

# DESIGN TO CONNECT: AN ONLINE DATABASE PROVIDING INSPIRATION FOR DESIGN EDUCATION AND PRACTICE

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## ABSTRACT

How to join two parts remains an important issue in product design and engineering. Many joining methods were developed throughout history, from beautiful wood joints over invisible adhesives to sophisticated welding processes. Design and engineering students must have knowledge of existing joining methods and connections. However, requirements, technologies and materials change and students must be prepared to design new, future solutions. Previous knowledge and experience can preclude new ideas. Therefore, it is important to use inspiration to find innovative solutions. The internet is a major source of inspiration. However, inspiration about joining is not provided yet in a concentrated and easy accessible way for design students and professionals. Besides, using inspiration from similar products lead to design fixation, which can preclude new and innovative solutions. Therefore it is important to consider inspiration from other sectors far beyond your own context. This paper presents an open inspiration database for joining methods and is illustrated with a case study. The database contains already more than six hundred inspirational multi-sectoral applications of joining methods in consumer products, lighting, furniture and beyond. The inspiration database can be used by students during design courses and projects. Students can browse through a visual interface or search on different keywords to find meaningful inspiration for their own design. They can copy, adjust and combine existing connections to create joining solutions for their own design. Students and design professionals can add inspiration to the database and share it with the community. The database provides design and engineering students meaningful joining inspiration in a fast way. Otherwise, it can help students to create the attitude to look at existing products from another viewpoint and learn from the way they are constructed and manufactured.

*Keywords: Design education, inspiration database, design fixation, joining methods*

## 1 INTRODUCTION

A 'connection' can be defined as a, interface between parts or functions and can be virtual or physical, permanent or removable (time), movable or rigid (space). In context of this paper, the focus is physical connections between parts and materials in products. A 'joining method' is the principle used to put parts or materials together, to create the connection. Many different connections can be designed using the same joining principle.

During the design of products, designers and engineers can rely on a comprehensive assortment of known connections developed throughout history. Students engineering and industrial design must have knowledge of the existing ways to join parts and materials. Software selection tools [1-4] are developed to support designers and engineers to select the most suitable joining method for their product. Each database contains a limited set of existing joining methods. By defining joining requirements, a set of relevant joining methods is provided. The existing selection tools are mainly developed for the design of mechanical products and machines and applied in the detailed design phase of the design process. Besides, aspects as the aesthetics and usability of a connection, which are important in product design, are not considered in the existing joining databases. In design education, students must be trained to create feasible (joining) solutions which combine technical, economic and aesthetical aspects. Not only the manufacturability and the cost is important but the aesthetics play also an important role in design practice, even on the level of the connections. Sometimes, existing solutions do not meet the requirements and designers are bound to explore new solutions. New

materials and production processes create new possibilities for designers and can lead to new ways to connect. Hence, the question how to join parts and materials remains an important challenge today. Design students must be able to design new, innovative solutions to solve future connection problems. Besides, the aesthetical aspects of connections must be considered.

## 2 EXAMPLES AS INSPIRATION

Practicing engineers and designers frequently make use of existing examples when engaging in design work [5]. They use previous instances of design elements as references to communicate [6]. All design is influenced by previous exposure to ideas in different formats and in different levels of abstraction [7]. Design proceeds by transforming, combining and adapting elements of previous designs, as well as elements and aspects of other objects, images and phenomena [6].

Previous designs can be very inspirational for design students and professionals. They comprise coherent combinations of design decisions and more information than any designer can think about at one [6]. Product pictures give both direct information about the appearance of the product but also indirect information about the strength, stiffness and many other properties [7]. For example, the design of the connection in Figure 1 gives a designer objective information as the applied joining principle, the geometry of the joint and the used materials. Besides, the image also gives more subject information as the usability, aesthetics and personality of the connection.

However, inspiration can also be a threat [8]. Previous studies [9,10] have shown that people tend to think in patterns to solve problems, which can be an obstruction to come up with innovative ideas. First, fixation can occur due to previously acquired knowledge. A problem is solved in a specific manner even though more appropriate methods exist. This phenomenon is defined as ‘Einstellung Effect’ [9]. Second, fixation can occur by seeing existing solutions. This phenomenon is defined as design fixation [10]. Both phenomena are illustrated in Figure 2. In the context of designing connections, designers can be fixed by joining solutions they used in previous projects or by seeing existing joining solutions in similar products. Therefore it is important that designers and engineers also use inspiration from other contexts and sectors.

