

Interior Design
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Lecture - 39
Interior Design: Future Roadmap; Opportunities and Challenges

Namaste. Hello, everyone. Welcome again to my NPTEL course on interior design. We are at the lecture number 39 today and we are focusing on interior design through the lens of future roadmap and interesting opportunities and challenges. So we are going to discuss this with the help of, you know, some case studies, some interesting literature, some experiments.

And we are going to especially talk about textiles and architecture today. It's a very, very specified field, but, you know, we can't do everything technically in this one lecture, but we can at least focus on interesting experiments and opportunities that diffusion of textiles and architecture create for us as interior designers. And of course, there's a list of references. So when we talk about textiles and space making, There is a long history which showcases this kind of potential of space making within the domain of textile crafts, specifically focusing on the techniques of weaving.

So, when we talk about, you know, textiles and architecture, role, significance and importance of weaving in architecture, and of course, at a structural level also, we often come across this German architectural theorist Gottfried Semper. And Semper, you know, is known for four elements of architecture, his works that were published in 1851, where he emphasizes on earth for the foundation, wood for construction, textile for enclosure and fire for climate. So, basically there is this kind of a classification, there is a material, there is an associated technique and there is an application aspect when we talk about the architectural application or the space making application. So Semper, you know, also believed in artworks and this interesting play of art and architecture, fusion of textiles and architecture. Also believed that paint was used on classical buildings as a protective material.

So for decoration, aesthetics, as well as a layer of protection. So there are several works by Semper, and I have just tried to provide an overview or summary of these. Some of the slides from this lecture are also part of my previous NPTEL course, Role of Craft

and Technology in Interior Architecture. And I thought it could be very interesting to talk a bit about this when discussing experimentation in interior design. So, you know, Semper also talks about color and that it had symbolic associations.

It's a great artistic expression. And this is the kind of inventory I was talking about, which I find very useful and insightful. So there is this three-layer order where we talk about material-associated technique and the basic space-making element, where we see the application of this material and technique to build this element for space-making. So here we are talking about clay, the associated technique is ceramics, and the element could be the hearth. Now, wood, of course, is associated with carpentry and the making of the roof.

And since we are talking specifically about the fusion of textiles and architecture, this is also highlighted here. So textile, the technique of weaving. And the creation of enclosures. So that is possible by utilizing textiles as a material palette, utilizing the technique of weaving, and then creating these enclosures. And for stone, it is masonry and predominantly creating substructures.

So, these are some of the colored depictions from Semper's early travels around Europe, and here also we see that there is highlighting of color, there is importance to artistic expression, there is a focus on matter and architecture, a focus on details and building elements. So, a lot of works done by Semper highlight this profound interrelationship between material, making, maker, expression, techniques, and skills. So, if we see the 1842 works focusing on science, industry, and art, there are proposals for the development of a national taste in art at the closing of the London Industrial Exhibition. And Semper talks about the necessity of inventions and the advancement of arts and sciences. There is another work which is quite famous: Comparative Theory of Building.

It reviews all building types, their locations, methods of building, and histories. 1859 Style in the Technical and Tectonic Arts or Practical Aesthetics. A very interesting and frequently referenced work. There, Semper discusses extensively the use of materials within arts, crafts, and architecture. Details involved in the tectonic arts and very interesting aspects about tactility, matter, architecture, art, and expression.

So, when we say the fusion of textiles and architecture, it's not something new. The fusion of textiles and architecture, including the processes, techniques, and materials involved, has a long and winding but largely neglected history. Only in recent times have theorists, architects, engineers, textile designers, material scientists, and artists expressed a renewed interest in the possibilities that this combination allows. And this combination and experiments centering on this fusion are of primary interest to me as an individual, as a designer, and as a professor of architecture, interior design, and design thinking. So, the German architect and theorist Gottfried Semper wrote extensively on the significance of art and architecture.

The first structure, the original abode of man, required not just structure, but the weave, the knot, the textile and the tangible. So, Semper talks about the structural implications of a weave or knot that we could imagine. create while focusing on textiles as base material palette and create tangible, structurally intact enclosures and similar build forms out of it. Textiles provide protection from heat and cold. absorb noise, give control of the amount of light entering the view.

