Prototyping
– a guide for entrepreneurs

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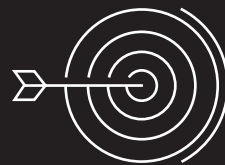
Lifestyle & Design Cluster.

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Introduction

> *Prototyping is problem solving. It's a culture and a language. You can prototype pretty much anything. A new product or a service, or a special promotion. What matters is to move forward so you achieve a bit of your goal. Not to waste time.*
>
> *– Tom Kelley, Partner at IDEO*

As a new entrepreneur you are faced with several questions you often do not have a complete answer to: What is my product or my service? Which idea is best? Are we solving the right problem with the right solution? Who should I sell to? What should the price and payment model be? How do I get my product or service to my customers? The list of unanswered questions is long, and the path from idea to a finished solution can be difficult to spot.

In order to succeed as an entrepreneur, it is of course crucial that you find good answers to these questions - and preferably as quickly, cheaply and efficiently as possible. This is where prototyping comes into play as one of the methods you can use to clarify the issues that need to tie your future business together, but more importantly help constantly assess whether you are on the right track with the development of the product or service.

Many entrepreneurs have made plans, strong market analysis, and probably also interesting pitches, but they often fail as they take their assumptions about what creates value for the user or customer for granted. While such analytical tools can be powerful for understanding and collaborating, they do not tell you everything you need to know to create the best solution for your potential customers.

In recent years there has been a shift in modus operandi towards a 'fail fast, succeed sooner'-approach, which is characterized by ongoing experiments and earlier involvement of external parties, and where continuous work with prototyping has become the central cornerstone of the workflow for both large and small companies.

With our years of experience as researchers, educators and our work with entrepreneurship, we have countless times experienced that targeted and well-thought-out prototyping can be a crucial method, that helps entrepreneurs further in their process. Prototyping can clarify key issues about product, service, customers, business model, etc.

We would like to pass on these experiences in this guide. First, we will review what prototyping is, why it is a useful tool, how prototyping can be used, and point out the challenges and pitfalls that lie in using prototyping wrong.

What is Proto-typing?

Prototyping is problem solving and by using prototypes in various forms you keep developing your work with the product or service on an informed basis and understanding. Proto-typing provides a contemporary alternative to the classic approach that focuses on analysis and long-term planning. A prototype is a representation, in any material or format, designed to create understanding, explore, or communicate your idea in a way that others can interact with it.

The term 'prototype' often makes us think of something that is almost done. If you visit an industrial fair, you will often see almost finished prototypes on display, and it is worth remembering that these prototypes have the specific pur-

An example: Bricks, wooden blocks and pizza boxes

Are bricks, blocks of wood or pizza boxes prototypes? The short answer is that they can be - depending on what function we use them for.

Function is more important than form when we talk about prototypes. The cheaper and simpler we can create a prototype the better. In other words, if we want to investigate whether our new solution has appropriate dimensions and weight for the use situation, we can use or modify already existing objects, such as a brick or a wooden block to simulate this – that is if it has the same dimensions and weight. If we want to investigate how a laptop plays into the workflow of some particular people we might be able to settle for pizza boxes that are weight-adjusted, rather than 3D printing good-looking but expensive plastic models.

The key is to make it as simple as possible, while keeping in mind that the audience must be able to understand the concept. The bottom line is that bricks, wooden blocks and pizza boxes are random things until we use them to simulate or instantiate something else.
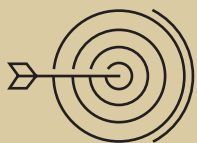
pose of demonstrating the product and examining whether users find the solution attractive enough for purchase. Before showing that prototype at the industrial fair, the product and the idea may have been through many iterations of prototypes, which we often do not see as a wider audience, but which often play an essential role in the final solutions. But most prototypes are typically very unfinished and are used to explore and challenge the assumptions we work with throughout the process.

Common to prototyping, regardless of which specific pro-totype is used, is that the prototype moves the idea outside the entrepreneur's own thoughts. Prototyping is thus about

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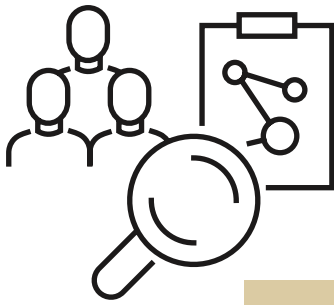
externalizing ideas, and manifesting what the future product, the future service or business model may look like. In prototyping you select the most relevant information into the prototype. Prototypes are therefore not limited to specific characteristics or attributes such as formats, materials or production techniques, but become prototypes based on the function and purpose we try to fulfill.

Prototyping is not just about the prototype as an object, but the entire process around the use of the prototype. It is throughout the process that prototyping helps us answer

Prototypes or prototyping?

