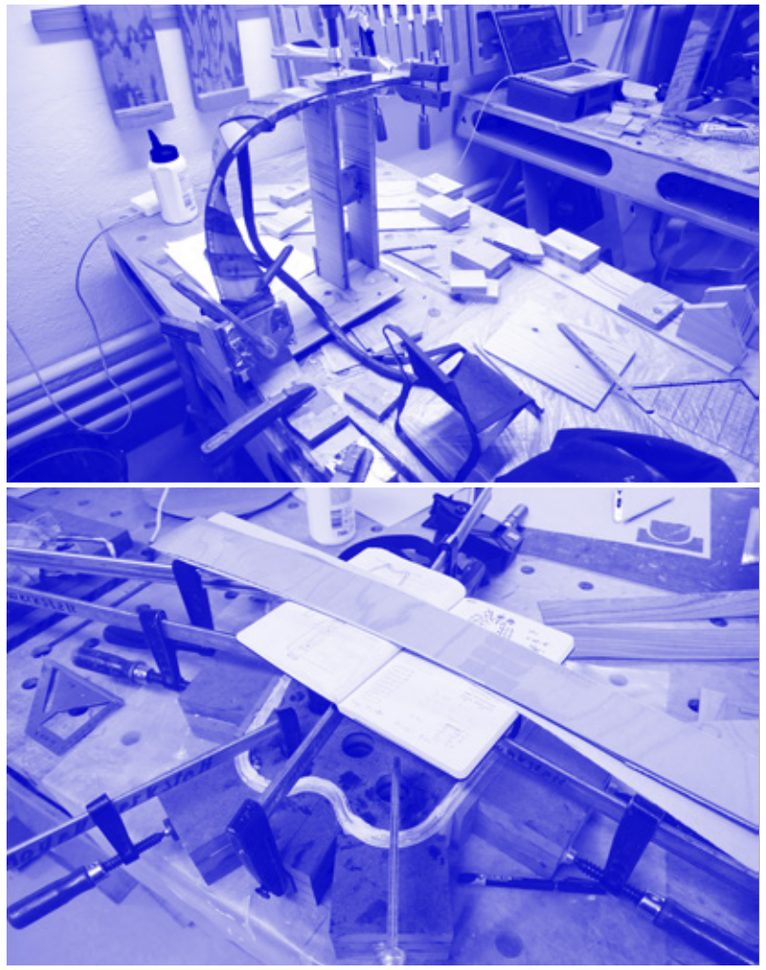
TO HEPHAESTUS →

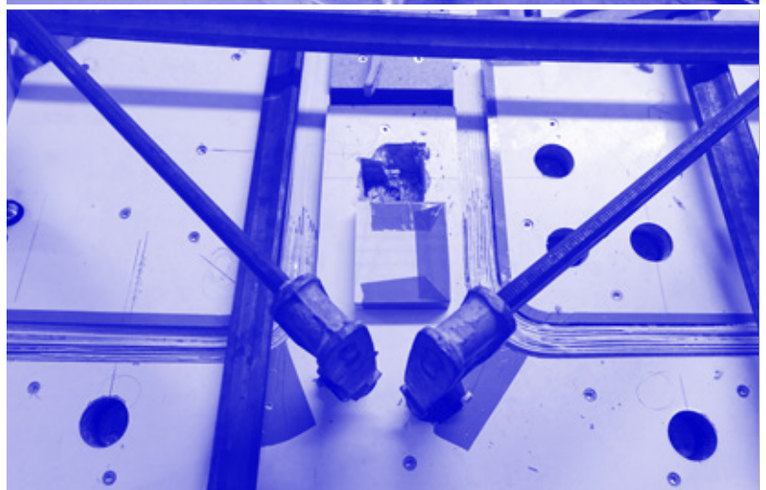
Sing, clear-voiced Muse, of Hephaestus famed for inventions.
With bright-eyed Athena he taught men glorious crafts throughout the world,—men who before used to dwell in caves in the mountains like wild beasts.
But now that they have learned crafts through Hephaestus the famed worker, easily they live a peaceful life in their own houses the whole year round. Be gracious, Hephaestus, and grant me success and prosperity! [1]

