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## **The Furniture Layout Using the Interior Design Guidelines**

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### **Abstract**

Space is a precious and finite resource. That is why creating desirable layouts of building interiors is a complex task as designers have to manually adhere to various local and global considerations arising from competing practical and design considerations. We are willing to specify the techniques and most successful combinations of the furniture in the Interior space, in order to satisfy the human needs for comfort and rest.

**Keywords:** furniture layout, measurements, interior space, combination

### **1. Introduction**

Good room layouts in building designs have to consider functional and personal specifications coming from the user, while also taking into account the final manufacturing cost.

Actually, the design and specification of furnishing is central to the work of interior designer. The selection and arrangement of furnishing typically comes after the architectural design of building's walls, floors, ceilings, windows, and doors has been completed.

The Designer has a big responsibility on himself, because people rely on him their future environment. They will spend most of their time in the apartment, so it should be functional, comfortable and pleasant. The design should be psychologically and visually pleasant and friendly.

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We will try to specify what criteria are needed in order to create the successful furniture layout in the room. In addition we are willing to analyze the tools which can be useful for planning and also can economize a lot of time and efforts of the Designer.

## **2. The general requirements for the space planning**

In space planning, the design professional blocks out interior spatial areas, defines circulation patterns, and develops plans and layouts for furniture and equipment placement. Space planning services consider numerous design parameters, including the client's project goals and priorities, the client's organizational structure and relationships, space allocation criteria, building codes and access for the disabled, furniture standards, circulation and work flow, design considerations, the constraints of fixed building elements and building system interfaces, security and privacy issues, and flexibility for accommodating future space needs.

Some clients seek space planning to address specialized functions or work flows, and in these cases the consultant will need expertise about the process and style of living, that takes place in the space and the special equipment involved. Entertainment, videoconferencing, medical facility, retail, and kitchen design are examples.

### **1. Skills:**

First and foremost, space planning requires the ability to visualize space in three dimensions and a keen sense of composition, scale, and proportion. Technical knowledge and familiarity with furniture and equipment are required to make dimensional calculations, propose appropriate furniture options (custom, ready-made, modular, systems, etc.), specify ergonomically appropriate furniture and equipment, and comply with applicable building and fire codes. Architects are generally qualified as space planners by virtue of their education and experience. Databases for cataloging furniture and equipment, and software to support them, are important tools for space planners who need to analyze these data. Although space planning documentation can be done manually, computer-aided design and drafting programs are useful for diagramming and for preparing layouts and three dimensional visualizations. For space planning in existing facilities, a camera is useful for recording existing conditions, and measuring devices are needed to generate critical dimensions [7].

### **2. Process:**

Each space planning project is unique. An architecture decision to compete for a particular project will depend on many factors, such as the size and scope of the project, the schedule, and the firm's background in the facility type. Regardless of the size and scope, the space planning process usually embodies the following increments of work:

- **Programming:**

Space planning services typically begin after the programming phase, which may be done as a separate service or as an integral part of space planning. Programming tasks usually include a space survey, which consists of an inventory of existing (or proposed) equipment and furniture, interviews with clients and users, and other data

collection tools. The information gathered is compiled and analyzed to determine the range of functions that must take place in the space and the accepted space allocation standards for each.

- ***Preliminary diagramming:***

Next, area assignments are prepared to estimate the approximate square footage needed for each function and/or space. Then spatial positioning and relationships may be illustrated by bubble and adjacency diagrams. Blocking plans (overlaid on the building core and shell plan) show horizontal boundaries of major functional areas and circulation patterns for each figure. Stacking diagrams and plans show how functions are placed on each available level. These preliminary diagrams are often included in the space program report, which is usually the first deliverable.

- ***Space plans and furniture plans:***

Following approval of the program report, documents for space planning are developed that include space plans for the interior and schematic furniture plans. Interior construction and structural requirements also are part of the space planning documentation. Once approved, these documents form the basis for the construction documentation of interior spaces and, when applicable, the selection and specification of furniture, furnishings, and equipment [9].

Space efficiency must be balanced against its effectiveness. The effectiveness can be achieved by the application of the steps below:

- 1. Measurement:***

Advice on improving space efficiency must be accompanied by clarity in measuring that efficiency. Measurement is necessary so that targets can be set and space efficiency attained. Space efficiency measurements depend on floor area, which must be measured using agreed definitions. There are several valid ways to measure space and analyze the total area within a building. They are based on the principle of distinguishing the areas used for different functions, including the structure of a building. The space efficiency of any building relates to three factors:

- the quantity of space, generally calculated in terms of floor area though occasionally volume may also be relevant
- the number of users, potential and actual
- the amount of time the space is used.

