Freeform Modeling Workshop

Hochschule für Gestaltung
Schwäbisch Gmünd

So, What is Freeform Modeling?

A *model* is a mold used to shape moldable substances into a specific shape. Most are viscous or doughy substances such as liquid metal, clay, wax, dough or butter. With the model, a relief can be reproduced as standard.

The term model is used in archeology and arts and crafts (for example, models are used in stucco work), but also in the modern molding and casting technique (in castings however, the mold is referred to as a die). Furthermore, certain foods such as Springerle are molded with models

The model or matrix is a casting and forming negative mold for castings and wrought products, which are used in commercial and industrial production to quickly bring the material to be worked into a shape defined by the model (so-called *prototyping*).

The objects that are molded with the model may consist of metal, clay, ceramic or plaster or plastics, but also wax or other formable substances. The model itself can also be made of metal, clay, ceramics or plaster; wood is unsuitable for industrial production, but has been indispensable in craft production, for example in glass blowing, but is also replaced by highly heat-resistant ceramics. The model and molded part should not be the same material as positive and negative may combine during solidification or hardening. If material equality can not be avoided, a separating intermediate layer must be applied before the casting process, which allows easy detachment of the molded article.

Models are also used in the production of stucco elements for wall and ceiling decoration. In the metal and plastic sector, there is specifically the profession of mold maker for the production of models.

Clay modeling is an important phase in the design process. 3D Virtual Reality is progressing rapidly, creating a clay model is still fundamental, especially when it comes to have a reference for an new exterior design.

With our parent company Design Consulting, we are offering structured and elaborated clay modeling workshops for designers and modelers. The main target of the workshops is not only to teach the technique and craftsmanship of clay modeling, but to understand the value of a clay model in the modern process of car design. Our experienced team has held the workshop in many different places worldwide and the response was overwhelming.

Computer assisted designing (CAD) is well known for several decades and employed for ceramic manufacturing almost since the beginning, but usually employed in the first part of the projectual ideation processes, neither in the prototyping nor in the manufacturing stages. The rapid prototyping machines, also known as 3D printers, have the capacity to produce in a few hours real pieces using plastic materials of high resistance, with great precision and similarity with respect to the original, based on unprecedented digital models produced by means of modeling with specific design software or from the digitalization of existing parts using 3D scanners. The main objective of the work is to develop the methodology used in the entire process of building a part in ceramics from the interrelationship between traditional techniques and new technologies for the manufacture of prototypes. And to take advantage of the benefits that allow us this new reproduction technology. The experience was based on the generation of a complex piece, in digital format, which served as the model. A regular 15 cm icosahedron presented features complex enough not to advise the production of the model by means of the traditional techniques of ceramics (manual or mechanical). From this digital model, a plaster mold was made in the traditional way in order to slip cast clay based slurries, freely dried in air and fired and glazed in the traditional way. This experience has shown the working hypothesis and opens up the possibility of new lines of work to academic and technological levels that will be explored in the near future.

This technology provides a wide range of options to address the formal aspect of a part to be performed for the field of design, architecture, industrial design, the traditional pottery, ceramic art, etc., which allow you to amplify the formal possibilities, save time and therefore costs when drafting the necessary and appropriate matrixes to each requirement.

Map of Basement
Hochschule für Gestaltung
Schwäbisch Gmünd

Freeform Modeling Workshop

Space, Time, and Volkmar

“ The surface has to unfold like a breath.”

The *Freeform Modeling Workshop* at the HfG Schwäbisch Gmünd offers tools and materials for clay and gypsum modeling. Volkmar Meyer-Schönbohm leads the workshop, teaching courses and providing assistance for student projects. Freeform modeling is a popular technique for designers and modelers alike for prototyping 3D models, allowing for greater flexibility compared to computer-aided techniques. In fact, many students report the tactile experience of modeling by hand to be meditative and relaxing, a sentiment proudly echoed by Volkmar himself.

