

# Time Bracketing

## An Interactive Photographic Approach to Time-As-Space

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### ABSTRACT

*Time Bracketing* is a novel technique to photographically depict a time-varying space or object in a single image without spatial distortion or fragmentation. The approach attempts to strike a balance between procedural generation and manual composition as well as between faithful depiction and digital manipulation. It also enables the clear representation of both dynamic and static scene elements. As a result, Time Bracketing puts the *subject*, rather than the technique, in the center of its artistic creation. This paper introduces the method, presents a custom-built authoring software for the creation of Time Bracketing images, and shows and architectural studies using the described technique and software.

### Categories and Subject Descriptors

J.5 [Computer Applications]: Arts and Humanities; H.5.2 [Information Interfaces and Presentation]: User Interfaces

### General Terms

Time-based photography

### Keywords

Time Bracketing, time-as-space, slit-scan, architecture, authoring software

## 1. INTRODUCTION AND RELATED WORK

Various techniques have been employed to represent the passing of time in media. The introduction of film posited a verisimilar relationship between actual time and represented time, as well as between actual space and represented space. However, this relationship has not been always preserved. Time-lapse photography — distorting the one-to-one linearity of time — has been employed since the beginning of film in the late 19th century. Advances in film technique, and in



Figure 1: Related Work: time-as-space in sculpture: Renato Bertelli's "Head of Mussolini" (1933); Evan Penny's "L. Faux: Tri-X" (2001).

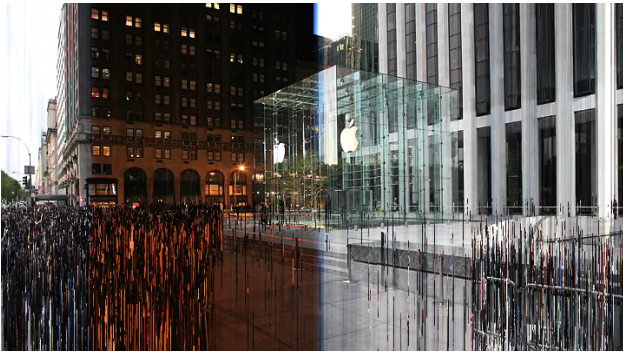


Figure 2: Related Work: Slit-scan photography as a short-span time-as-space representation distorting moving elements while keeping static elements intact.

particular the advent of digital video, has introduced a number of other time-to-time distortions, such as slow-motion, time-strobing, and time-warping.

The relationship between time and space in art has indubitably not been heralded solely by the invention of the moving image. Time and space, as well as the notion of verisimilitude along and between these dimensions, have been explored widely in the art and theory of the 20th and 21st century, in painting (for example, by the Surrealists), illustration, and sculpture (Figure 1).

In the early 20th century, slit-scan techniques have been used — for example by Lartigue — to span time-as-space in photography [1]. In static photographs, this technique results in a progression, usually of a short period of time on the scale of a few seconds, from one side of the image to the



**Figure 3: Related Work: A 24-hour linear time-as-space study of a building and plaza. The long time span results in large unchanged areas, while dynamic elements are fragmented and illegible.**

other, creating a distortion of moving subjects while leaving static subjects unchanged (e.g. [4]). In film, this distortion is maintained over time, with essentially the same effect [6]. Figure 2 shows the effect of slit-scan photography on video footage of moving subjects against a static background.

Digital imaging and manipulation technology ushered in more flexible representations of time-as-space. In 1994, Elliott presented a “Video Streamer” which displays video as three dimensional blocks of images flowing away from the viewer in distance and in time [3]. Since then, and with increasing frequency, new media artists have explored the digital depiction of time-as-space in static, dynamic, and interactive settings [5]. Most recently, Cassinelli displayed an interactive, dynamic, and tangible time-as-space application called “Khronos Projector” [2].

