Maestro: Design Challenges for a Group Calendar

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Abstract

Maestro - 3D group calendar visualizer aims at handling multiple schedules and highlighting common free times. One of the most powerful skills of Maestro is scalability according to the number of group members, which can be up to 18 users. The use of color and shape intends to create a more lucid picture of an organization's schedule, as opposed to traditional calendars which can overwhelm the user with information.

The goal is not to produce yet another calendar application, but to define an interactive information visualization technique. This work concentrates on highlighting the relevant information, using primitive shapes and color differentiation to avoid a complicated depiction.

Keywords--- Calendars, Design Process, time sheet, schedule, 3D Organizer, Information Visualization, Graphical Representation, Interactive Animation, 3D Graphics, Cylinder.

1. Introduction

Regardless of the intention to create another calendar application, Maestro has the main purpose to generate a new approach to one of the gaps in calendar applications which is also one of the main problems in information visualization; asthetics[1].

One important requirement for an interactive calendar is detecting the common free times of group members. Synchronizing the calendars of individuals and setting a time for a meeting or group work can be a problem, because of the possibility of scheduling conflicts between group members. Maestro's contribution lies in finding a 3D layout solution to visualize the load of complex calendar constraints, and highlighting the common free times of the group members using visual clues. Thus, Maestro proposes a system that visualizes members' weekly calendars and the daily calendar of the group. Users can both see the weekly (Figure 1) and the daily state of their agenda, and get a quick idea about the upcoming events at a glance. Maestro can also compare the calendars of the group members in its system and show common free times (Figure 2). This added feature will help the users in any occasion like family meeting, work conferences etc.

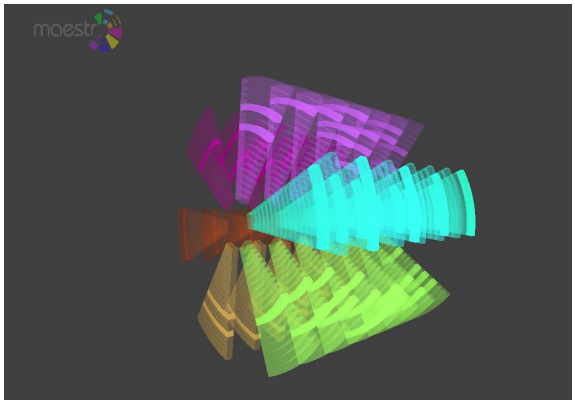

Figure 1. In Public Display Mode, the rotation of the main shape enables the user to see the load of the week at a glance.

Figure 2. In Interactive Mode, Common Free Time option highlights available hours in groups calendar.

As with some former approaches [2], Maestro tries to visualize time in 3D space but also lets the user display multiple time spans [3] at a glance in public display mode. In this mode, users can not only see a

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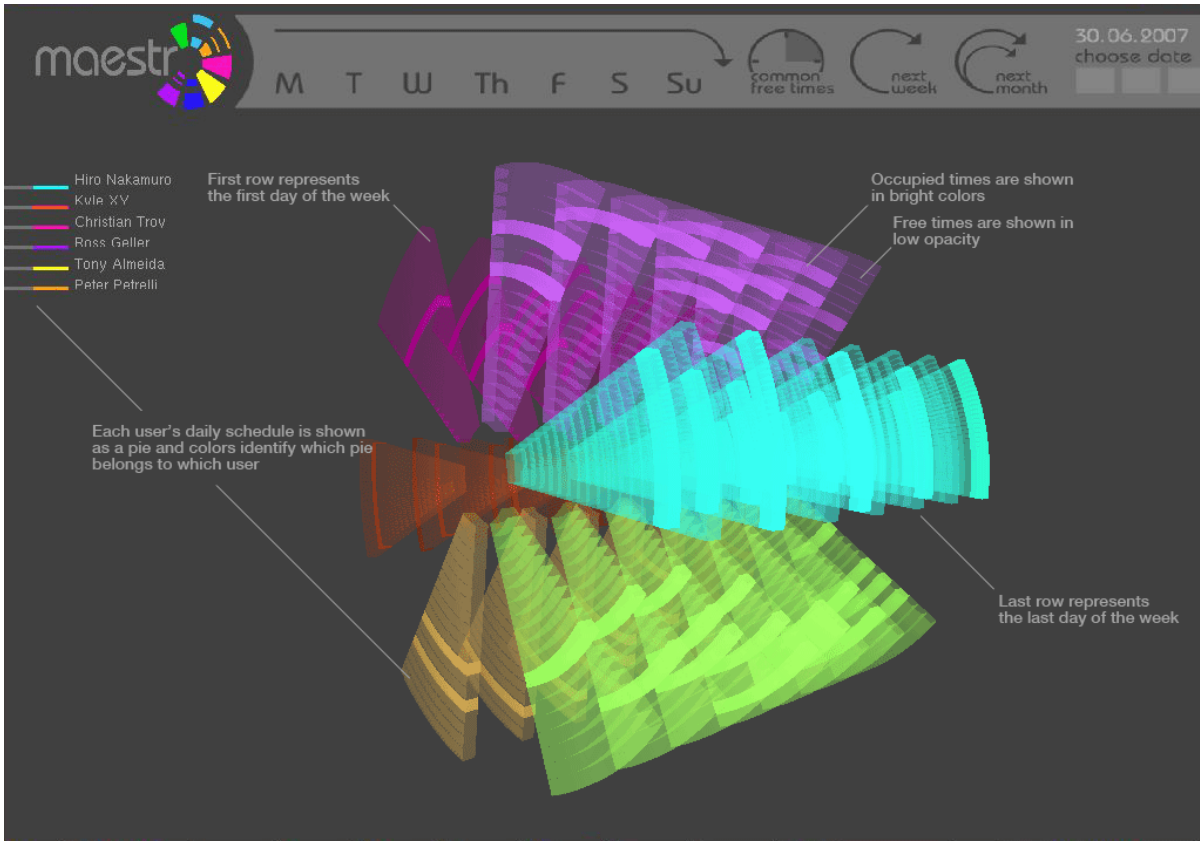