In this guide, we are primarily talking about prototyping and not prototypes. We do this because we want to focus on prototyping as a process that aims to provide knowledge or clarification on issues that are important to bring your entrepreneurial project forward.

Although prototyping as a process obviously centers around a prototype (for example, a mockup, a beta version, a roleplay or anything else we bring into play), the prototyping process involves decisions before, during and after the prototype.

Prototyping extends beyond the prototype, as the process also helps us to answer and ask questions. What we do with it, who we do it with, and for what purpose. Too many people focus on the prototype and forget why we make it. That is why we focus on the process rather than the object.
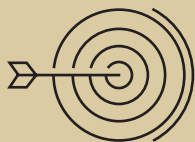
questions and discover unknown aspects of our idea. Whether a prototype is good or bad therefore depends on the roles it plays, rather than how complex and finished it is.

The best prototype in each situation is therefore one that in the simplest, fastest and cheapest way can make your abstract idea more tangible and help uncover your specific learning needs or purposes.

The focus on having an experimental approach in product or service development is seen in many of the popular approaches to business development, which have gained ground in recent years.

Approaches such as Design Thinking, Lean Startup, Design Sprints and Pretotyping are all popular approaches that have become a regular part of the workflow of both large and small companies.

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Common to all these popular approaches is the central role of prototyping, although the purposes and uses of prototyping differs slightly across the approaches.

Popular approaches to prototyping

- **Design Thinking** is a human-centered approach that seeks to create solutions based on human problems, where prototyping can play into all phases of the process. In Design Thinking, prototyping can play a role both in the very early exploration of problems and areas that can be improved, as well as in the later creative process, where users are engaged in the co-creation of solutions. Prototyping in Design Thinking therefore ranges widely from more exploratory use to more test-focused prototypes.

- **Lean Startup** is an approach to transforming ideas into products and associated business models. It is based on a "build-measure-learn model". Here, prototyping acts as a means to fast, cost-effective and ongoing testing of the hypotheses. Prototyping in Lean Startup is particularly centered around the so-called Minimum Viable Product that is applying to test critical assumptions rather than to explore.

- **Design Sprints** is an approach to rapid and systematic development, based on the overarching design thinking philosophy. Design Sprints highlight prototyping for quick, simple and cost-effective testing of what works and what does not. Prototyping in Design Sprints is inspired by Design Thinking, and therefore ranges widely from more exploratory use to more test-focused prototypes.

- **Pretotyping** is an approach to rapid development of new products using quick and simple pretotypes. These must help build the right thing before we build it right. Pretotypes find themselves somewhere between abstract ideas without form and more refined prototypes, which is why the purpose of pretotyping is to gather valuble information and fail quickly using the most simple and cheap pretotypes, so that we can gain insights into whether we should continue or stop.

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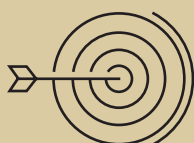
Why use Prototy- ping?

The great benefit of prototyping lies in the fact that it can help you reduce the likelihood of making costly mistakes in your business development, while increasing the likelihood of delivering the right thing to the right people. The journey from idea to real solution is typically long and filled with a lot of obstacles along the way. Problems often arise because ideas are based on gut feelings, historical data, past success stories, or on hidden assumptions that turn out not to be true in the face of reality.

It is important to remember that every business concept contains several assumptions, which typically have to do with customers wanting the solution, that the idea is financially viable, and that it is technically possible for us to create and deliver the solution. If we understand our own assumptions and draw on them to experiment with prototyping, then the project develops with the market, and we avoid large investments in the wrong solutions or on the wrong foundations. We learn to fail in much smaller and cheaper steps, so that we can improve in smaller steps, and can focus on building the business.

Whether we are developing on the business model or the associated product or service, prototyping can help us in experimentation. Studies in the development of business models have shown that successful development is a matter of continuously experimenting and adapting based on the learning it provides, rather than being a matter of making early, comprehensive analyzes and plans.

This is further supported by prototyping research, where scholars have demonstrated how an approach characterized by iterative and simple prototyping is directly linked to innovation in product development.

When we build prototypes in different versions, it also creates learning tools that allow us to investigate a future we have not yet built. It is impossible to know in advance which ideas will work, but the logic behind prototyping is to try to create some concrete experiences of what the future may look like, which we then can use to explore or test our image of the future. It helps us gain direct insight, so we avoid wasting resources or developing the wrong product.

We can sketch before we paint and think while we build. In this way, invite the contingencies and surprises that may arise when an idea suddenly has to face reality. Sometimes this even opens doors for things we did not know we did not know. The same can be true when we let other people interact with the idea. In this way, we improve the possibility that they can give us essential feedback we can learn from. If we do not have something concrete to collaborate or interact arround, then we risk talking about separate things even

An example: Standing Moon Landing

In the 1960s, the American company Grumman faced a whole new one type of task. The company had been commissioned to design the lunar landing craft (the so-called Lunar Excursion Module) for NASA's Apollo program, who would later write history by leading the first humans to the surface of the moon and home again.