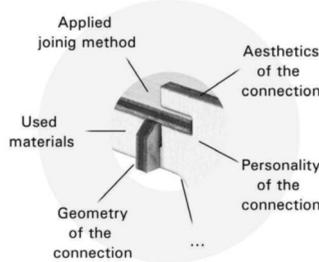


Figure 1. Images of connection examples comprise different types of information

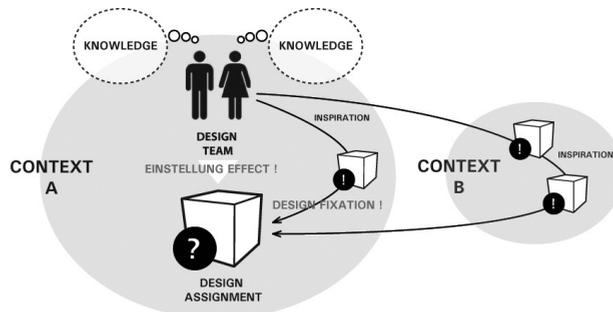


Figure 2. People can be fixed by previous knowledge (Einstellung Effect) or seeing existing solutions (Design Fixation). Inspiration from another, further context can prevent fixations

### 3 ONLINE INSPIRATION DATABASES

Today, the internet is an important inspiration source for design students and professionals. Blogs, image databases and communities provide daily fresh designs that can serve as inspiration. Several existing inspiration databases exist.

Design inSite [11] uses product examples to provide designers information and inspiration about materials and manufacturing processes. The idea behind the database is that seeing examples of successful applications may motivate designers to invest more time in exploring materials and processes that they either did not know about or did not think of as a solution [7].

Another existing example is the 'More Inspiration' database [12]. This database provides innovations classified by properties and functions. The user can search different solutions to fulfil a specific function. The database is based on the TRIZ methodology [13]. The general TRIZ problem solving process is based on finding a general problem in a specific context, generating generic solutions for this general problem and translate these back to the specific context.

These existing databases can be very helpful in design education and practice. They do not focus specific on connections. Grouped inspiration about joining methods and connections is scarce and not online accessible in an easy way. The available connection tools [1-4] consider mainly the assembly aspects of a connection and focuses on mechanical designs. There is still an opportunity to develop a database that groups and provides inspiration about connections, applied in products across sectors. This can be used by design students and professionals in the concept generation phase to create new connections in products and structures. Beside technical aspects of the connections, aesthetics and usability can be considered. This paper presents the Design to Connect (D2C) inspiration database and the use is illustrated with an example case.

### 4 D2C: AN OPEN INSPIRATION DATABASE FOR CONNECTIONS

The D2C inspiration database [14] is an online accessible database. A schematic overview of the D2C database is shown in Figure 3. It contains inspirational examples of connections applied in products, machines and structures across sectors. The aim of the database is to group and provide joining inspiration and make them available to design and engineering students and professionals. The database is openly accessible and users can add their own joining inspiration and share it with the community.

