

5-2001

EROS: Exploring Sensory Perception and Environmental Rhythms

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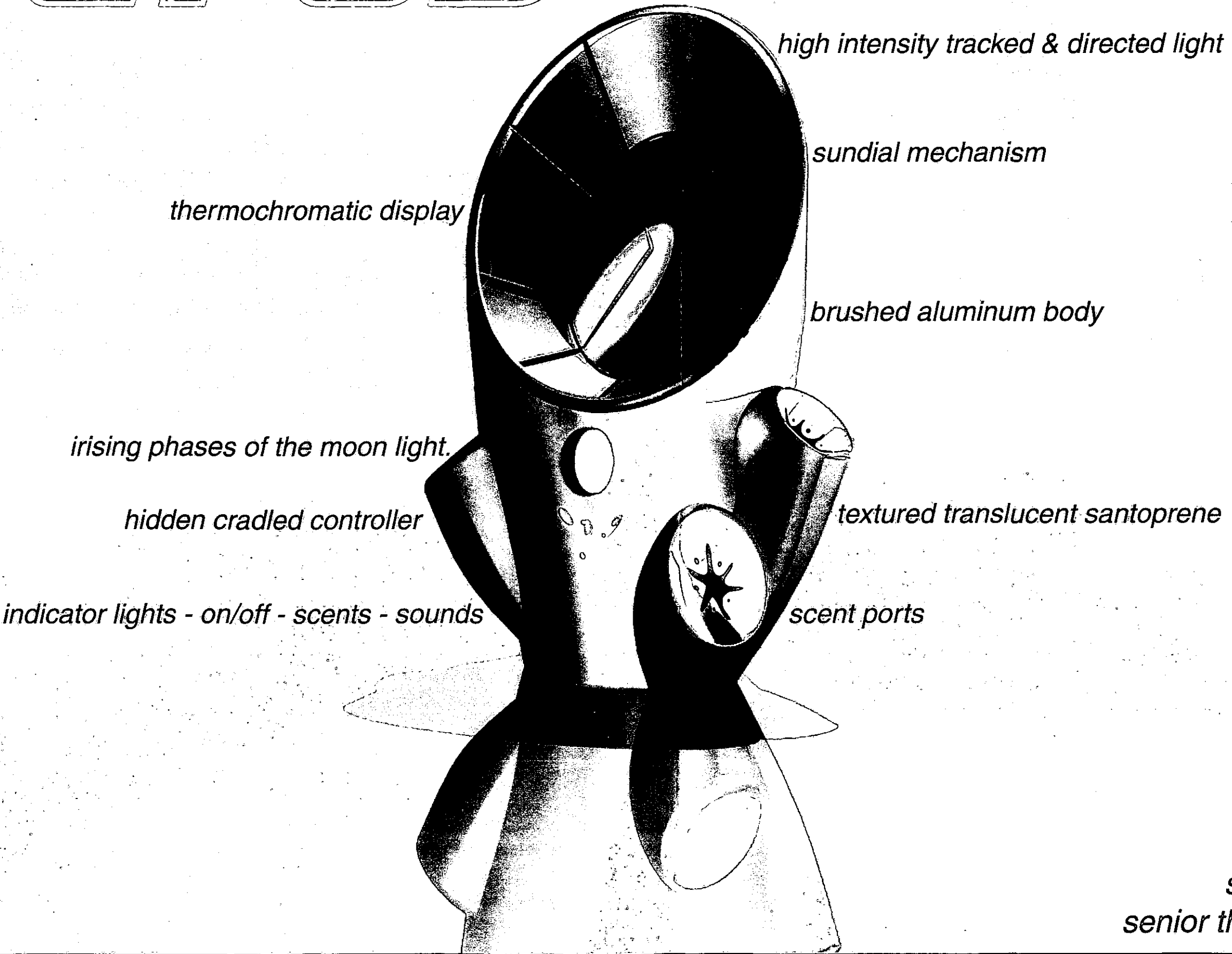
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eros

exploring sensory perception and environmental rhythms



high intensity tracked & directed light

sundial mechanism

thermochromatic display

brushed aluminum body

irising phases of the moon light.

hidden cradled controller

textured translucent santoprene

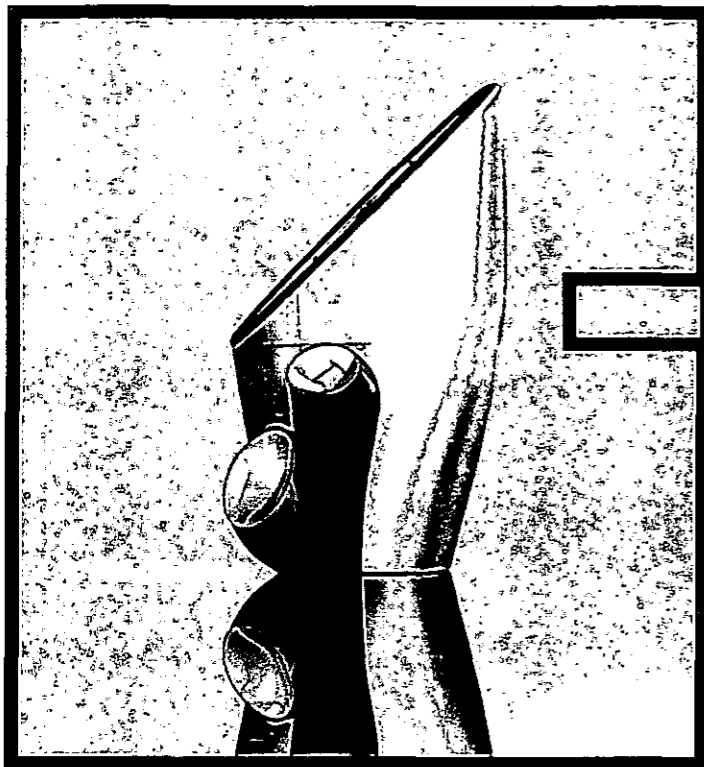
indicator lights - on/off - scents - sounds

scent ports

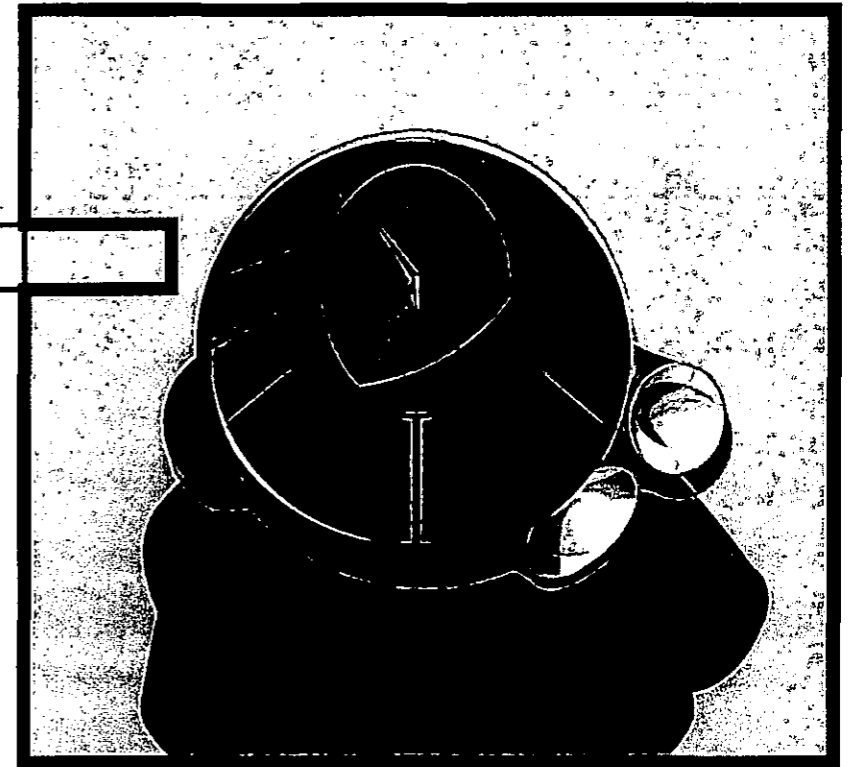
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senior thesis 2001*

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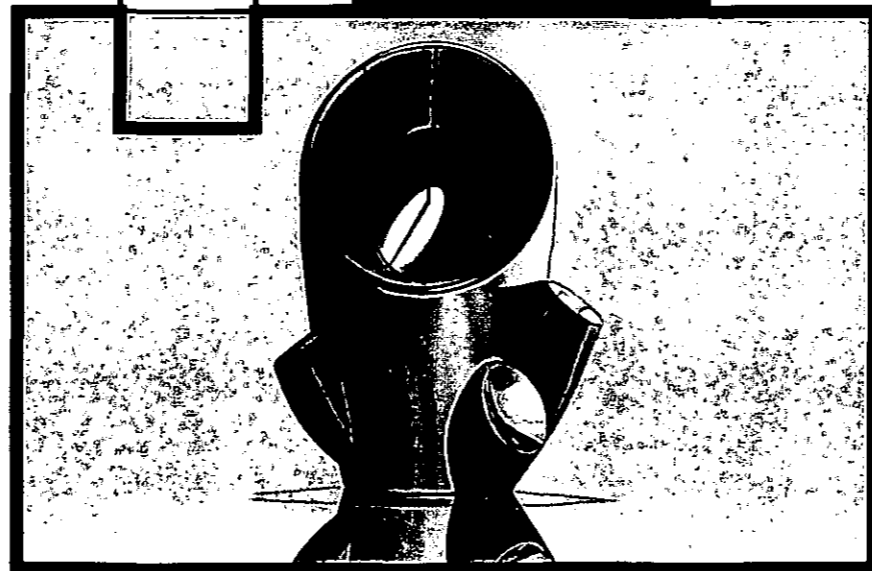
exploring sensory perception and environmental rhythms



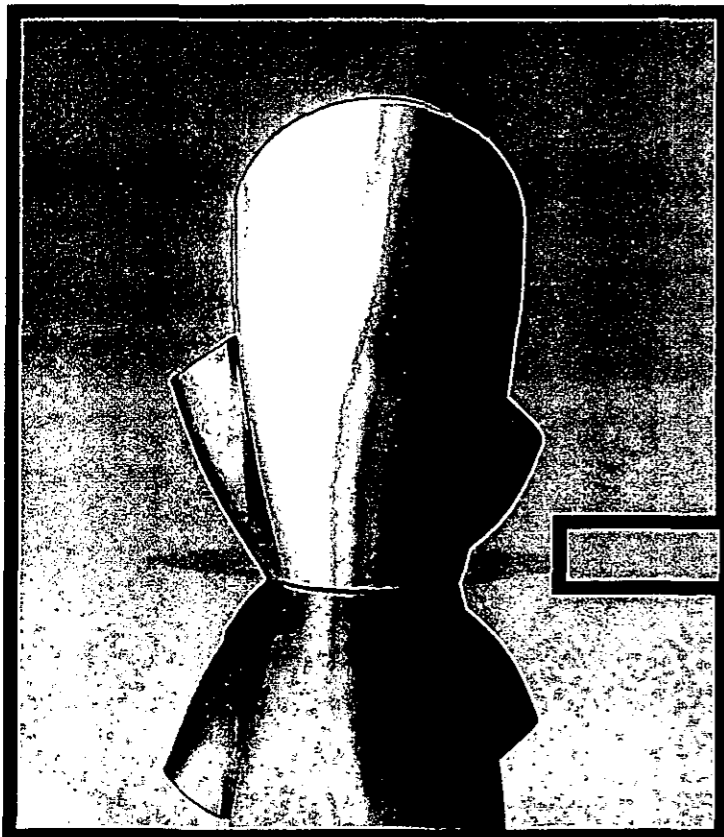
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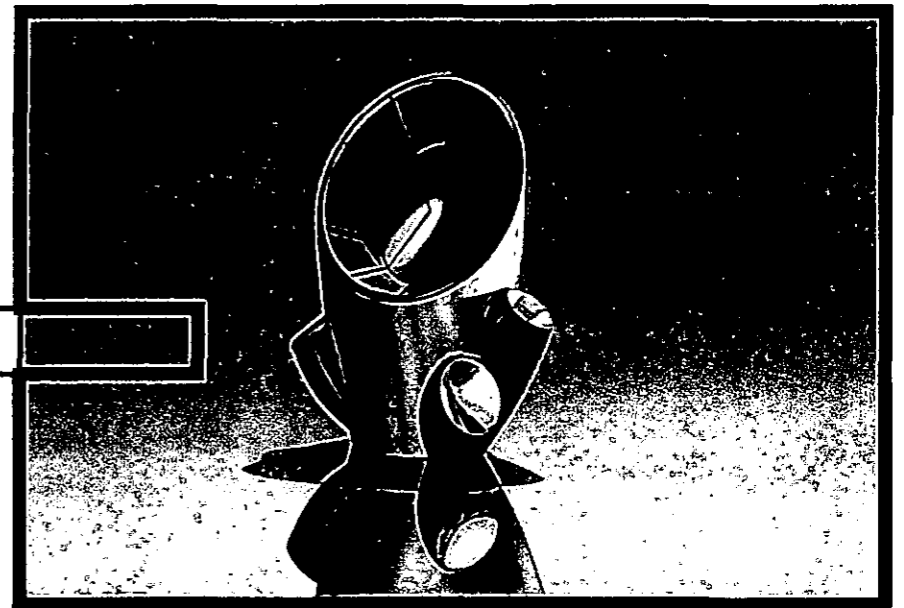
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front



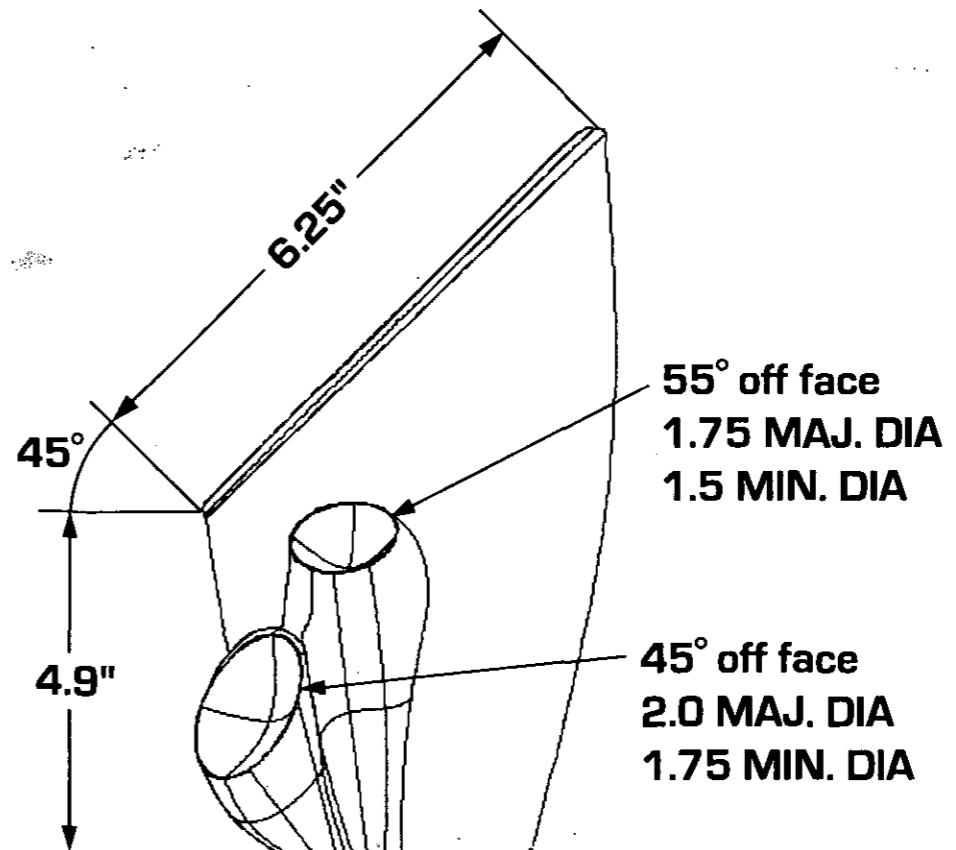
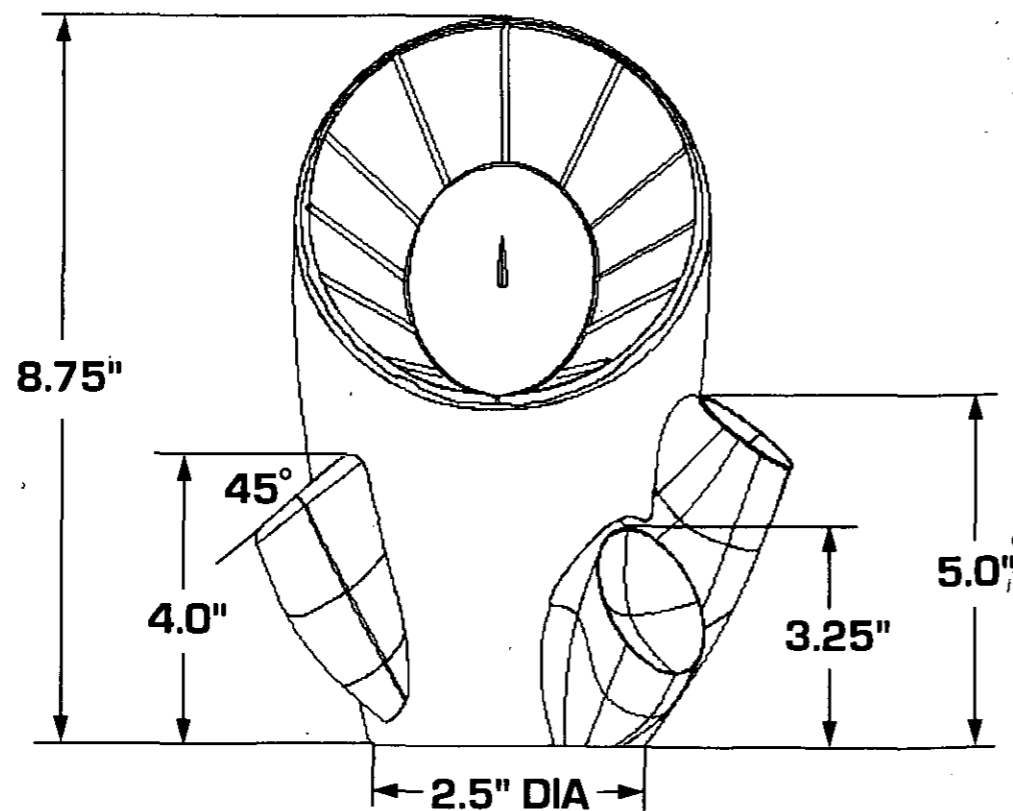
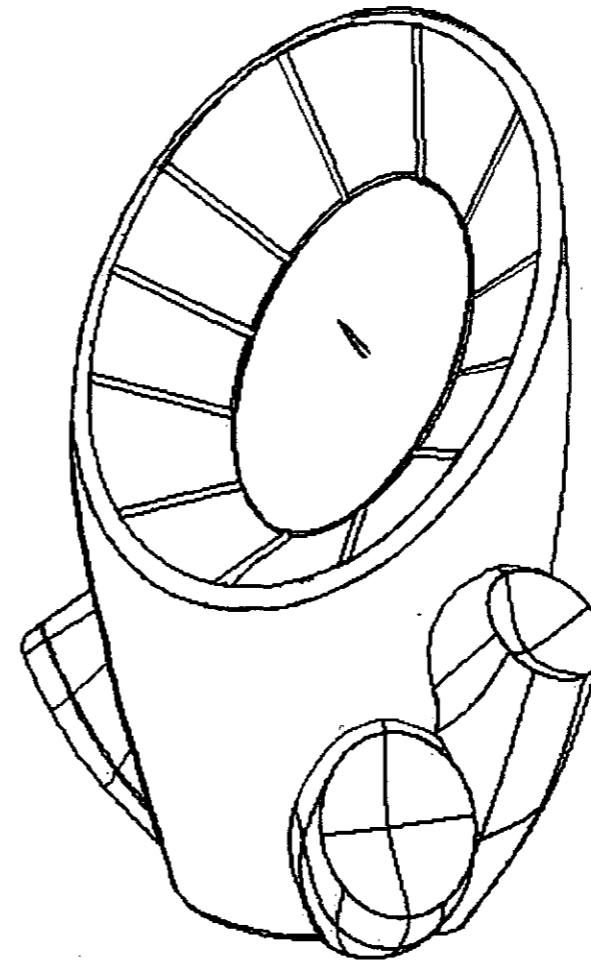
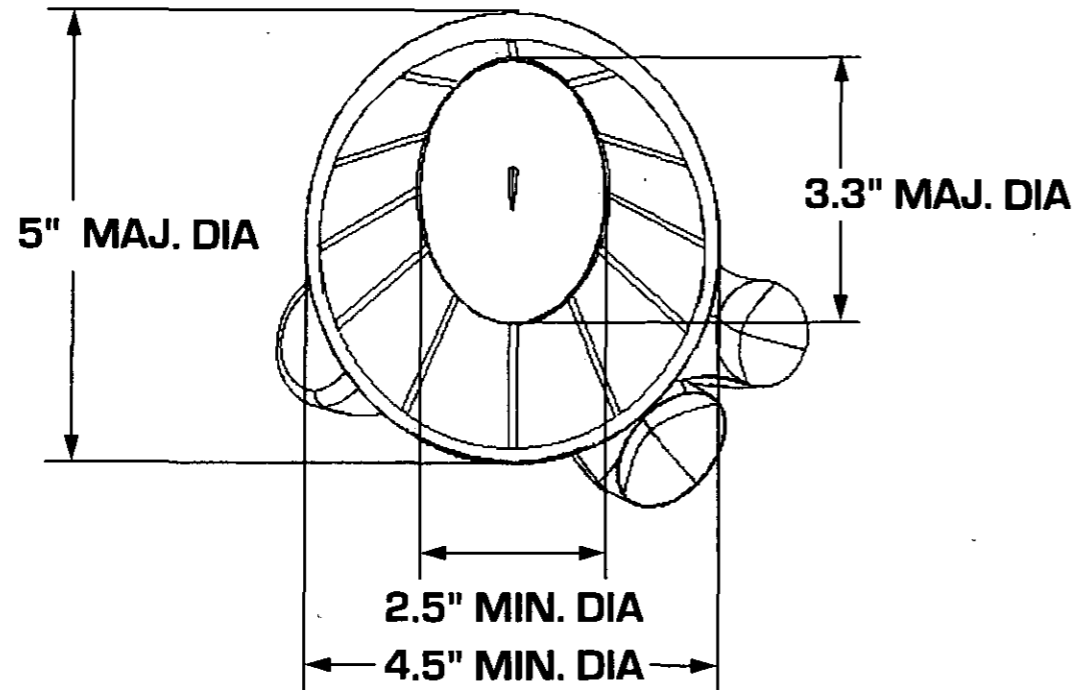
back