From designing vessels that would normally operate under terrestrial conditions, Grumman was suddenly faced with having to design a module that would operate exclusively in space. One of the big challenges concerned the heavy weight of the module, which especially came from the large windows needed for the astronauts to see from their seats.

The assumption was that the seats were a central part of the cockpit design, as the driving analogy for the development team was to seek inspiration from jet-powered aircrafts. To explore the possibilities, Grumman chose to build a very simple, full-scale cardboard model of the cockpit that could help explore geometry and decor.

The important thing was not the materials, but the function of their mockup - regardless of the many resources and competencies available. This should turn out to bring big surprises. Using their quick mockup of simple materials, it suddenly became clear that the astronauts could stand up, as the legs are good at absorbing shocks on impact, allowing for a much larger field of view, and thus the ability to redefine the size and role of the windows in the landing module.

In this way, the initial question of window design suddenly became a question of whether the astronauts needed to sit down at all, which was a radical idea at the time, and again affected the final design of the windows. The seats were taken out, the windows became smaller and triangular, and the module went from soft shapes to angular shape. From having developed with inspiration from jet-powered aircraft, the analogy changed to instead seek inspiration from helicopters.

though we may think we are talking about the same thing.

Prototypes can help us as means to collaborate and mobilize. Popularly said, a picture says more than a thousand words. David Kelly from IDEO argues that a prototype says more than a thousand pictures, and is central in collaboration, social meetings and mobilization of relevant actors. What separates the good idea from the bad idea often depends on the needs and experiences of the users. An idea is only as good as other people think it is – we need others to agree.

Prototyping helps us get out of the box so we can interact and develop with potential users and relevant actors as quickly as possible. But when we must interact or draw on others, it takes tangible things to show, test, discuss or explore. This

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is especially important if we seek to create radically new solutions where market analyzes and opinions do not give us significant insights into developments.

The purposes of using prototyping are many. Through a study of the literature in prototyping, we have identified some of the typical positive influences that the use of prototyping

Prototyping: Positive influences

- **Testing and evaluating:** Prototyping helps us improve our concepts and products using prototypes that can engage users early on, and as a tool for testing and evaluating various aspects of our ideas and solutions, which can support us in reducing and avoid mistakes, identify opportunities for improvement, and refute or confirm our assumptions and hypotheses.

- **Exploring:** Prototyping helps us explore situations, users, ideas and problems by creating and using prototypes as openings to imagine, generate and discover new alternatives, new possibilities and new understanding, especially in phases where the specific requirements for potential solutions and understanding of problems are not yet fully defined.

- **Communicating:** Prototyping facilitates communication between actors by using tangible prototypes as representative means that can be used to share and explain ideas and mediate social interaction and relationships by establishing common focus, limiting confusion, and qualifying feedback.

- **Learning:** Prototyping gives us access to valuable insights from mistakes, successes, and unexpected surprises. It improves our understanding of problems and solutions by generating new knowledge or reinforcing existing knowledge.

- **Reify:** Prototyping forces us to create prototypes that can act as cognitive collaborators and means to convert abstract ideas into concrete form that can create space for reflection between hand and mind.

- **Simplify:** Prototyping reduces complexity by allowing us to break down large, complex tasks and issues, give us ongoing results, and simplify coordination, collaboration and the integration of different actors at different stages.

has. However, it is important to remember that a prototype can play well in several areas at the same time.

How to Proto-type?

As an entrepreneur, today you have almost unimaginable opportunities to work with different forms of prototyping. This is primarily due to the following factors:

→ The understanding of prototyping has expanded to include the final stages of product development (where the prototypes can be considered as early test versions of products) to also apply in the early stages of a development process. In the early-stage prototyping can be used to build knowledge about elements of the business model, explore the problems and challenges of customers, and find potential solutions.

→ The context for prototyping has expanded from primarily to be used for testing and evaluation of different technical dimensions of physical products to also be used in the context of digital solutions, processes, services and experiences.

→ The emergence of new concepts and approaches to innovation, entrepreneurship and development processes, such as Lean Startup, Design Thinking, Design Sprints and Pretotyping, all of which involve different forms of prototyping as central cornerstones in the realization of solutions and products.

→ The availability of new technologies and services such as 3D printing, Cloud solutions and freemium access to services (such as Prototype on Paper that allow interaction with customers and own ideas) has given ordinary entrepreneurs access to a wide range of opportunities for new ways of doing prototyping.

→ New opportunities through crowdfunding both alone and in collaboration with various companies that allow entrepreneurs and startups to market validate with a prototype and finance the remaining development before full-scale production.