Figure 3. Important Aspects of Maestro

week's activities at a glance, but can also figure out the state of available free time of each day in that week.

This paper organizes the literature survey on temporal information visualization in the related work section, Maestro's working principles under the system section, the design path in the design process section and concludes with summarizing the solutions for the specific problems faced during the design process.

This research is the outcome of a transdisciplinary learning approach between fine arts / communication design and computer sciences, fostering group collaboration. The specifics of this approach have been reported upon elsewhere [4].This type of research skills are also considered as one of the main factors enhancing the recent expansions in information visualization [5].

2. Related Work

Computer-based calendars are mostly 2D applications designed for single users, which are adequate to store and manage data, identical to those paper-based calendars used in offices. Mackinlay [2] attempted different methods for 3D representations of calendars such as Spiral Calendar and Time Lattice. The Lattice attempts a technique similar to Maestro, combining calendars of different users in a group. Lattice introduces "Translucent Shadows" to display relationships between users. This technique produces complex objects and involves challenging interactions. The design language created in order to separate each calendar, offers a much more readable visualization.

Showing the 'load' of a calendar has also been a common goal in previous designs. As Tessler reported [3], the 'Busy-ness' level is shown with length-changing bars, or sometimes with numbers of primitives. One can intuitively understand the 'busy-ness' level of a week in the public display mode by comparing the area occupied by opaque and transparent regions and the load of a day from the interactive mode. In order to visualize the continuous flow of time, Carlis [6] used a spiral, in which periodic events are placed on the radius. Maestro represents the hourly schedule of a day on a sliced disk and duplicates the other days one after another, forming a cylinder through the replication of the individual disks (Figure 3). "Availability Bars" [7] also show multiple calendars, slicing a day into hourly regions. According to Faulring this design approach allows the user quick visual inspection. Finding the common available times of users, Maestro can show up to 18 people's schedules at a time, at best, while "Availability Bars" is capable of showing the most 3

Figure 4. Google Calendar with 10 Users

important people's schedules and summarizing other people's availability on a histogram due to space limitations.

Google Calendar, Microsoft Outlook and iCal are some of the well-known computer-based calendar programs where the user can also have multiple organizers and find the common free times across these calendars. However these approaches provide limited scalability. Google Calendar is sufficient to organize one person's schedule or a small group, but as the number of group members increases, Google Calendar becomes complex and some what misleading, causing users to make extra efforts to find available common times (Figure 4).

Maestro has daily and weekly scheduling modes, as do other internet based calendars. Those calendars display detailed information regardless of time frame's size. Thus as time interval gets wider, information density increases. On the other hand, Maestro doesn't include any text based information for weekly schedule display mode and prefers to give a quick insight about work load and availability of week, rather than "overinforming" the user. As a result, information density of the visual language is kept constant.

3. System

Maestro consists of two parts: a public mode to give an overview about the group's weekly 'busy-ness' and an interactive mode to enable users get detailed information.