A building can be said is “designed for space efficiency” when it provides:

- the minimum necessary space for the desired functions to be properly accommodated, with minimum ‘waste’ between net internal area and gross internal area (NIA:GIA, commonly expressed as the ratio net:gross) or between net usable area and net internal area (NUA:NIA);

- these measures are normally expressed as percentages;
- the minimum space necessary for effective living, learning, studying or working. A high level of space utilization because the space is used for the maximum possible amount of time [7].

## **2. *Space efficiency***

This applies to buildings that are refurbished, modified or built to accommodate the organizational changes that often accompany, and may be the incentive for seeking, estate rationalization.

## **3. *Resource and cost efficiencies***

Other efficiency measures incorporate concepts of lifetime cost and use patterns over time. The aim: to maximize efficiency benefits overall. Efficient space in these terms is:

- space that can be modified cost-effectively when functional requirements change, thus permitting reuse of buildings in the long term
- space that has been specified and detailed to give reasonable cost in use
- space that is built to last and will have a long life [9].

In this chapter we have characterized the common rules for the space planning. However, we would like to stop in detail on the furniture guidelines for the living room, which except of the points, mentioned above, include the other important recommendations.

## **2. *The guidelines for the furniture layout in the living room***

An empty room for the Designer it is an opportunity to express himself; and at the same the challenge. The Designer should apply all the appropriate proportions and measurements, to make the right accents and main points in the room. The most important it is to know where to start and to have the direct plan and conception.

The most important it is a comfort in the room, so the creator should be aware of planning, should know where to put things and prioritize the choices, like:

- ***Function:***

Consider how the room is used and how many people will use it. That will dictate the type of furnishings needed and the amount of seating required.

- ***Focal point:***

Identify the room's focal point - a fireplace, view, television etc. - and orient the furniture accordingly.



**Figure 1:** the art wall – the focal point in the room. Source: [11].

- **Priority:**

The largest pieces of furniture should be placed first, such as the sofa in the living room or the bed in the bedroom. In most cases this piece should face the room's focal point. Chairs should be no more than 8 feet apart to facilitate conversation. Unless the room is especially small, avoid pushing all the furniture against the walls. Also, it is important to choose the central point in the room. This isn't necessarily the middle of the room but most of the time it will be. Generally, this is where the coffee table, or center table should sit. If the home has a very long, or very large living room, it can be considered having two center points, one will be larger than the other.



**Figure 2:** the large living room with the two center points. Source: [12].

- **Symmetry:**

Symmetrical arrangements work best for formal rooms. Asymmetrical arrangements make a room feel more casual. The most important rule to remember when designing the living room is balance. Large rooms can take large pieces, but not every piece should be large. Small rooms can withstand a large sofa however large sofas command large coffee tables, which will quickly fill the room. Side tables, or end tables, very often hold table lamps and decor, so their size will depend upon how many items needed to place on the surface.



**Figure 3:** the symmetrical arrangement of the living room. Source: [14].

- **Traffic:**

The flow of traffic through the room should be also considered generally the path between doorways. The path with any large pieces of furniture should not be blocked. It is better to direct traffic around a seating group, not through the middle of it. If traffic cuts through the middle of the room, two small seating areas might be created instead of one large one.

- **To use the variation of the size of furniture pieces throughout the room:**

This allows the eyes to move up and down to scan the space. The large or tall items can be balanced by placing another piece of similar height across the room from it (or use art to replicate the scale). Not to put two tall pieces next to each other.

- **Variety:**

The combination of straight and curved lines for contrast looks effective. If the furniture is modern and linear, a round table for contrast can be used. If the furniture is curvy, the angular piece will match. Similarly, can be paired with solids and voids: combination of a leggy chair with a solid side table, and a solid chair with a leggy table.



**Figure 4:** the variation of the size of furniture pieces throughout the room Source: [14].



**Figure 5:** the combination of straight and curved lines in the Interior Design. Source: [13].

- ***Ease of use:***

The table should be placed within easy reach of every seat, the pieces of similar scale can be combined together, and every reading chair should be accompanying by lamp. The “correct” furniture is whatever works best for the habitants. For example, sofas create a more pleasant seating arrangement as it forces people to sit next to each other. It also offers flexible seating so more people can be placed into a room. Arm chairs, or side chairs, allow to control better where individuals will sit and what direction they will face. Chairs, can help break up space without being too large. The key is to find the balance between sofas and individual chairs.