→ Increased availability of various facilities through the emergence of new makerspaces. FabLabs and incubators have spread across most of the country and have often made relevant materials and techniques available to affiliated entrepreneurs and businesses.

As a result, you as an entrepreneur will probably often be met with calls to make prototypes and referred to places where you can get support. But before you embark on a fast and fun 3D print of your product idea, an A / B test, or a design an interactive roleplay for your future customers, it's a good idea to spend some time getting to know how prototyping works, what advantages and disadvantages are associated with the different options for prototyping, and not least reflect on what learning needs are most urgent

for you in your current stage of development.

In all these options for prototyping, there is a possibility that you will spend too much time on building prototypes and too little time on developing your business. A lot of entrepreneurs love to get new ideas, build things, or experiment with concepts and materials, but if you are not attentive, the creative work of building prototypes can divert your attention from the central task of building your business. And maybe you do not notice it at all.

Prototyping feels like business development because it involves lots of creativity, enthusiasm and construction work. But if it's the wrong thing you build, the wrong areas of your business you generate ideas on, or if creativity does not translate into action, well then, it's wasted time that can end up ruining your business. Prototypes are characterized by incompleteness, and there is no one-size-fits-all process of prototyping to follow. There is simply no one perfect formula for prototyping. Whether a prototyping process is good or less good depends on various factors, all of which determine how effective the given process is in helping you further in your development. In other words, we know that the choices we make, which dictactes how we prototype can make big differences in the time frame, costs, and efficency of our prototyping efforts, while at the same time, different techniques and methods can lead to different results.
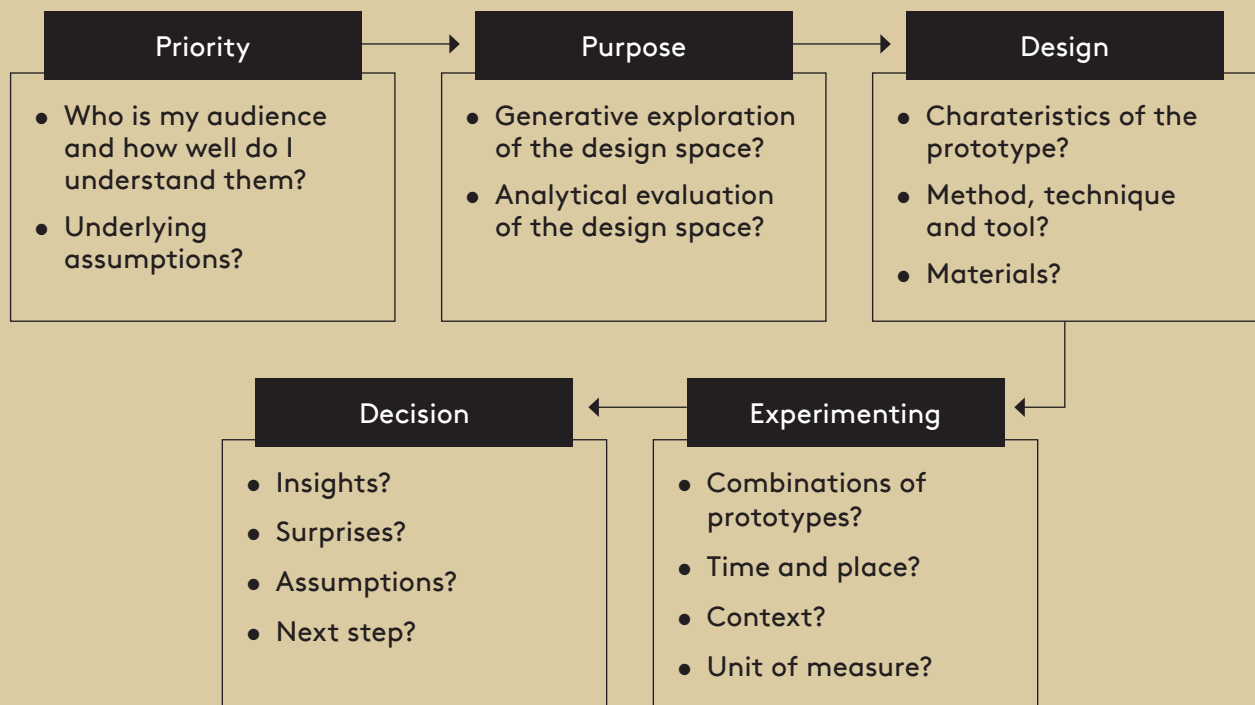
That said, there are some basic principles that can guide and adapt your prototyping to make it as effective as possible for your current situation and the audience you need to interact with - whether the audience is yourself, internally or external teams or potential users. When you start prototyping it is important to be aware that your process can take many different directions. The goal is to try to choose the right process for your current situation, but at the same time expect to be surprised along the way, which can give variations of paths and approaches - also beyond what you had expected. That is the power of prototyping.

