse, multidisciplinary teams**. Diversity brings immense value to the ideation process as people with different backgrounds, life experiences and cultures have different ways of looking at the world, which helps generate a wider variety of ideas and insights. In the example of **FC Barcelona**, data scientists, statisticians and PhDs looked at the same problem with different lenses and brought in ideas from their respective fields. Additionally, the **integration of the users** (i.e. coaches) in this process of ideation further widened the spectrum of possible ideas.

The case of **FC Barcelona** also nicely illustrates how **ideas adapt over time**. Ideas do not just appear in our heads and it is rarely the first idea that works best. The first idea is usually the enemy of innovation because it is the most obvious and incremental one. The strength actually lies in the process of refining ideas over time. The multidisciplinary innovation team at **FC Barcelona** had been refining their models of different tactical concepts for over a year. Thereby, new ideas have been developed along the process leading to adaptions of existing concepts or sometimes even to the design of completely new concepts. This process of ideation, prototyping and testing, stretched over a longer period of time, ultimately lead up to a strong solution.

There are hundreds of ideation techniques that help to generate ideas. Brainstorming is the most used technique. Although considered as a simple method, brainstorming must be structured around a specific problem to be effective, which underlines the importance of the previous stages of empathizing and problem definition. After generating a great variety of ideas, it is critical to follow a structured process in order to narrow down and select the best ones for execution. There are plenty of methods and tools to support the ideation process.

To conclude, this chapter highlights the importance of cross-industry inspiration and re-combining different ideas to a new context. It also stresses the importance of a diverse

team and the integration of the users to create a wide variety of ideas and insights which are continuously adapted and refined along the Design Thinking process.

Unit 3.2 Prototyping in Sports

3.2.1 Introduction and Overview - The strength of Designing Experiments

In the previous chapter, we have seen that ideas are mostly not new ideas nor solutions but seeds to possible solutions that can be taken from other areas and be recombined and adapted to a new context. Prototyping helps innovators and entrepreneurs to bring ideas to life, test underlying assumptions, learn how users think and feel, and check if a certain solution indeed solves the defined problem. It also allows innovators and entrepreneurs to think about solutions in a different way and spark new ideas. In general, organizations must learn to move prototyping to the beginning of the design thinking process because prototyping is not only about testing and refining the final solution but also about better understanding the problem space.

Table 2

Cases - Prototyping

Case	Name	Main Stakeholder	Short Description of Main Challenge
Case 11	Quantification of tactical football concepts	FC Barcelona (football)	Quantify tactical concepts and use AI to analyze it.
Case 15	Bill Bowerman	Nike (running)	Design running shoe that enhances athletes' performance.
Case 16	Zappos	Zappos (non-sports)	Sell shoes online.

3.2.2 Cases

Case 11: Quantification of Tactical Football Concepts (continuation)

Context and Challenge

As described in **Case 11**, the multidisciplinary innovation team at Barça Innovation Hub (BIHUB) designed several ideas on how to identify and quantify abstract tactical concepts with the aim to automate the classification of different game situations through machine learning and thus, enable tactical analysts to spend more time on qualitative analyses than video-editing work. First, they created quantitative models of tactical concepts that coaches used on a regular basis and second, they developed ideas of new tactical concepts that had not been used by the coaches yet. On a case by case basis, the team built simple prototypes of the different concepts and shared them with the coaches and analysts in order to collect their feedback, iterate and improve the final solution.

Innovation Process

During the prototyping and testing phase, the innovation team continuously tested several underlying assumptions such as:

- An AI-based solution is useful for coaches and analysts as it saves them time.

- The tool is intuitive and easy to use and understand for analysts and coaches.
- [A new concept] is useful for coaches and analysts to take better tactical decisions.
- The algorithm is able to classify different game situations correctly and in accordance to the understanding of the coaches and analysts.