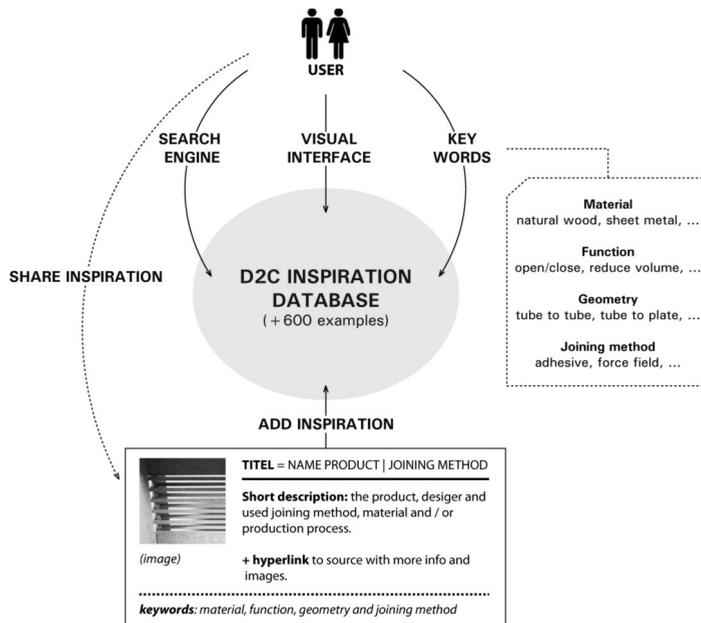


Figure 3. Schematic overview of the D2C database

The database contains already more than 600 inspirational examples. The examples are added to the database by the administrator but users can share their own inspiration. Each entity has a title which contains the name of the product and the used joining method. A short description tells the user more about the used material, process and the joining method. An image of the detail of the connection is attached to inspire the user. Some entities also contain a movie clip which illustrates the product connection or assembly process. A hyperlink leads the user to the source which provides more images and information about the connection and/or the product. Each entity is labelled with keywords for the applied joining method, used materials and the geometry and functionality of the connection.

There are several ways to get access to the content of the database. First, the user can browse through the visual interface and be inspired by the images of the connections. Second, the user can filter more relevant inspiration by selecting a keyword for the used material, function, geometry and joining method. Third, the user can search the database using the search engine. When the user enters a word, the engine search in the titles and descriptions of the different entities and show the selected entities. By clicking on an image, a pop up screen emerges which gives more information. A screenshot of the database is shown in figure 4.

To illustrate the use of the database, a design case by Master students in Industrial design where the database was applied is discussed.

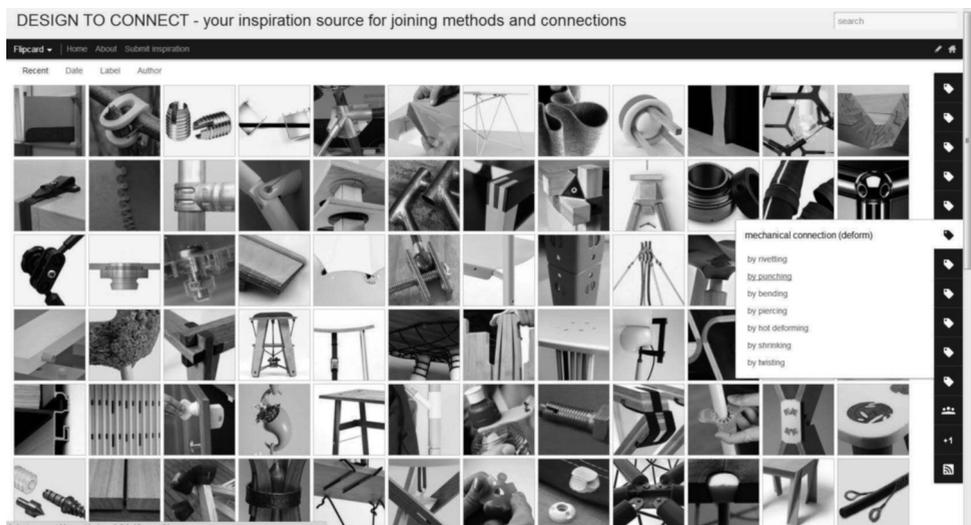


Figure 4. Screenshot of the D2C database

## 5 ILLUSTRATION CASE: THE PICNIC EXPERIENCE

For the design assignment, the students must design an innovative concept for a picnic basket. The idea created by one team was a basket that could be unfold to a small table and which includes a blanket. Several steps in their design process are illustrated in Figure 5. For their concept, the students were looking for a connection between the different parts that that could rotate but also would be stiff enough when it is unfold. The first and most obvious solution was the use of piano hinges. The students tested this solution in a first prototype. This was an effective solution, but tiny screws were used and the assembly time was long. Besides, in this product concept, the hinges were not aesthetical and seen as disruptive by the design students.

In a next step, the D2C database was applied by the students to find more inspiration to create other solutions. The students used the keywords to refine the available inspiration. In this case the students were looking for a connection that could fold or rotate. By selecting the keyword 'rotate' under the submenu 'function', a more relevant selection of 24 examples was provided (Figure 6). By clicking on an image, information about the product and connection is provided. The link goes to the source which provides more detailed information and more images.