During the prototyping process we often run into problems and surprises, which may call for a revisit of previous phases, or new assumptions. It may arise either in the problem understanding or in our solution proposals, which may call for other directions than what we expected. Your design process will most often take different directions depending on the purpose of each prototype, and the process will vary depending on what the purpose is, what audience you are interacting with, and what underlying assumptions you have.

Below, the process is visualized in a way that should help you get started with your prototyping. Keep in mind, however, that although the process is often visualized in a linear fashion

from A to B, it is rarely the case. Prototyping should instead be seen as an iterative process where we must be prepared to go back and forth between the different steps and phases. In the traditional development process, this might be seen as costly missteps or setbacks, but in prototyping, it is this flexibility to go back and forth that provides the strength.

Roadmap for Prototyping

Priority	Purpose	Design
• Who is my audience and how well do I understand them? • Underlying assumptions?	• Generative exploration of the design space? • Analytical evaluation of the design space?	• Charateristics of the prototype? • Method, technique and tool? • Materials?

Decision	Experimenting
• Insights? • Surprises? • Assumptions? • Next step?	• Combinations of prototypes? • Time and place? • Context? • Unit of measure?

Phase 1 - Prioritizing:

When you start prototyping, it is very important to focus on what the purpose is. We need to go beyond our immediate gut feeling, hidden assumptions and bias, which might otherwise end up shaping our analyzes and plans if we do not examine them. The best way to overcome these things is by bringing them to light so you can explore and challenge them through prototyping.

Prototyping is a conscious and purposeful process, rather than thoughtless experimentation, but it should not be limited by too much structure and overconfidence in the underlying

premises behind our purpose. The goal is to plan a bit to get a clear direction then prototype the rest. When you need to find out which prototyping is best for your current situation, you can often start from reflection on the current stage of development of the venture or project, the audience you need to interact with, and your assumptions underlying the proposed solution or the user issues and desires.

Start by asking yourself who the audience consists of, how well you understand them, as well as what blind spots and assumptions you have in either your understanding of their problem or in your ideas for solutions to them.

Once you have an idea of who your audience is and what assumptions you are dealing with. It will help you make decisions about what learning needs you have so that they can be prioritized towards the purpose that is most critical to focus on. Depending on what purpose you have, it will affect what process you embark on.

Phase 2 – Purpose:

Once you have an idea of what learning needs are most important to move forward with, then it is important to consider whether the given purpose calls for opening or closing the design space. The design space can be seen as the space constituted by the problems in a problem "space" and the possible solutions in a solution "space". Prototyping can be used to both open and diverge or close and converge the design space, but it depends on what our learning purpose calls for.

The generative exploratory approach is particularly useful for learning purposes that have to do with building and exploring alternatives, especially in the early phases, where time and resources are very limited (we have not yet invested in a direction and the uncertainty is particularly high). For example, if the purpose is to generate many different solutions to a problem, then it calls for a generative and exploratory prototyping that can open the design space and create options.

This type of purpose calls for a form of audition, where we should seek to explore different things to get an idea of where we can move forward. It can both be an exploration of the problem that can give us ideas for alternative problems that we might need to focus on instead, or it can be an exploration of the variety of possible solutions.

The analytical evaluation approach is particularly useful for learning purposes that seek to test or evaluate, especially in later stages, once we have clarified what the problem is, what any solutions might look like, and now want to isolate more specific questions related to the ideas. For example, if the purpose is to test specific questions or assumptions,

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> *It is important, especially when exploring ideas, that we go for quantity over quality. The goal is to get as many ideas developed so we can interact with them, turn them around, and in that way better evaluate, and maybe even discover new aspects of an idea.*

then it points to an approach characterized by breaking down and focusing, which can narrow the design space and help us make final choices. Such a purpose calls for a form of interview, where we usually have an idea of what we are looking for and what specific function the solution should be part of, so we should go after evaluating specific things to get an idea of which impresses most.

Phase 3 – Design:

Once we have an idea of what the learning needs are and what approach in prototyping it calls for, then it's time to build prototypes. Here, it is central to focus on the most simple, fastest and cheapest way, which can help us move forward with the learning purpose.

While it may be tempting to want to learn how to code, or to acquire advanced 3D facilities, the simplest way to get started can be by drawing on a piece of paper. The starting point for what we need to build and how we do it most efficiently should be found by looking at your learning purpose, your audience, your competencies and materials. Draw on simple techniques and materials so you do not limit yourself to what they can and cannot do - especially if you are trying to get as many ideas out of your head as possible - and try to make simple prototypes and build many of them. Keep in mind that even simple materials can often be used for more than one specific purpose, but often they can be used differently, or inspire other ideas, which then call for other materials.