Maestro imports the users' agendas and illustrates data with common demonstrations: the "pie chart figure", for example stands for daily schedules, a "cylindrical figure" consisting of daily schedules placed behind each other, stands for the weekly schedule. By switching between daily schedules, one can see the status of other users and highlight the common free times of the corresponding day. Maestro can also be used to unite multiple calendars created by one user. Thus, the user will have the ability to look at all of the calendars at once or individually.

3.1. Public Display Mode

In the Public Display Mode, Maestro shows the activities of a week. By switching into this mode, users get a general idea about the load of the upcoming week at a glance. Each schedule is represented with a unique color. The frontal pie is the present day; other days are placed behind one other, forming a cylindrical shape. (Figure 3)

Visualization of a whole group's weekly schedule on a 3D environment results in losing some information due to occlusion. In order to overcome this problem, main body rotates through its axis so that each schedule will be on the unoccluded region successively.

Tessler [3] states that many other scheduling programs offer the user different time spans: monthly, weekly or daily schedules which can be viewed. Yet, in most of the calendars, showing the daily and weekly schedules together is not a common feature. In the public display mode of Maestro, the main body rotates very slowly and gives the observer a chance to have an overview not only about the week, but also about each day. The Public Display Mode can also be used as a screen-saver or can be displayed on an individual screen for continuous monitoring.

For the Public Display Mode, an extra projection screen in communal areas was stipulated, such as school labs, lobbies etc, where users can get a quick idea about their own or their co-workers programs within seconds (Figure 5). Since the main purpose of this mode is giving a quick insight about the schedule's load, as a design decision, offering any text based information was avoided. Any detail about schedule entries can be reached via interactive mode.

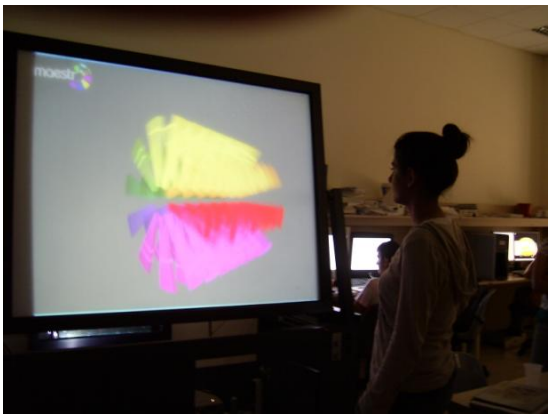


Figure 5. An Example about the Setup of Maestro's Public Display Mode in real life

3.2. Interactive Mode

By switching on the interactive mode, the details of schedules can be accessed. There are two axes on the interface of this mode: the upper-horizontal axis enables

users to view the activities day by day and contains stable data. The left-vertical axis of the interface enables users selecting another group member in order to look over his/her weekly schedule. This axis can be personalized according to the particular needs of an organization.

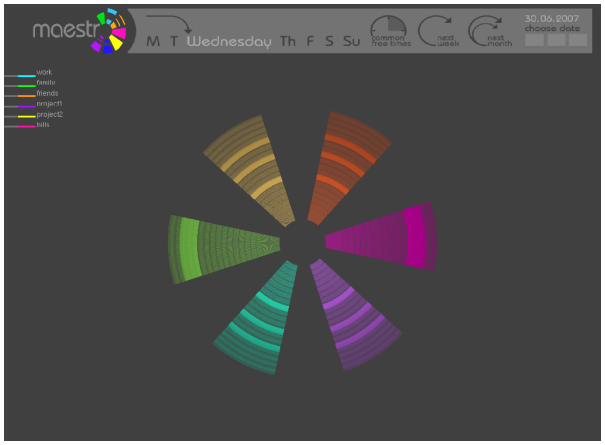


Figure 6. Maestro's Interactive Mode, showing daily schedule of a group

Since a calendar's main purpose is to plan social events, the time span represented in a day is limited. Each pie is tiled horizontally into 19 hours, which starts from 09:00 am and ends at 03:00 am. Represented time increases as the slices get bigger from inside to outside. By clicking on the related slice, users can screen the details of an entry. (Figure 6)

