Not all Days are Equal: Investigating the Meaning in the Digital Calendar

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CHI'15, April 18–23, 2015, Seoul, Republic of Korea.

dx.doi.org/10.1145/2702613.2732512

Abstract
The electronic calendar is a common tool used by large numbers of people to reflect and shape their daily activities. It's function and structure is rooted in legacy representations dating back thousands of years. Collaborating with designers and engineers our project seeks to re-consider what the calendar does for us and how we may perceive and represent our time, personally and collectively.

This paper investigates the background to *'the calendar problem'* and documents design-led research. Seeking to identify some of the key problems with the current representation and to establish criteria for new interpretations of the meaning of calendar.

Author Keywords
HCI, design, time, user interface,Experience; places; time; calendars; temporality; events; design; user experience; usability; making.

ACM Classification Keywords
H.5.m. [Information Interfaces and Presentation (e.g. HCI)]: Miscellaneous

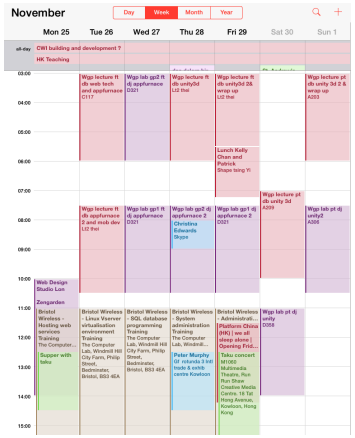

Figure 1: Typical digital calendar interface: Apple iOS

Introduction

The proprioceptive nature of the calendar and the cycle of the seasons and years is fundamental to our view of the world. Intertwined with this cyclic view is the lived, phenomenological experience of time, as described by Bergson et al. Underinned by the socio-economic value propositions of time as discussed by Marx, Smith and Booth. The traditional grid calendar can be seen to enforce industrial and commercial assumptions on both the representation of time and our perception of time (see figure 1). These assumptions, or affirmations, make the ongoing usage of the traditional metaphor inherently calendar-orientated rather than user-orientated.

The introduction of the vCal and the iCalendar format [15] and the interoperability and portability of data these standards enable has increased the reliability, uptake and usage of electronic calendars. Despite the increasing sophistication of the users and usage of digital calendars the layout, functionality and usability appears little changed from traditional paper and print calendars of 18th and 19th C. The near seamless interoperability of the underlying data between standards and platforms, such as calDAV [14] and iCalendar [15] appears to contrast with designs where some extreme skeuomorphic examples even mimic the stitched, leather bound volumes and wrapped page edges of their historical forebears. [24] Our aim is that our design led research and the design ideas generated contribute to the growing discussion on the representation of time in HCI and interaction design.

Process and Method

We set out to investigate the assumptions and conventions the calendar metaphor brings to our perceptions and representations of time. Through research and user interviews we generated criteria to guide a making process. Through the subsequent process we aimed to find some provocative alternative visualisations that would help reconsider the subtle personal, shared, economic and perceptual cues that are embodied in a calendars structure.

We employed a 'diffractional' reading and research approach, as popularised by Barad and van der Tuin [26] as a way of coping with epistemological problems of representation. We found this approach particularly useful in our specific case where we explicitly avoid attempting to solve all aspects of what could be considered a *wicked problem*. Attributed to Rittel and Webber, *'wicked problem'* [22] was a description of seemingly intractable problems within their field of social planning. Much has been written of how wicked problems may also occur within design [17] and the field of Human Computer Interaction. [27] In this instance we find a challenge containing the multi-layered problems of language, politics, perception, representation and cultural-historical aspects with no specific straight line to a single 'efficient' solution. [18]

We used a combination of user interviews, design workshops, physical making and fast prototyping in the project to investigate traditional calendar designs. Analysing their meaning and use and and imagining critical design provocations. We present a variety of ways in which our perceptions and representations of time, in a calendar context, may be re-imagined and consider new ways of thinking about planning and recording personal activities.