It is important, especially when exploring ideas, that we go for quantity over quality. The goal is to get as many ideas developed so that we can interact with them, turn them around, and in that way better evaluate, and maybe even discover new aspects of an idea, or possibilities for combinations between the ideas. The prototype cannot show everything at once, nor is the purpose of prototyping. Although it can be tempting to build many elements into one complete solution, the goal is to build one or a few elements related to the learning purpose into a prototype, and then alternatively build several prototypes at the same time.

Research has shown that simpler prototypes give better end results, but they also give power to more actors, so everyone has a better opportunity to come up with relevant inputs. If there are too many elements in play at once in the same prototype, then it will be difficult to give feedback to the audience, and the feedback that may occur will be difficult for you to benefit from, as it is unknown, which elements the positive or negative feedback are related to. At the same

time, feel free to use other materials for the prototype than those you expect in end solutions. In this way, it is made clear to everyone that it is an unfinished prototype, so that you avoid becoming too fixated or fall in love with a specific prototype, which limits your further journey. The task is to find the best match between technique and method that suits the learning purpose and the audience. For example, if the learning purpose points in the direction of rapid prototyping to investigate how a website could be built, then rather draw on paper prototypes than start coding.

The degree to which prototypes should be tangible, interactive and functional, and how much they should resemble elements and aspects of a potentially finished solution, simply depends on the purpose and the audience. It is always the learning purpose and the audience that dictates. The appropriate level of how much the prototype looks like something definitive is depending on the given audience for the prototypes, and the purpose of interacting with them. For example, if the audience for the prototypes is primarily yourself and your team, then they often do not have to look like anything special, as the design team is usually involved in what is being worked on. If the audience is external,

Examples of simple choices

- **Website or app:** Simple keynote, powerpoint or paper-prototypes

- **Service or experience:** Storyboards, roleplay, bodystorming or proxy objects to explore

- **Physical space and interior design:** Modify existing rooms, bricks/LEGO, drawings or paper

- **Physical products and machines:** Modify existing objects, paper, photos
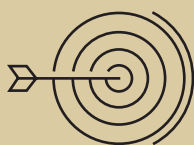
potential partners or users, so it will often require that the prototypes look like something they can relate to - at least on the specific dimensions, features or roles that you are exploring or evaluating. Keep in mind that prototyping is an iterative process, so start simple, as both the degree of how tangible the prototypes are and how much they resemble finality will typically increase during the design process.

Finally, it is important to be aware that when we make decisions and build in the design phase, new ideas sometimes open up, which can lead to new or different assumptions, which may call for us to revisit our priorities in previous phases.

Phase 4 – Experimenting:

Once we have built the prototypes to explore or test specific purposes, then it is central to get the stage set right so that we increase the chance that the prototype works as intended. If you are trying to put interactive prototypes into play with an audience that needs to interact and potentially modify them, then it is central to keep the context in mind so they do not become confused about what you would like their attention focused on. For example, if you want to investigate potential user experience of your solution, then it will be relevant to consider whether you want to investigate it by inviting them in, or by letting them bring home the prototype over a period of time. Should it be put into action in a natural or an artificial context? Depending on how we put the prototypes in play with the audience, it can provide different insights, so the goal is to seek the match between the activity, the prototype, and the purpose. At the same time, it will be necessary to consider which contexts, times and places best suit your given audience, so that you improve their experience of the prototypes.

Sometimes you will find that it calls for further prototyping of prototypes if you need to put the prototype properly into action. For instance, it can be useful to bring the prototype to life with roleplays or storyboards, which calls for the design of these in relation to either the current situations, where users typically experience the problem that calls for your solution, or the design of a roleplay for the potential future scenario of how the solution would work if it existed in a fully developed form.

If the purpose of the prototype is testing and evaluating very specific questions or assumptions, then it can often be useful to establish some clear goals in advance. For example, if we are trying to test whether potential users' willingness to sign up for our new catering concept, then the prototype can be designed as a minimum viable product (see Lean Startup), which has a clearly defined goal for how many potential users must sign up. The key is that we remember that prototypes are just one element in the user experience. Realizing this we can put the prototypes in action in ways that can realize their function in relation to the learning purpose and the given audience - regardless of whether the audience is you, an internal or an external one.

Phase 5 – Decision:

Once we have exposed the prototypes to the audience, it is time to interpret the new knowledge so that you can evaluate and make decisions. It is important that you reflect on how

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you create meaning from the information obtained, which will often be large and confusing amounts, and how you translate this information into new action and progress - both for you, your potential team, and your potential stakeholders.

A good way to evaluate the information obtained is to ask yourself: What insights has it provided? What insights are surprising compared to what you expected either relative to users' problems or the potential solutions? What worked well and less well? What new solutions or improvements do it point in the direction of? What assumptions have emerged either in the process itself or from the interaction?