oblique

EROS

Basic Mechanical Dimensions



Simply put, Eros is a sensory stimulation device. It relies on the human senses and their psychophysiological and associative properties. These properties or responses give the sensations that Eros emits a therapeutic and entertaining value.

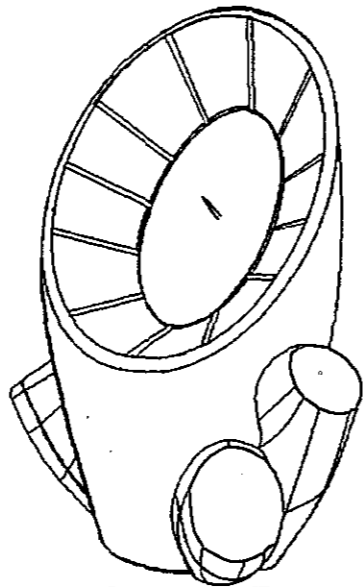
Relaxation and enjoyment, as well as visual beauty, are benefits to the human living experience.

Eros is a programmable and customizable output device for these sensations. Eros involves a variety of technologies - an iSmell or Digiscent unit, a thermochromatic display, and a photo-responsive interior light source. The light source itself changes ambience and colors to accent moods and smells. The whole device is designed around the concept platform of a clock - a clock that displays time in visual quantities that go beyond the minute and the hour - seasons, months, and years - as well as equinoxes, solstices, and growth seasons are all rhythms of our environment.

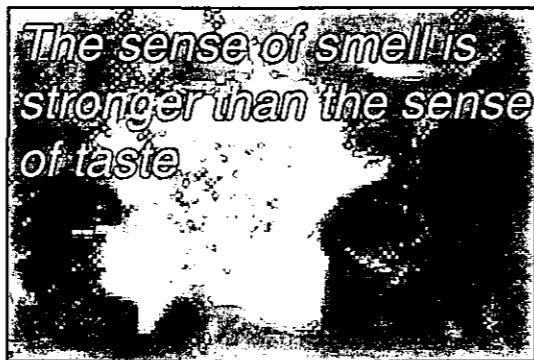


Identical twins have an identically genetic smell

Human Factors Evaluation



Aroma Ports



The sense of smell is stronger than the sense of taste

Eros's smell technology is non-invasive - it permeates only a small area of the user's living space - and is completely controllable at all levels. It can be programmed to synthesize nearly 20,000 different, distinct smells through the controller or a computer interface as a peripheral device. The smells themselves are up to the user - online sites could provide collections or "albums" of smells that are symphonied with therapeutic music or sounds.

Display

OPEN WINDOW DIALS 99% EFF. USE FOR QUANTITATIVE DATA ONLY. COUNTERS ARE EASIER TO READ THAN DIALS. ALTERNATE SECTOR IS GOOD FOR VERTICAL RELATIONS. AVOID MANUAL CONTROL AS OPP. TO INCREASE RULE NOS. INCREASE CLOCKWISE. DIAL ROTATES COUNTERCLOCKWISE TO INCREASE.

COUNTERS 99% EFF. FOR QUANTITATIVE READINGS ONLY. USE BLANKS HERE NOT ZERO. READ LEFT TO RIGHT. FRAME COLOR TO MATCH DIALS TO MINIMIZE SHADOWS. LEAST COUNT NOS. SHOULD SNAP INTO POSITION. ILLUMINATION IS OF FCULT WITH COUNTERS.

CHARACTERS ALL CHARACTERS TO READ VERTICALLY. NO VERTICAL WORDS. PREFER SANS SERIF (FUTURA MED. OR OTHER). STROKE HEIGHT 1/8 BLK ON W. 1/16 ON BLK. BACKGROUND CONTRAST 75-80 PERCENT. OPEN TAILS. LOW ERRORS. STD HEIGHTS.

DOT-MATRIX READOUT 92% EFF. ILLUMINATED. FOR LED, TV, PHIL LIGHTS. AVOID LOWER CASE. LETTER HEIGHT: 2'-6" (51.7mm). MIN DOT DIA: 0.2" (5.1mm). LED LIGHT EMITTING DIODE) LONG LIFE, EFF.

SEGMENT-MATRIX READOUT FOR LED, TV, PHIL LIGHTS. NOT AS LEGIBLE AS DOT MATRIX DISPLAYS. REFLECTING LIQUID CRYSTAL DISPLAYS (LCD) ARE BAD AT LOW LIGHT.

GRAPHIC DISPLAYS FOR LED, TV. GOOD FOR QUALITATIVE INFORMATION. GRAPHIC SOLUTIONS ARE POSSIBLE.

OPEN WINDOW DIALS 99% EFF. USE FOR QUANTITATIVE DATA ONLY. COUNTERS ARE EASIER TO READ THAN DIALS. ALTERNATE SECTOR IS GOOD FOR VERTICAL RELATIONS. AVOID MANUAL CONTROL AS OPP. TO INCREASE RULE NOS. INCREASE CLOCKWISE. DIAL ROTATES COUNTERCLOCKWISE TO INCREASE.

COUNTERS 99% EFF. FOR QUANTITATIVE READINGS ONLY. USE BLANKS HERE NOT ZERO. READ LEFT TO RIGHT. FRAME COLOR TO MATCH DIALS TO MINIMIZE SHADOWS. LEAST COUNT NOS. SHOULD SNAP INTO POSITION. ILLUMINATION IS OF FCULT WITH COUNTERS.

CHARACTERS ALL CHARACTERS TO READ VERTICALLY. NO VERTICAL WORDS. PREFER SANS SERIF (FUTURA MED. OR OTHER). STROKE HEIGHT 1/8 BLK ON W. 1/16 ON BLK. BACKGROUND CONTRAST 75-80 PERCENT. OPEN TAILS. LOW ERRORS. STD HEIGHTS.

DOT-MATRIX READOUT 92% EFF. ILLUMINATED. FOR LED, TV, PHIL LIGHTS. AVOID LOWER CASE. LETTER HEIGHT: 2'-6" (51.7mm). MIN DOT DIA: 0.2" (5.1mm). LED LIGHT EMITTING DIODE) LONG LIFE, EFF.

SEGMENT-MATRIX READOUT FOR LED, TV, PHIL LIGHTS. NOT AS LEGIBLE AS DOT MATRIX DISPLAYS. REFLECTING LIQUID CRYSTAL DISPLAYS (LCD) ARE BAD AT LOW LIGHT.

GRAPHIC DISPLAYS FOR LED, TV. GOOD FOR QUALITATIVE INFORMATION. GRAPHIC SOLUTIONS ARE POSSIBLE.

CIRCULAR DIALS 89% EFF. QUANTITATIVE/QUALITATIVE AND SNAP CHECK. NOS. INCREASE CLOCKWISE. AVOID CLUTTER. OPTIMUM DIAL DIA 2.75-4" (70-102). 1/4" (102-152) FOR HIGH ACCURACY. ALTERNATIVE CONTROL LOCATION. SCALE BREAK IS DESIRABLE. CLOCKWISE TO INCREASE READING. ASSOCIATED CONTROL PREFERRED LOCATION.

CHECK DIALS (FOR GROSS READINGS) ORDER OF SEQUENCE. NORMAL POSITION FOR VERTICAL ARRAYS. PREFER HORIZONTAL ARRAYS AS SHOWN. OPT - 0 POINTER POSITION FOR CHECK READING. MIN SPACING.

SCALES MINIMUM NUMBER OF MARKINGS IF NOT REQUIRED. 5 RECOMMENDED SCALES. CAN ADD ZEROS OR DECIMALS TO DIGITS ABOVE. AVOID SCALES: 2.5, 5, 7.5, AND 8. 12. AVOID MIXING DIFFERENT SCALES NEARBY.

INDICES MINIMUM SIZE SCALES FOR LOW ILLUMINATION. VIEWING DISTANCE: 28.38" (71.814mm). MINIMUM SPACE BETWEEN INDICES: 2X INDEX WIDTH IF INDICES ARE WHITE ON BLACK. 1X INDEX WIDTH IF INDICES ARE BLACK ON WHITE. SIZES ARE DIRECTLY PROPORTIONAL VIEWING DIST.

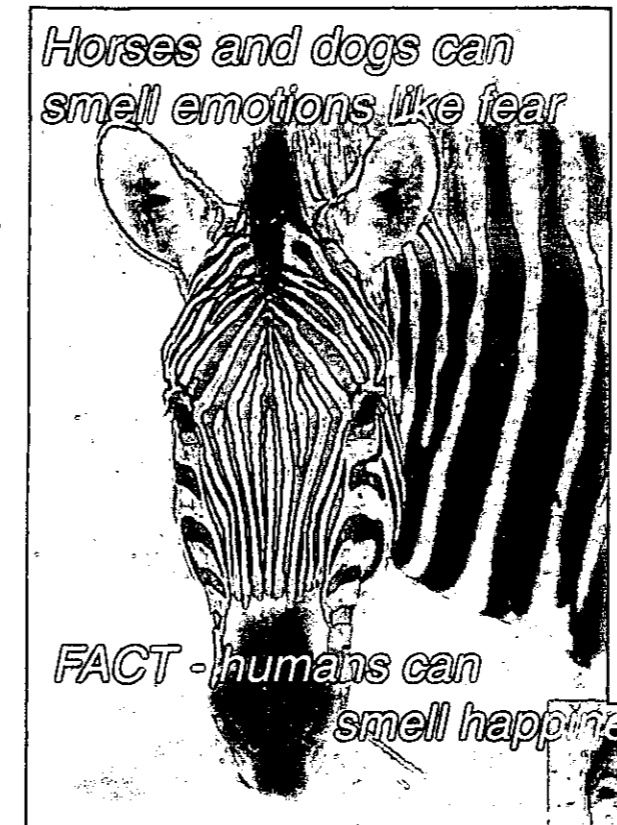
GRAPHIC DISPLAYS FOR LED, TV. GOOD FOR QUALITATIVE INFORMATION. GRAPHIC SOLUTIONS ARE POSSIBLE.

HORIZONTAL SCALES 72% EFF. QUANTITATIVE/QUALITATIVE AND SNAP CHECK FOR SCALES AND MOVING POINTERS. FOR LEFT HAND (AL). NOS INCREASE LEFT TO RIGHT. TURN KNOB CLOCKWISE TO INCREASE. RECOMMEND FIXED SCALE AND MOVING POINTER.

MULTI-REVOLUTION DIALS LIMIT MULTI-POINTER DIALS TO 2 HANDS. ALTERNATE LONG SCALE CHECK AND QUALITATIVE DIAL HAS COPIES FOR PRECISE DATA. SOME WATCHES HAVE FOUR SUBDIALS EG. DATE, DAY, MONTH AND SEC. MULTI-POINTER DIALS ARE CONFUSING TO READ. THE COMMON ALARM CLOCK WORKS IF SLEEP HAND IS RED AND ALARM HAND IS INCONSPICUOUS.

POINTERS AVOID ORNATE POINTERS WHICH ARE OBSTRUCTING.

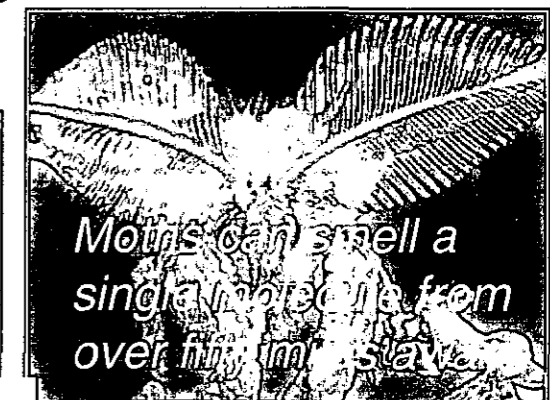
REFLECTED LCD READOUT USING SEGMENT MATRIX. GOOD FOR QUALITATIVE INFORMATION. GRAPHIC SOLUTIONS ARE POSSIBLE.