Calendar structure and time perception :

Time Series Data

In daily use the visual calendar metaphor and its implicit structuring of time appears to create a number of interesting collisions between different types of lived time. The calendar simultaneously represents the personal and the public, work and home, value and scarcity and mechanical and experiential time. The digital calendar in its common form creates a mechanical grid of equidistant hours, days, weeks, months and years, divided into convenient slots or spaces into which to insert pre-booked activity. On initial evaluation this appears at odds with the lived time it represents.

Calendar representation of time is rigid in its measure and in its quantity. A user can view a block of 24 hours, starting at 00:00 and ending at 23:59. He or she can view 7 days, starting on Monday or (optionally) on Sunday. A user can view a grid of 5 rows of seven days, commonly starting only with the first week of the month or they can see a sometimes overwhelming array of 12 blocks of 5 rows of seven days. Beyond these standard options this is commonly the limit on the flexibility of digital calendar visualisations.

When compared to other time series data visualisation tools and methods, such as the wide rage of approaches described by Aigner [3], the standard viewing arrangements for calendar based time-series data appear inflexible. As a metaphor for representation of the personal in a work or shared timespace environment it appears particularly rigid or gives less contextual information when compared to other data visualisation scenarios.

Spatial bias in time perception

The common calendar structure shows days of the week laid left to right with time processing from left to right in all areas. In the week view and month view this left to right metaphor is generally reinforced. From a linguistic perspective this could be considered particuarly euro-centric. As the work of Chen and Boroditsky [8] [12] has uncovered, native language structuring influences most notably the comprehension but also the mental spatial structuring of time. Bonato et al 2012 working in a similar field investigating the influence of subconscious spatialisation and visualisation of time found evidence to support this idea. Saying that; "Humans represent the subjective time flow on a spatially oriented mental time line that is accessed through spatial attention mechanisms" [6]

The economics of time

Many kinds of time are represented in calendar usage. Literature reveals time as an area of potential mystery and disagreement in almost every avenue of research. Leaving the A series vs B series argument of McTaggart (1908)[21] to one side and working from the 'B' perceptual basis of time as an actuality, reveals numerous other interpretations of *'time'* to consider. Though not exhaustive by any means the ideas influencing our investigation ranged from the concepts of life as duration from the phenomenology of Bergson to the attention based expansion and contractions of time from neurophysiological time-perception studies and the socio-economics of time. The economics of time is large area of study with several prominent works discussing time. Such as Smith's view of the Labour Theory of Value (LTV) and Marx's "Time of production" "Time of circulation: and "Organic time" [25] In his 2013 book Tombazos analyses the three volumes of Marx's *'Capital'*

and goes so far as to pose the idea of *economic capital* as a specific form of organising *social time*.

As Booth says in his extensive analysis of the political economies of time. "Time is thus analyzed as one of the goods over which a person disposes" underlying the repeating theme of the *value* of time. He goes further and adds that "The freedom of time is accordingly understood as its non-coercive transfer from one person to another"[7]

Time, as the old adage goes, *is money*. The calendar in this situation can be seen as both purchase order and invoice for the transactional economics underlying that well known statement.

Classifying time use
When classifying time-types the work in the area of time-use studies is particularly relevant. The time use classification series first proposed by Dagfin Aas in 1982 [2] and subsequently used by the New Zealand Statistical survey [19] is useful in our case and defines used time in the following ways;

- Contracted time
- Committed time,
- Necessary time
- Free time

As is becoming clear, calendar recorded time events may have multiple meanings and reference multiple *'time types'*. It must be noted that all these uses of time are recorded in almost identical ways. Leaving the nuance of or the explicit usage of time indicated to be inferred from the surrounding contextual data, if it is available.

Body time
The calendar, at its core, is a micro-scale map of the rhythms of the solar system we see from where we stand on planet Earth. The oldest roots of the calendar and the notion of recording past and future events are based upon, and measured against, our experiential observations of our world around us. Ancient earthworks works such as StoneHenge in Salisbury Plain, UK through to systems such as the Mayan Haab dating from 5th Century pre-Columbian Mesoamerica (Bricker 1982)[9] all reflect our solar precession.