DESIRE

Humans have the innate desire to transform their surroundings through action—for me, this always manifested itself in making. As a craftsman, I explore the world with my hands and use them to get a glimpse of insight into subjects otherwise hidden from my sight. When writing this I am reminded of something deeply established in the conditio humana and related to Hannah Arendt's principle of "natality" and what she calls "the miracle of beginning"[2]. It is this continual arrival of the new that drives my mind to explore the world around me in different ways each day. Curiosity, often called virtue by artists, is far more common than claimed by creatives and not in any way native to only a limited set of professions. It expresses itself in the simplest of things. The feeling that I know something must work the way I imagine it might serve as an example of a mental projection that everyone can relate to—this vague intuition and its related idea drives me personally through a sort of restlessness and shows me that uncertainty that harbors the spark of the beginning and makes me want to try again and again.

Practical activities foster curiosity through their immediacy. Take for example the old carpenters' saying, "measure twice, cut once",—it stems from an often slightly brutal practical experience that turned into wisdom passed on from generation to generation. The wisdom of others does not protect the novice craftsman from making the mistake himself. I myself have cut with confidence after measuring something, only to notice moments later that my work piece was shorter than expected. This fact has to be experienced in order for the individual to comprehend its meaning and turn it into practice. Although the craftsman's initial intent was to make something, by trying and failing, he ended up not simply creating something new, but instead he transformed his own approach to making. This newly gained caution is not a simple measure of avoidance, but a way of rethinking one's actions and ultimately transforming the way we contemplate





our own behavior. We usually think of the maker as the one working a material to create an object, but the inversion of this process takes place as well and the object also transforms the maker. Making in that sense is understood as a reciprocal process between maker and object. In the best case, we are able to increase our self-confidence and deepen that initial curiosity—the new as a constant in our endeavors gives birth to our own personal growth.

IDEALS

The Homeric hymns speak of the Greek god Hephaestus[13], son of Zeus, and tell the story of him bringing salvation to "man dwelling in mountains like wild beasts"[14]. The wisdom he offers in order to save this man is his craft. The hymn should not be read in a romantic context that glorifies the hard life of a blacksmith in ancient times, but brings to light an early idea of liberation and the political potential of craft. The Homeric hymn to Hephaestus shows that the notion of craft is deeply related to independence and the formation of a sharing culture. "easily they live a peaceful life in their houses the whole year around"[15] takes us from the mountain dwellings to a more civilized form of living and working together. On the subject of independence and craft, Noam Chomsky, American linguist and political dissident, likes to quote Wilhelm von Humboldt, a major classical liberal thinker, in his lectures and books. "Humboldt put it: if a craftsman creates something beautiful but does it on external command, by the orders of someone else and under coercion, we may admire what he does but we will despise what he is, because he's not human; he's a machine."[16] Taking Humboldt into account, we can see that the hymn is in fact an exemplary text that postulates a free society, and similar to John Dewey's, an American philosopher, psychologist, atheist and educational reformer, his line of thought exemplifies the interplay between education, society and democracy. Dewey referred to the platonic educational philosophy to explain the fundamentals of education by writing that "a society is stably organized when each individual is doing that for which he has aptitude by nature in such a way as to be useful to others (...); and it is the business of education to discover these aptitudes and progressively to train them for social use."[17]. Dewey tries to tell us that the premise of self-fulfillment through work is of great importance, Humboldt, on the other hand, shows the endangerment of free will that our modern economic system imposes on us. Freedom and independence are both tightly linked to the idea of craft as a human activity that fosters the creation of social values in our society through collaboration. Educational reformers such as Dewey try to change our society at its foundation by changing the way we teach and understand the process of education itself. A man named Otto Salomon, a revolutionary Swedish educator of the 19th century, brought social values, political philosophy and craft together. He is the father of *Slöjd*[18]—an example of a system of handicraft-based education for elementary school children. Salomon stated the aims of educational *slöjd* as follows:

1. To instil a taste for and an appreciation of work in general.
2. To create a respect for hard, honest, physical labor.
3. To develop independence and self-reliance.
4. To provide training in the habits of order, accuracy, cleanliness and neatness.

5. To train the eye to see accurately and to appreciate the sense of beauty in form.
6. To develop the sense of touch and to give general dexterity to the hands.
7. To inculcate the habits of attention, industry, perseverance and patience.
8. To promote the development of the body's physical powers.
9. To acquire dexterity in the use of tools.
10. To execute precise work and to produce useful products.[9]

Salomon was convinced that the school system of his time was too rigid in the way things were taught and realized that handicrafts were a crucial medium for transforming the system and moving away from mass education. For him, individualized education, adapted to the needs and interest of the individual child, was of utmost importance. Salomon taught the course for participants to think and act independently, to develop their own lessons and self-confidence.