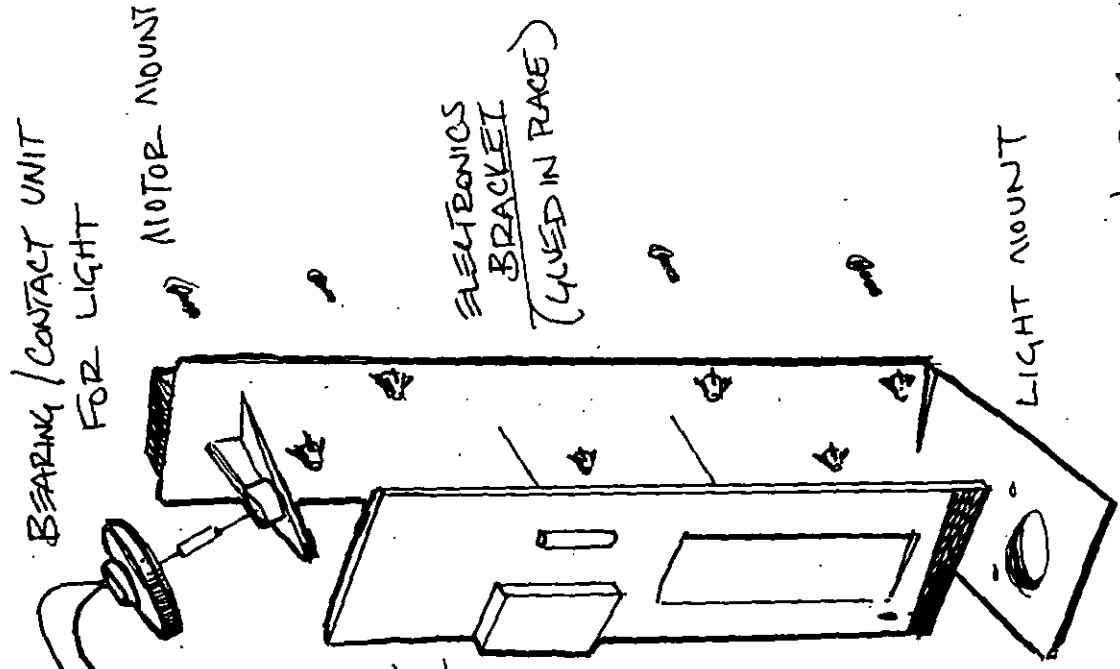
Horses and dogs can smell emotions like fear

FACT - humans can smell happiness

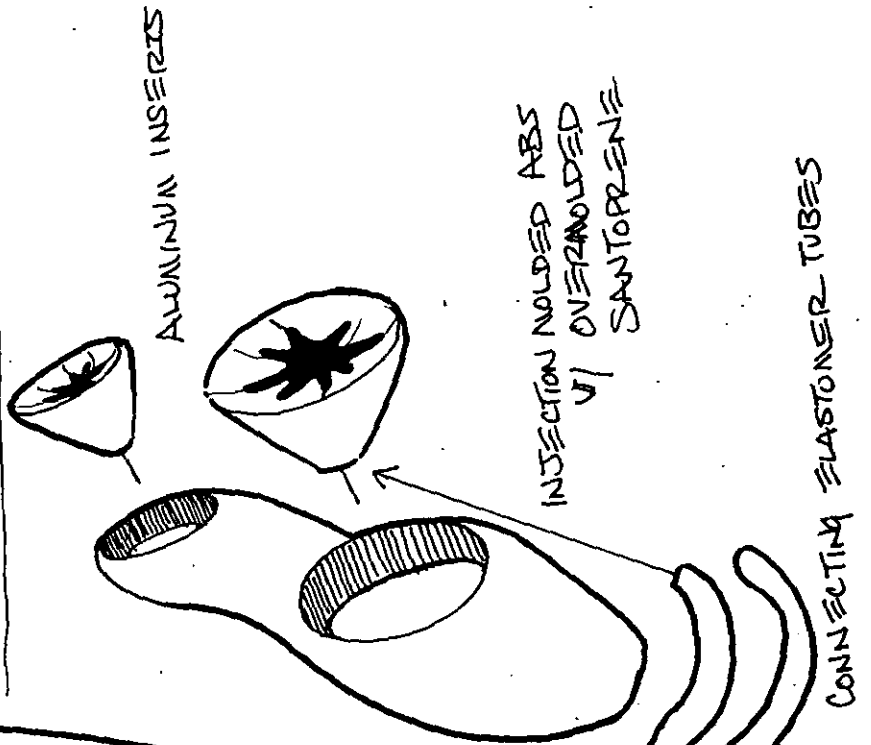
Eros has a cradled controller with standard sized push buttons accommodating the 5% female to the 95% male. The controller's shape is easily cradled in the palm, yet is also able to be held in several different comfortable positions. The controller accommodates both left and right hand users as well as individuals with limited dexterity or use of only a single hand.



Mouins can smell a single molecule from over five miles away



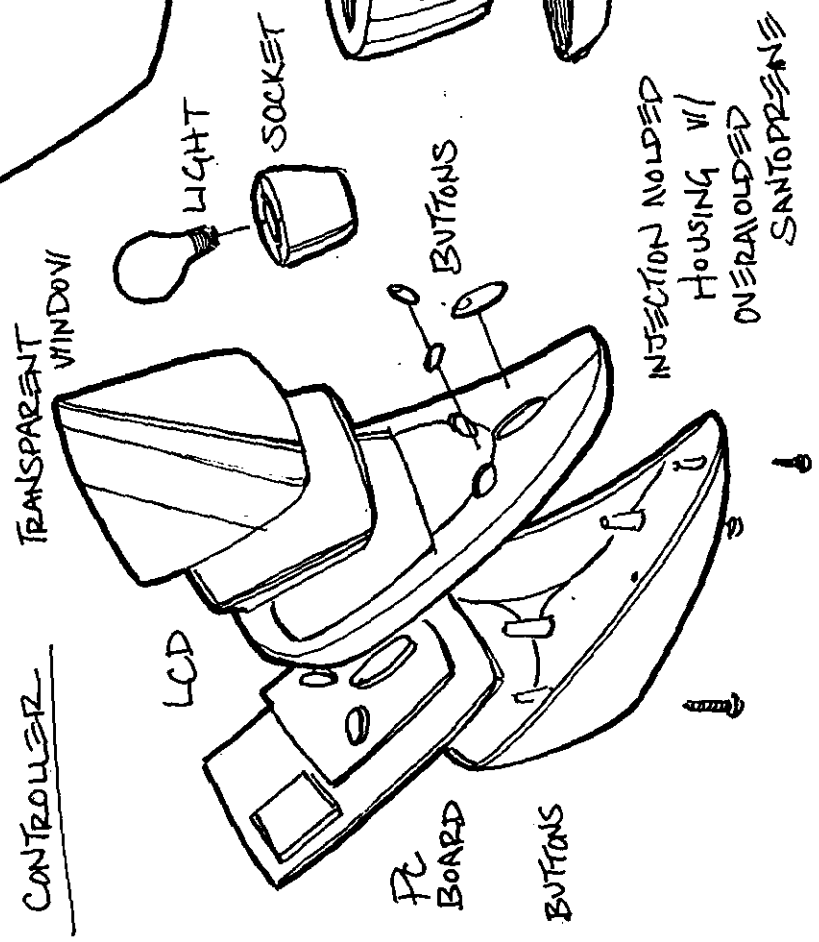
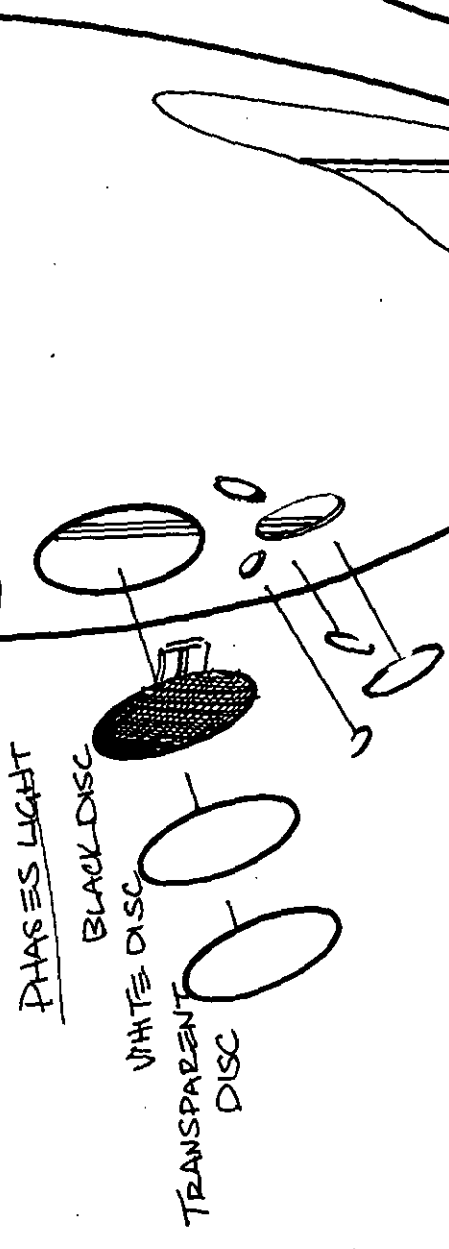
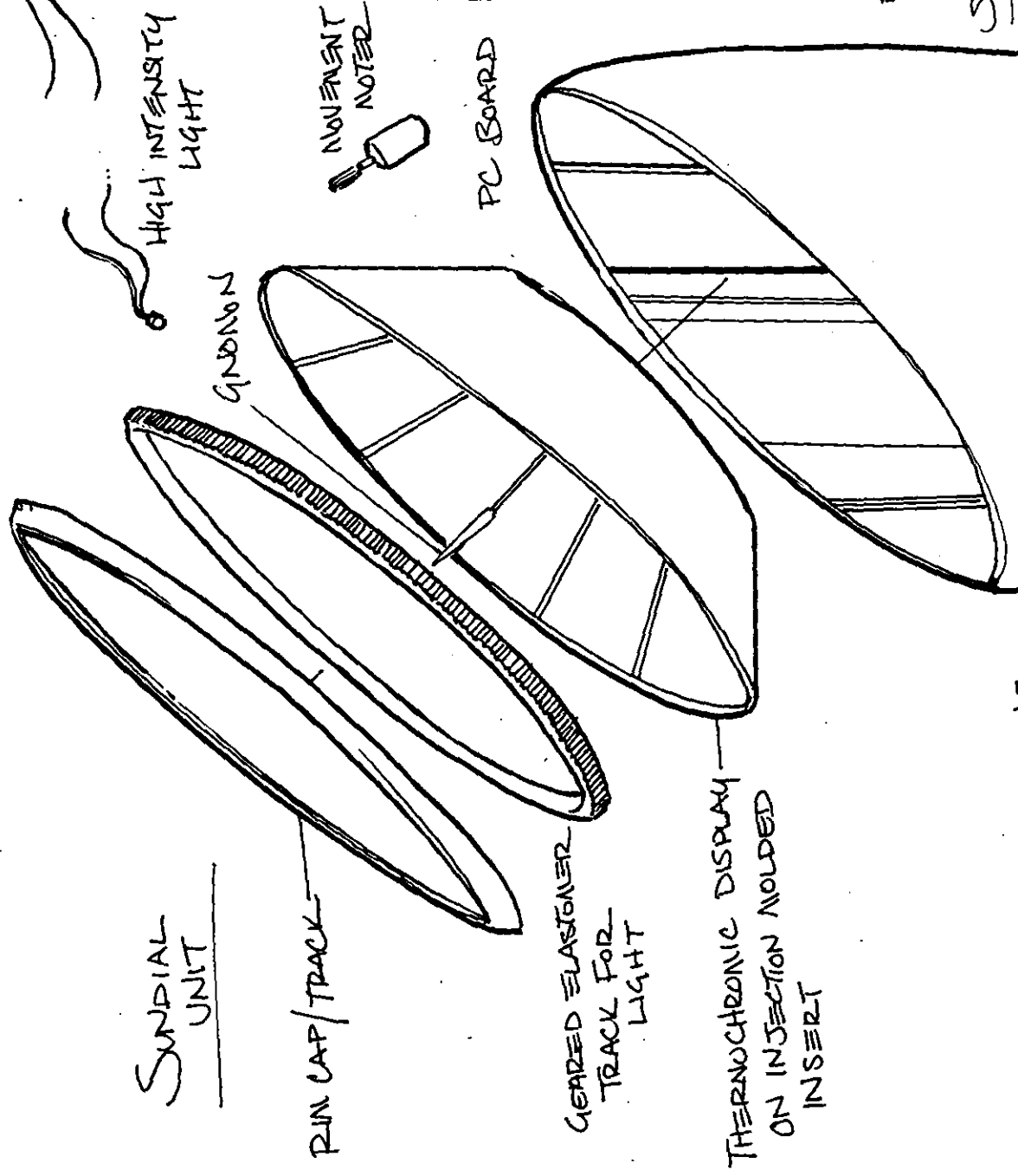
SPUN, BRUSHED ALUMINUM HOUSING



DIGISCENTS ISMELL UNIT

THREADED REMOVABLE CAP

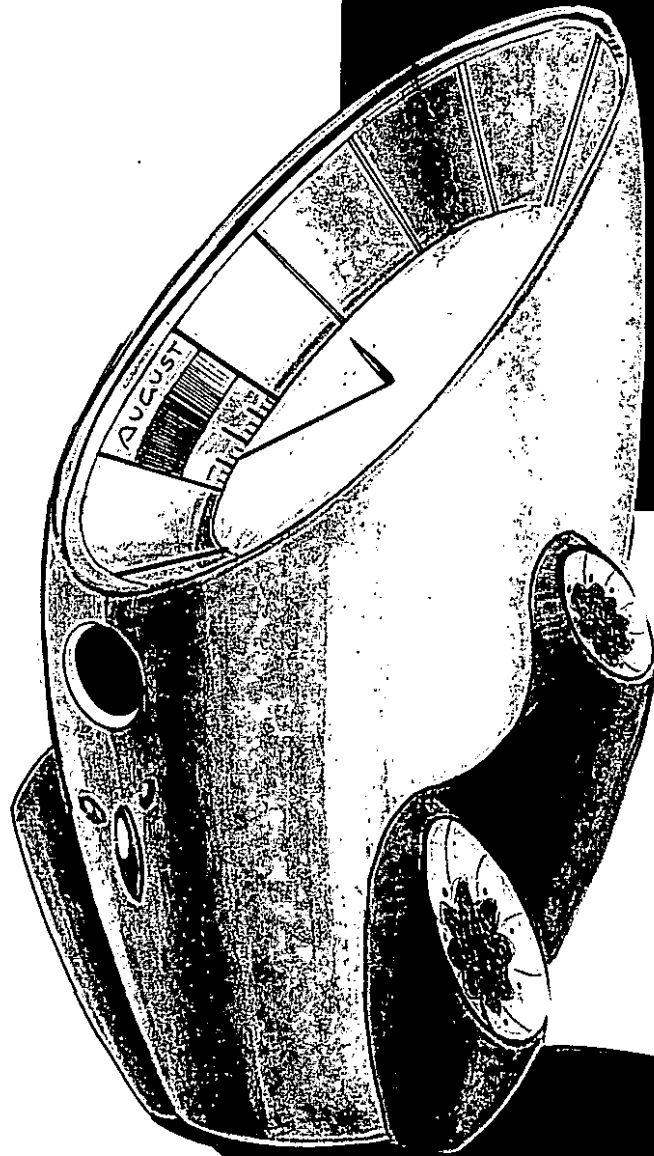
PROS
EXPLODED VIEW
SCOTT HEINE



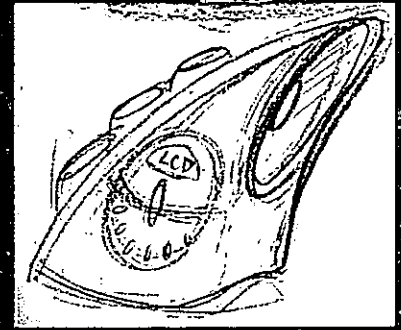
INJECTION MOLDED HOUSING VI OVERMOLDED SANTOPRENE

SENIOR DESIGN THESIS 2001

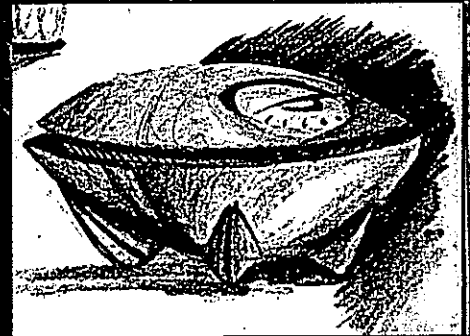
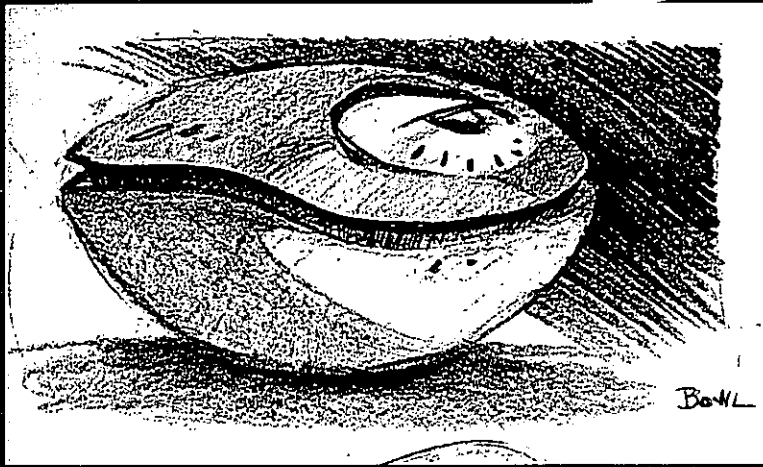
SCOTT HEINE



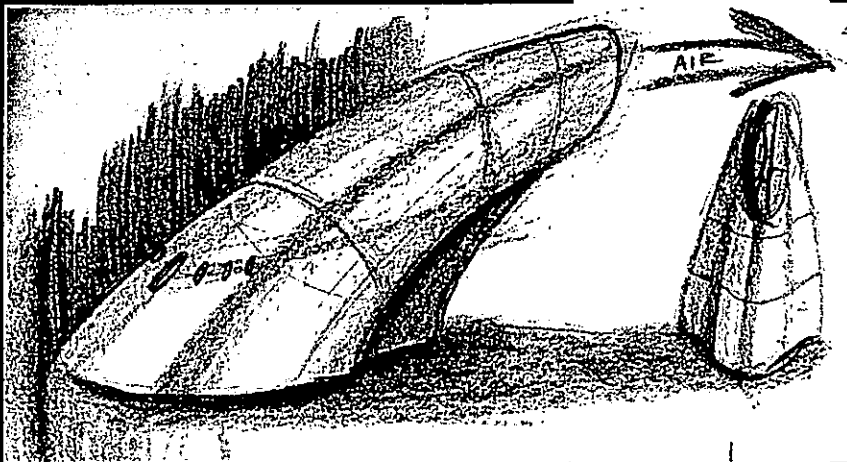
The product I was designing had no precedent for form.



In beginning ideation, I embraced my freedom and explored all types of sensuous shapes.



I focused on communicating air flow for the aromas that would eventually be emanating from this object.

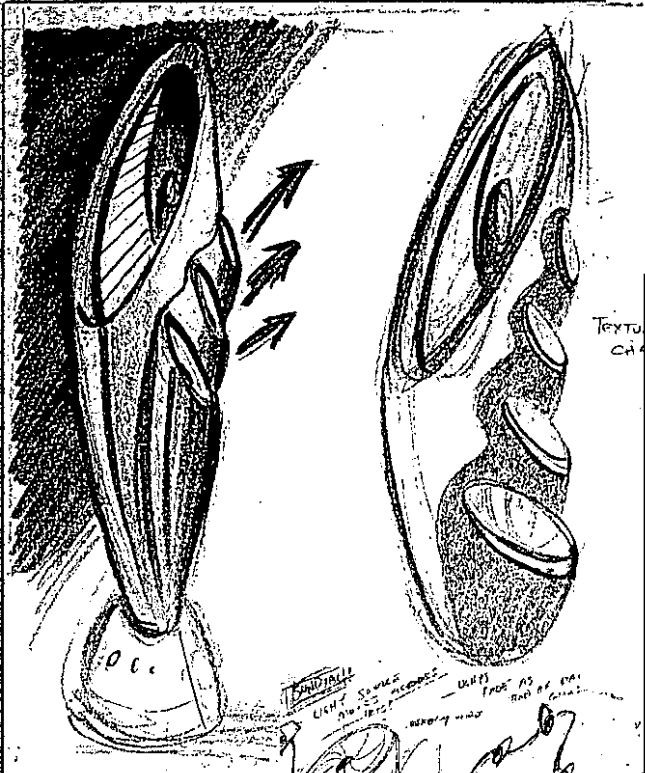
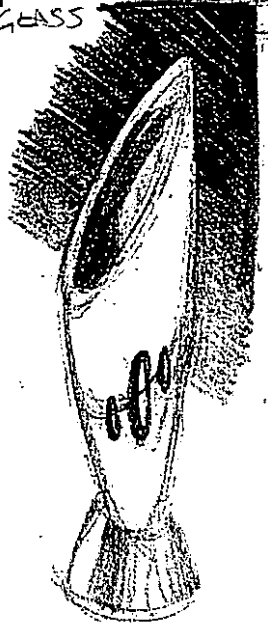


I also wanted to communicate nature through organic form while keeping the device more than just a purely aesthetic object.