The experimental psychological work of Berkovich-Ohana, Goldstein et al (2013) [5] investigating altered states of consciousness indicates clearly the correlations between a phenomenological sense of time and body in a variety of test subjects. "Hence, we hypothesized that an altered sense of time and space would be related to an altered sense of body ... A possible candidate mediating this connection is the insula, related to both proprioception and the sense of time" [5] In this context the notion of calendar carries within it the pattern of forces that have shaped our bodies and our sense of time and of self.

This proprioceptive experience of time, situated in the circadian and in evolutions response to our particular developmental location, 150 million km from the nearest star, roots us directly in the phenomenology of time. An area that Husserl described as the most important and difficult of all phenomenological problems [20]. Whilst the calendar is immutably based upon our immediately local physical conditions, 24 hour diurnal cycle, 365 diurnal cycles to an orbit of our home planet the visual calendar appears so abstract as to reflect little of this.

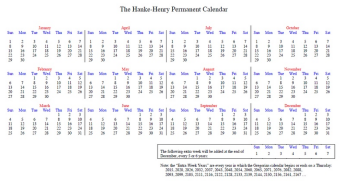

Figure 2: Hanke Henry Permanent Calendar

Calendar structure
Historically there have been many attempts to reform the traditional Gregorian Calendar. This calendar model structures time series data into 12 months, with mixes of 28-31 days each, encompassing 52 weeks of 7 days each. This model necessitates the inclusion of an occasional leap year as a corrective measure to bring the year length back into line compared with the solar mean.

The International Fixed Calendar or Cotsworth plan is a solar calendar designed in 1902.[13] It records a year of 13 months each containing 28 days, with one or two days a year belonging to no week or month. It is a perennial calendar, where every date is always fixed on the same weekday. Whilst it was never officially adopted in any country it was the official calendar of the Eastman Kodak Company from 1928 to 1989. [23] The Hanke-Henry Permanent Calendar was a proposal that aimed to reform the current Gregorian Calendar by making every year identical (see figure 2). In it every date always falls on the same day of the week.

Additionally there have been approaches to normalize the shifting cyclic nature of date and days in the Gregorian calendar by normalization and standardisation. Other approaches such as internet time and the briefly popular SwatchBeat universal time, [1] launched in 1998 seek to define a universal clock time for calendar. This approach of a universal time use also alleviates, to some extent, the problems encountered when one moves the calendar model into a world context with time-zones.

Alternative calendar structures
The calendar metaphor deals primarily with duration. Every event has a length and every experience recorded in the calendars description of the past or the future also had a person, a place and a temporality to it. This parallel is at the heart of the modern nature of Calendar, that it records the personal, that it implicitly relates to the experience of time whilst translating that into its own abstracted model of mechanical time divisions. From a philosophical perspective all is calendar, from the seasons to the diurnal, all is a representation of the experience of duration. Onto this lived record of possible past and possible future an abstract grid is applied.

In some sense the calendar could be considered a representation of B Series time, where every moment 'is', existing continually and always happening. With our relationship to it - removed as we are from the structure of the calendar and divorced by its mechanistic impossibility - forced into a position of an A series view, of future, present and past. Trapped outside an impossible abstraction watching events pass us by. Our experience is forward only and conflicts with the calendar, as it changes reality, as recorded events change from unreal future to real present to unreal past, just as Augustine of Hippo wrestled with.