Their manifold characteristics and application potentials make textiles a highly interesting architectural material. Textiles further possess very special, sensually tangible, often poetic aesthetics. So, there are a lot of pieces of literature and scholarly works and historical examples that showcase this interrelationship between architecture and textiles and interesting applications and new possibilities that could emerge out of the fusion. Being simultaneously a functional technique and a symbolic means of representation, the knot was a mediating figure between the ritual act, the technique of making and the actual work of art or craft. In time, the motif of the knot was developed further in the more complex techniques of the braids.

so what you see here on screen my braid that's also structural actually there is a proper technique to it it holds the entire braid in place so complex techniques of the braid the read the seam and the weave all constituting primordial symbols of ordering So we see this also in our built forms, in furniture, in the cords that we use, the kind of clothing and apparel that we wear. Even the jeans that some of us wear also has a certain weave or a stitch to it which holds all the fabrics together and keeps it in place. So there are of course structural details when we zoom in and look through that lens. So here you can

see some of the demonstrations where we see the structural intactness and structural integrity imparting details of these textiles.

So whether it's a braid, knot, or weave. Here we can see some complex structures. When we combine two or three modules and intertwine or interlace them, there is more structural stability. So In his drawings above of crochet and knitting, Semper clearly illustrates the potential for structural arrangements and space-defining qualities that textile crafts possess.

According to Semper, textile art had a significant influence on the development of architecture. This is very important—the premise of this entire lecture and discussion, and also a hypothesis on which I'm still building. A lot of research work that we are doing here at IIT Roorkee through PG and PhD theses focuses on aspects like this. Today, I am going to show you the findings of one of the theses that focuses on this aspect. Simple textile techniques of the weave and the knot constitute the joining techniques of structural elements, which could also be seen in Maori architecture—a very specific and distinct architectural style with a very specific context.

These techniques stood in complete contrast to the building techniques of early European explorers. We do see a lot of demonstrations of the fusion of architecture and textiles at different eye levels for making different space-making or building elements. There may be a diverse inventory showcasing different motifs, weaving patterns, etc. This depends on the communities involved and which part of the world these weaving techniques come from. This is another very interesting illustration of weaving techniques—look here.

The similarities with both Maori architecture and arts are astounding. We also have references of these kinds of weaving techniques and patterns and applications, of course, from India also, whether it's your cot or, you know, another piece of furniture and so on. These are some of the applications and contemporary expressions when we talk about fusion of architecture and textiles. So this is a cultural complex that you see on the screen. The spectacular glimmering facade that we see over here is a eulogy to Semper's clothing or dressing.

A supple ornate surface draped over a tectonic volume. A Semperian notion of textile becoming architectural style. So this is a contemporary expression drawing inspiration

from Semper's works. This is another example or application that you see over here. So the Paris-based architect Dominique Perrault is famous for his explicit and extensive textile-based architectural urban designs.

This is interesting. For more than 16 years, he has been researching the relationship between textiles and architecture as part of his broader project on the contemporary city. So these interrelationships between, you know, textiles and architecture, weaving and space making is something that also captures my interest and attention. And we are continuing to work on this as a small research group here at IIT Roorkee, me and my students and the kind of projects that we are doing. This is another very, very interesting and fascinating exploration.

This is a collaboration between the famous Chigeru Ben and the equally famous Arup. They have tried to capture and demonstrate architecture and textiles through the vocabulary of this timber fabric that we see here, creating experimental spaces and enclosures. Contemporary architectural techniques make use of woven and knotted structures. Research into such structures has been led by the Advanced Geometry Unit of Arup, which I mentioned earlier. The AGU's work is characterized by a highly mathematical, topological approach, as evidenced by their research into knot diagrams.

Those weave diagrams, knot diagrams, coil diagrams, and braiding diagrams that I showed you from Semper's portfolio have applications in contemporary expressions and form the basis of much experimentation in textiles and architecture. The AGU has also studied the topology of the weave and its application to large-scale structural systems. This technique is called macro weaving. It involves the discrete bending or compression of shell elements rather than fabrics to form tension-only surfaces. They are still exploring macro weaving and related techniques for creating large-scale structural applications, employing textiles and architecture.

This is another interesting example. This is a tower. It's a design prototype. I'm not sure if it was actually built, but this was a competition entry, showing a very interesting contemporary fusion of textiles and architecture. The weaving seen here, the coiling enclosure in the facade, and the entire space engulfed within it serve as an interesting example of the fusion of textiles and architecture.