## 2. MOTIVATION

Most time-as-space applications are procedural in nature, insofar as they follow a strict mapping between time and space. Short-span mappings, such as those employed by traditional slit-scan photography usually contrast dynamic with static subjects leading to an intentional distortion of moving scene elements. Longer-term time-as-space studies usually focus on static subjects, as commanded by the temporal and spatial resolution of the study, rendering dynamic elements illegible (see for example, Figure 3). Additionally, the long exposure time, the procedural mapping from time to space, and the necessary choice of a static subject results often in seemingly unchanging areas of the image.

In either case, the *manipulation* — be it distortion or fragmentation — and not the *subject* is at the conceptual stage-front of the artwork.

*Time Bracketing* attempts to restore the centrality of the scene’s subject to the realm of time-as-space photography, by presenting the artist with tools to create a seamless study of the changing scene. This results in unique time-as-space photographs which allow for the simultaneous faithful depiction of both dynamic and static elements, while retaining a natural seeming, yet physically impossible representation of the study subject.

The name “Time Bracketing” is a play on the more common term *exposure bracketing*, which uses a number of different photographs of the same subject from the same point-of-view to render a high dynamic-range image of that subject. In that vein, Time Bracketing is a photographic method to render high temporal-range images of a single subject.

## 3. TECHNIQUE

Time Bracketing studies time-as-space by combining a set of images of a subject taken from the same or similar vantage point into a single image. Each image that is incorporated into the composition covers an arbitrarily-sized and arbitrarily-oriented trapezoid-shaped slice of the final photograph. In addition, each image slice is gradually transitioned to neighboring image slices by using cross-dissolving superimposition.

Importantly, the number of images, the choice of images, the size and orientation of slices extracted from each image, as well as the length and direction of transition between the images is not procedural, but instead left to the artist’s decision based on the subject and illumination at hand.

By using arbitrarily large segments the artist can choose to incorporate dynamic elements into the composition, while at the same time using small slices to span a long time period over a short spatial area. By manually extending the spatial transition, the photograph can combine temporally and color distinct image slices seamlessly. By varying the orientation of each segment, the artist can adapt the time-as-space mapping to the particular object, disguising the transition in the subject’s own geometry.

The result (and artistic intention) of Time Bracketing is to create the initial impression of an innocuous photograph of a natural scene, allowing for a secondary, and hopefully surprising, exploration of the temporal progression, thus focusing first on the image subject, and only then on the technique.

## 4. SOFTWARE

Time Bracketing is made possible with a novel authoring software written specifically for this application (Figure 4). The software application was written in *Objective-C* using Apple Computer’s *Cocoa* Framework, and *Core Image* Framework.

The software enables the artist to load images into a common bin, and — using a sub-pixel resolution viewer — align these images for seamless compositing. The artist can then choose the image slices with cross-dissolve transitions of arbitrary size and orientation, resulting in trapezoid-shaped slices as discussed above. The transition regions and their shape can then be interactively adjusted, with real-time preview allowing the artist to fine-tune the resulting composite. Composites can then be exported in preview or production resolution for further processing or print.

## 5. TIME BRACKETING STUDIES

The technique described herein is of particular interest to architectural study, which is often concerned with the passage of light across a certain building, structure, or space. The