Eventually, the use of textiles in combination with wood panels, shown in one of the examples, was seen as a potential solution by the students. After transforming this idea to their own product, this concept was tested with a second quick prototype with satisfying results. The concept was further developed and adapted which resulted in a third and final prototype. The design of their basket was finalized and much attention was given to the aesthetical details of the connection.

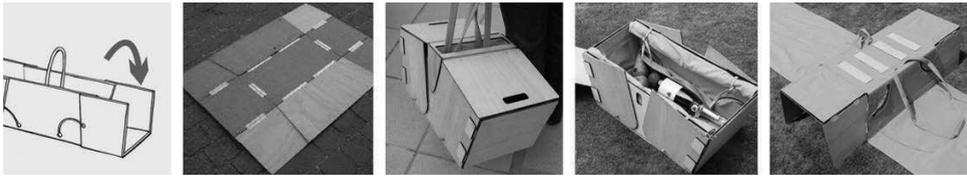


Figure 5. The “picnic experience”: (1) Sketch, (2) first prototype with piano hinges and (3-4) final prototype with textile hinges

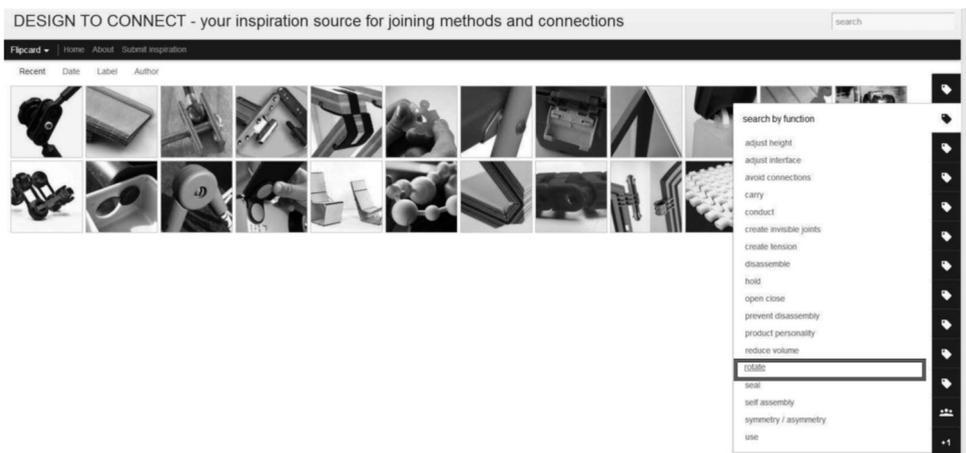


Figure 6. The keywords can be used to select more relevant inspiration

## 6 CONCLUSION AND FUTURE RESEARCH

How to join parts and materials remains an important challenge in design and engineering. Design students and professionals must have knowledge of existing solutions but future requirements lead to new connections challenges. Existing selection software focuses on existing solutions. Besides, aesthetical aspects of connections are not considered. Design and engineering students and professionals must be able to create new and innovative connections and consider aesthetical aspects of the connection.

All new design is influenced by previous exposure to ideas. Existing inspiration databases does not focus on connections. Examples of connections applied in products comprise much information, including the aesthetics. However, using product examples can also be a thread. Previous experience and seeing other designs can fixate people and preclude new and innovative solutions. Therefore it is important to search inspiration in other contexts. The inspiration database presented in this paper provides connections examples applied in products and structures in different sectors.

The D2C database is illustrated by a student design case. The database is already online accessible [14] and used by several students and professionals over the world. The current version is made with the Google Blogger [15] platform and have some limitations. This version was continuous adapted during the research to the needs of a users group which contains design students and professionals.

Future research will evaluate the D2C database. This will be done in two ways. First, the use and visits of the database will be evaluated in a quantitative way using Google Analytics [15]. Second, the use of the database in design practice will be evaluated. This will be done in a qualitative way with a small user group which includes design students and professionals.

In a next version, the user must be able to refine inspiration by selecting a combination of several keywords. In the current version, only one keyword at the time can be selected. At the moment, users can add inspiration by sending the information to the administrator. This can be improved by an online form where the user can add the information. Hence, the administrator only must approve the input to add it to the inspiration to the database. This is to preserve the quality of the database.

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