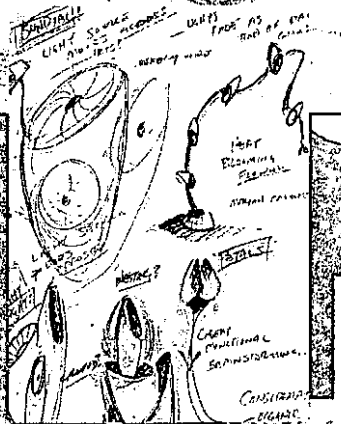
This drawing of an art glass-like vessel inspired my pursuit of the drawings below.

The explorations began to involve port-like openings which would communicate the release of "sensory information".

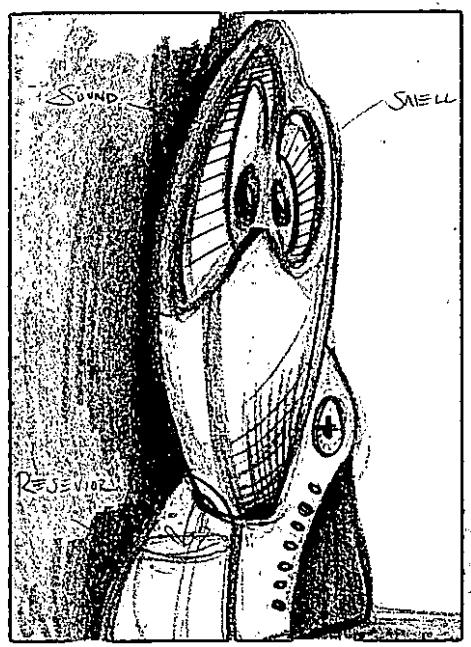
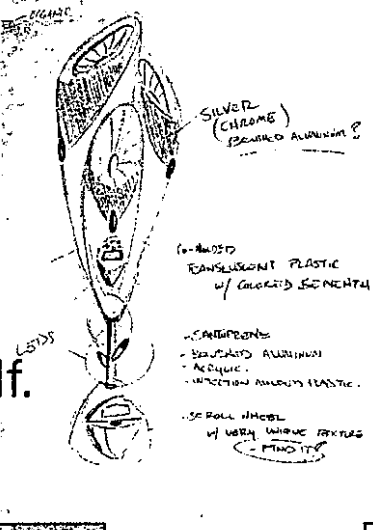
ART GLASS



I began to realize that I could provide a sense of mystery and wonder through the form which would prompt the user to explore its function.

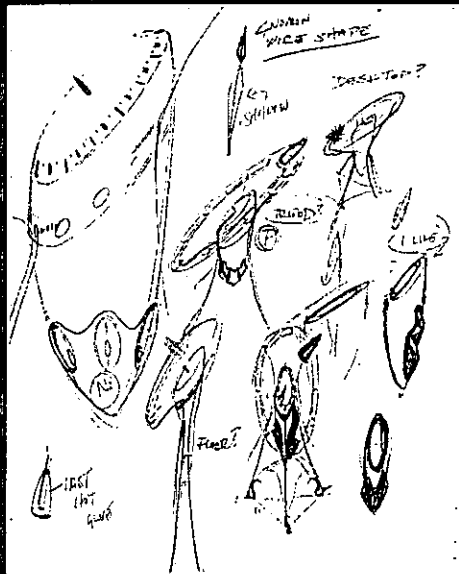
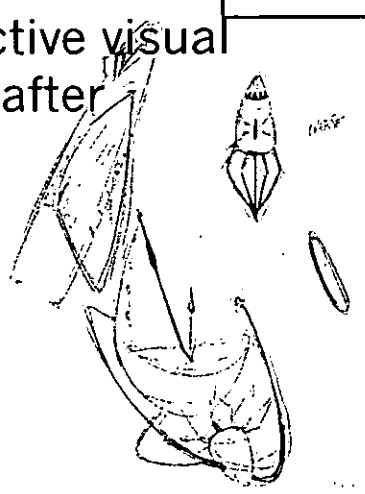


I also began to realize that I needed to communicate an interactive visual element that went beyond the form itself.

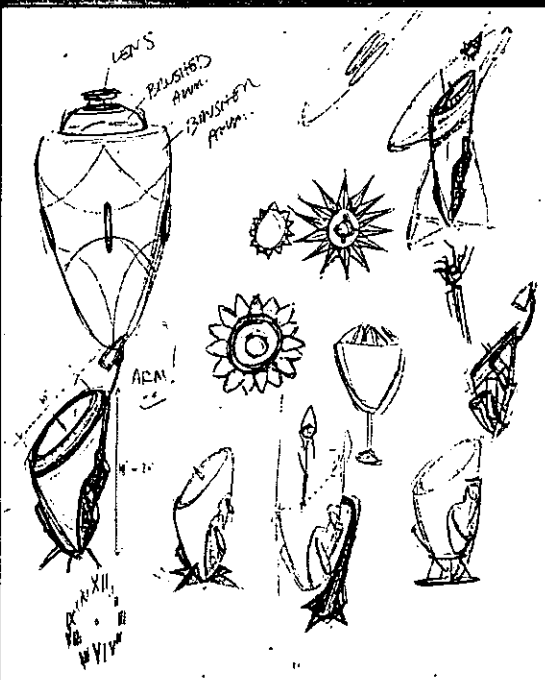
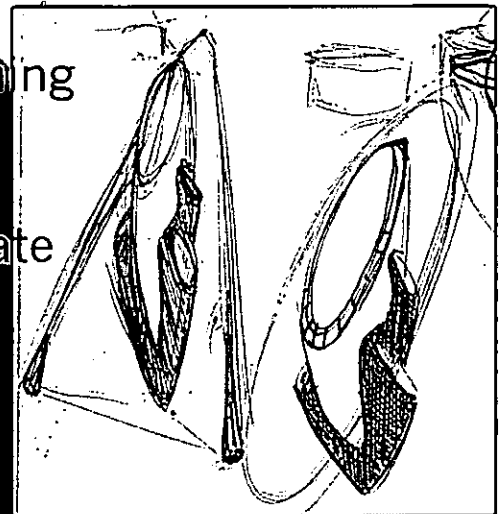


While looking for that interactive visual feature, this sketch followed after research on sundials.

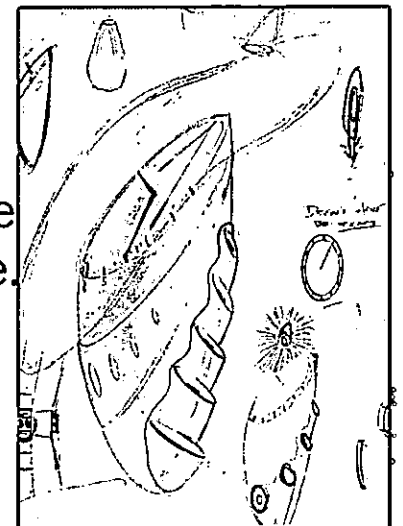
I wanted to combine the intriguing elements of the sundial with my organic, coral-like form.



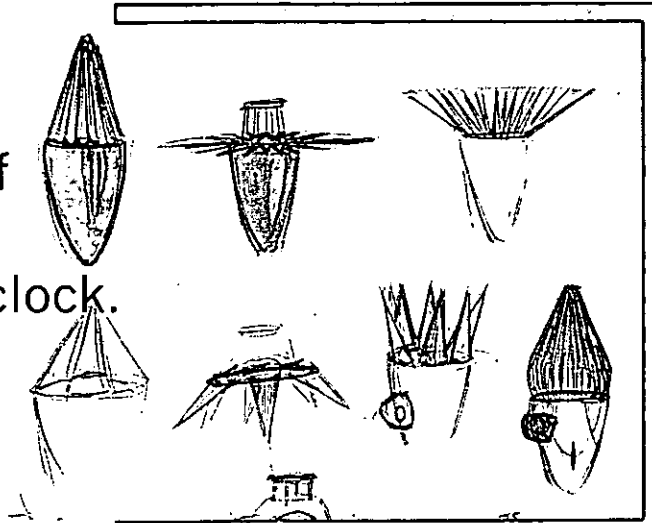
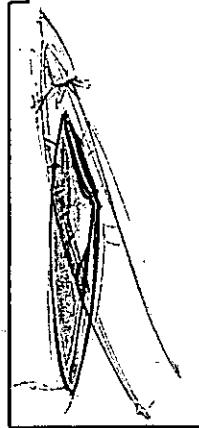
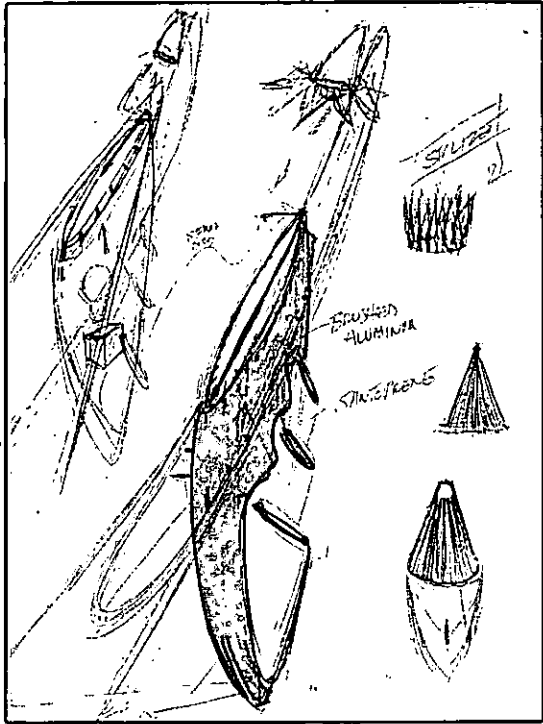
I also began to investigate blooming elements and sun-like orbiting lights to accentuate the idea of the sundial.



I also decided to add the capabilities of this device being an integrated part of a sound system while still maintaining the aroma/scent functions - so as to provide an entire sensory experience.

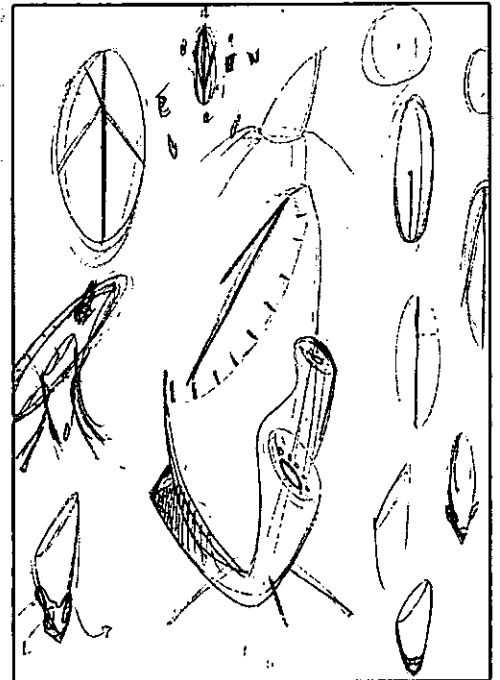
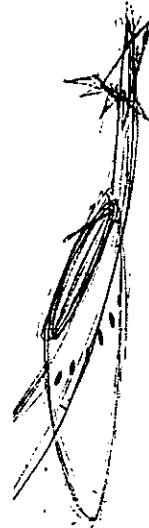
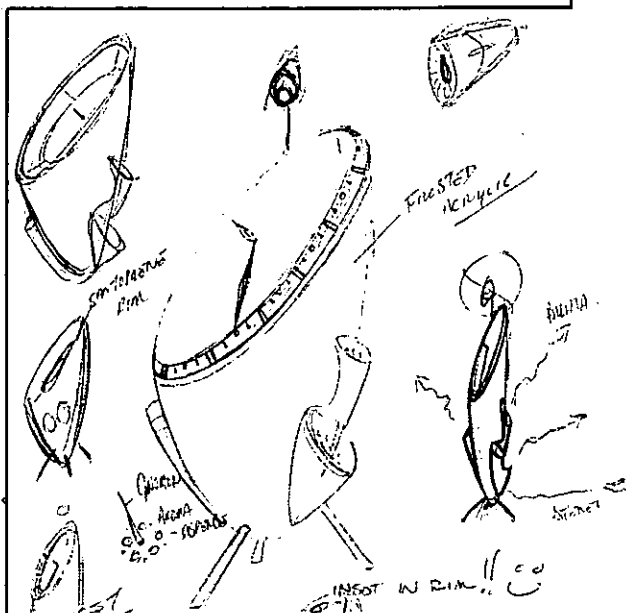


Here is exploration into a blooming, orbiting light that would highlight the "gnomon" of the sundial and cast a shadow that would be the hand of the clock.



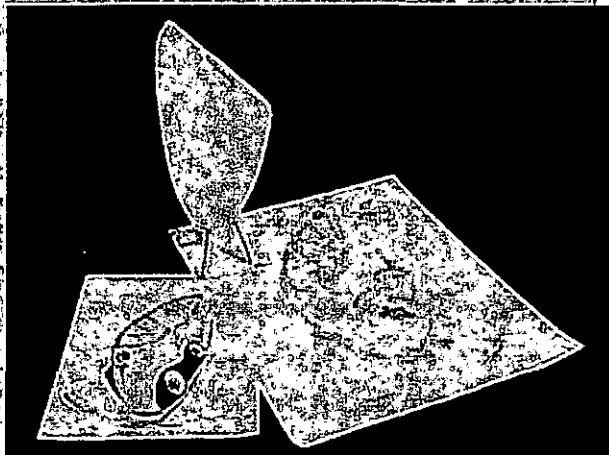
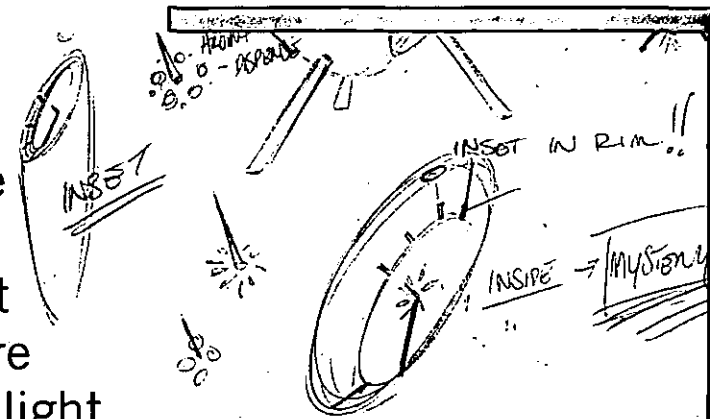
I struggled with maintaining the purity of the form while trying to find a sensible solution for both the light and the supporting structure for the device.

I wanted to avoid having the product look too mechanical or unrealistic.

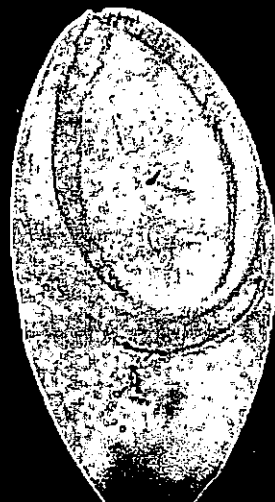


I realized the device was becoming too complex - I moved to simplify it.

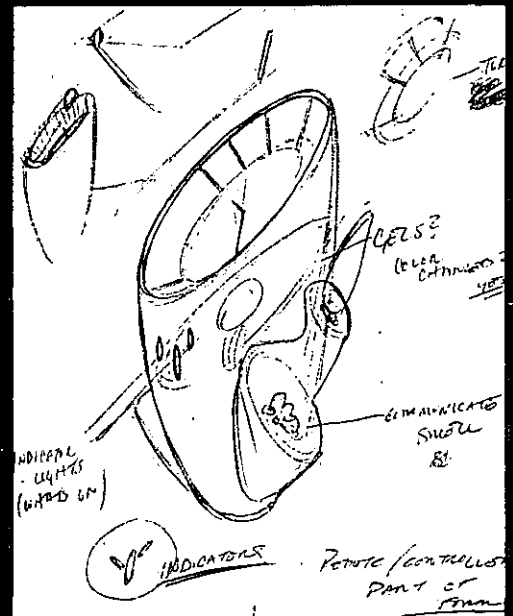
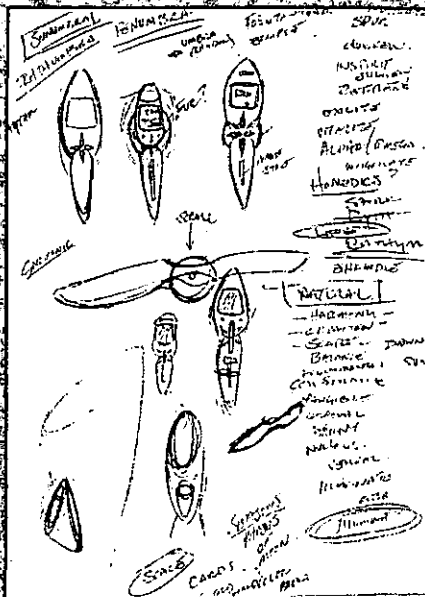
A notable design discovery is seen here in this sketch. I decided to inset the face of the sundial, thus lessening the problems of disruptive ambient light and providing a much more aesthetic place for the orbiting light inside a track in the rim of the face.