Industrial Clay is an extremely versatile tool, with many wide-ranging uses for the medium. Model-making has been a tool for designers for thousands of years. You try something out, tweak it, scrap it, and try again. It turns the imagined into the real, and lets the idea speak for itself.

Opening Hours

MON–WED	09:00–12:00 13:00–15:30
THU	09:00–16:00 *(only clay workshop)*
FRI	closed

Rapid Prototyping

Despite the rise of digital tools and rapid prototyping, it has never been more important for designers to make things with their hands. Comfort with three dimensions as a sketch and development tool enhances a designer's sensitivity to form tremendously and helps them understand how products are made in the real world. If you can build it, you're halfway to knowing how it could be manufactured.

Building models by hand is fundamental to industrial design—it's what makes our profession a craft. Spending time with CAD makes you a better modeler, but spending time with a physical model makes you a better designer. It allows you to see your design in the real world, in a way that simply superimposing a rendering into an environment cannot replicate. The practice of validating ideas through physical prototyping, whether it be quick and dirty paper mock-ups or high fidelity clay models, is slowly dying. There needs to be a resurgence of prototyping within the modern work-flow of industrial designers A slight shift in proportions can make a world of difference in how someone perceives the appearance, function, and value of a product. The automotive industry is a great example of how shifting proportions can lead to very different emotive values within form. Generally speaking, all automobiles incorporate four wheels, an engine and a trunk, a front/back windshield, and side windows and doors. The spatial relationship and scale of all these components is what defines the difference in various types of automobiles, such as SUVs, sedans and station wagons.

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Designer and Modeler

The most important stage in the process of completing a design model is occupied by creative activity and the joint work of the modeler and the designer. There are various combinations of the two – a new designer and an experienced modeler, a veteran designer and a veteran modeler – so it is difficult to define their respective scopes of responsibility or their relationship. Figuratively speaking, it is similar to that between a composer and an instrumentalist. A composer creates a piece of music that reflects his/her image. The instrumentalist transforms the image on the musical score into a sound that reflects his/her sensitivity and skill. The modeler also expresses the designer's image, but in cubic form and with maximum skill and sensitivity. The information on which modeling is carried out is based on the designer's ability to convey an sketches, renderings, keyline drawings, and language.

Interpreting such information calls the modeler's sensitivity and technique into play: how should information be interpreted? How should unexpressed portions be treated? Creative work calling for one's sensitivity and skill – that is what connects the designer and the modeler. Just as the composer and the instrumentalist are both creators, so are the designer and the modeler. Society is paying more attention to design than ever Before; thus, the work of the modeler is greatly changing.

The basic role of the modeler is to cooperate with the designer in putting his idea into a solid form which eventually is a commercial product. Design model function varies with stage: embodying ideas, elaborating shapes, reconfirming the whole form as a final product, and serving as a database for transfer to production. As function changes, so should the role of the modeler.

A modeler's creative work can be roughly broken down into the following three phases :

1. *Giving the design a framework*
   The designer's image is transformed into a solid form that observes the specified proportions and primary dimensions.

2. *Elaborating on surfaces and lines*
   Further pursuing the designer's image, overall proportions and a massive, dynamic impression are represented th rough well-handled surface and lines. A shape that is close to the designer's image or even superior to it is sought.

3. *Final refinement*
   Finally, the car's 'flavor' is reviewed, including all the details. So me additions may be made to bring the model closer to perfection. For such creative work to be done more smoothly and the results to be better reflected in the product.

Clay Modeling

There are many different types of clay. There is the clay that children play with, ceramic clay, the clay mixed with oil used for artistic modeling, and the industrial clay (ID clay) used for product design development. Either oil clay or industrial clay is used for car modeling. Among modeling clays are cinnamon oil clay and Leon clay. Both are soft have a high moisture content, are viscous and can be handled at room temperature (the higher the temperature, the easier to handle). ID clay are also oily, but they are hard at room temperature, and only become soft and easy to handle when heated. There are various types of ID clay for different applications, but quality clays have a uniform color, fine grain, offer little expansion and contraction due to temperature changes, pack easily, and provide a good finished appearance. It is particularly important a clay scrape well – if it can be shaved off effortlessly with a rake, work proceeds smoothly. In Japan, the most widely used clay is one called J525. This is a Chavant clay with high quality and offering

Working in clay gives modelers and designers a more tactile, fingertip feel for the design that simply cannot be replaced by any other medium and is ideal for sorting out optimal ergonomics. Later, these full 1:1 Clay models can then be scanned into 3D CAD, and converted into 3D production designs for production. One useful advantage of clay is it can be finished and painted to resemble a realistic prototype. This is the process advanced R&D studios use when creating concept cars at key automotive design shows.