- ***Flexibility:***

Having multi-functional furniture is the best way to have success in the living room, regardless of the usage of space. Ottomans can be coffee tables or extra seating. Benches can store extra blankets and seat additional guests. Nesting tables can be spread out throughout the space when more surfaces are required. A sideboard can

be an extra serving table or bar during a party. In a multi-use living room, the pieces that can work in a variety of ways.



**Figure 6:** multifunctional furniture that can be used for the different purposes. Source: [14].

- **Lightening:**

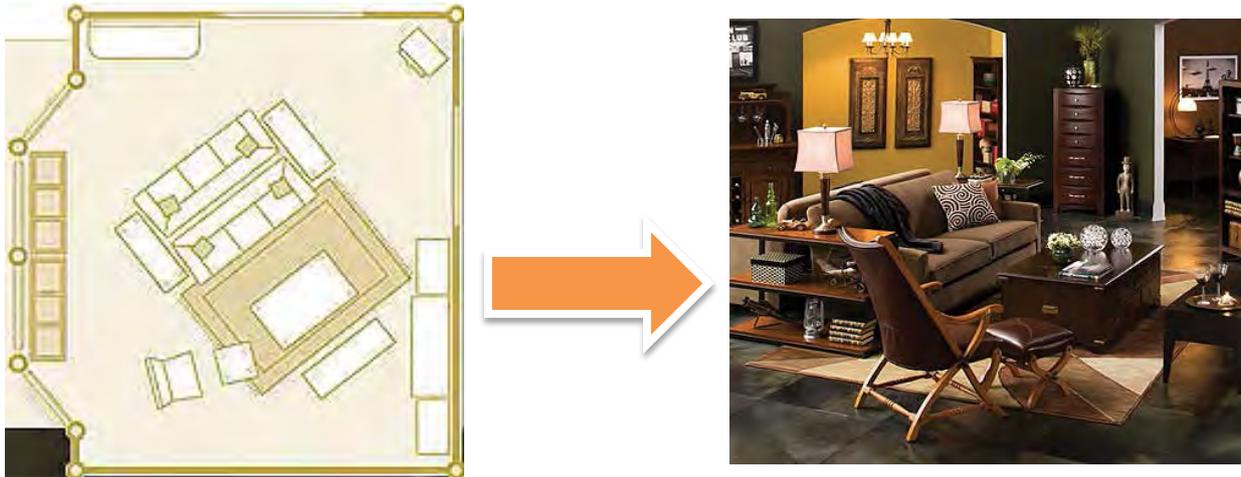
Properly lighting for the living room means having light come from various sources and various positions. Directing the light source from the ceiling, table lamps, sconces and floor lamps will not only give a balance of good lighting, it will allow to change the feel of the room very quickly.



**Figure 7:** the light coming from the various sources and positions. Source: [13].

- **Planning:**

Before the rearranging the room, it is better to visualize the design on the paper, or with the help of the computer programs (which we will discuss in the following chapters). It is easier to try the different furniture and color configuration in the paper or computer, than to move and replace all the furniture in the house [7, 9, 15].



**Figure 8, 9:** the planning of the room and the result. The goal for this room was primarily to create a castle-like atmosphere with two distinct zones that accommodate several people at a time. Source: [15].

In general, we can assume that an effective furniture layout must address both functional and visual criteria. The functional criteria evaluate how well the layout supports the human activities that take place in the space, such as conversation, rest, or movement. The visual criteria concern the perception of the layout as a visual composition.

Functional criteria for furniture layout are based on the constraints imposed by human physiology and the effects of spatial layout on human behavior.

The visual criteria concern the perception of the furniture layout as a visual composition [1, 8]. The primary visual rules of thumb used by interior designers are visual balance, alignment, and a dominant point of emphasis.