These questions can give an indication of whether you can continue with the development of one or more of your ideas, or whether you should change something, or drop the current direction of solution altogether. When the process indicates that solution proposals should be dropped altogether, it can often be related to the fact that your understanding of the users' problem may be based on incorrect premises, which should give rise to an exploration of the problems and the situation or situations in which the problems arise.

Keep in mind that even though it may seem as if the prototyping has failed, it will often be necessary mistakes that we have found cheap, simple and easy after all, rather than having developed and invested in directions based on potentially wrong grounds.

Overview of the characteristics by the good process

→ **Purposeful and intentional:**
The prototyping process is a means to an end. Once you have a clear idea of what prototyping should help you with, you will help yourself and those involved to make quick decisions so that the process can speed up in the simplest way. If you do not have the purpose and thought behind the process, then you risk an inefficient and costly journey that leaves the whole process to chance. However, remember that the logic of prototyping is to avoid too much planning, so specify the purpose, and prototype the rest - it is usually only on the journey itself that surprises and insights emerge.

→ **The good match between structure and flexibility:**
Allow prototyping to be an iterative process where the goal is not necessarily to go through the phases from end to end in each course. When we work with prototyping, we will most often encounter challenges,

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surprises or mistakes that raise new relevant questions and assumptions that may be necessary to get off the table before we move on. In the same way the interaction with various materials will also often give us some insights, even before something is actually tested by others, which will give rise to updates our learning needs and priorities.

→ **Collaboration and communication with all involved:**
By involving the relevant parties, whether it is internal or external, as early as possible we make sure to give everyone the opportunity to participate in the development, provide more perspectives on both issues and solution proposals, and even open for co-creation of solutions.

→ **Quick actions rather than analysis:**
When we act, we provide the opportunity to make vital mistakes early, which is essential in learning, and thus help the process further. It is through mistakes and thinking with our hands that we can become aware of whether we lack certain insights or work from premises about what users' problems are or what a valuable and workable solution should be able to. Try to act as quickly as possible, as greater time consumption is not associated with more success in the end.

→ **Quantity over quality:**
Regardless of whether we are trying to explore or test, a key characteristic of the good prototyping process is a focus on quantity over quality. The goal is to get as many ideas developed so that we can interact with them, turn them around, and in that way better assess, and maybe even discover new sides of an idea, or possibilities for combinations between the ideas.

→ **Separation of construction work from experimentation:**
It is often beneficial to separate our creation of prototypes from our evaluation and testing of these, when we develop creative solutions. By providing space to unfold the construction work and be creative before we evaluate and judge, then we increase the chance of
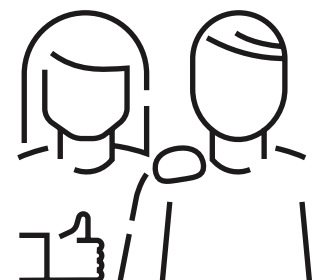
Get started with Proto-typing

Prototyping can be a rewarding and effective way to grow your business, but it can also be a dead end that sucks energy and resources out of your entrepreneurial process - and that even without you necessarily discovering it before it's too late. Based on the research and our experience of working with entrepreneurs, we have gathered the following good advice for your future work with prototypes:

Define prototypes broadly and focus on prototyping:

There are almost endless possibilities when it comes to pro-totypes, and the possibilities for different types of prototypes are constantly evolving as new technologies emerge. Whether a given prototype is effective or good depends on whether it helps us answer the most pressing questions we face.

It is important to think of prototyping as a process and not limit it to the given prototype object, but instead view pro-totypes broadly defined as representations of a design idea regardless of what form or material it consists of. If you focus too much on the specific prototype and what it is technically possible to create, then it can end in costly defeats if the prototype fails in the encounter with the outside world. Keep in mind that the simplest representation can sometimes be at least as effective as a complex prototype.

The specific purpose is alpha omega:

Always keep a specific learning purpose in mind when pro-totyping. That way you avoid ending up in a vicious spiral of endless experimentation, where the vast amount of poten-tial feedback can paralyze and confuse rather than support and accelerate. It is therefore essential to keep its purpose in mind when deciding which techniques may be useful to us in the development of one or more prototypes. If we use prototyping without having an assumption or a learning purpose in mind, then at the same time we also leave the prototyping process completely to chance.

Set aside time for prototyping:

It is important to set aside time for prototyping in your de-velopment process if you want to avoid developing soluti-ons that are potentially not valuable to your users or that risk being developed as solutions to the wrong issues for users. However, it has a double meaning to set aside time for prototyping, as it both indicates to prioritize prototyping in development work, but at the same time we should also seek to push the pace up when prototyping, as it can be beneficial to avoid failling in love with a given solution or getting lost in the details.