Industrial Clay is an extremely versatile tool, with many wide-ranging uses for the medium. Model-making has been a tool for designers for thousands of years. You try something out, tweak it, scrap it, and try again. It turns the imagined into the real, and lets the idea speak for itself.

“ It enables us to intuitively create a form that appeals to people’s hearts and mind.”

Computers haven’t changed this. No desktop design simulation, VR goggles, or even lush artistic rendering can change the value of having an actual thing in front of you to look at and touch. So it should come as no surprise that physical modeling still thrives in design studios around the world—particularly in the automotive industry. It’s the primary tool that designers use to craft their vision, and by far the easiest way for production teams and execs to fully grasp and evaluate the work, both aesthetically and practically.

The big brown models sitting statically in design studios represent just a slice of the medium’s overall usefulness to industrial and automobile designers. The material holds fine details without cracking or drooping, so precision molds can be made from the model. It’s also surprising to see the extent to which the physical world of clay modeling and the digital design universe comingle. Clay can be CNC-milled (allowing for a degree of quick and repetitive precision manufacturing as the designers progress with their work) and it can be digitally scanned, allowing the changes brought on by the model to be reintegrated into the virtual design workflow.

List of Materials and Conditions for Selection

Ease of processing
What equipment you own
The time allotted for finishing the model
Possible need for or frequency of modifications

Appearance
Will the material be visible on the outside
What effects are you aiming at
Who are you going to show the model to

Endurance
Application of the model
Environment in which model will be displayed
Period for which the model will be used

Weight
Method and course of transportation
Frequency of movement

Strength
Avoid increased weight and costs

Safety
Whether or not the material is harmful

Price
Should be inexpensive but fulfilling requirements and use.