### 3. The acceptable measurement for the furniture layout in the living room

However, it is difficult to find the room where everything is arranged right. That is why the planning playing the major role before the start. In general the design rules are meant to be broken, but not when it comes to proper height and furniture spacing. The basic measurements for the spacing and placement. Dining Room:

- **Distance between the walls and the dining room table:** Ideally, provide at least 36" between the dining table and any walls or other furniture on all sides to allow seats to slide out easily.
- **Distance between a dining table and an entrance:** Provide around 48" between the table and an entrance to allow people to enter and exit the room with ease.
- **Vertical space between a dining chair and dining table:** Chairs and chair arms should be able to slide under the table with ease. Leave about 7" between the chair arm and apron of the table.



**Figure 10:** Modern furniture placing in the dining room, considering all the rules and measurements. Source: [14].



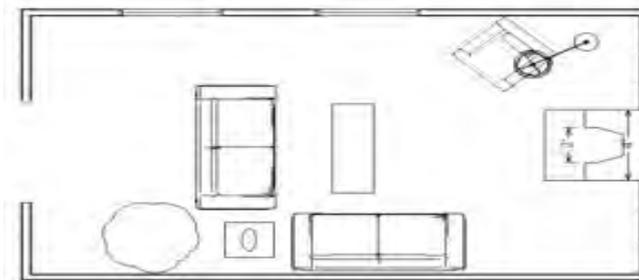
**Figure 11:** The living room designed for the comfort of conversation and rest. All the element are applied accordingly to the guidelines. Source: [11].

- **Distance between chandelier and dining table:** This is one of the more flexible topics. Low hanging lighting sets a more modern tone, but even so, it should never interfere with the ability to make conversation— no need to put the face down to the table just to see the dinner guests. However, a light hung too high will detract from the cohesive feel of a room as well. A good rule is to hang lighting between 24"-32" from the table.
- **Area rug and dining table:** A rug should span about 36" wider on all sides of a dining table to allow chairs to pull out easily without catching.
- **Space between dining chairs:** Ideally provide about 24" between chairs to prevent hitting elbows and to allow people to slide chairs in and out without any collisions or bruised knuckles.



**Figure 12:** Late 18<sup>th</sup> century Louis XV fauteuils living room design. In comparison with nowadays, the focal point in the room were mostly the books and fireplace. Source: [15].

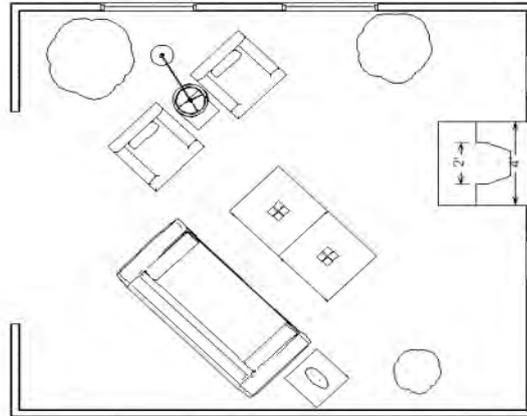
- **Living Room:** Distance between a sofa and coffee table: Allow around 18" between the table and sofa edge to give enough leg room but to be able to set down drinks or reach appetizers without straining. Coffee table heights vary greatly, but a good rule is to keep the table height and seat height within 4 inches of each other.



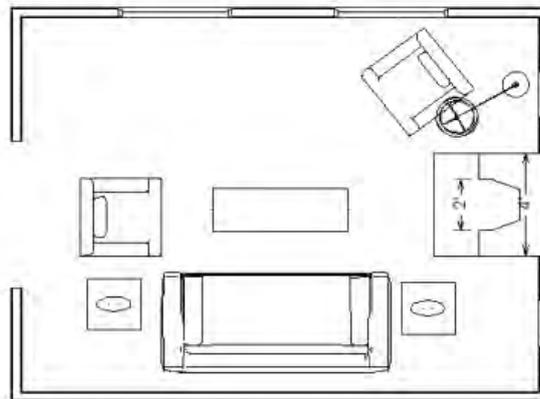
**Figure 13:** The example of the furniture arrangement in the long room. Source: [7]

- **Distance between seating furniture:** Aim to provide between 3.5' and 10' between seating options to help conversation flow without crowding a room.
- **Side table and sofa height:** In general, an end table should be approximately the same height as the arm of your sofa or chair. This allows guests to set down or reach for drinks without straining, and it also lends a more cohesive feel to the room.
- **Distance between TV and sofa:** There should be about 7' between the TV and seating options. Area rugs and furniture: Too often area rugs end up feeling like bath mats. To keep your area rug from feeling random, at least the front two legs of a sofa or chair should rest on the rug.
- **Distance between room-size rugs to walls:** Allow about 24" between the wall and room-size rug in a large room, and between 12"- 18" in a smaller room

To avoid emphasizing the length, furniture will be placed in contradiction to size. In other words, the larger couch will be positioned perpendicular to the longest wall. If the room is extremely wide, but still long, you can divide it into additional areas, specifically designed for a purpose (a reading corner).