In order to test these assumptions and get user feedback, an easy-to-build and easy-to-test software visualization tool and simple algorithms were created. For the visualization tool, the team first used many numbers and graphs to display the different metrics. However, after first feedback from the coaches, they realized that it was too "statistics-heavy" and too complicated to understand. The coaches said that they wanted to grasp the main insights of the metrics within 1-2 seconds. Thus, the team changed to more visual aspects in the next version of the prototype. In the following iteration and user testing, they learned that every single metric should be linked to a short video. Although the metrics were seen as useful to point out specific aspects of the game, coaches and analysts always wanted to check the specific situation in the video as well. So, the team adapted the visualization tool in a way that the coaches could not only see the different metrics in the dashboard but also click on them to consult the respective video. Lastly, it became clear from the user feedback that a short summary would be helpful for coaches to better communicate the main message to the athletes. Therefore, in the next sprint, the innovation team implemented a short summary into the visualization tool.

Apart from the visualization tool, the team also tested the usefulness and functioning of different layers of algorithms. For the transition concept, the team created a first algorithm that summed up the positioning of the players during a game. Soon, the innovation team presented the first prototype to the coaches and asked for their feedback. The feedback was very positive, and the coaches even asked for an additional feature concerning the profiling of the players. Thus, the prototype was extended by a new layer of profiling. Moreover, the innovation team had the idea to include a feature that indicated who dominated the space on the pitch. Since there was yet no algorithm that quantified space control and creation, the team developed and included a second algorithm that would help coaches and analysts better understand which players generated more speed and owned more space on the pitch from a collective point of view as well as from an individual player's point of view. Although the feedback was again positive, the coaches indicated their preference for having a tool which was mainly focused on the previous aspect of tagging different game situations based on positioning and profiling. So, the sports analytics team dismissed the concept of space creation and space control again and concentrated its efforts on refining the positioning and profiling features.

The stepwise development of the visualization tool and the algorithms show how the final solution has been built in an iterative process over time. The innovation team has built multiple prototypes of different concepts and continuously tested them with the coaches and analysts in order to decide whether to integrate them in the final solution (for detailed explanations around testing see **Case 11**).

Case 15: Bill Bowerman

Context and Challenge

Nike was co-founded by Bill Bowerman, the legendary track and field coach at the University of Oregon and by Phil Knight, one of his athletes. Most people have heard of Knight, but only a few know Bowerman who was not only a passionate coach, but also an early sport scientist. Bill Bowerman believed that American tracking shoes were too heavy and clunky to reach optimal performance. He wrote to leading footwear companies with ideas on how to improve the shoes to better serve athletes. However, they were not willing to listen to his ideas. That is why Bowerman started experimenting with shoe designs himself. He deconstructed tracking shoes to study their anatomy and then assembled different uppers over various lasts. Phil Knight was actually the first athlete who tested Bowerman's self-made shoes. Moving forward, also other runners in Bowerman's team wanted to try the prototypes and that is how Bowerman started to create customized running shoes for his athletes to improve their athletic performance and give them an advantage in the race (Bill Bowerman: Nike's Original Innovator, 2015). This was not just a self-defined challenge of Bowerman's but a real user need. Steve Prefontaine ("Pre"), another Oregon Track Club athlete Bowerman coached, was obsessed with better and lighter shoes, and that was what finally inspired Bowerman and Knight to found Nike. Actually, Nike started as a distributor of Tiger shoes, a Japanese brand (later bought by Asics), but then moved away from being a distributor to creating own shoes in-house. Bowerman's shoe experimentation and Pre's crusade for better athlete shoes was fundamental for this move. In 1972, Pre competed in the Olympics, wearing a pair of Nike. At that time, he was seen as one of the most charismatic and talented runners ever. Only three years later, he tragically died in a car accident at the age of 24. Pre was much more than a talented runner, he was an inspiration for Bowerman and Knight to build up Nike (Knight, 2016).

Soon, Nike shoes were on the feet of many other great athletes. To wear Nike meant something more than being good at sports and wanting the best equipment. It meant that you could be someone who could inspire the masses. Knight transformed the company into one of the largest apparel brands and best marketed companies in the world. However, it should not be forgotten that it was Bowerman's insistence through prototyping to meet the needs of the individual athletes and achieve athletic excellence, which actually made Nike successful. The company might not exist if Bowerman had not been so obsessed with innovating around the performance of his runners. But how did Bowerman lead this process of prototyping and experimentation?