CRAFT

Craft is the execution of a set of activities that relate to material and technique, with dexterity and traditions in a specific trade. Not often is craft associated with liberal thought and sharing culture, this happens mainly because of the myths that surround the lives of famous craftsman that distort our view of this subject. The recreation of the well-kept secrets of Antonio Stradivarius still occupies the efforts of countless violin builders all over the world. Entire sections of museums and books are devoted to his violins, lost techniques, materials and tools. Of course, much can be learned by studying the artifacts of a talented man and his assistants, but too much emphasis is placed upon the seemingly perfect replication of his instruments.

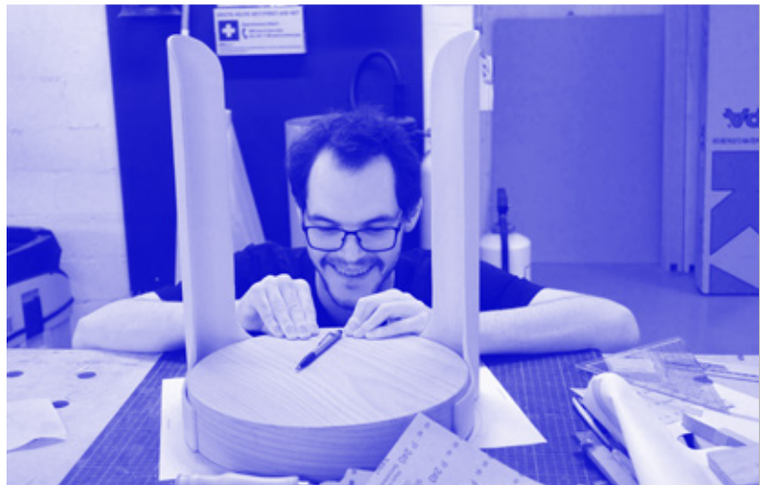
Stradivarius is historically speaking the exception and not the rule among craftsmen, with his secrecy resembling more the behavior of an artist than an educator.[10] Sharing of knowledge through education is the foundation of our long-standing tradition in different trades. It is common for carpenters, after completing their apprenticeship, to travel around as journeymen to gain experience from other master craftsman before they settle to become independent craftsmen themselves and complete the cycle by taking on their own apprentices. This practice is just common sense and ensures the distribution of knowledge and innovation among tradesmen.

Anyone who has ever tried to pick up a new skill knows that a lot of time can be spent on doing so if one attempts to learn something without proper instruction. Not to say that trial and error, as long as it follows a certain logic, is not a fundamental principle of learning something new—getting the basics right is undoubtedly much faster with some sort of help. The fact alone that we mastered the fundamentals enables us to expand our knowledge and be creative with our craft. When we work with a material such as wood, it is a good thing to remember that we build on a long-standing tradition. People have made remarkable things in wood, ranging from simple chopsticks and spoons, to woven baskets, furniture, boats, buildings and bridges. In the extreme, wood has been worked as green (chairmaking) and carefully dried for hundred years (Japanese drums). It is used in its natural form, freshly cut from a tree and as glulam beams in modern