**Figure 14:** The furniture arrangement in the square room. Source: [7]



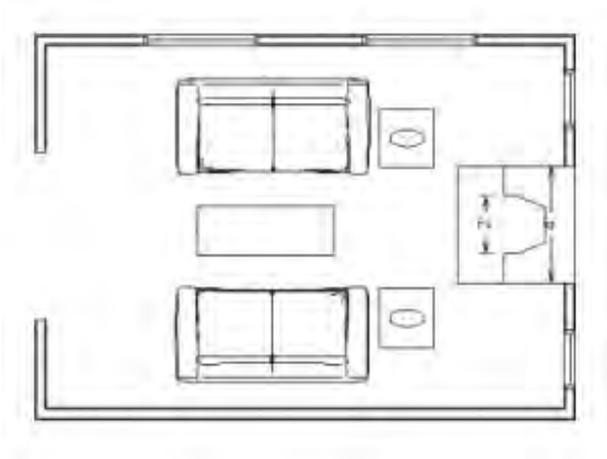
**Figure 15:** Perpendicular positioning of the sofas in the room. Source: [7]

If it is small, furniture will be placed along the walls, in parallel. You can also try grouping furniture, and placing them either perpendicular (or also parallel). If the room is wide, you can try moving the same furniture group around corners, thereby working off the angles.

There are many ways to place furniture around a living-room. The basic rule is to form a main “island” to promote a central place where people can hang out together.

Two sofas are placed perpendicular to each other, at right angles. Additional furniture (tables, chairs, etc.) can then be placed to support the couches, usually to build off the angles.

In the figure 16 two sofas are placed face to face. One of them can also be replaced with two chairs side-by-side. A coffee table and/or rug bridge the gap [7, 9, 15].



**Figure 16:** the face to face placing of the sofas. Source: [7]

Summarizing all the information above, we can conclude:

- It is preferable to avoid overloading the room with furniture. Promote a minimalist approach.
- The furniture should not be aligned to the walls, therefore leaving a large empty space in the middle of the room. Instead, it is better to group the furniture together and get away from the walls.
- The plan should be done ahead. It will help to minimize the efforts; economize the time and spending.
- In order to redesign the room with existing furniture, it is needed to move them around. If there is difficult to find the combinations desirable, it may be because you have too many already.

#### **4. The computer software for the designing of the Interior space**

Space planning is an integral part of interior design and building design services. Other closely aligned services may include programming, facility management, furniture and equipment acquisition, asset inventory services, move management, and tenant services.

The best way to plan a placement is on paper. However, nowadays with the development of the computer technology, there are several of programs for the design of interior space and furniture placement in the room. Instead of spending countless hours on planning the spaces, there is an opportunity to imagine it virtually first. The program allows measuring the rooms dimensions, the location of windows, doors, heat registers and electrical outlets; and test various furniture configurations.

### 1. “My deco 3D room planner”

The program allows uploading the existent floor plan, or playing around with pre-loaded floor plans. “My Deco 3D Planner allows inserting walls, doors, windows and selecting from a gallery of interior finishes. The interface is relatively simple to use, and allows to view the plan and 3D image at the same time. It is possible to move the camera around to see the different views, and paint the walls and ceiling from the numerous color selections. To make this program realistic, real products are used for inserting into your model. There is a choice from small kitchen appliances to garden tools in your garage.



Figure 17: The design of the bedroom in the program “My Deco 3D room planner”. Source: [16].



Figure 18: The variety of the flooring materials and color combinations in the “Design room” program. Source: [16].

## 2. “Design a room”

This program allows seeing different color combinations of flooring, cabinetry, ceilings, walls and even countertops while staying in the comfort at home. Design a Room allows to choose a room in the house, then pick a style (ranging from contemporary, traditional to global fusion) and play around with colors, textures and finishes. Choosing finishes in a room can be a daunting task but program allows choosing from already installed inventory of finishes, and even allows you to choose coordinating paint manufacturer wall color. This design tool is for designing a room and the ability to see the result before execution, or before paying. The best thing about this free online 3D tool is the ability to learn about the products before buying. The program allows the user to get the realistic look, and not just put together a room that looks nice, but isn't functional.