A making experiment: It did not have to be like this:

Issues we identified with current calendar implementations are considered in both practical terms of current ideas in the visualisation of time series data [3] but also in terms of the implicit meaning of the structures underpinning data and types of representation. The research through design approach utilised in the project is rooted in the same arena of critical design popularised by Dunne and Raby [16] and evaluated as an effective design approach by many commentators and discussed at length by Bardzell and Bardzell (2013) [4] and others. Following our research into the key problems identified with the usability and data representation in common calendar interfaces we

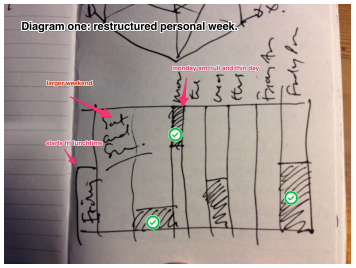

Figure 3: Initial sketches showing personal perspective on time allocation on a day basis
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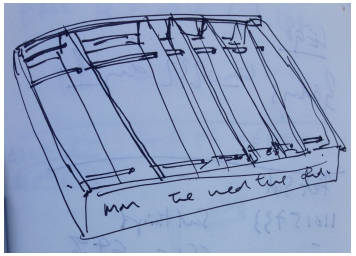

Figure 4: Sketch expansions of variable time allocation mechanism
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approached a free making phase, generating guidelines for design collaborators and co-investigators.

Making Brief to collaborators:
At its core a calendar is Time-Series Data. Inside it the perception of time and the metaphors used to represent it impose or reinforce societal and cultural norms. Affirming what is and is not time and how our ideas of time are structured. The Calendar metaphor contains a number of elements that could be considered problematic or limiting. Especially in how it's structure represents time and subsequently forces us to consider time.

The Calendar model of time is infinite and lived time is not. As noted in our previous work [11] [10] this arguably becomes a case of A series representation vs B series experience. Each moment recorded in a calendar always is - with no past, present or future. Our view onto the calendar translates these tense-less moments from a perspective of directional movement through B series existence. Against this background how can we design mechanisms that enforce or illustrate the experience of B Series time and represent scarcity in calendars and interact and represent more fully the lived experience of time?

We distilled commonly discussed problems that we encountered. We found that the Calendar often does not;

- Show resource (time) limits on allocation
- Present a human/proprioceptive cycle of time
- Present season or climate restrictions
- Differentiate work vs personal division of time
- Indicate financial or resource value of time
- Indicate geospatial issues in event allocation
- Allow alternative working structures and patterns, providing alternatives to what Dunne and Raby refer to as an 'affirmative' design.[16]

From this analysis a set of priorities or key specification criteria were created and collaborators were requested to choose one of the criteria/ requirements and to develop a new or novel calendar intervention. The design or intervention they were asked to come up with needed only to address a single criteria and could be in any media or any form.

Design a calendar to;

- See any time period/range in any combination
- See any duration/event by any search criteria
- See priorities and tasks
- Prevent inappropriate or over booking of time
- Indicate geospatial issues between duration events
- Reflect proprioceptic (human physical) experience
- Differentiate between industrial and personal time availability
- Differentiate between monetary and personal value

The shorter specification/provocations were prepared and shared among a range of collaborators that included artists, interaction designers, product designers, software engineers and visual designers. Many of the design exercises started in workshop style discussion and quickly progressed to iterations of drawing and physical making.

Investigations: The design projects

A range of design interventions were developed during the second phase of this project. Each dealing with different aspects of the problem and requirement list and seeking a critical insight into the wicked problem presented by the calendar.

Figure 5: Physical making to illustrate variable time allocation on day basis

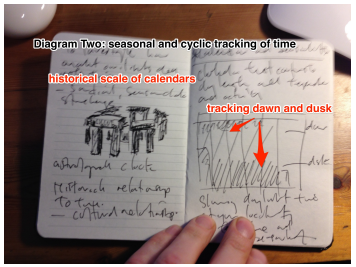

Figure 6: Sketch examples tracking dusk and dawn, proprioceptive data ©Daniel Buzzo

Investigation One: Drawing out the shape of a week
Gives examples of proposed and lived alternative shapes to the calendar against the narrative description of a week.