Innovation Process

Everything started with an experiment in Bowerman's garage in 1970. One morning, when Bowerman was having breakfast with his wife, he looked at the waffle iron in the kitchen and had the epiphany. There it was – his new tool to form shoe soles. He said to his wife: "You know, by turning it upside down – where the waffle part would come in contact with

the track – I think that might work." (Blitz 2016). Bowerman took the waffle iron, went to his lab and poured urethane into the waffle iron. During the next weeks, he experimented with the waffle iron and different types of materials. Thereby, Bowerman challenged standards of traction, biomechanics and cushioning. He wanted to create a light and comfortable shoe with excellent traction (Nike's Original Teacher and Innovator, n.d.).[1]

Figure 12. Bill Bowerman's Waffle Trainer

Source: Shaffrey, T. MarketWatch. Retrieved October 2020 from https://www.marketwatch.com/story/nikes-moon-shoe-to-sell-for-160000-at-auction-2019-07-17 screenshot by author.

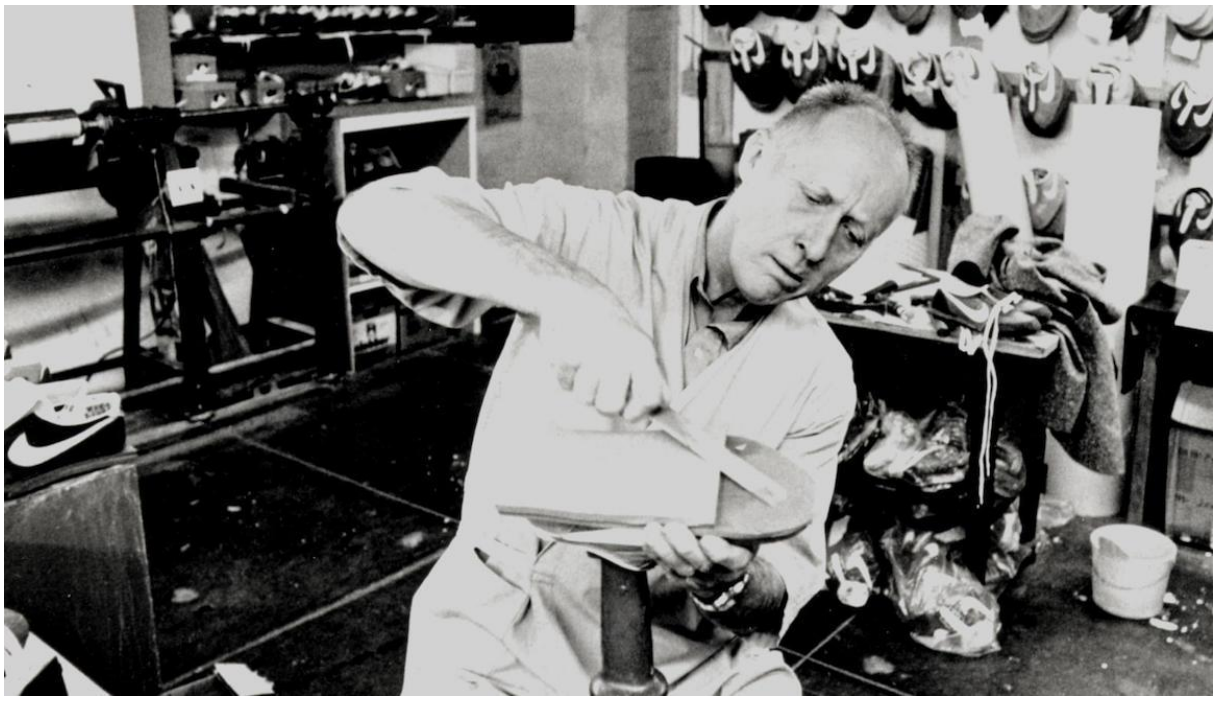
Although the first iterations were crude, the athletes liked the feel of the waffle sole. Bowerman refined the concept and prototyped multiple variations for every single race and for every athlete. The shoes were tailored to the body of each athlete. Bowerman would draw the outline of the feet of each athlete and also note individualities such as a slim ankle or extended heel. Furthermore, he would take the height and weight of each athlete in order to calculate a shoe-weight-ratio with the aim of making the shoe as light and responsive as possible. Bowerman knew that one ounce could potentially save an athlete of 56 pounds a mile what in theory ends up saving a second. Thus, the main underlying assumptions that Bowerman tested could have been the following:

- The weight of a shoe influences the race time.
- The grip and responsiveness of a shoe influences the race time.
- The shoe is comfortable, and athletes enjoy wearing it in trainings and races.