## 3. “Sweet home 3D”

This 3D visual software is ideal for the more customize options to the average room and decor space planning program. The interface is laid out into 4 sections:

- 1) The furniture catalog in the upper left hand corner allows you to choose components by name in a quick fashion. Similar to a Windows Explorer format, the tree layout navigation allows the user to drag and drop components directly into the floor plan.
- 2) The floor plan shows you in a 2D format where the walls, windows, doors, and furniture are placed.
- 3) The 3D pane shows the plan in a 3D fashion immediately after placing in the floor plan. This view will help users that need help visualizing the plan as they design.
- 4) Lastly, the home furniture list displays the dimensions, size, etc. of each of the components. This helps in laying out furniture to the exact size that needed.



**Figure 19, 20:** The floor plan in the 2D dimension and the example of the dining room in the 3D view. Source: [16].

#### 4. “Smartdraw”

Smartdraw is a suite of programs for visual graphics and presentations. Graphic choices include charts and graphs such as: project charts, timelines, marketing charts and flow charts. Under the flowchart application are floor plans and individual room plans. This program allows designing, customizing and presenting drawings on a beginner and professional level. The program can be used to plan out office space, apartments, individual rooms, and even building elevations [5, 16].

We are able to select one more tool in order to place the furniture in the room. These approaches assist the layout of general rectangular arrangements and do not incorporate furniture layout guidelines. Focusing on furniture layout [2] “object association” constraints that are designed to facilitate direct manipulation of furniture arrangements is introduced. For example, the user can constrain a bookshelf to slide along walls without penetration or separation. There is presented [10] a constraint based furniture layout system that incorporates pairwise relationships which enforce stability, non-penetration, and alignment; also an [3] agent-based procedure for furniture layout. In contrast to these techniques, the approach is based on established layout guidelines employed by practicing interior designers. These guidelines include global criteria such as visual balance, which cannot be expressed as a collection of object associations or pairwise relationships. Layout problems arise in a number of domains and one common strategy is to use optimization techniques to find a layout that satisfies domain-specific criteria. Most of these approaches were developed for off-line layout and do not support direct manipulation or generation of multiple high-quality alternatives. While many physical and software tools are available for visualizing furniture arrangements [4], these tools simply alleviate the physical strain of moving furniture pieces to prototype different layouts. The placement of the furniture relies entirely on the user’s expertise, which is often insufficient to produce effective furniture arrangements. This system assists furniture placement by providing optimized suggestions based on interior design guidelines.