architectural applications. The list of things that can be done with wood is quite extensive. It is obvious that there is an overlap between trades and, for example, the knowledge of a shipbuilder, a joiner and a toymaker. Nonetheless, the knowledge and skill required to become a master craftsman in any one of these trades is not to be underestimated—even for a craftsman of a similar trade. True, there is much common ground but the reality of production is what sets the trades apart. Tricks of the trade, so to speak, form a big difference between a joiner and a cabinetmaker. In his book L'Art du Menuisier-Ébéniste (1774), André-Jacob Roubo,[11] carpenter and cabinetmaker, describes the various techniques involved in mastering the art of marquetry. He suggests that in order to master this trade, a craftsman not only needs a strong foundation in cabinet-making but extensive material knowledge that ranges from handling copper, mother of pearl, ivory, to tin and others, on to the chemistry involved in staining and treating wood. The plates of his book show a wide range of unique tools and their use in the process of making or, as he might have said, making as perfect as possible. One of the inconspicuous tools in Roubos' book is the *polissoir* (polisher). The *polissior* is used to burnish wood fibers after planing and in some cases to apply beeswax to that same surface. By looking at the simple nature of this tool, essentially a bundle of corn straw tied together by a string of some sort, it becomes clear that a *polissior* is not something you would buy, but something you would make. This is true for many of the appliances and tools shown in Roubos' book; they were meant to be made by the craftsman himself. The extended range of materials and the specialized tools that the *Menuisier-Ébeniste* had to master would be foreign to any joiner of that time. Knowing about the small tool called the *polissior* and how to use it is what makes learning a new trade difficult. There is a lot of common ground between the different trades and once, for example, the proper motor skills to perform some task have been developed, adapting them to perform similar tasks is much easier than starting from scratch. However, even this fact cannot compensate for the missing, accumulated, intrinsic knowledge that a tradesman collects during his professional life. Moving from 18th century carpenters to musicians, we can explore a more contemporary example: the fingers of a concert pianist are not faster than the fingers of the average human being. Recent studies showed that we humans tend to move our fingers generally at around the same speed. The difference in speed arises not from superhuman power but simply from the fact that the fingers of a concert pianist know where to go next. If we want work with a craft-based educational approach, we need to ask ourselves how to bridge this gap between intrinsic knowledge and the accumulated experience of trade-related technique.

LEARNING

I was aware that the attempt to produce functional plywood furniture with our students was a project with an uncertain outcome. It can be argued, as does Robert Wearing, contemporary joiner and cabinetmaker, that students and amateurs alike have the advantage that they "can proceed so slowly and by such small steps that success is almost guaranteed"[12]. I agree in theory, but in my experience, reality often paints a different picture. I realized at some point that you have to know what to look for in order to be able to succeed and eventually pay attention to the details required to consistently produce a result of satisfying quality—doing something in small steps is not going to help without a clear path ahead.



As an educator, it is my role to lay down that path and to select techniques and methods that the students can master within the short timeframe of an elective class like this. The process is a quest for balance between the in-depth research and simplified work assumptions needed in order give small lessons and input into specialized topics. One example of such a simplified assumption is the bundle of straw or fur analogy to explain the behavior of wood grain when planing. When you explain to someone that tear-out in a planed surface can effectively be avoided by going with the direction of the fur and not against it, they immediately understand what they have to do. This analogy between grain and fur is actually barely accurate and at best a gross oversimplification of a topic that can fill books by itself, but it helps layman and craftsman alike to get work done effectively.

The experience I had with bending wood and plywood furniture was very limited—I bent guitar sides and did some purfling, as well as a shaker box a couple of years ago. This meant I had to investigate the topic myself before even attempting to teach anyone. I thought I knew enough from pictures and some examples I had seen to try to reproduce the classical *Artek* L-leg as a do-it-yourself introduction, to acquaint myself with the problems at hand. Before my first attempt, I consciously decided not to consult any books on the technical side with information on jigs, bending radii, wood species and moisture content. I literally took the first piece of timber that I could find, planed and cut it to size and went over to the bandsaw to cut the upper part of the leg into some sort of fan. The next step was to build a fixture or jig to bend the wood. As expected, the first trial run was a disaster. The fixture was on the weak side and the cuts filled with veneer and glue seemed to be too far apart from each other—my leg just snapped under the clamping pressure that I had to apply to conform the timber to the fixture. Close examination of the cracks showed me that the grain of the wood was quite irregular exactly in the part that I selected for the bend—I should have known better. I went on improving the fixture, the way I selected the wood and the species and even put the part of the wood that had been bent in water before the glue-up. Five more tries later and I had successfully produced my first halfway decent L-leg. I noted that the level of consideration necessary to produce a functional part with this technique is not to be underestimated and that wood species, grain direction, spacing and length of the cuts are critical.

The next test for me was to compare conventional lamination of wood to the *Artek* L-leg method. As I suspected, stacking the thin wood strips parallel to each other with glue in between the layers was easier and less prone to failure than the other method. With this technique even sharp bends can be achieved, depending on the thickness of the wood. Producing the form for this sort of bending can still be significant and time-consuming.

In addition to this simple lamination experiment, we tried a slightly more elaborate setup with a shop-made vacuum bag which yielded similar results.