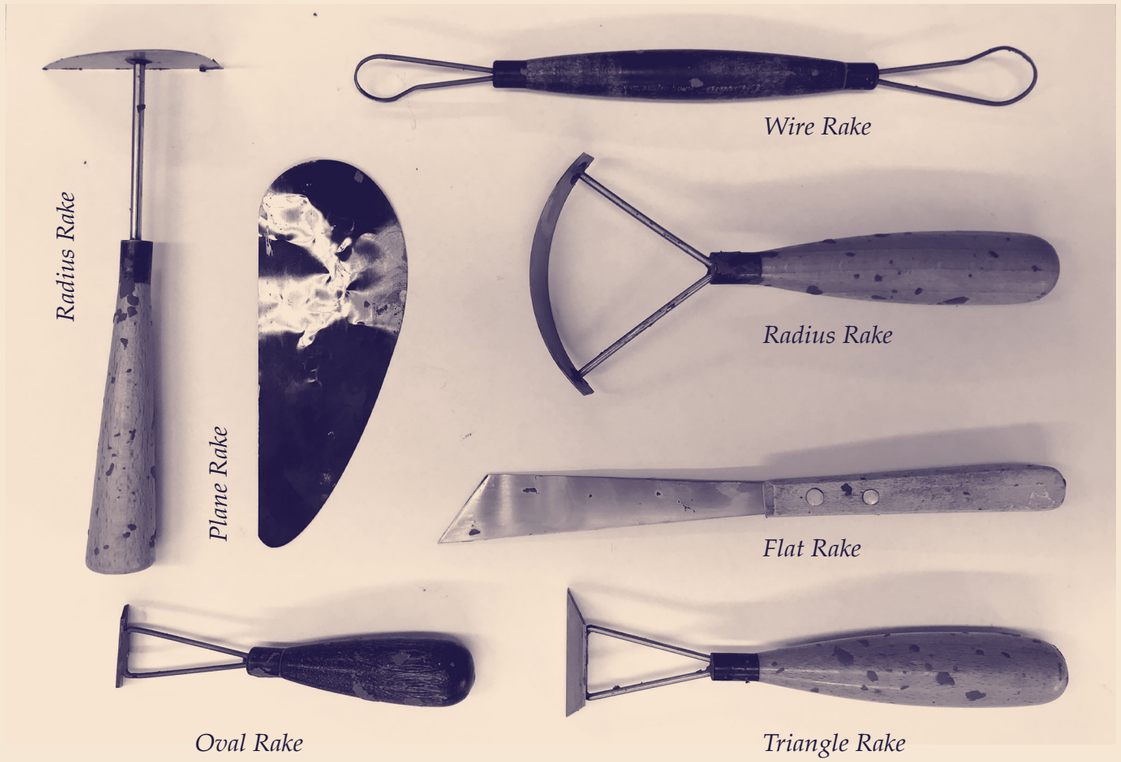
Advantages and Disadvantages of Clay

Advantages

- Easily moldable at 50–60°C
- Reusable (arbitrarily many times)
- Stable (hard) model at 22°C
- Model can be modified at any time to any shape by reheating
- Clay attaches to wood or Styrofoam without any glue or adhesive.
- Models can be coated with special paints
- Can be used as a negative mold for plaster, polyester, or silicone

Disadvantages

- Weak edge stability
- Cannot be used for deep draw molding
- Stable coating is difficult, since clay can expand/contract with temperature



Tools

The main purpose of a rake is to remove material in an efficient manner, therefore giving you a clay form that is representative of the design required, even if it is a very rough representation. By achieving the basic form very early in the modeling process, the designer has time to consider changes that will enhance the overall look thus leading to an appealing design.

Rakes come in various forms; from large flat rakes which are used primarily on convex surfaces, to curved rakes which are used on concaved surfaces. They usually range in size from 2" or 50mm to 6" or 150mm in width but can be of any size if custom made. The blade is normally double sided which gives you the opportunity to file teeth into the opposite edge. The reason for this is to reduce the amount of resistance when shaping the clay surface.

A great number of tools are used for modeling, but this does not mean you must have all these tools in order to go about modeling work. In fact, it is even better if you make your own tools and use your ingenuity to select the set of tools you need. The development of cars to be mass-produced entails design and production, so frequent exchanges of data with the design and other related departments are necessary when working on models. This data must have a precision of $\frac{1}{10}$ mm or better, so the proper equipment, jigs, tools, and materials allowing timely and efficient exchange of data are a must. On the other hand, for design models which are intended as independent studies and therefore do not require highly precise data, you can reach better, more sensitive results by working freely with your own hands and the tools you are accustomed to, without relying too much on other equipment. The tools we use today are basically the same as the ones around 20 years ago in that their purpose is simply to create forms.

The equipment, jigs and materials, though, have evolved into computer-controlled measuring instruments and NC (numerically controlled) cutters so that they improve the speed, efficiency and precision of the job of reproducing set forms or transforming these into data. A great number of tools are used for modeling, but this does not mean you must have all these tools in order to go about modeling work. In fact, it is even better if you make your own tools and use your ingenuity to select the set of tools you need. The development of cars to be mass-produced entails design and production, so frequent exchanges of data with the design and other related departments are necessary when working on models. This data must have a precision of $\frac{1}{10}$ mm or better, so the proper equipment, jigs, tools and materials allowing timely and efficient exchange of data are a must. On the other hand, for design models which are intended as independent studies and therefore do not require highly precise data, you can reach better, more sensitive results by working freely with your own hands and the tools you are accustomed to, without relying too much on other equipment. The tools we use today are basically the same as the ones around 20 years ago in that their purpose is simply to create forms. The equipment, jigs and materials, though, have evolved into computer-controlled measuring instruments and NC (numerically controlled) cutters so that they improve the speed, efficiency and precision of the job of reproducing set forms or transforming these into data.