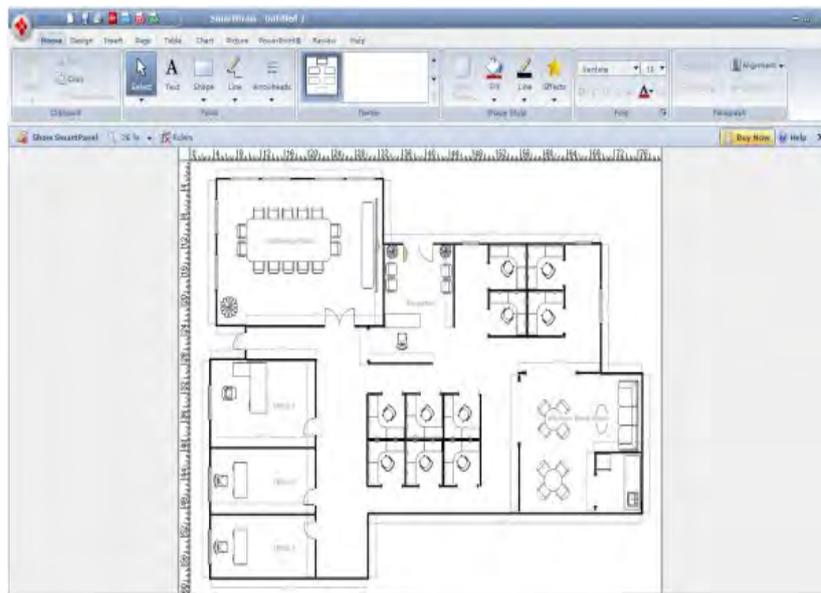
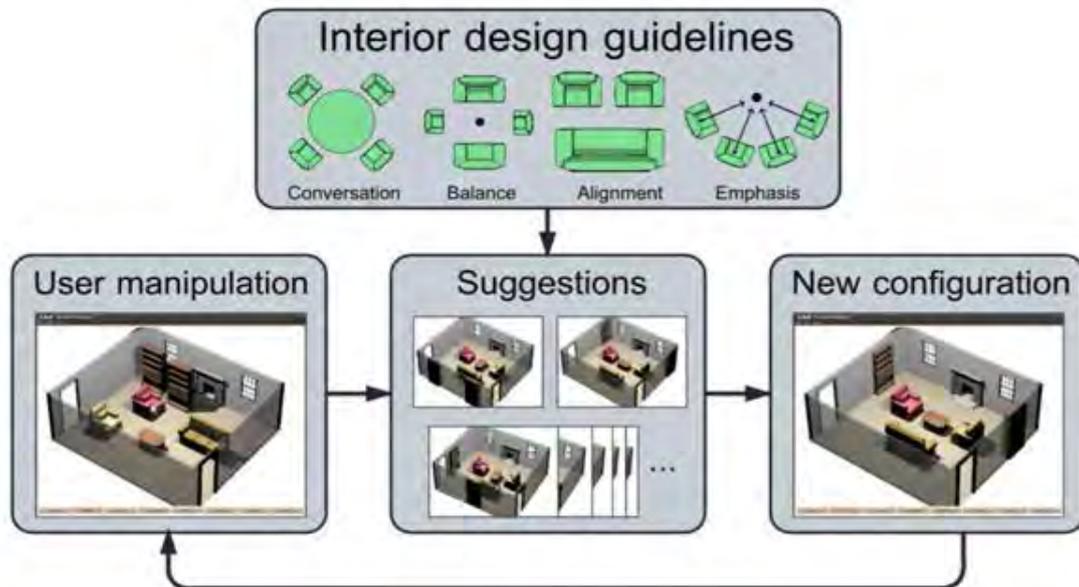


Figure 21: The plan of the furniture layout, created in the “Smartdraw”. Source: [16].

The figure 22 gives an overview of interaction with our system [6]. First a layout session begins by creating a room and populating it with furniture. The furniture items are selected from a library that contains categorized 3D models in canonical orientation. Throughout the session, the user can manipulate the furniture and request suggestions. This is further illustrated in the supplementary video.

The suggestions are generated by sampling a density function, defined over the space of layouts of the current set of furniture in the specified room. The density function is defined using idealized analytical formulations of interior design guidelines. The sampler runs in a separate process, so that the user can continue the session while suggestions are being computed.

The suggestions allow the user to quickly experiment with many arrangement options that are already optimized with respect to interior design guidelines. The user can constrain the suggestions by fixing some of the items in place. The constraints simply reduce the dimensionality of the sampled space. This approach allows the user to progressively pin down the desired layout.



**Figure 22:** System overview. In response to user manipulation, the system suggests new arrangements that respect user-specified constraints and follow interior design guidelines. Source: [16]

## 5. Conclusions

We have presented a furniture layout system that is driven by a set of interior design guidelines.

First of all, the room should be evaluated according to the ground place and the space available for the creativity.

Secondly, if the room is tightly packed with furniture, with little to no free space, the effectiveness of the rearrangement and successful design going down. In the first chapter, we have evaluated and analyzed the general criteria needed for the effective furniture layout in the living room and living space. The Designer first of all should have the skills and creative thinking; in addition the process should be followed. In this case, all the criteria's: space available, the cost-effectiveness, the desire of the habitants.

We have mentioned all the important sections that should be covered by the Designer, in order to create the successful space layout. Mostly, the Designer should pay an attention to functionality of the room. How many people will live in the space? What is the purpose of the room? Also, the central point should be chosen correctly, in order to stimulate the positive atmosphere and communication. There should be use of the different furniture and variety of shapes, to make the room more interesting and creative. And the most important is planning before the actual rearrangement. It helps to save the amount of time and efforts.

We have also reviewed the appropriate measurements for the room, also the most convenient furniture layout in different types of room: long, square etc. The chapter four was the review of the programs that can be used for the planning and designing of the furniture layout in the room. There is an opportunity to check the material and colors, to try the different variety of the furniture placement.

In general, we can conclude that the room arrangement should satisfy the basic human needs, by being pleasant and beneficial for living.

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