A simple workshop exercise began the first of the design interventions. Beginning with the development of a narrative of an individual lived week. We then considered how the values and balances expressed between differing types of time implied in the narrative could be displayed within an existing calendar paradigm. (see figure 3)

We investigated the value structure of the personal week, with discussion of the relative merit, accessibility and utility of different days. In a western European context personal time, i.e. commonly Saturday and Sunday, were considered of more intrinsic personal value than that of weekdays (Monday-Friday).

In initial design sketches Friday afternoon was reclassified to be part of the weekend and Monday morning removed from the calendar altogether. The justification being that from a work and productivity perspective Monday morning was always allocated to other tasks and as such was not a time that additional events could or should be scheduled into. The remainder of Monday was considered to be the smallest part of the week perceptually. Represented by being the thinnest in area compared with other days and forming an area less than a quarter of Saturday and Sunday - these days now combined and re-designated 'the weekend', with Friday morning close behind. (see figure 4)

Reflecting on this simple visualisation of the experience nature of time led to a series of physical making exercises as exploratory steps toward practical interactive solutions. (see figure 5)

Further investigation and iterative design work on this individual project considered the historical nature of calendars in a macro context with the cyclic nature of the seasons and dawn and dusk. These natural environmental factors being acknowledged to be of significant influence on the structure of personal experiential and commercial time. Consideration was given to indication of daylight, based upon location as was the problem of the cyclic changes created by the passing of seasons and their influence on perceptions and usage of time. (see figure 6)

Annual cyclic events entered into the calendar were proposed to have the ability to warp and change the structure of days or weeks. Such as recurring personal or family birthdays influencing time before and after the identified event. Changes in the availability and kind of activity that are suitable for different seasons. E.g. refraining from starting new projects in December or before summer vacations in July. Researching purchases in March before the (UK based) financially year end in April etc.

Investigations were made into giving events both a distorting weighting that would warp the fabric of the calendar but also a taste' or flavour' that would influence the activities that were suitable for different calendar seasons. When approaching travel and collaborative working, with events involving other people, the issue of locality and timezone became highly visible.

Investigation two: The calendar as 3D topography
We considered the additional dimensions of information implicit in the kind of calendar designs we were proposing. The requirement to add additional dimensionality in our time series data prompted investigations of three dimensional representations of basic combined calendar data.

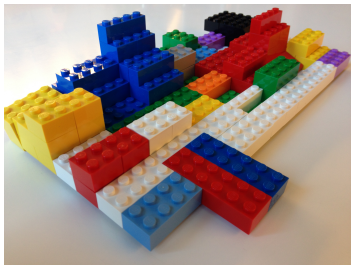

Figure 7: Physical making investigations of 3D time series data

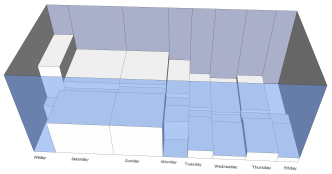

Figure 8: 3D calendar data visualisation

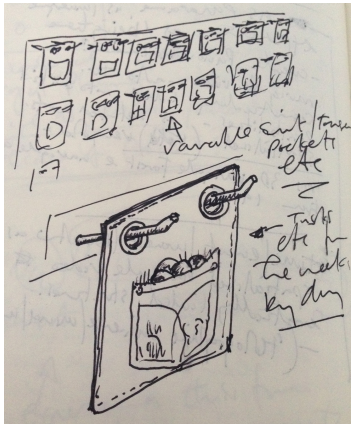

Figure 9: Pocket calendar early sketches ©Daniel Buzzo

Allowing additional value to be placed upon slots, days and time through a calendar cycle, be it day, week, month or year allowed representation of complex relationships between differing types and needs of time.

In this instance it was a specific investigation of activity. With work and task allocation 'effort' tracked in a z axis, with x and y representing a grid of days and hours. This gave an immediately comprehensible view of the activity, 'busyness' or work throughout a time span. Early designs focused on the standard week by week work allocation. (see figure 7)

The X (height) value afforded to individual blocks of time or days indicated additional dynamic value on a day by day basis. Friday afternoon evening being the literal and metaphorical high point of the week with Wednesday being the opposing low point.