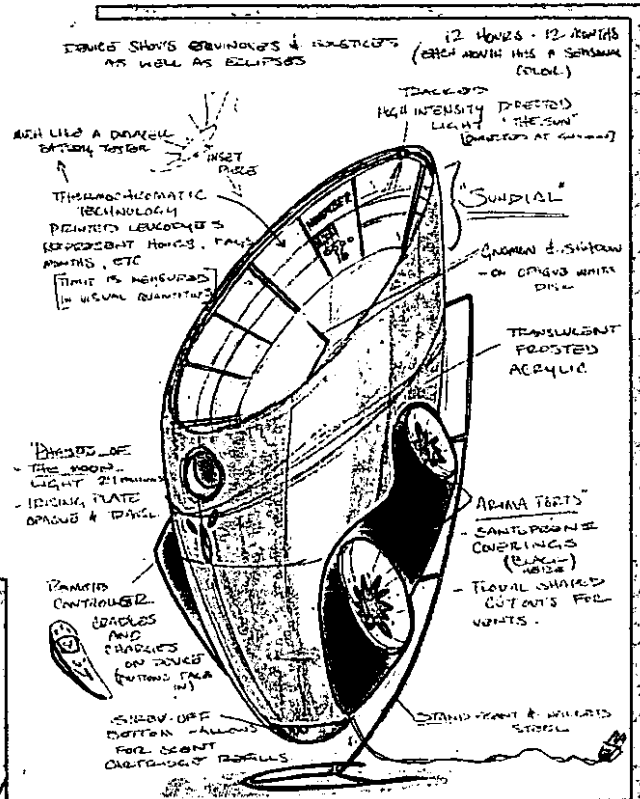
I began exploring the basic shape in three dimensions. These models, while very basic, gave me a better understanding of the scale of the product.



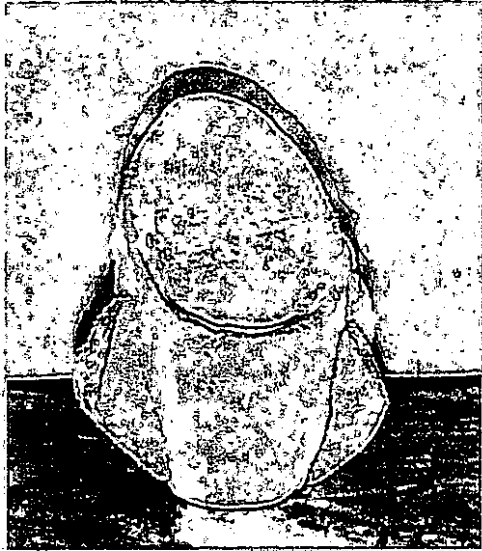
I also revisited the aroma ports, deciding to make one of them a concealed remote control in which the user could program his/her sensory experience in an interactive and comfortable manner.



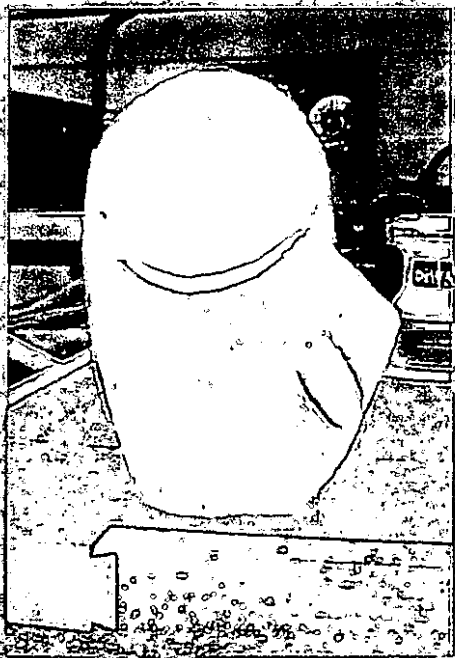
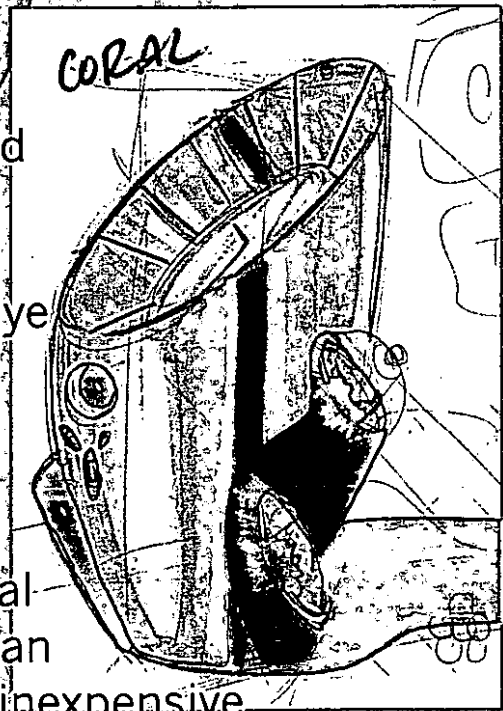
This was a crossroads in my design. I had come this far with sketching, but still lacked the basic support structure that this object needed. Through more three dimensional sketching, I decided to truncate the form near the bottom, thus giving the device a the feel of growth or emergence from the surface it was placed.



I also added an irising light that displayed the phases of the moon as well as some indicator lights on the front of the device to add more visual and functional interest.



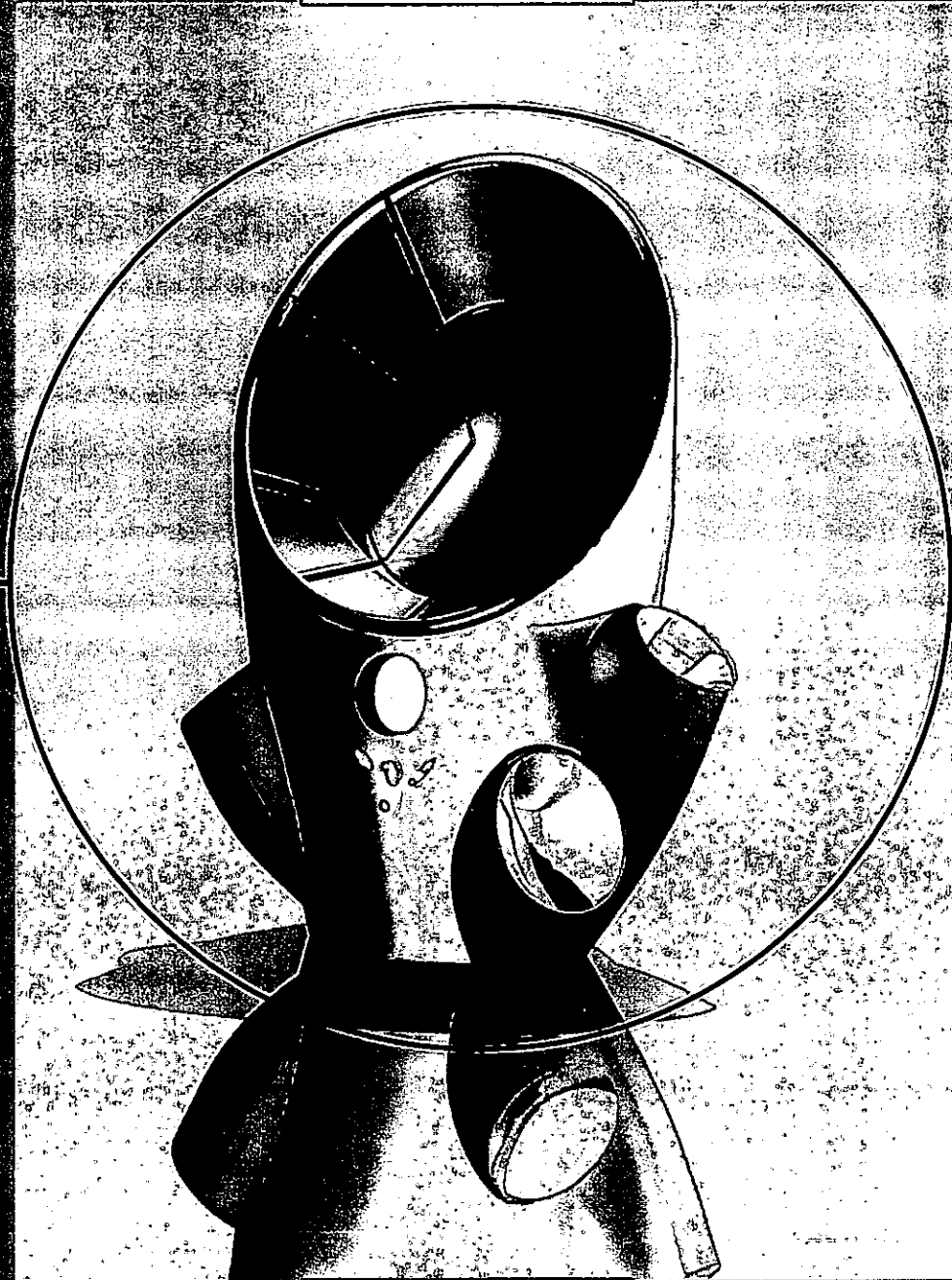
For the sundial display, I determined that I could use a thermochromatic lithographed leucodye on the inside of the inset surface. The dyes turn clear or colorize with heat provided by electrical resistance and give an extremely efficient, inexpensive and visually beautiful way to communicate graphic content like an LCD.



This is my final solution.

Eros

Eros is the early Greek counterpart of the Roman Cupid; son of Chaos. The name represents the primal forces of nature and the essence of harmony and creative power.



The form expresses a natural growth or coral. I wanted the added organic flower shaped cutout



SENIOR THESIS 2001

SCOTT HEINE

EROS

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Senior Thesis Brief - Concept Statement

Scott Heine

Product Concept

This product is a new entry in the **sensory therapy** market category. It combines current technologies with some new concepts about how we spend our time indoors. Our relationship with the outdoors and the indoors is currently contrasting - but with reason. They are two separate places in our day, and we spend on average about 90% of that day indoors. We, for the most part, believe that we cannot exist in or enjoy the benefits of either concurrently. The **attributes** of nature itself (outdoors) is held as a highly therapeutic benefit or value. The act of experiencing nature is to many therapeutic and associated with being healthy. This product will hopefully address the lack of control we have in our indoor environments - as well as explore some ways that natural environmental rhythms affect our daily lives.

We experience our environment through our five senses. Being indoors shields us from the sensory feast that is the outdoors. This is most often with purpose. Being inside provides us with temperature control, light level control, cleanliness, privacy, comfort and so on - yet there may be those who desire more control, or elements of both environments simultaneously. The associative properties of smells and sounds are often relaxing and comforting in themselves. The window is our simplest indoor means of experiencing our immediate natural surroundings and the television our secondary means for experiencing places beyond our immediate surroundings. Other means include the Internet, radio and books or magazines. Much of our time indoors is spent using these things - and they are all very legitimate in their own ways, but they are usually sensory specific (one sense)- as in the television or the radio (sight & hearing).

My approach is to create a device or system that enables the user to control their indoor environment on a multi-sensory level. It combines concepts of aromatherapy [smell] and audio [sound] with lighting [sight]. Current aromatherapy is based on heating oils that emanate fragrances. Current sound therapy devices are often small curvy housings with an arc of buttons on it that provide the user with several audio choices like heartbeat, rain, babbling brook, or white noise. These devices are hardly taken serious by most consumers - in terms of perceived value as well as with issues of quality. Part of this is how they are marketed and part of this is due to the fact they truly are poor quality products. The aroma devices are sold in the gift area of most department stores and require expensive fragrance bead refills. The audio devices have very poor audio quality to keep them within reasonable price limits. There are very few devices that attempt to combine all three elements - aroma, audio, and lighting. None of these products have significant market differentiation either. My solution will tackle these quality issues, establish serious market differentiation, and greatly expand the variety of aromas and audio by possibly using both **digiscents iSmell** technology and **mp3** technology. This approach may also provide a system of reading outside weather/environmental conditions and then communicating such information through itself inside. My primary goal is to give the user control of their indoor environment for reasons that may vary among individuals - relaxation, entertainment, therapy, aiding sleep, and overall indoor environmental improvement. Effectively communicating natural environment inside the home and establishing a beautiful, interactive interface are important secondary goals. I would like this design be a **leap** in both the function and the form.

DESIGN THESIS DELIVERABLES

SCOTT HEINE

- RESEARCH - PROVIDE THESIS BRIEF, EXISTING PRODUCT DESCRIPTION IN GRAPHIC FORM AND TEXT FORM, AND A TECHNOLOGY REVIEW INCLUDING INFORMATION ON HOW THE PRODUCT WORKS, THERMOCHROMATICS, LCDs, LEDs, DIGISCENT AND SNIF TECHNOLOGIES, AND THE SUNDIAL. PRINTED AND STAPLED AS A REPORT.
- SPONSOR FEEDBACK - PRINTED DIALOGUES BETWEEN RICK PETERSON OF ZIBA DESIGN AND MYSELF, WITH CAPTIONS OF HOW I APPLIED THE SPONSOR FEEDBACK TOWARD MY SOLUTION. PRINTED AND STAPLED AS A REPORT.
- THUMBNAILS, 2D & 3D SKETCHES - SCAN AND COMBINE IN A GRAPHIC FORMAT THAT HIGHLIGHTS DESIGN BREAKTHROUGHS AND DIRECTION CHANGES. PRINT AND BIND IN A CHRONOLOGICAL ORDER.
- VELLUM MODEL - TWO 11x17 PRINTS OF PRODUCT. FIRST PAGE IS A FULL COLOR ISOMETRIC VIEW DISPLAYING FORM AND GEOMETRY OF OBJECT AS WELL AS FUNCTION. SECOND PAGE IS A COMBINATION OF SEVERAL VIEWS FROM DIFFERENT ANGLES. PRINTED AND MOUNTED FOR SHOW.
- OPTIONAL RENDERING - RENDERING WITH A VELLUM PAPER OVERLAY SHOWING CALLOUTS, PARTS AND GENERAL AREAS OF PRODUCT. MOUNTED FOR SHOW.
- MECHANICAL DRAWING - VELLUM, MODEL TO SHEETS, DIMENSIONED AT TOP FRONT AND SIDE WITH OVERALL DIMENSIONS. DIMENSIONS WILL NOT GET VERY SPECIFIC. PRINTED AND MOUNTED FOR SHOW.
- EXPLODED VIEW - HAND RENDERING SHOWING ALL MAJOR PARTS INCLUDING MATERIALS, WALL THICKNESSES AND CUSTOM & STANDARD PARTS. MOUNTED FOR SHOW.
- HUMAN FACTORS - GENERAL DATA ON BUTTON SIZE, SHOTS OF PRODUCT IN USE, BLUE FOAM STUDIES, CONTROLLER DETAILS, ETC. 1 PAGE, PRINTED AND MOUNTED.
- FINAL APPEARANCE MODEL - SELF EXPLANATORY. TWO SLIDES FOR STEVE BELLETIRE.
- POWER POINT PRESENTATION - I HAVE NOT DECIDED ON HOW TO PRESENT, IF I HAVE TIME I WILL PROVIDE A POWER POINT PRESENTATION. (I WOULD LIKE TO HAVE ONE IF POSSIBLE)

THESIS SUMMARY AS OF FEB 11TH.

SCOTT HEINE

1 The questions I have researched are - How can I bring people closer to nature through product design? How can I make an indoor environment more natural? How can I communicate natural rhythms to a user? These questions will be answered through my design. The research I have conducted deals with aromatherapy, sound therapy, psychology, sundials, astronomy, seasons, sleep patterns, flowers, and existing products - which only are beneath the aroma, sound therapy, and sundial category. My market research and identification deals with experiences and actualizers for the most part. I have conducted surveys that are directed to a wide variety of individuals. The questions asked varied from preference of scents to world travel. I am using this information to better define my target group and thus design a product that can meet their needs and be a significant benefit for their daily lives. My market is substantial, yet not mainstream - it is upper middle class and above - this is not to say that my product will not benefit lower "classes" - it just **may possibly** be expensive. I have almost no legal issues except for UIAA electrical appliance safety standards. There are also no real benchmark designs in this category, which is - I believe - new. My design approach is based on communication of natural environment - so it will most definitely be considerate of environmental issues - and probably ridiculously esoteric about it too.

2 My research sources as of right now are surveyees, the Internet, psychology books, existing product designs and their respective makers, myself and my colleagues - in dealing with the esoteric end. My inspirations right now are coming from natural environment and experiences that I and others have had - i.e. what do you like about the outdoors, what is your favorite naturally occurring smell -(it can't be cookies - unnatural occurring), etc.

3 Questions that remain to be answered include the ones above as well as the basic - 'How will this thing work?' and, 'How will this thing look?'

4 Project package will include - final model, computer model, sketches, sketch mock-ups, market analysis board, benchmark board, renderings, finished concepts, function examples that will display what cannot be able to be communicated through my final appearance model, human factors assessment, bibliography and research documentation in the form of a report, completed surveys, assessments of such, cost analysis, mechanical & material specification drawings, exploded/ assembly drawings, and much more!

Scott Heine

SPONSOR FEEDBACK SUMMARY AND DIALOGUE

Senior Thesis Intellectual Sponsor:

Rick Peterson
Director of Business Development
ZIBA Design
Direct: 408-918-6445
Cell: 408-205-6351 www.ziba.com

Rick Peterson from Ziba design gave me three essential sets of feedback. His first helped me adjust my problem statement and my entire design direction. I also learned from his comments on my drawings where I wanted to focus aesthetically - the art glass shape. As to function, I revisited my needs/benefits and product purpose and made significant changes and progress to each respectively. His second confirmed my function and form as well as helped continue their development - I changed the base design after his suggestions confirmed what I had already been dissatisfied with. His final set of feedback was from "Gustavo", a practicing design colleague and co-worker of his - Gustavo gave excellent yet some wild concept suggestions on my design whereas I was already progressed past my point of no return. I am pleased with my direction as well as the significantly helpful feedback from ZIBA Design.

Below is a transcription of myself and Rick Peterson's dialogue on my Thesis

[Scott Heine]:

Dear Mr. Peterson, I was recently given your name by Steve Belletire, head of the Southern Illinois University Industrial Design Department whom you've met. Steve is my primary instructor along with Larry Busch. I'm aware that you were a graduate of SIU Design in 1980 and had Larry as an instructor. I realize that you must be very busy, but I am contacting you to see if you are interested in being an intellectual sponsor for my senior design thesis. All that would be required of you would be occasional reviews of my sketches/drawings/photos that I would fax to you and professional advice and guidance on the execution of this project. Such is the value and importance of this professional contact, intellectual sponsorship is required for SIUC's senior design thesis. I will call you soon to follow up on this email. I greatly appreciate your time Mr. Peterson. Very sincerely, Scott Heine

[Rick Peterson]:

Scott, I would be happy to be an intellectual sponsor for your project. My role has been more on the business side of the design world, however, I can get some additional input from my ID colleagues should I feel that is necessary. Take care and I will await more from you later. Mr. Peterson.