So there are these transparent and translucent membranes which constitute the entire facade of the tower. So the project has solved major problems in the use of textiles in architecture and has made weaving a building a potential reality. So this is a very interesting experiment. I found it quite fascinating. Since we are talking about diffusion of textiles and architecture, I'm going to give a very overview kaleidoscopic picture of different fabric types, their properties and what they could be utilized for when we talk about applications in interior design.

Now, these are very technical points of discussion and I will not be able to tell everything in depth, but we have tried to put up some inventories and charts and highlight some important information. So starting with weaving, of course, just trying to tell it in a very overview manner. A lot of us may be from the weaving background or from NIFT or from that kind of an associated field. But for the rest of us, weaving is a method of textile production in which two distinct sets of yarns or threads that you see over here, the weft, and the warp.

They are interlaced at right angles to form a fabric or cloth. It's a very very structural way of creating things because there is a structure when we try to you know put things together the two yarns and we try to interlace them. So there are different kinds of weaves and again just looking at visuals and not getting into the theory or the technical details about it. I am just showcasing you the most popular and predominant kinds of weave. So, there is a plain weave which we see over here, the warp and the weft.

This is twill weave. We can see the differences already. This is basket weave. This is satin weave. So,

The patterns are different. The way of weaving is different. This is jacquard weave. This is knit weave. There is uncut pile weave and cut pile weave.

These are some of the kinds of weaving patterns. Now, if you want to know more about these, you could research them or write to me or reach out because there is a lot of data and prototyping experiments we have done, but it's difficult to show everything due to limited time. I was talking about these kinds of inventories, and here we have highlighted some popular types of fabrics and their interesting properties, which help us use them for certain applications. There is voile, there is poplin, there is muslin, and

some of the properties when we talk about voile: it's lightweight, it drapes and gathers very well. It could be used in accessories.

then for poplin soft and medium weight good wear resistance but poor crease resistance and it is perfect for making banners or table drape displays in stores etc so for interior design projects there may be certain uses of these fabrics Then there is muslin, low moisture absorption, smooth and delicate, good drapeability, light to medium weight, low crease resistance. And it is the primary fabric of chair and sofa. Also used in curtains and window shades. So these are the applications for interior design projects or interior architecture projects.

There is also the... famous and popular Georgette. There is Gaze, there is satin. And when we talk about georgette, it is a sheer fabric, very lightweight.

It is used for interlining or lining. It is used for a lot of accessories. Satin has a nice luster. It has a smooth surface and it is used for interior furnishing, fabrics, upholstery, etc. We did talk about furnishings, fabrics, upholstery.

So quite used there. We have velvet. It is smooth and soft, thick and bulky. Good warmth retention, good drape, good crease resistance. It is also extensively used for upholstery, curtains, and cushion covers for interior design projects.

There is flannel, there is drill. Now, drill has very high tensile strength—that's an important part—and this could be explored and experimented with for some kind of semi-structural or structural applications owing to this tensile strength. And it is used for industrial purposes, for wall coverings, and a lot of other purposes which are highlighted here. There is terry, there is denim, there is corduroy. So when we talk about terry, it is very absorbent and comfortable.

It is used for a lot of accessories, especially focusing on kids. Denim resists snags and tears. So it also has applications at varied levels. And corduroy, again, is used for draperies and upholstery owing to the properties that it has—the material properties. There is also chiffon, there is cambric, there is single-jersey knits.

When we talk about chiffon, it also has a set of properties that make it suitable for many uses. And when we talk about structural applications and experimentation, I'm always looking for fabrics that have high tensile strength or can respond to other kinds of

forces. that our built forms and structures are subjected to. So, chiffon also has high tensile strength and is therefore used in the furnishing industry. So, that's a very interesting and extensive use of chiffon.

Then we have double jersey knit. We have more kinds of knits, and all of these have different properties and are used for different purposes. So here, this one is also used for medical purposes. So this is again a sort of inventory, and I'm just trying to highlight the possibilities of this fusion between textiles and architecture. interior design and focusing especially on interior design, you know

specific use of upholstery, for drapery, for some kind of space-making applications which are not showcased here in this inventory, but I will try to showcase them through the experiments that I'm going to show in the subsequent slides. And finishes, textures, those kinds of details could be done through these different fabrics. Then there are more of these, you know, fleece knits, French terry knits, and so on. And since not all of us are from this background, they may be new for us to learn about. But it's a good exposure and a good piece of information.