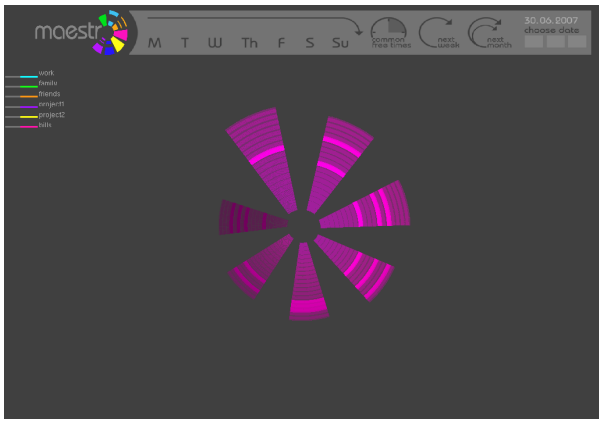


Figure 7. Maestro's Interactive Mode, showing weekly schedule of a group member

In addition, by enabling the "common free time" option the user can highlight the common available hours of the day (Figure 2). The Common Free Time mode creates an unavoidable honesty between the members of a group. The "you-know that-I-know" [8] factor in the common free time mode makes the group members more responsible about creating an honest schedule and attending scheduled group meetings.

3.3. Technical Details

There are three steps in implementation process: building the 3D model of the main body, designing the interface, synchronizing animations with menu commands.

Maestro 3D model was developed with C++, making use of OpenGL library. The model is built up from polygons and assigned proper alpha values to each tile, to create a transparency difference between occupied and unoccupied tiles (hours).

Interface of Maestro was designed using Photoshop and covered on the screen as a texture. Connection between menu and animations is done via detecting mouse clicks and movements.

The group calendar data visualized is imported to Maestro as XML files to give flexibility to apply users' schedules exported from some online calendar applications such as Google Calendar.

4. Design Process

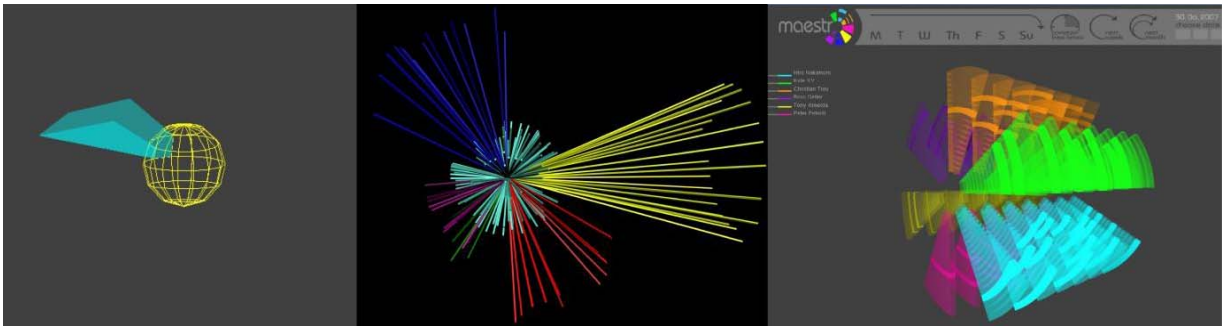
4.1. Shapes

In the beginning, Maestro's main body was a simple sphere figure separated by latitudes and longitudes. With longitudes, the sphere was sliced into 7 equal volumes, and according to the number of users in the group, each slice was separated with latitudes. To represent the data, each part was extruded according to schedules. This attempt created a rough shape, which was hard to identify with busy schedules and many users (Figure 8.a).

As a second stage, for the perception of the separate schedules, the sphere was composed of thin bars. The bars were paired into groups, where each group represented a day and each bar represented the schedule of a member. Although distinguishable colors were used, realizing each day-group was an important problem. Furthermore sphere figure was hard to tile in equal shapes and was impossible seeing the bars positioned at sphere's back side.

Giving the user an overview of the schedule of an entire week or a day was one of the main goals in Maestro's design process. With the spherical representation, described above, having an overview was almost impossible, even with zooming into and through the rotation of the sphere. Without having an overview comparing the schedules and finding common free times in a day also became impractical (Figure 8.b).

In order to visualize the information as simple as possible 2D and 3D views were combined. 2D views are more convenient to show text based information in a



(a) (b) (c)

Figure 8.Maestro's Design Steps

schedule, whereas a 3D view is more suitable to demonstrate the load of a week or a day at a glance

To create a self-expressive system, using primitive shapes and highlighting the relevant relationships was the bottleneck of the method. Inspired by pie charts, each day was presented as a pie, which forms a cylinder when all the group members' calendars are shown together. Between each slice there is a blank space, to ensure differentiation of each slice. Since a 360^{o} full pie is divided into the number of users; increasing the number of members will narrow slices and the representation space as well.

Placing daily pies in a row, created the weekly representation. This formed a bigger cylinder-looking shape. Showing Maestro in isometric view diminished the artifacts of occlusion and created an understandable overview (Figure 8.c).