[1] "Bill Bowerman: Nike's Original Innovator."

In each training and race, Bowerman tested one of the above assumptions for each athlete individually. He tested them one at a time by taking race times for each athlete and by measuring the wear-and-tear of the shoes. Besides, he also collected qualitative data by directly consulting his athletes. After each race, he would sit down with the athlete and ask for their feedback. He would then take that feedback and go back to another prototyping session. After hundreds of iterations, the Waffle Trainer was born. It worked for every surface, it was light, comfortable and good-looking.

Figure 13. Bill Bowerman experimenting with tracking shoes



Source: Bill Bowerman [Online Image]. Nike. Retrieved October 2020 from https://news.nike.com/news/bill-bowerman-nike-s-original-innovator screenshot by author.

Bowerman's methodology around prototyping was scientific but also very applied and practical. He continuously measured training and race times of the runners as well as the wear-and-tear of the shoes. Thus, he constantly put his prototypes in an applied testing environment in order to learn and improve the shoes for the next training or race. Bowerman was a real innovator and his striving to help athletes perform at the highest level as well as the philosophy of rapid prototyping which is all about failing initially, iterating, learning and solving a problem in a new way still fuels Nike's innovation culture today (see Case 12).

Case 16: Zappos (non-sports)

Context and challenge

In 1999 it was hard to believe that a startup that purchased shoes from local shoe stores and sold them online would become a critical player in online retail. But that is exactly what Zappos did. When Nick Swinmurn started Zappos in 1999, he summarized his idea in three sentences: “Footwear is a $40 billion industry in the US, of which catalogue sales make up $2 billion. It is likely that e-commerce will continue to grow. And it is likely that people will continue to wear shoes in the foreseeable future” (Hsieh 2010).
So, although Swinmurn was convinced by the business, the idea that people would buy shoes online was still worthy of doubt and first needed to be tested.

Innovation process

In order to prove that his business idea of selling shoes online was viable, Swinmurn went to a local mall armed with a camera and photographed different pairs of shoes. He then created a very simple website, uploaded the pictures and posted the shoes for sale. He simply displayed the shoes including the prices from the mall - women, men and kids’ shoes from over 100 brands to shop from with no shipping fees or sales taxes. Soon, there were some first customers. Every time an order was made, Nick Swinmurn would run to the local shoe store, buy the shoes, run to the post office and ship them out to the customers (Ponomarev, 2019).

Figure 13. Zappos MVP

Source: Zappos MVP [Online Image]. Quora. Retrieved October 2020 from https://www.quora.com/Where-can-I-find-a-screenshot-of-the-original-Zappos-MVP-webpage screenshot by author.

This was the first MVP (minimum viable product), the very first model of Zappos. Obviously, this model would not work in the long run, as Zappos was losing money on each purchase but it was good enough to test basic assumptions. Swinmurn's intention was to validate the assumption that people were willing to buy shoes online. Moreover, it was a good way to study the market and learn about consumer preferences.

Besides the front-end online store, Swinmurn had not developed anything yet. The whole back office was not there yet. There was zero infrastructure and almost zero inventory (Straughan, 2016). Like this, Zappos could bypass high costs as buying inventory for an online shoe store is very expensive and complicated due the high variety of sizes and models, plus the leftovers of sizes and models that no one wants. So, Zappos initially faked the whole back-end which was invisible to the customers. However, from a customer-point-of-view everything seemed to be perfectly in place. Zappos is a great example of an

MVP that was all about testing first hypotheses cheaply, gauging consumer demand and getting early feedback on its website.
After having proved that consumers were willing to buy shoes online, Zappos established a partnership with UPS and opened a fulfillment center in 2002 to pack and ship orders to customers. The company experienced rapid growth in the following years and got acquired by Amazon in 2009 for $1.2 billion, which allowed Zappos to further diversify into apparel and accessories (Christoffer 2019).