How To Make A Clay Model

Remove clay from the oven

At 50-60°C, clay is optimally malleable and can be freely formed by hand. After heating the clay in oven for a few hours, the clay is ready to be used for modeling. Within 15-30 minutes, the clay will begin to dry and can no longer be formed by hand.

Attach clay to your fixture

Larger clay models should be attached for styrofoam fixtures when modeling. Styrofoam blocks are firmly attached to a wooden or metal base and punctured with shallow holes throughout. Firmly press the clay onto the styrofoam, fully filling the holes.

Shape the model with your hands

After attaching clay to your fixture, form the rough model outlines with your hands before the clay dries. Be sure to attach chunks of clay in round balls: uneven surfaces are likely to build air pockets when dry.

Grab your tools

Once the clay has dried to room temperature, its firm surface can be scraped and smoothed using various modeling rakes. Modeling rakes come in all shapes and sizes for each and every surface type.

Refine the surface

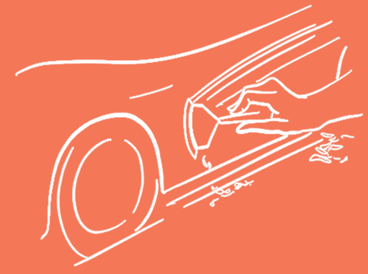
Once the rough shape has been formed, begin crafting the edges and contours of your model. Smooth the surfaces first: smooth edges are only formed between two smooth surfaces.

If you scrape too much...

Unlike other modeling materials, hardened clay models can be modified even years later. Clay can be added to the model by reheating the desired surface and attaching warm clay. Simply heat the desired surface with a heat gun and squeeze in a warm ball of clay. After drying, the surface can be re-scraped using regular modeling rakes.

Smooth the surface

In the final step, smooth the surface with a plane rake. When in doubt, run your fingers over the surface of your model to feel the uneven surfaces. The final model should appear both smooth to the naked eye and to the touch.



Final Touches

At room temperature, clay hardens but does not dry. Hardened models can be smoothed and shaped using different palette and scraper tools. Clay can be added to the model by reheating the desired surface and attaching warm clay. Unlike other modeling materials, hardened clay models can be modified even years later.

Gypsum Modeling

Gypsum is a raw material used for all things ceramic. Gypsum is naturally occurring mineral (calcium sulfate dehydrate), which is quarried and ground to a fine powder. Gypsum plaster is produced by heating raw powdered gypsum to 120-130°C. When mixed with water, gypsum plaster begins to recrystallize and can be used as a modeling material. After the water fully evaporates, the resulting model is sturdy and particularly absorbent. Oftentimes, plaster with particular properties is desired, such as especially sturdy plaster for compression molding or especially porous plaster for casting. The material properties of gypsum plaster can be manipulating by varying the ratio of gypsum powder to water.

Plaster mold casting is used when an excellent surface finish and good dimensional accuracy is required. Because the plaster has a low thermal conductivity and heat capacity, the metal cools more slowly than in a sand mold, which allows the metal to fill thin cross-sections; the minimum possible cross-section is 0.6 mm (0.024 in). This results in a near net shape casting, which can be a cost advantage on complex parts.

Advantages and Disadvantages of Gypsum

Advantages

- Excellent surface finish and good dimensional accuracy
- Minimum possible cross-section is 0.6 mm (0.024 in)
- Near net shape casting, which can be a cost advantage on complex parts.
- No shrinkage cracks
- Quick setting time
- Models can be coated with special paints.
- Can be used as a mold for plaster, polyester, or silicone

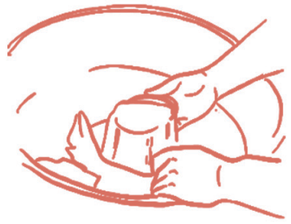
Disadvantages

- It cannot be used in moist situations
- Cannot be used for models with thin shapes models are heavy and brittle
- Breakage in models are permanent

Process

Gypsum is a raw material used for all things ceramic. Gypsum is naturally occurring mineral (calcium sulfate dehydrate), which is quarried and ground to a fine powder. Gypsum is a raw material used for all things ceramic. Gypsum is naturally occurring mineral, which is quarried and ground to a fine powder.