[Scott Heine]:

Mr. Peterson, Thank you very much! I deeply appreciate your time and assistance. The thesis is still in the proposal stage; which I can have to you by the end of the week. The product category is an off-shoot of the housewares industry; a home aroma therapy/ambient light/ambient sound type device. I am very excited

about the potential end user experience this product could provide as well as the lack of serious entries in this market. Sketching and ideation will be launched this weekend. I will be in contact with you very soon. Thank you again Mr. Peterson - this means a great deal to me. Take care.

[Scott Heine]:

Mr. Peterson, Tomorrow I will fax you a copy of my design brief, which basically describes what I plan to do as well as some research into the whole "sensory therapy" category. I also have about ten pages of pretty wild form sketches. I haven't even begun to approach interface or configuration considerations yet. I am currently working on that. These drawings were simply to motivate me and get my mind thinking or a design "leap" instead of just a "step" or "stretch". Feel free to comment directly on the drawings and brief. If you need better copies of the drawings I can express mail them at your convenience. The studio fax number is 618.453.7547, I think you may have to call first to send them - someone should be there during the day. Feel free to call me at home too if you have any questions about the content or if the faxing doesn't work properly. Once again thank you very much for your assistance and guidance, it is deeply appreciated. Take care.

[Scott Heine]:

Mr. Peterson, I faxed 13 pages of drawings and my design brief to you yesterday, I hope you received all of them. I probably did not provide the most adequate information - I hope that you understand my project. I apologize about not taking the time to explain the exact process to you over email or phone. I thought that sending you the design brief would get you aquatinted with my thesis. Please feel free to respond to the material in whatever method is most convenient for you. Please tell me what your impressions of the project are, as well as the drawings. I am open to all criticisms, expansion on ideas and forms, and whatever guidance you can give me. Once again, I appreciate your time and effort very much Mr. Peterson. Very sincerely, Scott Heine

[Rick Peterson]:

Hi Scott, Product Concept: I do agree that there is a product opportunity in your description. It seems your sights (product expectations) are set impossibly high. A life which combines indoor and outdoors seems to be in balance. Being outdoors is very therapeutic, space, open space, a visual feast, colors, textures, movement, sunshine on our eyes and skin, there is just no substitute. Wind blowing on us and creating movement all around us. Not to mention the sounds and smells. It is actually very hard to fully experience the outdoors because of the extreme amount of input. Indoors in contrast is very safe and controlled. A place to hole up and regenerate. So being indoors makes us appreciate the out-of-doors and being outside makes us appreciate being inside. So do we want to experience the outdoors when we are indoors? I don't know. Do we want the ability to change and enhance our experience indoors, Yes! Have you seen the Helios light fixture? It is \$1200. light from an Italian designer that has made a light that allows you to change the hue to any color. His thinking was to have a light source change hues during the day, thus keeping one in touch with the natural cycles of the sun. Does it do it? I don't know, but it is cool and I do want one, but haven't shelled out the money.

Being outside is such a unique and compelling experience, I don't think you can compete. Having a device that, in some ways, reminds you of pleasurable experiences outdoors sounds good. Or it could trigger

some direct responses that are pleasurable as well. That is where the sounds, smells and lights come in. I would not mind having a device that could be soothing or perhaps stimulating. The aroma therapy I have seen are oils that have distinct fragrances and the company that makes them says each fragrance has a unique effect on the body. However, these smells do not smell like the outdoors. Negative ion generators can give the air a smell of "after a rainstorm", but have other problems. Part of the facts about being outdoors is you don't always know what you are going to get. Some smells are strong and bad. Sometimes the bay or ocean smell great other times it smell like rotting salty vegetation. So I think a lot of the pleasurable smells are so by association mainly. They go together with other pleasurable experiences. Smells out of context do not have the same effect. Also, I question the weather communication functions. What did you have in mind for this? Any digital readout takes people out of the experience and get cerebral. Does it function as a home humidifier? I don't think so. Then the moisture it would give off would be non-perceptible. Also, what was your thinking with regard to the light function. A lava lamp style mood light or something bright enough to affect a whole room.

All this said, I think there is a product here someplace, I think the problem statement is not honed in yet.

Thoughts on your designs:

Drawing 1, references to natural plants are cute but confusing. I personally don't like them, unless it is very whimsical and therefore mostly for other designers. I would think the form should be a object of beauty. Something pleasing to look at. Or should it disappear into the environment and not draw attention to itself? I go for being pleasing to look at. I like the details in this drawing and all the call-outs.

2. the upper drawing should be expanded upon. Sculptural but no reference. The lower, squid, too morphological.

3. Art glass, a definite direction to pursue. Upper and lower right intriguing.

4. Boombox, looks like an appliance. However, it seems like a size that would work given the interior needs. Do you have a volume estimate for your device? I need to know more about scale and size of your ideas.

5. & 7 are the strongest from my point of view. A complex surface with interesting interactions and finishes and textures. Sculpture with a function beyond beauty. Has ports that look like a place to smell, but doesn't use the flower analogy literally, maybe symbolically or stylistically. Inviting exploring of the function of it. Does it all without being cute.

6. boombox, robot man and clock radio. You really want people to not assume they know the function of this new category of devices.

8. I view this as an appliance, but a strong potential direction if you want your device to read as an appliance. Kind of architectural, worth pursuing.

9. Plant reference, not for me. Lower, appliance again. but could be good. drawing lacks detail.

10. top of page, a jar? This is a potential direction. Classic in its shape, medieval, Greek, Roman or Arabic. Magic comes from the jar....

Conclusion,

Work on: What problem am I really solving? What unmet need does this product fulfill? The problem statement for the Lava lamp might have looked really silly, but it is a very entertaining and simple device. Now you can say looking at ocean waves, fire, aquariums and lava lamps are all mesmerizing. My reaction, is that this device is a relaxation enhancer and therefore would have a different skew.

By the way, put more details into the drawings. I had to guess on many of the drawings. Use call-outs to highlight functions, features and materials. If it is a form study, say so. All for now. Good luck, Rick Peterson.

[Scott Heine]:

Mr. Peterson, Much thanks for the excellent feedback. I agree with practically all of your advice and suggestions. As I look at my thesis brief - I see that it is somewhat outdated to my present direction. I included a revised copy below. Hopefully it will seem more realistic. I am particularly interested in your description of our current relationship with the outdoors and indoors. It IS a high-sensory experience to be outside - yet I did mean for us to retain that current relationship. The indoors itself IS a place of rejuvenation and safety. That is a much better way of describing it - I made it sound like they were severed completely. I think the "thesis" statement of the brief - "making indoors - outdoors" is poor wording. I was trying to avoid the "enhance your sensory experience" statement because I thought that would make the project sound hoaky - yet this is really what I am trying to achieve. I think what you said about having the ability to change and enhance our environment is key. Control of our surroundings - indoor environment - on a deeper level than just the thermostat is really what I should be trying to communicate. A "perceived natural environment" is probably too big of a leap. I am struggling with the benefit and value of this device. I am looking for this to be beyond "entertaining". The Lava Lamp is a good benchmark - but does it provide a real human benefit? I really want this product to do that. I have been pouring myself into the concept end of this project after I did those form studies. I have been researching flowers, sundials, sleep patterns - to get a better idea of what I am able to communicate besides smells and sounds. I tend to be looking more and more into lighting. I have not seen the Helios light - I'll look it up. Normally I would have honed the function of this product long before I ever set drawing pencil to paper - especially for this product category, which has almost no visual precedent. I was somewhat pressured by faculty here to submit drawings to you for review. I feel embarrassed to send you such raw images with almost no explanation. They were ALL form studies and I should have labeled them accordingly. I have to say I dislike the plant references also. I have already been pursuing the ones you have suggested - although I have been thinking more about the interface and function. I promise the next set of drawings will include callouts, elevations, and so on as well as some completely new ideas - both form and function. Once again Mr. Peterson, I am thoroughly grateful for all your time. Your feedback was outstanding and I can see that it probably took some time to decipher these sketches. Thanks again! Scott Heine

[Scott Heine]:

Greetings Mr. Peterson, I wrote before that I was extremely pleased with your feedback, I appreciate your honesty - the comments were significantly helpful in adjusting my direction. I am sorry that you were unable to be a bigger part of my process - I was ill-prepared for the true amount of work designing a product from the ground up is. I have been working like mad though in redirecting my concept back to reality. I am at the point of no return now with my thesis and I must pursue my present direction until the end. My product is still open for much change in itself - but the category and heart of it must stay the same. Following your suggestions I pursued the "art-glass" visual concept in hundreds of different ways - while also continuing to research basic concepts of life rhythms and measuring of time. I began to study sundials and thought of incorporating this concept into an aromatherapy device. By doing this I feel I am able to give the device a new outward purpose rather than having it as merely a fragrance dispenser. I conducted a user survey with some forty people, and although not a huge number of individuals, the results all pointed to this simpler objective. So finally, the attachment I included is my current direction. The device is essentially a clock. There is an element of mystery and intrigue in that one must approach the clock and actually view into as if it were a vessel or pot. It indicates time in visual quantities. The inside of this pot is printed with a thermochromatic leucodye onto a translucent backlit acrylic - which when connected to a microprocessor

and controlled with varying degrees of resistance through each "cell" I was able to achieve an incredibly cheap and visually entertaining time display. This technology is on disposable AA Duracell batteries. If you can imagine each "bar" in the attached drawing changing color and rising like in a bar graph. This display indicates hours, days, months, equinoxes, solstices, and time itself as a renewable elliptical quantity. In the inside rim of this vessel is a high intensity directed light that runs on a track, it is directed at the "gnomon" in the center and this is what casts the indicating shadow or clock hand. There is only one hand - minutes so far are determined by this hour hand as well. I feel this feature gives the device an authenticity. It actually functions in the same way a sundial does - except more accurately and much easier to read. There is also a very simple light on the front of the device that shows phases of the moon. It is two irising plates, one translucent white, one opaque. There are 29 phases and thus 29 positions for this light. This way the user always knows when he/she may view a full moon, or a large moon when taking consideration of equinoxes. There are twelve hours on a clock - and twelve months in the year. Each month has a seasonal hue - all set through the printed layer beneath the leucodye in the vessel. The leucodye is a black dye that turns transparent when heated. Heat is achieved through electrical resistance. The aromatherapy portion of the clock is pretty simple. It applies digiscent technology. A pantone or RGB like process combining three chemicals to achieve an astounding array of smells. The vents are cutoff from the interior of the device by a molded manifold. The scent is mixed and dispensed by a small fan in tiny amounts - this feature is fully controllable by a remote controller that is stored on the device. The chemicals are refilled by a cartridge that is accessed at the very bottom of the vessel. The entire device itself may act like a lamp. I was thinking of having it photoresponsive - or it giving an amount of light out to as how dark it was around it. The housing would then be injection molded translucent frosted acrylic. That's what I have so far Rick. I apologize for the long wait between messages and the length of this message itself. Let me know what you think about this new development as soon as you are able. Once again thank you very much for all of your time and help. Scott Heine

[Rick Peterson]:

Hi Scott, Hey, we like the direction you are going. The concept is very strong. We have some questions on the enclosure work, the stand being our biggest concern. I will forward you more thoughts soon. Meanwhile, check out the article in InCA. on page 9 - Ambient Intelligence. You can down load it from the link below. take care, Rick Peterson

[Rick Peterson]:

Here is some feedback from Gustavo...

Rick, I think this is a really cool concept. The self-contained nature of it is what I think makes it look like a 'sharper image gizmo'. What about having a higher level of interaction with this thing that just looking at it as you would look at a wall clock. Maybe the sundial cast shadow on a table/ ceiling, across the room etc. So you take a glance at your indoor environment and can deduct thing like where the sun is, as compared to just what time it is. The aroma ports are a cool detail, but why not to fill them right from those same holes, like watering a plant instead of a cartridge (with reminds me of a printer). Remote control: do you need it? Why? I can see a remote controller 'cheapens' the idea of a more esoteric 'sculpture'. If there is really a need hiding it is a good idea. By I rather don't have it in there. I love the moon faces detail. I can see that positive negative could be a cool thing if it's done with, light, the bubbles of the aroma liquid, or something not so tangible as a mask sheet of plastic/metal. Materials wise: Frosted acrylic and santoprene is so 90's/Y2K :). why not aluminum, wood, fabrics, natural fibers, bamboo? or molded wood board. For the aroma ports 'splashes' what about cast metal inserts, liquid 'liquid metal shape'. I don't know I just think just

be a push into a quality object, not like another consumer product look like. I'm not to sure about the inverted desk lamp on a stand. I guess that is also a big factor that limits the user interaction. Is it something I could hold? or something that lays on the ground and beams my apartment ceiling? Anyway, those are my thoughts. Gustavo

User Survey; Results and Analysis

This survey's purpose is to generate information that will be used to determine the best possible solution for a **sensory perception/therapy** device or product. It combines current technologies with some new concepts about how we perceive our indoor surroundings. This research will be applied to **designing the experience** dealing with enjoying the benefits of the outdoors and indoors either concurrently or simultaneously. The attributes of nature (outdoors) are held as a highly therapeutic benefit or value. People often think that this experience requires traveling to a place, investing money and time, or simply beyond their situational means. This product will challenge that ideal.

We experience our environment through our five senses - sight, sound, smell, taste, and touch. The act of being indoors is an escape from the intensity of these sensations from the outdoors. My approach is to create a device or system that enables the user to experience some of the most enjoyable elements of nature - without the harshness of authentic weather; like humidity/rain, extreme temperatures, sunburn, brightness, wind, etc. It combines concepts of aromatherapy [smell] and audio therapy [sound] with light [sight]. This survey will help me develop a product that is truly a benefit for you, the potential end user.

*The most popular answers are in **Bold** below.*

Age 30 Gender even male/female

1. Do you own an aromatherapy device or scented candles? circle one?
no & yes candles How often do you use it? once a week

2. How many hours a day do you spend indoors? 18 hours a day
How many in your living or family room? 3 In your bedroom?
(excluding sleep time)? 2

3. If you were to have a device like this, where would you put it? Top answer - bedroom, second - living room, third - office
(What room in you house? - or maybe at work?)

4. What do you prefer: ambient light or direct light? circle one

5. When you relax - where do you go? outdoors and bedroom

6. Do you require complete silence to fall asleep, or do you prefer background noise? answers were an even split

7. What is your favorite season? 1- summer 2 - spring 3 - fall 4- winter Why? color, temperature, smell

8. What would you rather smell - circle one fragrance per pair

- perfume or **real flowers**
- oak leaves or **vanilla candles**
- **the ocean** or a Glade Plug-In

- Febreze or cedar
- fresh rain or clean laundry

9. Do you own a lava lamp, water garden, bird clock, massage devices or any other product that you use to enjoy yourself or relax? _____

most popular answer was lava lamp - but many used the video games , stereo and computer to relax - most popular female answer was bath products and the shower/bathtub itself.

10. If you could instantly travel anywhere, where would it be?

hot/summer island/desert environments

reasoning for many answers was often color and smell related Any comments? Please write on the back of this survey!

This survey provided a great deal of information for me. I validated my problem statement and discovered that there *was* a need and benefit for the product I was planning to design. I also realized that my market would indeed be specific and that I was going to have to design this product for that particular group. I also was refreshed by the answers almost unanimously pointing me in the natural environment direction. This survey shows that people truly enjoy the outdoors and yet are not able to be outdoors for more than a few hours a day - which is mostly traveling in between indoor environments. I also felt that the survey participants showed a desire for a quality product that provided a genuine, realistic experience. I was surprised at the distaste they had with the present products in this market category being cheap, poorly performing, and unnatural. I was most surprised by the comments on the benefits of the clock radio elements of current products - not for the alarm feature but as a stylish time informing device. People like to know what time it is - or more importantly *about* what time it is. I was also very enlightened on the fact that nearly all of the survey participants liked to relax in an active or interactive manner as opposed to simply being inactive or sleeping. Many played musical instruments, video games, went for walks, actively listened to music, used the computer and used the shower or bathtub. These are almost all interactive experiences. This helped push me in the sundial direction - the sundial being an interactive and natural time telling device.

Senior Thesis Research & Product Statement

Scott Heine

Eros in early Greek mythology was represented as one of the primeval forces of nature, the embodiment of the harmony and creative power in the universe - attended by his brothers Pothos ("longing") and Himeros ("desire") and himself the constant attendant of his mother, Aphrodite, the goddess of love. This design is named after what it hopefully represents - *the embodiment of harmony and creative power*. Eros is essentially an aromatherapy device, a lamp, and a clock. To describe it as such sounds as if it is a Frankenstein combination of unrelated technology, though it is truly a thoughtful fusion of such - it is better described as an *exploration of sensory perception and environmental rhythms*. Eros pushes current, established perspectives on how we view our indoor surroundings and how we view time as a linear constant. Eros's design goals include bringing a natural, tangible conscience to the indoor living space as well as displaying time as a cyclic, circular, visual quantity. Eros achieves that through the technology discussed below.

While conducting my research for my senior thesis, I investigated four main topics - 1. thermochromics, i.e. thermochromatics, leucodyes, 2. sundials, natural environmental rhythms, 3. aromatherapy, digiscent and iSmell technology, and 4. the science behind olfactory physiology. These elements together with an intriguing form were the foundation of my product development stage in my senior thesis.

Digiscents, an Oakland, California based company recently received the Edward de Bono Award for the "Most Practical and Effective New Idea of the Year" for it's new iSmell technology. This technology is fairly simple - Digiscents has developed a process - much like the Pantone process for printing - that combines three chemicals in varying combinations to synthesize over 20,000 different smells. The process has won several best new technology awards across the country - but the product that has been designed to take advantage of this new technology is a peripheral device for a personal computer, supposedly "enhancing the web interactive experience." The idea is that consumers and individuals looking for smell entertainment will be able to test products with a secondary physiological sense as well as smell everything from dirty socks or websites solely devoted to flatulence. I myself, as well as a great many

others - from investors to consumers - are quite skeptical of the practicality of this application. The process is ingenious - and it's consumer product application potential is probably enormous. Digiscents owns the technology, and this iSmell peripheral device is a first generation device testing the market. Eros, my senior thesis is a close-at-hand product application for iSmell technology. Eros is a more sensible, maybe more grounded application for iSmell - as well as harnessing it's smell variety in ways that current aromatherapy devices don't even come close. To sum up my product designs purpose in using this technology - the primary difference between Eros and other aromatherapy devices is that the current devices rely on fragrance beads that recreate perfume like fragrances like "Gardenia" or "Chamomile" whereas Eros will have the capability or very accurately recreating nearly *any smell* - from a northern pacific western red cedar forest to freshly squeezed orange juice. The iSmell technology gave me my basis for designing such a product and such a capability puts Eros on a different level than existing products.