Physical prototypes moved into 3d visualisations and then interactive prototypes in the Unity3D environment. Data from the iCalendar format was parsed via JavaScript to JSON format and incorporated into the Unity3d development environment.(see figure 8)Placement of events in the week occurs via a variety of mechanisms. Experimental methods of generating events, particularly meetings, are arranged by representing the meeting as a sphere of various types and materials (dependent upon the value, type and importance of the meeting). These are dropped or fired onto the terrain of the week with simulated gravity and elastic collision. The *'meeting sphere'* then finds its own suitable location driven by simulated physics forces in the calendar model (gravity, elastic collision and friction).

In initial testing it was discovered that in the majority of cases meetings rolled downhill to Wednesday lunchtime.

Intervention three: The trouser pocket calendar
The trouser pocket calendar is a physical proposal that tracks activity type and available resource matched to task;

Rear pockets from trousers of different types are hung onto a 7 day calendar grid. Differing designs and materials of the garment segments indicating the 'kind' of day to be anticipated. Formal, athletic, summer, winter etc. Tokens representing tasks and task amounts are placed into the pockets of each day/garment. (see figure 9) There are a fixed number of tokens available each week, corresponding to the anticipated time/emotional resource available.

This tracks and reflects the type of activities one may be undertaking and allows an estimate of how much work can be done in a week. The simple metaphor illustrates the formal/informal activity orientated rhythm of the week and imposes finite resource limits on a rolling weekly basis.

Calendar as indicator of cost
When viewing a calendar as a tabulation of work and cost, when engaging in the exchange of time as value *not all days are equal*. Requesting my expertise to design or problem solve on a Tuesday afternoon is an easier exchange for me than the same task requested on a Sunday evening. The standard calendar, however makes no distinction and give no indication to the potential client that I value my days as anything other than equal. Hence they appear surprised at my reluctance to discuss the problems with their website on a Sunday afternoon while having dinner with my family. Living like that:the view of a colleague's calendar thing all scrunched up letting you know it is not a good time to call,

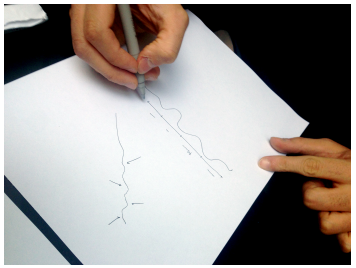

Figure 10: Early sketches of an intertwined calendar.

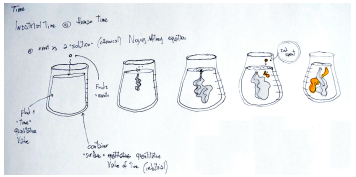

Figure 11: Industrial vs human time. An illustration of contained intertwined event visualisation. ©Nicolo Merendino

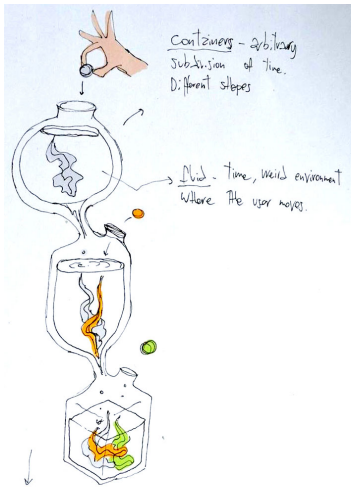

Figure 12: Week by Week intertwined events ©Nicolo Merendino

The intertwined timelines
Working with industrial designer Nicolo Merendino from STEIM, a series of visualisations based on ideas of intertwined interpersonal events were created.