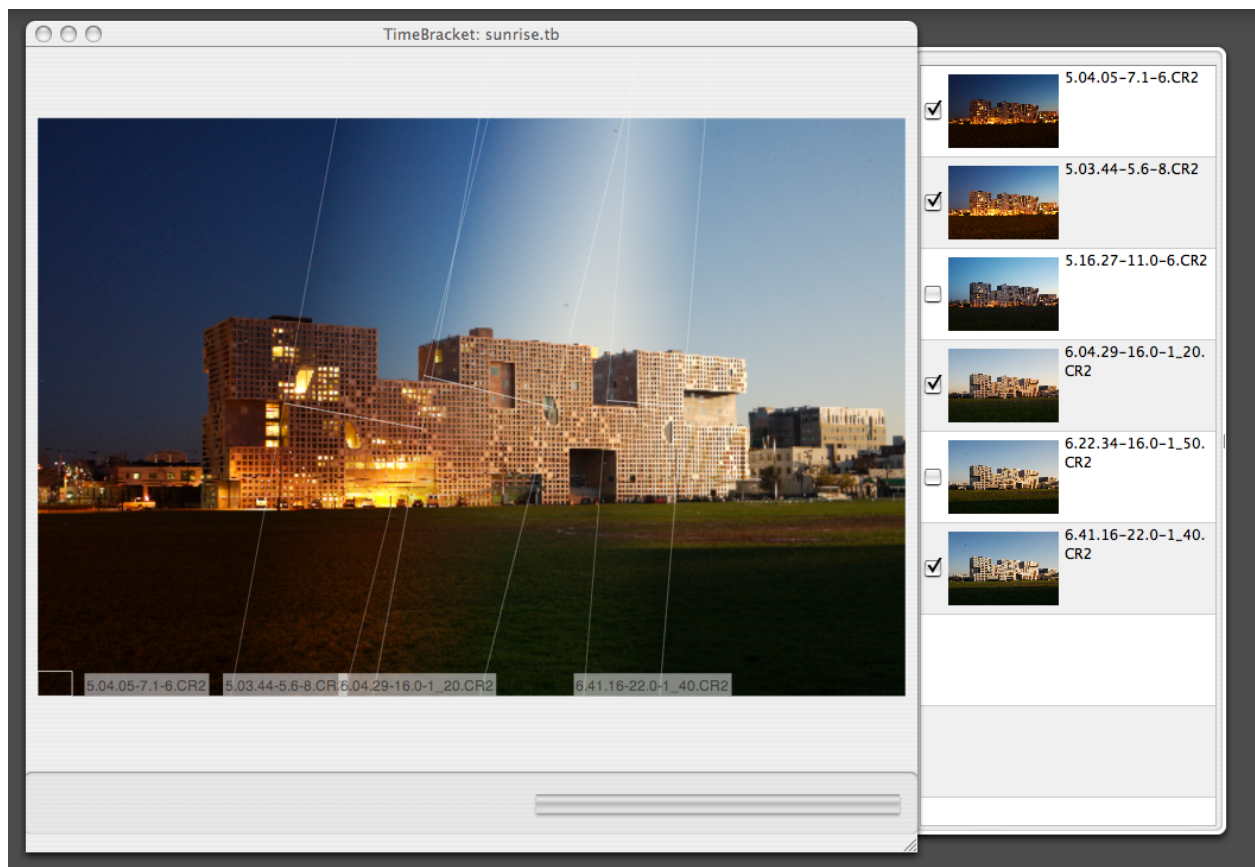


Figure 4: Screenshot of the Time Bracketing authoring software.



Figure 5: Exterior Time Bracketing Study.

submission to the exhibit is a series of Time Bracketing composites of day- and night-illumination of several buildings and interior spaces. Employing shorter time scales, Time Bracketing has also been used successfully in portrait photography (not presented in this work).

Figures 5, 6, 7 present exterior Time Bracketing studies of architectural scenes, while Figure 8 shows an interior Time Bracketing composite.

## 6. CONCLUSION

After a long string of strictly procedural methods representing time-as-space, Time Bracketing offers a new vision of



Figure 6: Exterior Time Bracketing Study.

digital time-as-space technique balancing the subject opposite the technology, and the artist's input opposite the digital tool. The result of this approach is a natural-seeming photographic composite spanning strikingly unnatural periods of time in a single image, allowing for exploration of time, light, and space.

## 7. ACKNOWLEDGMENTS

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**Figure 7: Exterior Time Bracketing Study.**



**Figure 8: Interior Time Bracketing Study.**

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