While generating form ideas for packaging the iSmell technology, my thesis professional sponsor suggested that I try designing more for an interactive experience. I had also been searching for an element that would help my user interact more with the product - an aromatherapy device is not a heavily used device. In my design brief I had stated that I was trying to design for all the senses - harnessing and orchestrating sound and light with this device. On a "eureka" type whim, I began researching sundials. I found that they were very unique devices, very popular in Europe, and a very interesting way to communicate natural time rhythms - which had been part of my design goal. I developed a way to incorporate the sundial aesthetic into my existing form and function. The face of the device is inset, with a sundial gnomon in the center - a small, high intensity light runs on a very simple, flexible track around the inside rim of this face and directs its light onto the gnomon in the center - this casts a shadow toward the rising slopes on the face and points to the "numbers" (bars) on the clock, acting as the clock hand. So the clock has no movement, and no digital display. The light is controlled and set by a simple internal chip which is then controlled by the user through an exterior, hidden, cradled controller - which also controls the aromatherapy functions.

To further communicate the rhythms I was trying to visually express, I decided a very simple, yet unique display was required. After a discussion with my professor Steve Belletire on LEDs and batteries - of which Duracell has a tiny energy indicating display - I began to research thermochromics, which are color changing dyes. I

found that this technology, while very sophisticated, is used mostly for stickers, radiation indicating badges, color changing t-shirts, and batteries. The technology is based on leucodyes - which change color with heat or UV radiation. The dyes can be printed through many common processes and have a good range in color. The dye found on Duracell batteries is actually a black dye that turns transparent with heat, provided by electrical resistance, on top of a yellow background. I decided to have the face of the clock/sundial be printed with a dark navy blue or black color that would turn clear in certain sections for specific reasons - indicating date, season, seasonal colors, equinoxes, and solstices - all in a visual quantity - bar graphs, pies, etc. I had achieved my design goal in a unique, very inexpensive manner - without cheapening the authenticity of the device with an LCD.

Then there is my research on human olfactory physiology. I focused mainly on the effects of aromas on the human psyche rather than on the science of how we smell. I could go into great detail with what I found - like the disorder that prevents the ability to smell - Anosmia, or how identical twins have a genetically identical smell, or how dogs and horses can smell fear and bad weather - but I digress. What I essentially learned is that good smells make people feel good. We can smell happiness. Happiness is a smell, maybe different for all people, but nonetheless, smell, in part, is directly associated with emotion. *Eros has the potential ability to have a real, significant, benefit and affect on all users except of course those with Anosmia - yet Eros still provides a very interesting visual function as well. That brings us to Eros's audio function.*

Eros, through USB and other such audio/visual connectors is able to connect to a personal computer or stereo system. Through software and simple internal chips, Eros can orchestrate three senses at once - sight, sound, and smell, associating them with music, places like the sounds and smells of the ocean, and a simple, very unique, visual display showing time.

This concludes my product statement and research summary - following are samples of some of the research websites I used in conducting this thesis. There is a section on each research topic I discussed - Thermochromics, olfactory physiology, digiscents, aromatherapy, and sundials.

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So It Does What?

Basically...

Thermochromic (a.k.a. "thermochromatic" or "chromatic") ink changes color, appears or disappears it heats up or cools down. Photochromic (a.k.a. "photochromatic") ink goes from clear to colored w/ exposed to sun light, then back to clear when unexposed.

Depending on the kind of DynaColor™ ink you get, you can make it change by breathing on it, rubbing it with your fingers, sitting on it, sticking it in the fridge or freezer, blow-drying it or holding it in the sun or under a black light.

DynaColor™ interactive inks are available for most printing processes, including offset, flexography and screen printing. They come in 11 standard colors (10 for photochromics), plus a few custom colors.

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Heat It. Freeze It. UV It.

What Can I do With it?

We're tempted to say, "You name it," but that would be a bit of an overstatement. But just a bit. We put together some ideas for you below, to get the creative juices flowing...

Thermochromics

DynaColor™ thermochromic inks come in three standard color-change temperatures: "Low Temperature", "Body Temperature" and "High Temperature". [Click here](#) for more details on available temperatures. The Low Temperature ink is used for applications in the refrigeration temperature range like beverage labels. Body Temperature is designed to show color at normal room temperature, and change when you rub it with your finger or breathe on it. It's used for things like documents and security packaging. The High Temperature formulation changes color just below the painful temperature for skin, and is used in safety labels and hot beverage labels.

We know what you're thinking: "Hey, can I hide a message with this stuff?" You betcha. We've got ways to do it with offset, flexo and screen printing. Since each of these printing processes gives a different level of color & opacity, each message-hiding technique is different, but they all work. We'll teach you how to do whichever one you need, for FREE with your ink order! [Contact us](#) for more information on each of these methods.

DynaHide™

This is our name for the message-hiding technique designed especially for **offset** inks. It's patented just like the ink itself, in case you care. When you order offset ink, we'll teach you how to do it. It creates a camouflaged message or image of most whatever you want. You can do it with any temperature DynaColor™ ink, but the most common temperature is Body Temp. Not only will it magically appear when you breathe on it, rub it or sit on it, but it will also show up on a color copy. It's great for securing valuable documents & products.

Photochromics

Technical Mumbo-Jumbo

[Win a Palm VII!](#)

[What Is Interactive Ink?](#)

[What's It Good For?](#)

[Does It Come In Purple?](#)

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Yawn!

.....

This is the part of the site that contains all the techie stuff, organized by ink type, for those of you who need it (or who have nothing better to do).

If, for some reason, you still feel like talking tech after reading this section, you can always Contact CTI for more information

.....

Thermochromics

("Heat-Reactive" or "Temperature-Sensitive" Color-Changing)

These heat-activated inks change colors or disappear when they exceed a certain temperature, then change back when the temperature decreases to below that same "activation temperature." They are all offered in three standard activation temperatures: 15°, 31° and 45° C. Other custom temperatures are available from -5° C to 65° C, at an extra charge.

Offset

CTI's original, patented formulation, for use in document security, labels, or advertising. Conventional wet (lithographic) and dry, as well as UV curable wet and dry formulations available.

- Conventional, Wet & Dry
 - [Product Data Sheet](#)
 - [MSDS](#)
- UV Cure, Wet & Dry
 - [Product Data Sheet](#)
 - [MSDS](#)
- [Rheological Characteristics](#)
- [DynaHide™ Message Hiding Technology](#)

Benefits of DynaColor™ offset ink as a security feature:

- Patented, secured ink and printing process
- Cannot be reproduced on laser printers or color copiers
- No special lights or devices needed for detection

- Laser and impact printer compatible
- Can be applied to the front or back of a document – cut sheet, continuous or small roll
- Easily recognizable; No need for interpretation

Flexographic/Gravure

This ink is available in both water-based and UV formulations. It offers excellent color strength and changing characteristics, and is very well suited to labels, packaging, and receipt rolls.

- Water-Based
 - ⊗ [Product Data Sheet](#)
 - ⊗ [MSDS](#)
- UV Cure
 - ⊗ [Product Data Sheet](#)
 - ⊗ [MSDS](#)
- Solvent-Based ^{NEW!}
 - ⊗ [Product Data Sheet](#)
 - ⊗ [MSDS](#)
- [Message Hiding Techniques](#)

Screen

This type of thermochromic ink gives the strongest color and best opacity, due to the thick ink films possible with screen printing. Great for printing novelties & premiums, direct mail, and advertising pieces.

- Paper Screen
 - ⊗ [Product Data Sheet](#)
 - ⊗ [MSDS](#)
- UV Screen
 - ⊗ [Product Data Sheet](#)
 - ⊗ [MSDS](#)
- Textile Screen
 - ⊗ [Product Data Sheet](#)
 - ⊗ [MSDS](#)
- Epoxy Screen ^{NEW!}
 - ⊗ [Product Data Sheet](#)
 - ⊗ [Resin MSDS](#)
 - ⊗ [Hardener MSDS](#)

DynaHide™ Message-Hiding

DynaHide™ is not an ink, but a technology that allows the hiding of a message utilizing DynaColor™ thermochromic offset ink, in conjunction with a non-thermochromic ink hidden message, screened to density that provides blending or camouflaging of the hidden message. [Contact CTI](#) for printed samples of this powerful new technology!

What's it going to cost to use DynaColor™ and DynaHide™ on my piece?

Approximate ink cost per square inch, by ink type, not including fixed costs such as setup, cleanup, are usually less than half a penny per square inch of coverage. [Click here](#) for more details.

.....

Photochromics

("Sun-Reactive" or "Light-Sensitive" Color Changing)

These inks are colorless in the shade, then develop color when exposed to sunlight or other UV light. Each of these inks come in ten standard colors, with limited custom colors available.

Offset

- UV Curable ^{NEW!}
 - [Product Data Sheet](#)
 - [MSDS](#)

Flexographic

Great for direct mail and novelty applications, as well as for covert product security packaging and secure labels.

- Solvent-Based
 - [Product Data Sheet](#)
 - [MSDS](#)
- UV Curable ^{NEW!}
 - [Product Data Sheet](#)
 - [MSDS](#)

Screen

- Textile Screen
 - [Product Data Sheet](#)
 - [MSDS](#)

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Other Miscellaneous Technical Information

FDA Information

- [UV Offset, UV Flexo & UV Screen](#)
- [Solvent-Based Screen](#)
- [Water-Based Flexo](#)

Recommended Substrates

[See a chart](#) of some of the substrates on which our inks will work.

Thermochromic Inks in Document Security Applications

An [address](#) given by Lyle D. Small, CTI's Founder and President, at Gorham's Document Security Conference, March 1997

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DynaColor™ photochromic inks are solar-powered magic. They are invisible unless UV light, like sunlight, hits them. Then they bloom into color. This special brand of magic is great for everything from high-security documents & products to interactive advertising & direct mail pieces. With photochromics, you don't even need a special technique to hide an image; the hidden image is built into the ink.

Click the button below for application examples.

Application Ideas

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School of Biosciences Cardiff University CF10 3US, UK	tel: (44) (0)29 20 874105 fax: (44) (0)29 20 874094

last update 7.7.2000

Index of Research:

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The aim of this study was to correlate the perception of varying degrees of olfactory stimulation (a conscious event) with the olfactory event related potential recorded on the scalp (OERP). The OERP reflects both sensory transmission (physiological) and cognitive (psychological) events.

Olfactory Event-Related Potentials (OERPs) were recorded by EEG using monopolar electrodes located at Fz , Cz , Pz, T3, C3, C4, T4 electrode sites (International 10/20 System) in 28 young students (range 18-25 years). Brain potentials were amplified and digitised and an average was created for all subjects for 20 trials, while the subjects concentrated on a visual task. Pulses of amyl acetate (saturated vapour) were mixed 1:3 with medical air for 35, 50, 75, 100 and 200ms duration and delivered at 2.5, 5, 10 and 60s inter-stimulus intervals (ISI) respectively. In each condition, the odour was delivered between 5 to 15 times. Each session was separated by a 2 min break to relieve fatigue and allow for neuronal recovery. Airflow, temperature and humidity were kept constant. The amplitude of the OERP was measured as the difference between the negative and positive peaks (sometimes referred to as N1-P2 or N1-P3). For the psychometric test the subjects were given the same stimulus protocol. A number of pulses, between 15-25, were delivered and they were asked to record how many they detected.

There was a decline in the number of odour pulses detected both with decreasing stimulus and ISI. In the matching set of physiological experiments there was also a decline in the OERP

when either odour concentration or ISI were decreased. The decline in perception as ISI decreases probably results from the process of adaptation occurring in the olfactory receptor neurones, although there may also be a contribution from central habituation, and this is reflected in the decreased OERP amplitude. The increased amplitude of the OERP with increasing stimulus strength results in increased perception once the stimulus has achieved a threshold value. Perceptual and physiological thresholds were similar.

We are investigating the effects of certain odours on the following physiological parameters:

- heart rate
- respiration rate
- EEG activity
- blood oxygen
- skin resistance

Smell has the ability to affect our physiological and psychological state via two mechanisms; (1) the intrinsic pharmacological properties of the odour molecule itself and (2) contextual association and memory. This latter has been extended to conditioned reflexes in animals.

We respond differently to different smells. While the biological significance of malodours is clear, the reason for the existence of pleasant odours is less obvious. Can we observe differences in our psychophysiological response to malodours and pleasant smells?

Alpha-wave content of EEG in response to aromatherapy oils

Using EEG recording in my lab we have analysed the effect of two essential oils, ylang ylang and rosemary, on the alpha-wave content of the brain activity of second year students. The generation of alpha waves by the brain is thought to be associated with the degree of arousal; high alpha wave activity being associated with a low level of arousal (relaxed state). The EEG was recorded over the occipital region of the scalp referred to the vertex, with the eyes closed.

The protocol was to pre-relax the subjects, record the EEG for 2 mins and then apply the odour to a face mask, wait 3 mins and then record another 2 mins. The mask was then removed, 3 mins allowed for equilibration and a further 2 mins of control activity was recorded.

The alpha-wave component was determined by power spectrum analysis of the data between 8-12Hz (the frequency of the alpha waves).

While there are clear trends (see figure on right) - rosemary depresses alpha-activity while ylang ylang enhances it, a longer recovery period following exposure to the odorant is needed.

Rosemary is a well-known stimulant and ylang ylang is a soothing, relaxing aroma. The results are therefore supportive of the suggested effects of these two oils.

While this work was a little fun to make students think about the olfactory system it has its serious side. Can we detect changes in physiological state in response to odours? Can we make use of this to understand enough about human psychophysiology to be able to use it therapeutically?

To detect and measure anosmia (loss of smell), to help people who have lost their sense of smell, or to evaluate treatments to cure anosmia, we need to be able to measure the activity of the olfactory system. At present this is difficult. To measure it requires the recording of electrical activity in response to a stimulus (smell) by placing wire electrodes far up the nose. Current methods are invasive and uncomfortable at best.

We are developing a method for recording the activity of the olfactory system non-invasively by placing electrodes on the surface of the nose. We simultaneously record the electro-olfactogram (EOG) from the olfactory epithelium, and the olfactory event-related potential from the scalp.

We hope to be able to investigate:

- anosmia
- recovery from anosmia
- therapy for anosmia
- physiological vs psychological components of the olfactory event-related potential (OERP)

The characteristics of the psychological perception of the malodours butyric acid and n-valeric acid were studied by olfactometry. The odours were delivered to the nostrils via a teflon canula in a continuous air-stream with a total flow rate of 3 L/min. The duration of a random number of odour pulses was set by computer-controlled solenoid valves to last for 35, 50, 75, 100 and 200 ms with inter-stimulus intervals of 2.5, 5, 10 or 60 s. Subjects were required to indicate the number of pulses they could detect. The results showed that the number of odour pulses detected increased with increasing the pulse duration or inter-stimulus interval. 3D curve fitting with an exponential function revealed that the perception of odour (the percentage of odour pulses detected) was positively correlated to the concentration (pulse duration) and the inter-stimulus interval in both odours tested. However, more interesting phenomenon were revealed by analysing the data in terms of gender. The perception of n-valeric acid was different between male and female subjects. The perception was correlated both to the concentration of the odour and the inter-stimulus interval in male subjects, while it was only correlated to the inter-stimulus interval in females. As for butyric acid, there was no significant gender difference in the correlation of perception with the concentration and inter-stimulus interval. Furthermore, the threshold of the perception of both odours was higher in male than in female subjects. The results suggest that there are different perceptual models for different odours and that, for certain malodours, women are more sensitive than men.

The Electro-olfactogram (EOG) is considered to be the summated generator potential of the olfactory receptor cells and therefore represents the peripheral olfactory events. The aim of the present investigation was to study EOGs in healthy human subjects. Fourteen volunteers participated in the study. Electrical activity of the olfactory epithelium was recorded with a Ag/AgCl electrode (0.8mm dia) positioned in the olfactory cleft, in response to amyl acetate delivered by an olfactometer. EOGs were recorded in 11 out of 14 subjects. No responses were obtained when control air was used or when the electrode was positioned in the nasal respiratory mucosa. Three different patterns of responses were obtained from the olfactory epithelium. A negative electrical potential was recorded in 9/22 (40.9%) recordings. A second type of electronegative on-off-EOG was found in 2/22 (9.09%) recordings. The third pattern was a positive potential recorded in 4/22 (18.18%) cases. These wave forms appeared after a latency of 40 to 154 msec (mean \pm SE = 77 \pm 10.36 msec). The variable polarity of these olfactory potentials needs further clarification. Similar findings were observed by Takagi and colleagues in frogs, who classified these EOGs into five fundamental forms [1], and suggested that the positive potentials originated from the supporting cells whereas the simple negative potential represented the activated olfactory receptor cells. Further studies are being conducted to test these ideas.

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Role of smell



Smell is one of the chemical senses, the other being . They are so called because they sense chemicals and smells are, of course, chemicals. With these senses we sample our environment for information. We are continuously testing the quality of the air we breathe (this will alert us to potential dangers, e.g. smoke) as well as using this sense to inform us of other relevant information, such as the presence of food or another individual. The chemicals detected by our sensory systems need to have certain properties. For instance, odour molecules must be small enough to be volatile (<300-400 relative molecular mass) so that they can vapourise, reach the nose and then dissolve in the mucus. This tells us that smell, unlike taste, can signal over long distances (an early warning device). We appear to have an innate ability to detect bad, aversive smells. One-day old babies give facial expressions that indicate rejection when given fish or rotten egg odour.

But, is our olfactory system doing more than just giving us warnings? Yes, of course. Amongst other possibilities, it serves a recognition function. We all have our own unique smell (some more pleasant than others! - but that's another story, see "mate choice" below) and can recognise and be recognised by our smell.



Dogs can distinguish between the smell of T-shirts worn by non-identical twins (they couldn't tell the difference between identical twins - presumably because they smell identical!). Children can distinguish between the smell of their siblings and other children of the same age. Babies recognise their own mothers' smell and mothers recognise their own babies' smell. Emotion can be communicated by smell. Dogs and horses are very sensitive to the smell of fear in humans. Recent research has shown that a panel of women can discriminate between armpit swabs taken from people watching "happy" and "sad" films. Men were less good at this. The emotions of others, for example fear, contentment, sexuality, may therefore be experienced and communicated by smell. Memory is often associated with smell. Smell and memory are intimately linked - although this phenomenon is not well understood (see Smell & Memory, below).