4.2. Colorization

Each user was mapped with a separate color, in order to represent another dimension of information. Based on the traditional color theory, which was firstly designed by Sir Isaac Newton in 1666, firstly 3 pigment colors (red, blue, yellow), which can not be created through the combination of other colors were used. Through the mix of 2 colors out of these three, 3 secondary colors were obtained. Mixing one primary color with one secondary color enabled to acquire 6 tertiary colors. In this way, a 12-Color Wheel was created including the primary, secondary and tertiary colors in color theory. Colors from this color wheel can be used in schedules up to 12 people. Versions of the tertiary colors can also be added to create a schedule up to 18 people. Using Maestro for more than 18 users can make the public display mode harder to differentiate between users. Since bright colors are used, putting a gray tone for the background, created a neutralizing effect on the foregrounded colors. (Figure 9)

4.3. Layout

To create a balance between the colorful representations of schedules, light gray colors (with %45 and %70 brightness values, but 0 Hue and Saturation values) were used for all the elements on the interface. Using circles to generate buttons had the intention to create a common language between the main body and the interface. The rounded font "Bauhaus" for all textual elements was also selected to maintain a harmony between all the components.

A legend was created on the left side of the screen, in which each color represents one user and each of these colored lines is followed by the name of that user.

5. Conclusion

The concentration of the work presented here has been the creation of a new information visualization method for calendar applications. In the design process of Maestro, space and color limitations restricted the scalability of the model. For different sizes of groups, versions of Maestro were developed. Corresponding to increasing number of members, representation surface for each person gets smaller. Likewise, numbers of differentiable colors are finite. Thus, to visualize the schedules up to 18 people, the model performs sufficiently.

Maestro's approach to group scheduling problem comes out with a solution, that assumes members to have common free times. This scenario may not always be the case, because of conflicts common available hours may not exist. Besides, information obtained from people's agendas may contain some complexities. Some activities may not be mentioned on calendars and some activities may be addressed in shorter/longer time intervals, which leads to debatable hour suggestions. In a further study, this problem can be partially solved by letting Maestro find the partialy scheduled time frames where most of group members are available, but some aren't. As Maestro highlightes common free hours with bright colors, color shade of the partially scheduled time frame can change as the percentage of the free space within the time frame changes. The shade can get lighter as the free time increases and viceversa, e.g. 90% and 80% free hours will be shown with a light green and a darker green, respectively. By higlighting these alternative hours, members can negotiate with occupied members

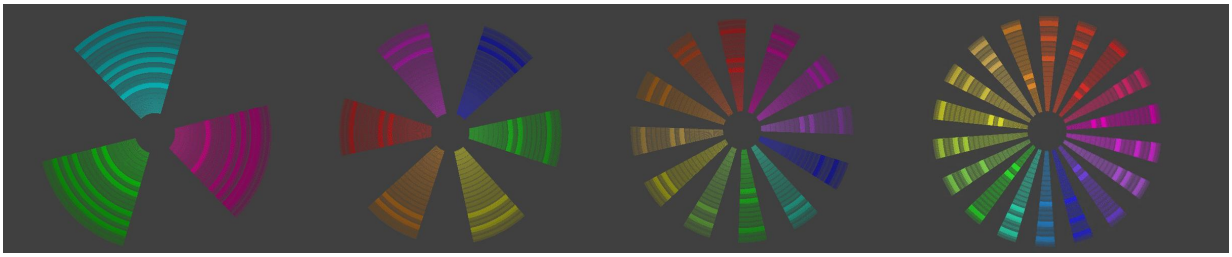


Figure 9. Color Palettes for various numbers of users

about arranging their schedules for a meeting. By letting users define their priorities in their schedules and therefore including an importance coefficient into the program, members may assign importance levels to their activities.

The target was to accomplish all three activities of a user while using a calendar, i.e. the implementation of a "glance-look-interactive" [9] approach. After users attain a sense of the density of a week at a glance in the public display mode, they can look up the details of their program by choosing the day from the menu in the Interactive mode. Users can also use the common free time feature to see the group's availability status at this particular day.

A reminder option to alert some activities, the switching mode between users and ubiquitous access may be added as part of future work. The animations within the application can also be improved, as well as added on to, for extended interaction and visualization capability.

Like "Many Eyes"[10], a web site that offers visualization services to users, which enables visualization of uploaded datasets, Maestro may be published as a plug-in to calendar applications, for visualizing uploaded schedules.

Lastly, there is a design question left: "May this visualization technique be applied to different multidimensional datasets?" This is the point where future work on Maestro will be based on.

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