An alternative to the conventional lamination with formwork is freeform lamination of wood for complex bends in multiple directions. For this process, a slow-setting glue is applied to the different layers, then the wood is stacked and clamped in a vice on one side and is then twisted and bent to approximate the desired shape with the help of weight and clamps. After the form has been found, rubber tubing is tightly wrapped around the lamination part to act as a clamp and ensure a good bond between the layers. This technique works best for one-off parts and is not well-suited to repetitive parts.

One step up from this was steam bending. The process of steam bending is an age-old method for plasticizing wood that involves the use of a steam box, bending straps and a well-designed form. Careful wood selection is crucial for steam bending. “Quarter sawn wood, which is cut perpendicular to the annual rings, is the best for bending … Plain sawn lumber is not well-suited to bending because it is cut tangentially to the annual rings, which makes it break easily if forced too much.”[13] Depending on its dimensions, the kiln-dried wood is soaked in water overnight before putting it in the steam box for several hours. “The rule of thumb for time in the steam box is one hour of steaming for each 25 mm of thickness of air-dried wood and one-half hour per 25mm or green wood.”[14] Once the wood is pliable enough, it is put in the bending strap and with the help of a couple of people bent over the form. “When wood is bent, the fibers on the convex side of the curve will be stretched while those on the concave side will be compressed … When a piece of wood is forced to bend too much, the outer fibers will start to run. With more force, more fibers will run, and eventually the piece will break.”[15] The bending strap helps to introduce compressive force into the bent piece and counteracts the tension forces that result from bending on the convex part. As for the compressibility of wood we can say that: “When a beam is bent beyond its elastic limit, greater deformation occurs in compression than in tension. In fact, about 1% elongation in tension causes failure. Steaming the wood increases the compressibility to as much as 30% or more but only slightly increases the elongation ability in tension, perhaps no more than 2%.”[16] As with the other techniques described above, we tested steam bending different wood species, with and without forms and straps, longer and shorter exposure to steam, to gain as much practical experience with the technique as we possibly could.

MODELS

In a process such as this, the model is used as an explorative tool to study technical and design-related topics with the students. The term model refers in this context to every process or object that has an iterative nature and is by its definition unfinished, under development and serves as an investigative tool. This assumption makes it easier for the student to deal with the steep learning curve involved in learning a new skill. We try not to focus on the final result but on the process itself and by doing so try to divert the pressure resulting from the will to achieve a good final project into the creative process itself.

Similar to how I proceeded with my own tests for this class, the students’ design proposal is split up in smaller parts and for each of these challenges a physical model is built. Depending on the complexity and the technical difficulties involved, I try to encourage the students to work with a multitude of sketch models. Each one of these models is providing us with an opportunity for new discoveries. The small sketch models build the foundation for our discussions and are vital to the process because they inform us about how to proceed with the project.

A typical way of working on a design challenge with students would be:

1. SKETCH MODELS
The sketch model is a fast three-dimensional sketch of an initial idea. Material and scale are of no importance at this stage. Any kind of drawing is strictly forbidden. We usually start our classes in this way because of the immediacy sketch models provide. Thanks to their roughness, they grant plenty of room for creativity and ideas and help improve the students’ three-dimensional imagination.

2. IDEATION MODELS
These are classical scale models that help to define and refine the design. The scale of these models ranges generally somewhere between 1:10 and 1:2, depending mainly on the project itself. The models of this stage are fairly accurate and made with fast and readily available materials (cardboard, foam etc.). This is the time to take the design through various iterations and to finalize the shape of the object to the point were the first study models become necessary.

3. VERIFICATION MODELS
These are 1:1 Models made out of easy-to-manipulate materials to verify the proportions and important dimensions of the design. The use of auxiliary construction elements is common to stabilize the model and allow for physical tests (sitting). Ideation and verification models are closely interlinked and going from one to the other is frequently necessary.

4. STUDY MODELS
Depending on the design, the material, construction, fabrication techniques and form will be investigated separately at this stage. These models deal with individual challenges of a design and help with testing of the various aspects one-to-one. In the case of our class, a significant amount of time was spent at this stage to find adequate solutions for production and mold making.

5. PROTOTYPES
This is the moment when form, material and production come together. The prototype consists mostly of parts made with the final material and allows for extensive physical testing. Close examination of the prototype shows weak spots in construction and critical points that need to be addressed in further iterations.