So, again, like here, if you talk about the French terry knits, they have warmth retention. They have very high dimensional stability. So, accordingly, we could think about the applications, conduct experiments, and design prototypes accordingly. More of these over here. So within knits, there is also a variety, and all of these demonstrate different kinds of properties.

So, like this one over here, if you see the Weller knits, they are also used for upholstery purposes, which is in great demand in interior design projects. Now, I was talking about some experiments focusing on all the above that we just saw. So these are the findings of one of the PG theses done at IIT Roorkee. This work was done by my student Isha, and it was a pleasure and honor supervising her because she has done a lot of hard work. We have also presented these findings in three conferences and are working on journal papers based on them. So basically, she was trying to investigate weaving, its structure, types, and understand the potential of weaving techniques to create space-making applications. And she was primarily focusing on the case of Kerala.

But before that, of course, she also created this comparative inventory, which highlights cases from all over India where we see the potential fusion between weaving

techniques. And space-making applications. So it's a four-objective inquiry, and it is very rigorous and interesting work. So not everything is visible here on the screen, but this is the data collection framework. Like I said, it was a very rigorous process.

On and off field work. So a lot of frameworks, inventories, flowcharts, and meticulous methods of working on site and then doing experiments after coming back. So all those frameworks we see over here. And these are different weaving crafts of India, especially focusing on Kerala over here. And we were also looking at a specific case of the houseboats and where we see the application of weaving and creating those enclosures and structures.

So she was looking at the coconut weaving and also at the cane and bamboo craft, especially for the case of Kerala, while also mapping the other techniques and material aspects from the state when we focus on weaving. So this is the bamboo weaving craft and some details about it. And this is the coconut weaving craft and some details about it. These are only some infographical findings. There is a detailed report.

And if somebody is interested, we could share the published papers once they are out in public. And basically, she also mapped the entire community, the material culture, the people who use these crafts or who are the knowledge bearers of this craft and who are carrying forward this legacy. And she did that entire documentation. So bamboo craft in Angamalli and there is this coconut craft in Kumaragam. So those are the kinds of clusters she visited.

Of course more clusters but then she narrowed on coconut and bamboos. And, you know, there were these interviews, discussions, observations. So a lot of interaction, study-based approach, participatory research-based methods and then working on site with the community. And then, of course, she tried to document and decode the selected weaving craft of Kerala through the lens of material culture. Material culture, it will take another lecture to explain it, but it's not about only material, but it's about the entire backdrop of culture, the community involved, any aspects of trade, commerce, socio-economical, political reasons why a certain way of building is predominant and where does the material come from, who practices it, what craft it is, all of that. So material culture is a very interesting way of establishing these interrelationships between human and surroundings, the way we see things, the way we make things. So that was her

objective. Third, because I told you it's a very, very rigorous work that she did. And then, of course, objective four was experimenting and through prototypes demonstrating the space making potential of the weaving crafts of Kerala.

So when she was trying to, you know, produce these experiments and prototypes, before that she was also trying to understand through an eight-part lens these weaving crafts of Kerala. So what are the societal dynamics and, you know, some reference images, the backdrops of culture, market, craftspersons, their current status and condition. And then she was looking at another important aspect, which is the weave parameters. So, you know, what are the underlying aspects, the warp weft ratio, spacing, directionality, weaving pattern and also exploring bamboo and coconut. So what is possible in bamboo versus coconut or both of them or to what extent?

And then these are the kinds of patterns. Weaves or weaving patterns that she could identify. These are only few here on the slides. There are actually a lot more in the report. Third aspect was types of weave and pattern and more details, whether they are traditional or contemporary.

What are their physical properties? And what could happen in bamboo, for example, the plain weave, the twill weave, the hexagonal weave. And when we talk about coconut and this weaving craft from Kerala, you know, you can keep the midrib intact, focusing on the coconut or the midrib removed or the midrib split. So there are a lot of techniques also related to bamboo and coconut, bending, splitting, a lot more actually. So that needs to be understood.