How To Make A Gypsum Model



Add plaster to water

Adding water to the plaster creates an island on top. Ratio of this 'island' to the water must be ⅔ island, ⅓ water. Once the island is formed, let it sit for 5 mins.

Pour the plaster in the mold

Be very carefull whilst putting the plaster in the mould. putting it quickly may result in inconsistancy of the plaster when dried. Make sure plaster is filled in every corner of the mould to get sharp edges.

Make the island disappear

Mix the combination well so that the plaster powder is comletely dissolved in the water. Check the consistency of the mixture. It shouldn't be too watery or too lumpy.

Make the air bubbles disappear

Once you pour the plaster solution in the mold, stir it carefully so that the bubbles rise up and disappear. Bubbles are the absolute worst when it comes to sculting the plaster once its formed. Make sure to remove them carefully.

Stir the mixture

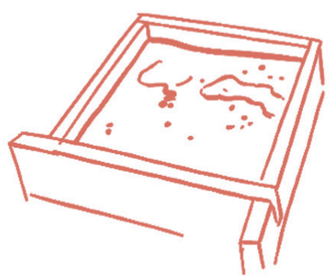
Stir the mixture well so that consistancy remains constant throughout. While stirring, look out for lumps of the plaster powder that might have formed at the bottom. Make sure to find and get rid of stray lumps.

Remove the excess

Clean the excess plaster that is overflowing the mold. The material properties of gypsum plaster can be manipulated by varying the ratio of gypsum powder to water.

Heating and cooling

Mixing Gypsum with water is an exothermic reaction. One good way to find out if your mixture is settled is to analyze the temperature. The solution first gets warm and then starts to cool down. Once its cooled down, you can use this mixture to pour into the mold.



Remove the plaster block

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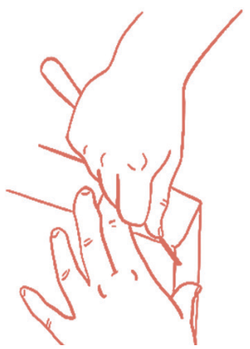

Scraps and Models

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The Meditative Experience

Self Expression and Self Discovery

In an intensive therapeutic environment, you are continuously invited to give verbal expression to your thoughts, feelings, perceptions, and experiences. However, words are not the right medium for all forms of expression—there are thoughts we have that are too painful, complex, or overwhelming for words to hold. Freeform modelling provides a new, rich language to give voice to your inner self through sculptural form, allowing you to experiment with physical media to discover new avenues of communication & introspection of the mind with both others and yourself.

Stress Relief and Relaxation

The tactile experience of clay and plaster can invite a deep sense of relaxation and well-being. Your heart rate and blood pressure lower and your stress level naturally sinks as your mind and body become enveloped in the world of creativity. The clay naturally disrupts intrusive thoughts that interfere with your ability to live in and enjoy the moment. By allowing you to step outside of yourself and devote your energies to the production of something new, pottery can provide a much-needed emotional reprieve and new perspectives.

Mastery and Self Confidence

Freeform modelling allows you to discover previously unrealized strengths as you gain mastery over the creative process, developing both technical skill and expressive abilities. The sense of mastery you gain as you develop your personal artistic style can be a source of invigoration, enhancing your confidence and sense of purpose at an emotionally vulnerable time in your life. In freeform modelling, there is no competition, no right way or wrong way, but only there are infinite possibilities for creating pieces that speak to you.

Breathing Space

The purpose of freeform modelling is to provide a breathing space for the industry to take time to perform that very task. In the present study, having breathing space in suffering afforded patients time and the strength necessary to prepare themselves and the family for the forthcoming death.

Acknowledgments

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Urmi Banerjee
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