3.2.3 Analysis and Discussion

First of all, the analyzed cases stress the importance of conducting **multiple experiments and iterations**. Trial-and-error or learning-by-doing should be at the core of each innovation process. In the example of **FC Barcelona**, the multidisciplinary innovation team has constantly been creating prototypes and setting up experiments in order to test and refine the software visualization tool as well as the different layers of algorithms. With each iteration, the team integrated the feedback of the coaches and analysts and refined the prototypes to then test them again in the next iteration. The team would probably not have found out about the importance of including videos or short summaries in the visualization tool if they had solely done one single experiment. Moreover, after creating a first simple version of the space control and creation algorithm something unexpected happened. The coaches indicated that this concept would not have priority for them at this point. So, the innovation team pivoted back to their initial idea and dismissed the concept of space creation and control.
Also the example of **Bill Bowerman** nicely shows how prototyping and collecting user feedback over time helps to continuously refine a solution (or realize the necessity of big pivots). Bowerman became obsessed with experimenting with new running shoes in order to help athletes slash seconds off their times. He created tailored shoes for each of his athletes and after each training or race he adapted the design based on the performance and feedback of his athletes. After hundreds of iterations, he finally found the perfect shoe design which was light, comfortable and resistant. Bowerman's insistence through prototyping redefined athletic footwear and laid the basis for the billion-dollar empire of Nike. It can be seen that in the process of experimentation, Bowerman had **clear metrics, KPIs and expectations**. This is fundamental in order to know whether a solution is working well and how well it is working. For all his experiments, Bill Bowerman had clear expectations in terms of training times and the wear-and-tear of the shoes. The constant aspiration of getting better race times was the engine of the prototyping and testing cycle. Furthermore, Bowerman used basic materials from home to create his first shoe prototypes. He used a waffle iron from the kitchen and experimented with different types of liquid materials to create shoe soles and then shaved off material to make them lighter.

Another nice example of **simple, quick and cheap prototyping** is **Google Glass**. Google Glass simulated the experience of controlling software with the hands and having digital things overlaid in the eyesight with basic materials like coat hangers, hairbands, chopsticks and presentation clickers. It took them only one day to set up the first, and incredibly just 45 minutes to set up the second prototype. They learned very quickly through this process of rapid prototyping and discovered important insights about social and ergonomic aspects (Chi, 2013).

In addition to creating cheap, quick and scaled-down versions of early-stage prototypes, it is also crucial to start with simple experiments that **test the basic underlying assumptions first** (e.g. the foundations of the whole business model). **Zappos** created a very simple website in order to validate the basic assumption that people were willing to buy shoes online. Besides the rudimentary online shop, **Zappos** did not own any inventory, nor did it have a proper supply chain. Every time a customer bought a pair of shoes, the founder went to the local shoe store, bought the shoes and sent them to the customer. Although this was certainly not a viable model, it was a cheap and quick way to test the basic idea of selling shoes online.

Also in the example of **FC Barcelona**, it can be seen that experiments evolved from simple towards more complex, and from testing critical assumptions first towards testing nice-to-haves. For example, the team solely included the positioning of the players in their first prototype and only later added additional layers to it. In general, they tested one hypothesis (i.e. concept) at a time, which allowed them to learn more initially.

Lastly, it is important to **start prototyping and testing early**. The earlier an idea is tested, the less money and time is spent in the case that it fails. An excellent example here comes from **IBM** (Savoia, 2012). 40 years ago, **IBM** assumed that the reason why people did not adopt computers on a wider basis was the keyboard. At that time only a few people like writers, secretaries or programmers knew how to type. So, they had the idea to invent a speech-to-text technology that would allow people to bypass the keyboard. They conducted a small experiment to test if people would actually buy the product. They put testers in a room with a microphone and a screen. People thought **IBM** would already have the perfect speech-to-text translator, while in reality there was a typist sitting in the other room. The results from the test showed that actually no one would buy the device. Through this very simple experiment **IBM** learned that the problem was not the keyboard. And this learning made them save millions of dollars.

To conclude, this chapter underlines the importance of testing ideas often and early by producing simple and cheap prototypes of the solution in order to test the most important aspects of a solution first and maximize the rate of learning.

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