First of all, it's very important to understand the anatomy of material itself, its properties, what are the opportunities it offers, what kinds of forces it can resist and what are the opportunities it creates for application, especially within the milieu of interior architecture. So those kinds of investigations are all a part of this thesis. Fourth important aspect, space making elements. And there are some underlying aspects, you know, some memory association, some elements that could bring in the aspect of creating identity, you know, for the local context, the regional identity of the state. And whether they are handcrafted or not, some play of light and shadow could be utilized and in what manner, ventilation and visibility.

Again, the potentials in bamboo and coconut are also the challenges and the kinds of elements that could be designed. Then she was looking at scalability, which is very important because we wanted to talk about scalability in the sense that it's possible to create certain utilitarian objects with the help of these techniques and these two crafts. But is it possible to scale them, diversify the product range, and create new experiments? So these were all the experiments. So maximum possible length, usage in terms of square meters, what volume could be covered—all of those technical details.

The sixth important aspect: applications. At what scales? In what capacity? Seventh, longevity and durability. So the life cycle assessment matters.

How long is the lifespan? What is the longevity of these prototypes? And can they also be utilized in large-scale projects and for future possibilities? And lastly, very importantly, sustainability. We are talking about SDGs.

We are talking about circularity. We are talking about all these important aspects. So environmental sustainability, social sustainability, and economic sustainability. I would also add aesthetic sustainability and many more aspects of sustainability that we are focusing on. So that was her eighth point in this eight-point matrix where she was trying to investigate and analyze these weaving techniques.

And these are the experiments that we finally prototyped and developed. So the space-making element here is a door. And where does the inspiration for joinery come from? So sandwich joinery is inspired by the basket, which is this. And then how it is constructed.

So these are the working drawings, like 3D exploded views. And we see the application of weaving techniques here. At the level of the space-making element, which is a door. The next space-making element she could explore is a window. And again, what were the inspirations for weaving patterns, for the designs, and what kinds of designs were finalized and experimented with?

And they are working drawings with proper design recommendations and different designs. Permutation combinations and variations are possible within the space-making element. Everything was mapped in great detail. Then, this is a railing, and this is very interesting here. They used the concept of cross-pollination of two materials.

So, stainless steel and bamboo. So, of course, some armature and some weave were put together, and this kind of system was designed. This is for the partition wall, and here the inspiration for interlocking comes from the traditional product that this community makes. Based on that, this kind of experimentation was done, and then this prototype was designed. This is a partition wall, and here some kind of understanding of parametric design was also employed, and some software simulations were done. We see here the code used to generate the parametric design, and then it was applied over here.

So, this is a very contemporary expression utilizing weaving as a technique and this craft from Kerala, designing the contemporary expression in the space-making element of a partition wall. So, a very interesting experiment. We also see the application in the entire facade itself, and it could be designed accordingly, looking at the dimensions. So, the scalability was achieved through modular design, and these modules could be repeated in permutations and combinations to come up with interesting patterns and details. And a lot of variations and interesting patterns are created through this.

So this is the detail of the facade itself. More details when we talk about the facade, and here also we can design an entire system like an integrated system, cross-pollinating materials, going a further step. We could also cross-pollinate two crops or two techniques, but of course, that's a Another elaborate experiment altogether. And one of my students is actually working on that now, moving ahead from this experiment and cross-pollinating with another technique, then deriving and designing space-making applications out of that. This is for the ceiling, and this is the inspiration for the design.

So we always look at what the community does, what their understanding of the material and technique is. And we try to learn from their skills and knowledge and then sitting with them, working with them, showing them these designs, taking their inputs and then of course doing some software simulations and physical prototyping. And model-making, then we come up with these kinds of experiments, and these are on a proper scale with working dimensions. So all these possibilities and experiments are quite fascinating, and a lot of work still needs to be done. So if anybody among you wants to join hands and work further with us, you're more than welcome to write to me.

This is again a partition wall—again, very, very interesting—taking cues and inspiration from surroundings, learning from the craftspeople and community skills,

and then trying to design these elements. So this was all about the experimentation, interesting opportunities, focusing on interior design projects, where I specifically talked about weaves, fabrics, textures, interlacing textiles, and architecture for creating interesting space-making avenues. And the next lecture is actually the last lecture of the course. And I'm going to summarize all that we learned in week number eight. These are the references.

Quite a lot of them. You could always refer to these. There are books as well as websites. Thank you so much. I'll see you next time.