Stemming from descriptions of the relationship with the designer's family members, the metaphor of intertwined timelines was extended into practical treatments for an intertwined calendar. Through iterative ideation an investigation into possible treatments for synchronising and relating differing tasks was drawn up. (see figure **??**) The calendar was visualised as a series of pools, tubes, jars and receptacles into which 'events' could be inserted.(see figure 11) These events were suspended and enabled to grown through fluids of different viscosity. The fluid in the vessels representing available time. Events encountered temporal requirements of other participants and intertwined, creating areas of separation and of confluence as arranged by the participants. (see figure 12)

Further development

Our project has combined wide ranging enquiry and crafting design together to consider how we represent and are influenced by representations of time. We discovered how the representation and measurement of time changes our perception and subsequent experience of calendar based time. We have used the personal as an entry point into playing with the experience of time recording and organisation in the digital realm.

Many things we live with every day are lingering paradigms that have ceased to make sense. The issues of moving beyond historical metaphors are seen in many contexts; the qwerty keyboard, the equirectangular map. These representations are often the hangovers of a mechanical age and older societal metaphors and concepts. As has been seen in the slow change in digital scheduling representations, we carry the old into the new, often with out question.

The making criteria developed in the research phase of the project can be seen as solid grounds for future investigation into the area of representations of time. Not only limited to specific calendar contexts but more widely applicable in any lived scenario. We argue that as users become more data literate possibilities for new directions are available.

We believe that not all days are equal and propose that the evenly spaced digital calendar is ready for change.

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Commentary

For alt.chi paper
Not all Days are Equal: Investigating the Meaning in the Digital Calendar

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It is the ordinary things that have the most power over us. The calendar, for example, has been shaped by religious, economic, political, and social factors. Particular world views became inscribed. Consequently, the calendar may be far less innocent than expected. In fact, it is a representation of real interests and forces; it is hegemonial. Let me add some own thoughts to Daniel and Nicolo's excellent paper.

Obviously, calling the "free" days of a week the "weekend" supports the mindset of a protestant work ethic (Max Weber) – the ideal of hard labor topped by a little leisure. It sustains the notion of "saving the best for last" (called "negative time preference" by economists), the virtuous and rational human ability to be future-orientated, to delay immediate gratification, to save and to plan. However, these "qualities" turn us into the ideal cog in the wheel of an ever-accelerating, resource-depleting economic system, which has long lost its purpose of increasing the well-being of people. And while I believe that self-regulation is important, a meaningful balance between living in the "here and now", i.e., savoring the moment, and planning for the future seems the healthier to me. So let's start the week with some free days, indulge, and when it gets boring, we work a little to pass time. Friday afternoon can become the new beginning of the week, instead of the dreaded Monday. Remember, a post-growth economic will require us to work less, not more. Another puzzling feature of calendars is the lack of a representation of free, personal time. Currently, it is just "unused", undedicated time. The implication is clear. If a calendar is full, one is a busy, hard-working person, if the calendar is empty, one is not. An empty calendar is a luxury; a full calendar a necessity. There are feelings of guilt, and rejection ("I am not needed") attached to an empty calendar. About 15 years ago, I had a serious disagreement with my boss. Suddenly, I had an empty calendar in a department, where everybody else was working their asses off (pardon my French). The empty calendar is a symbol of insignificance. This is at odds with what people really need –time for themselves, their families, friends, personal projects. "Time affluence" is not only a potential road to more happiness. It's also a road to solving pressing ecological problems. So let's start filling our "work" calendars with free time. Finally, the calendar, especially when used with reminders, implies a punctuality, which doesn't fit the nature of many events. Many events do not require a definite time slot, but still need time allocated. There is no need to call your mother every Sunday on 11 a.m. sharp to chat. There may be better times; there may be more need to talk on other days, yet it should be done sometime. Many people are aware of this and do not enter "time opportune" events into their calendars. Through this, a fixed event will always have priority, even if it is actually less important, just because it is in the calendar. We all know the problem of "procrastination" and I believe this to be in part a matter of how our calendars are structured. Our *ReMind* project (Laschke et al., 2013, Overcoming Procrastination with ReMind. Proc DPPI, 77-85) successfully provides a different representation of tasks and time, in the spirit of Daniel and Nicolo's present work.