> *No matter how much insight you have into the users, be sure to build with a focus on the users.*

Attack the premise of the learning purpose:
Be aware that there may be underlying premises under the immediate learning purpose. For example, the learning purpose may be to test whether someone signs up for pre-purchase on our upcoming app but be careful to attack the premise of why the problem in question even calls for us to have to develop an app later. It can often prove essential to explore these underlying premises, and here prototyping can also be used.

Set learning objectives based on the current stage of development:
When setting learning objectives, be careful not to go into solution mode too quickly. We humans often tend to want to think convergently quickly and gather our ideas into potential solutions. Although prototyping has great strengths in the gradual validation and testing of our ideas for solution proposals, it is also an extremely powerful method for exploration that is often necessary before we set up possible solutions.

Know your audience to prepare prototypes:
It is important to have some insight into the audience who will be interacting with the prototype or for whom you want to showcase the prototype to. No matter how much insight you have into the users, be sure to build with a focus on the users.

It is pivotal to make decisions about which aspects that are necessary to instantiate with the prototype and which aspects are merely nice to have, but not necessarily required for it to serve the purpose. For example, if the learning purpose is to see how many people pre-order a non-existent solution in order to examine user interest, then it is necessary for the prototype to appear as a real product, even if it is not. On the other hand, if the purpose is to investigate what a given size of a pocket fitting product should have, then it is not necessary to build anything other than a wooden block of the given size.

Know your prototype to prepare your audience:
Be clear and aware of what the purpose of the prototyping activity is, and what it cannot answer. It is an essential part of the prototype's use to communicate clearly to the audience what the specific purpose of the prototype is. This is particularly important as the purpose of the prototype is not always clear, especially for actors who are not part of the prototype's creation, or for prototypes where they do not immediately resemble a final solution. Here you can prepare the audience by making it clear to them what the purpose of the prototype is, and what the purpose is not.

> *By quickly trying out different materials and prototypes, we can overcome the fixation on a specific idea, and open the door for good solutions that may lie in combinations or aspects of different ideas.*

The context plays into how effectively the prototype works in meeting other people, so be sure to pay attention to how the context surrounds the prototype.

Build only what is needed:
Only incorporate the features of the prototype and proto-typing process that are necessary to explore and test the specific learning objective and move it forward quickly, so you avoid becoming emotionally attached to a particular prototype. If you spend too much time, you risk becoming too attached to the individual solution. If you simultaneously build too many features into the prototype at once, then you risk using too many resources in the wrong direction, while the many features make it challenging to assess feedback, as this can relate to several elements of the prototype. Go for making them as simple and unfinished as possible so that they retain a flexibility.

Build several prototypes:
The strength of prototyping lies especially in its ability to explore problems and solutions, but in working with hands and materials, we also allow ourselves to avoid getting stuck on an idea prematurely.

It is important to be cautious about this kind of fixation, and provoke it, as we may end up building prototypes that show what we want to see. By quickly experimenting with different materials and prototypes, we can overcome the fixation on a specific idea, and open the door for good solutions that may lie in combinations or aspects of different ideas.

Apply simple materials and techniques:
Especially in the early divergent stages it's about capturing a lot of questions and ideas, which often involves post-it notes, quick mockups, cardboard models and paper prototypes.

The important thing is to use whatever you may have available, which allows you to quickly communicate your thoughts without being slowed by the material and production process itself. The easier, faster and simpler you make these tools, the easier it is to perceive them as unfinished, and throw them away again without being locked into potentially erroneous imaginations too soon.

Similarly, it is important to draw on the techniques that are both simple and accessible rather than rely on more advanced techniques that often require specific competencies, which can slow our prototyping efforts. A cardboard model can work at least as well as an advanced, laser-cut model if the purpose is to interact with relevant actors about the solution.

Make many simple materials available:

In addition to use the simple materials you have available; you can make sure to have many different simple materials available. It enhances the ability to combine in different ways, and quickly draw on different materials without becoming dull.

If you only surround yourself with one or a few simple materials or techniques, such as, e.g., 3D printing facilities, then you often tend to build prototypes based on this technique without exploring alternative materials or techniques. Make sure to have several different materials e.g., cardboard, paper, crayons, post-its, tinfoil, etc. available. These types of materials will be both open to simulation of all sorts of ideas, but at the same time also give rise to manifestation of a wide range of ideas without being slowed by techniques and materials.

Take advantage of the missing links in the prototype:

While the specific parameters built into a prototype can help fulfill all or part of the learning purpose, be aware that the shortcomings of a prototype can also tell a story. They can create positive surprises or prove to be key elements that need to be integrated and tested in subsequent iterations.

We hope this guide has inspired the work of prototyping. The potential for working with prototyping is great for many entrepreneurs. But there are many pitfalls and there is a risk of wasted time and wasted resources. With this guide in hand, you can hopefully avoid the worst of these, and unleash the potential of your business.

Prototyping – a guide for entrepreneurs