The main focus of this model-based method lies in the discursive nature of the group discussions and tries to avoid the classical teacher-student relationship, where one provides the answers and the other one has to follow them. Sadly, classical education deals mostly with given truths and the ambiguity provided by constantly asking questions is seen as a nuisance that makes everyone uncomfortable at best. The way I try to teach, the students are faced with someone who is not telling them if something is good or bad and even rejects these terms altogether. The decision to teach like this comes from the belief that the guidance they need is not one that can be imposed on them, but rather one that respects their individu-

ality. It is my personal goal to enable the students to have a chance to expand their own horizon themselves and to take on personal responsibility to gain self-confidence as growing individuals.

SKILL

“It is as hurtful to underestimate technical skill as it is to overestimate it. Therefore, let no teacher imagine that he can successfully undertake instruction in *slöjd* with slight and superficial knowledge on the purely technical side. It will soon and surely be made clear to him that this is not the case. If he has not himself the necessary technical dexterity for his purpose, it will be difficult, indeed almost impossible, for him to make clear to his pupils how they are to handle their tools and execute the work prescribed. Neither will he be able in an efficient way to supervise their work and criticize the quality of what they produce.”[17]

The goal of all the references, the experiments and methods described in this text is to show that a continuous curiosity is at the core of teaching craftsmanship. There are no recipes for how to teach a subject or how to approach a new material or technique other than the notion that it is a highly individual process and that for the sake of being open should not be formalized.

Dexterity and wit is without a doubt a core requirement but not as important as the courage to fail and try again. The process of failing has done more for my development as a craftsman than any accidental success could ever have. It seems only natural that people lose interest in something if the outcome of a process is absolute certainty. Realizing this shows me why I have a clear inclination towards uncertainty and open processes. David Pye[18], former Professor of Furniture Design at the Royal College of Art, separates work into two categories: “workmanship of risk” and “workmanship of certainty”. “In the former, the result is constantly at the mercy of the maker, and a single careless move will spoil it. In the latter, once the tools are properly set up, the result is guaranteed.”[19]. Rethinking our work and the way we work is certainly troublesome—but in the end we might have a chance to discover a path to overcome and reflect on predefined principles that sometimes misguide our lives.

—

1 „Homeric Hymns - to Hephaestus“
2 See: Arendt H. (1998). The Human Condition. University of Chicago Press
3 Hephaestus is the Greek god of blacksmiths, metalworking, carpenters, craftsmen, artisans, sculptures, metallurgy, fire and volcanoes.
4 Homeric Hymns - to Hephaestus
5 Homeric Hymns - to Hephaestus
6 Noam Chomsky (2004), Chomsky on Democracy & Education, Cambridge University Press, P. 243“
7 John Dewey (2005), Democracy and Education, TarcherPerigee, P. 80-81“
8 Salomon coined the following definition: Slöjd is an old Scandinavian word having as its origin the adjective slög that means ‘handy’. Slöjd means ‘craft’ or ‘manual skill’.
9 Otto Salomon (1892),The teacher‘s handbook of slöjd, Silver Burdett & Co, P. 2
10 For more on the life of Antonio Stradivarius see: Hill W. H., Hill A.F., Hill A.E. (1963), Antonio Stradivarius His Life and Work (1644-1737), Dover
11 See: Roubo A.-J (1774), L’Art du Menuisier-Ébénist. Bibliothèque des Art, des Sciences & des Techniques
12 Robert Wearing (1996), The Essential Woodworker, Lost Art Press, P. 8
13 Tage Frid (1993), Tage Frid Teaches Woodworking Book 2, Taunton Press, P. 3
14 Robert B. Hoadley (2000), Understanding Wood: A Craftsman‘s Guide to Wood Technology, Taunton Press, P. 178
15 Tage Frid (1993), Tage Frid Teaches Woodworking Book 2, Taunton Press, P. 3
16 Robert B. Hoadley (2000), Understanding Wood: A Craftsman‘s Guide to Wood Technology, Taunton Press, P. 177
17 Otto Salomon (1892),The teacher‘s handbook of slöjd, Silver Burdett & Co, P. 8
18 David Pye (1914-93) was a former Professor of Furniture Design at the Royal College of Art, London
19 See: Fine Woodworking Magazine, Edition of November 1978