Calendars are powerful in shaping how we experience and make use of time. This in turn is crucial for our individual wellbeing as well as the environment. Let's make new calendars to critically reflect our practices of time use and to explore alternatives.

Commentary

For alt.chi paper
Not all Days are Equal: Investigating The Meaning In The Digital Calendar

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I really enjoyed reading this paper. It touches upon an interesting issue, which we all deal with in our daily lives: perception and representation of digital calendars. The paper is very well written, motivating and definitely thought provoking. I specifically liked the introduction and description of issues with current digital calendar. I think that the first half of the paper was much stronger. In the later half of the paper, the design objectives and description of design was not always clear. There were also issues around captions, and legend, which were minimal and not so informative. However, there were discussions and representations of many interesting ideas.

I would have liked to see more discussion about increasing contextual information. I do believe one of the shortcomings of existing digital calendars is saving tentative tasks/plans by users. Those saved information rarely get updated and remain in the calendar. Therefore, calendar often dose not represent the "truth" when looking at the past activities. On the other hand, it takes a lot of time and effort for the user to update past activities. Thus contextual information can help a user to relate the facts better and make a better judgment. The idea of representing day time, seasons, geospatial, work/personal time, and other contextual information, can be very useful indications. I am really interested in more discussions about this topic.

I expected more emphasis on A and B time series. One issue with A series is that the past tasks belong to past and digital calendars currently treat past data as past time. To clarify my point further, when you edit a series of events, you have the option of applying the update to the future events but not the past events (or let say just only the only the one happened last week). Another interesting topic to further explore is search function.

There are many interesting points about how we should think of redesigning the digital calendar, which has not been discussed later. I believe this paper will provoke many interesting discussions around the issue and I am very interested to see other possible design proposals.

Commentary

For alt.chi paper
Not all Days are Equal: investigating the meaning in the digital calendar

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Not all Days are equal examines "the calendar problem" from a design-led research perspective. Its goal is to use a research-through-design approach to identify key problems with current calendar representations and establish criteria for new interpretations of their meaning.

This paper strongly places the problem in the context of the more than thousand year history of the traditional calendar and how it enforces industrial and commercial assumptions of perceiving and representing time.

The main thesis put forth by the authors is that digital calendars have yet to conceptualize time in ways different than existing paper calendars. The traditional calendar, in its paper and digital forms is perceived as rigid, euro-centric, mechanical and lacking contextual information. The authors believe that digital calendars have a unique opportunity to address these challenges.

This problem is analogous to how the first step in developing new computing applications has traditionally been to recreate an analog predecessor rather than create new solutions for the new medium. The authors believe that digital calendars have remained stuck in this first step.

In a series of design experiments, the authors present novel and interesting ideas on time-representation, although it is unclear the extent to which these ideas emerged before, during or after the experiments.

One of the most interesting ideas involves acknowledging the effect of recurring cyclic events. For example, in preparation for a birthday, an individual might spend days finding presents, coordinating guests and other logistics. After the event, he or she might be equally occupied organizing the pictures taken or attending the tasks that were neglected because of the event preparation. In this way, both the time before and after a given event is affected by it. The authors suggest that these events do not have clear-cut boundaries as the traditional calendar suggests.

Curiously, the first design exercise asks participants to design around the notion of *the week*, which seems to validate a fundamental concept from the traditional calendar, rather than replacing it. The rest of the exercises lack enough detail to be as informative as the introduction and motivation.

Future work could determine what other units can be used to represent time instead of earthly or solar revolutions. Similarly, the notion of a calendar as a whole could be a "lingering paradigm" just like the ones the authors wish to re-invent. If so, rather than re-representing it, we should consider replacing it completely. Otherwise, a new definition of a "calendar" should be provided to explain what one is or should be.

It is exciting to see the authors are considering this when they state their work is "Not only limited to specific calendar contexts but more widely applicable in any lived scenarios". Overall, this is a refreshing first step in re-evaluating the representation of time in Human-Computer Interaction.