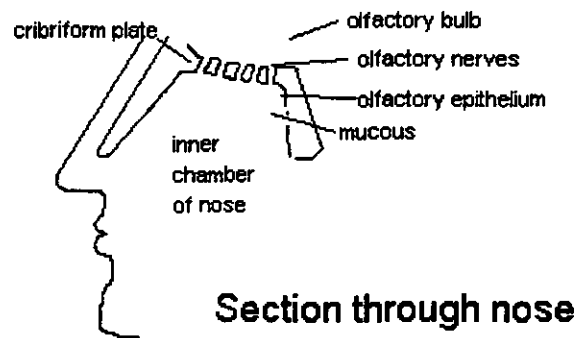
How we smell (some estimates suggest we can distinguish around 10,000 different smells), why we smell and the impact of smell to our everyday life are poorly understood. We certainly underestimate the importance of smell to our well-being - ask an anosmic (someone who has lost some or all of their sense of smell). Some anosmics suffer from depression and their quality of life is severely affected - at the

moment there is little that can be done to help them.

There are suggestions that smell can influence mood, memory, emotions, mate choice, the immune system and the endocrine system (hormones). We can communicate by smell - without knowing it. 😊
In fact the sense of smell could be said to be at the mind-body interface.

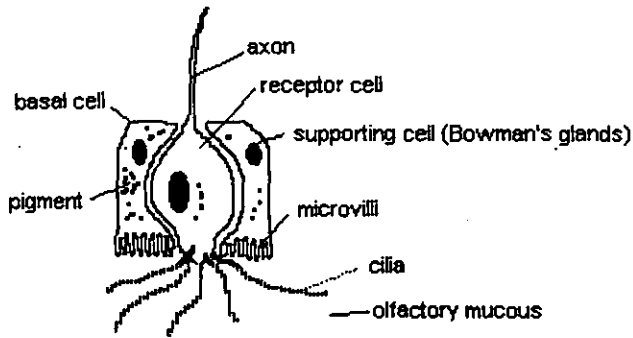
The olfactory system

Smells are detected in the nose by the specialised receptor cells of the olfactory epithelium. These are called olfactory receptor neurones.



Section of nasal cavity

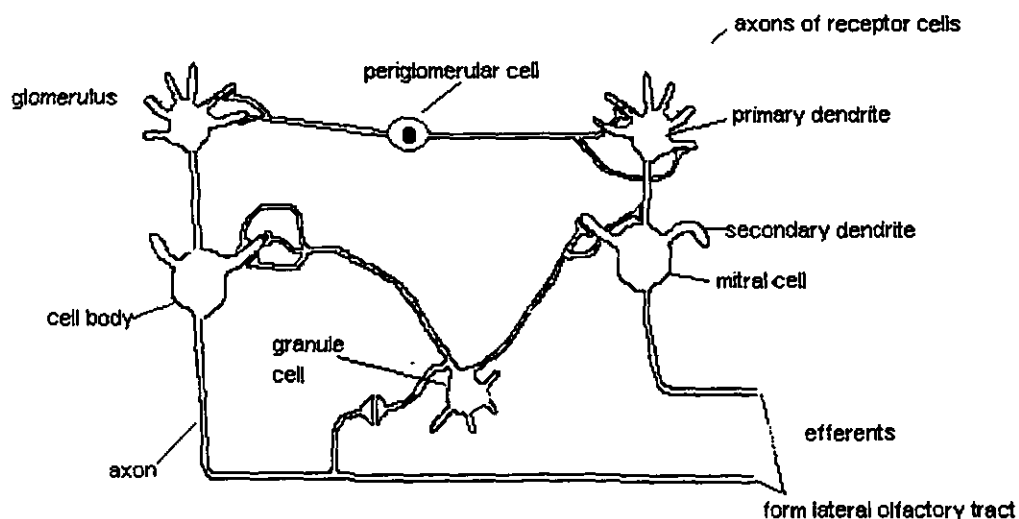
In the roof of each nostril is a region called the **nasal mucosa**. This region contains the sensory epithelium - the **olfactory epithelium** - covered by mucus. The area of this olfactory region is 5cm^2 in humans and 25cm^2 in cats. The epithelium contains, as well as the sensory cells, Bowman's glands producing the secretion that bathes the surface of the receptors. This is an aqueous secretion containing mucopolysaccharides, immunoglobulins, proteins (e.g. lysozyme) and various enzymes (e.g. peptidases). Also found in the nasal mucosa is a pigmented-type of epithelial cell: the depth of colour is often correlated with olfactory sensitivity, being light yellow in humans and dark yellow or brown in dogs. Pigment may play a part in olfaction, perhaps absorbing some kind of radiation, like infrared. Finally the nasal epithelium contains the receptor cells - some 10 million in humans (more in rats and cats). They possess a terminal enlargement (a "knob") that projects above the epithelial surface, from which extend about 8-20 olfactory cilia. These cilia do not beat (being non-motile) but they contain the smell receptors.



Nasal epithelium

The olfactory receptor neurone

The *receptor cells* are bipolar neurones in the nasal epithelium. They are unique to the extent that they are capable of regenerating. They possess cilia which project into the mucus and, at the other end, axons that project to the olfactory bulb. 10-100 axons form up into bundles that penetrate the ethmoidal cribriform plate and terminate in the olfactory bulb, converging on synaptic glomeruli. There are two olfactory bulbs, one in each nasal cavity. In humans there are about 6M receptor cells in each nostril and this rises to 50M olfactory receptor neurons in the rat.



Neuronal connections in the olfactory bulb

Olfactory connections

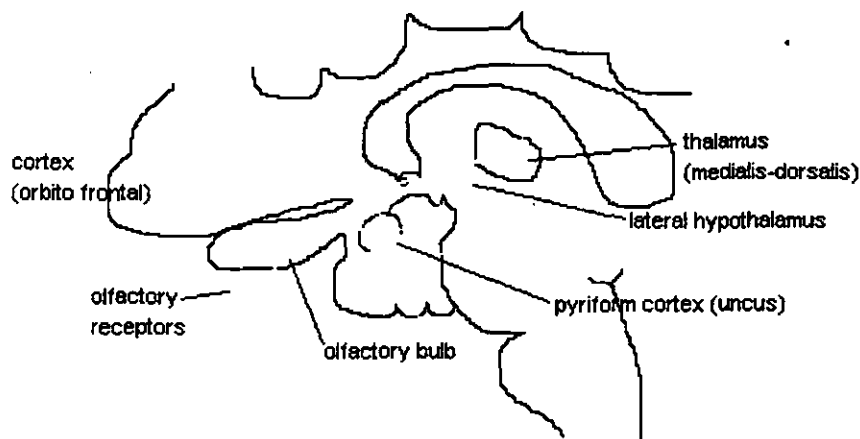
- *Mitral cells* are the principal neurons in the olfactory bulb. There are about 45,000 of these cells in each bulb in the rat and around 50,000 in the adult human. They have a primary apical dendrite

which extends into a spherical bundle of neuropil called a *glomerulus* (see below) which receives the input from the olfactory receptor neurons. Their axons merge together to form the *lateral olfactory tract*. They possess collaterals, involved in negative feedback and positive feed-forward.

- *Glomeruli* are roughly spherical bundles of dendritic processes - some 25 mitral cells may send their primary dendrites to a single glomerulus - and it is here that they make contact with incoming olfactory nerves (in rodents the branches of 17,000-25,000 olfactory axons). In the rabbit there are about 2000 glomeruli per olfactory bulb.
- *Periglomerular cells* are involved in lateral inhibition at the level of the glomeruli
- *Granule cells* are inhibitory interneurons. They receive both contra- and ipsi-lateral input.
- The *lateral olfactory tract* terminates in the pyriform and prepyriform areas from where the primary projection goes to the thalamus (medialis dorsalis). Axons project from here to the neocortex (orbito-frontal). In addition, primates have a pathway that runs via the limbic brain to the hypothalamus and is involved with mood (and memory) and neuroendocrine regulation. This latter pathway is responsible for the so-called "affective" component of smell.
- *Centrifugal pathways* have a "wipe clean" function to reset the system ready for the next input and also with dis-inhibition. When hungry smells have a greater effect!
- The architecture of the bulb results in 1:1000 convergence of olfactory receptor neurons to mitral cells. Thus a lot of information about individual receptors is thrown away but this increases sensitivity since contributions from many receptors are added together.

Central olfactory pathways

Neurons from the lateral olfactory tract project to; (1) the amygdala, septal nuclei, pre-pyriform cortex, the entorhinal cortex, hippocampus and the subiculum. Many of these structures form the *limbic system*, an ancient region of the brain concerned with motivation, emotion and certain kinds of memory. The septal nuclei and amygdala contain regions known as the "pleasure centres". The hippocampus is concerned with motivational memory (the association of certain stimuli with food). (2) Projections are also sent to the thalamus and thence to the frontal cortex for recognition. There are many forward and backward connections between each other these brain centres.




Olfactory hallucinations

coupled with feelings of *deja vu* occur in "uncinate seizures", a form of temporal lobe epilepsy, and sometimes there is a generalised intensification of smell. The uncus, phylogenetically part of the "smell-brain" (or rhinencephalon), is functionally associated with the whole limbic system (which includes such brain areas as the amygdala, hippocampus, pyriform cortex and hypothalamus), which is increasingly

recognised to be crucial in determining and regulating the entire emotional 'tone'. Excitation of this, by whatever means, produces heightened emotionalism and an intensification of the senses.

Olfaction and EEG

Electroencephalography (EEG) has been used to study olfaction. For more detail . Fragrance manufacturers have for many years been trying to demonstrate that certain smells are relaxing. This can, in theory, be done using EEG. One of the brain-waves measured by EEG is called the "alpha-wave". It has a particular frequency of 8-12 Hz (or waves per sec). Increased alpha-wave activity in your brain is a sign of relaxation (more correctly speaking - a *lower state of arousal*, since you produce them when you are drowsy and just before you fall asleep).

There are companies that market perfumes with claims that they do relax you. The problem is complicated by the many things that can affect psychological state. But, there are effects that can be measured under certain circumstances (see section on)

Theories of olfaction

1. Molecular shape
2. Diffusion pore
3. Piezo-effect
4. Molecular resonance
5. Nose as a spectroscope

1). Molecular shape

Chemists noted that C4-C8 chains of certain aldehydes/alcohols had strong odours. 6-C benzene ring altered its smell greatly according to where the side chains were situated, whereas larger rings (14-19C atoms) could be rearranged considerably without altering their odour. The "lock and key" hypothesis (Moncrieff, 1949) was borrowed from enzyme kinetics and applied to smell. He proposed that distinct primary odours had receptor sites. Amoore (1963) proposed 7 primary odours because of their high frequency of occurrence amongst 600 organic compounds; camphor, musk, floral, peppermint, ether, pungent and putrid. These 7 primary odours were proposed to have different shaped receptors corresponding to the shape of the molecules.

With the discovery of odorant binding proteins, this theory is enjoying a revival.

2). Diffusion pore

This theory of Davies and Taylor (1959) suggests that the olfactory molecule diffuses across the membrane of the receptor cell forming an ion pore in its wake. The diffusion time and affinity for the membrane receptor determine thresholds. But, it is difficult to explain the different qualities of smell. The same problem of frequency coding and stimulus intensity as for the previous theory of molecular resonance exists. The different odour would cause a different size pore and therefore a different receptor

potential, giving rise to a particular firing rate - but in olfaction, stimulus intensity is frequency coded and not the different quality of the odour.

3). Piezo effect

This, slightly off the wall theory was proposed by Rosenberg et al (1968). They believed that the carotenoids (in the pigment of the olfactory cells) combine with the odorous gases giving rise to a semiconductor current. They tested the idea and found a reversible concentration-dependent increase in current of up to 10,000,000 times and proposed a weak-bond complex formation which increased the number of charge carriers. However, there were problems with this theory; (1) receptor cells do not contain the pigment and (2) weakly odorous short chain alcohols gave a greater increase in semiconductor current than smellier long-chain alcohols.

4). Molecular vibration

The frequency of many odours is in the infrared (IR). Is this resonance associated with their smell? This idea was suggested by Dyson (1938). Male moths are drawn to candles because the flickery IR emission is identical to that of the female moth's pheromone. Different frequencies of IR could give rise to different smells. If the whole vibrational range was used, up to 4000cm^{-1} , the detection of functional groups would be explained since many compounds with distinctive odours vibrate at around 1000cm^{-1} . There is an immediate problem - that of the body's natural IR heat. Perhaps the pigment acts to absorb this IR radiation. Another problem is that frequency coding is proportional to stimulus intensity in olfaction, so different frequencies of IR could not be converted into different nerve firing frequency.

5). The nose as a spectroscope

This theory, proposed by Luca Turin (1996), originates from the work of Dyson (see above) who suggested that the olfactory organs might detect molecular vibrations. Turin has proposed that when the olfactory receptor protein binds an odorant, electron tunneling can occur across the binding site if the vibrational mode equals the energy gap between filled and empty electron levels. The electron tunnelling then activates a G-protein cascade. Receptors are therefore "tuned" to the vibrational frequency of particular odorants, rather like cones are "tuned" to particular wavelengths of light.

Odorant binding proteins

Proteins, found in the olfactory mucus, have recently been discovered that bind to odorants. These have been termed the Olfactory Binding Proteins (OBPs). Odorants dissolve in the aqueous/lipid environment of the mucus and then bind to an OBP. It is thought that these proteins facilitate the transfer of lipophilic ligands (odorants) across the mucus layer to the receptors, and also increase the concentration of the odorants in the layer, relative to air. There are two other proposed roles for these proteins as, (1) a transporter, in which they would bind to a receptor with the ligand and accompany it across the membrane and (2) as a terminator, causing "used" odorants to be taken away for degradation, allowing another molecule to interact with the receptor. The protein could also be acting as a kind of protector for the receptor, preventing excessive amounts of odorant from reaching the receptor.

Odorant receptors

It appears that there may be hundreds of odorant receptors, each present in small number. A large family of odorant receptors has recently been cloned (Buck and Axel, 1991) and the mRNA encoding these proteins has been found in olfactory tissue. These families may be encoded by as many as 1000 different genes. All of them contain 7 transmembrane domains and these hydrophobic regions contain maximum sequence homology to other members of the G-protein linked receptor family. There are striking features of these olfactory receptors, like the divergence in sequence in the 3rd, 4th and 5th transmembrane domains, that suggest a mechanism whereby a large number of different odorants may be discriminated.

A recent Science article by Zhao et al (1998) demonstrates that a recombinant adenovirus can be used to drive the expression of a particular olfactory receptor gene in the rat olfactory epithelium. Electrophysiological recording showed that increased expression of a single gene led to a greater sensitivity to a small subset of odorants.

G-protein activation

A large number of G-proteins have been found in the olfactory epithelium. The G-s like G protein, G-olf, which has been cloned and is found in great abundance in the receptor cells (as well as in other neurons), stimulates adenylyl cyclase (AC) and both molecules (G-olf and AC) have been localised to the olfactory sensory cilia.

Channel activation

G-olf, a member of the G-s family of G-proteins, activates adenylyl cyclase. Consequently when an odorant binds to a receptor that is coupled to G-olf, the net result is an increase in intracellular cAMP. cAMP binds to and rapidly opens a cation-selective (Na^+ , K^+ , Ca^{2+}) channel from the inside of the membrane. These are a class of channel known as cyclic-nucleotide gated (CNG) channels. The cAMP-gated channels have little or no voltage dependence and their activity depolarizes the cell. Ca^{2+} enters the cells via the cation channel and activates the Ca^{2+} -dependent Cl^- channel, causing Cl^- to efflux from the cell - another depolarising influence. This would ensure an increase in the firing of action potentials along the axon of the olfactory receptor cell.

Calcium

There is evidence that another category of G-protein is involved in the activation of the membrane-bound enzyme phospholipase C (PLC). PLC hydrolyses a lipid phosphatidylinositol 4,5-bisphosphate (PIP_2) in the plasma membrane, producing inositol trisphosphate (IP_3) and diacyl glycerol (DAG). Both IP_3 and DAG can act directly on ion channels and also on intracellular Ca^{2+} stores. It has been proposed, that both cAMP and IP_3 /DAG systems may co-exist in the same cell and may be activated by different odorants. They might even have contrary effects, since a rise in Ca^{2+} might activate Ca^{2+} -dependent K^+ channels which would hyperpolarise the cell and slow or terminate firing.

Perception of odours

Walter Freeman and his colleagues have shown that every neuron in the olfactory bulbs participates in the generation of olfactory perception. In other words, the salient information about the stimulus is carried in some distinctive pattern of bulbwide activity and not in a subset of specific neurons. In the absence of a stimulus, the pattern of activity across the olfactory bulb has "chaotic" characteristics. However, upon receiving a stimulus the chaotic behaviour rapidly assumes a cross-bulbar pattern. This pattern need not be the same each time for the same odour, but may change its characteristics depending upon the previous stimulus. This system allows for odorant conditioning, and also explains how we can be sensitive to odours we have never previously experienced.

Smell of fear

Dogs and horses can smell fear in humans. Recent work by Denise Chen (Chen & Haviland-Jones, *Physiology and Behaviour* (1999) 68; 241-250) has demonstrated the ability of underarm odour to influence mood in others. The implication of this work is that a chemical signal is secreted in sweat which communicates the emotion. Further evidence of chemical signalling in humans comes from work by Martha McClintock: armpit swabs taken from donor women at a certain phase in their menstrual cycle and wiped on the upper lip of recipient women can advance or retard menstruation in the recipients depending upon the phase of the donor (Stern & McClintock, *Nature* (1998) 392, 177-179). We seem to possess the ability to secrete compounds that can relay information about our mood to another person. Can we prove this more directly by experiment? If we know what these compounds are can they be used to alter mood?



Anosmia

Anosmia is a condition in which the sense of smell is reduced or lost entirely. It can be caused by traumatic head injury (e.g. a fall in which the head receives a severe blow) or a virus (a bad cold, or infection of the nasal mucosa). Some people are born without a sense of smell - congenital anosmia, and some develop it as a consequence of another disorder, e.g. Alzheimer's disease. Generally, traumatic head injury causes an irreversible anosmia (although some people have reported a recovery) and viral anosmia is temporary (although some people report long-term effects). Anosmia is not life-threatening and for this reason, and because of a lack of information available to GPs (medics), it tends not to be treated (certainly this is true in the UK). As a result it is hugely under reported - it is much more common than you might imagine. There are a limited number of treatments at centres scattered around the world. I am trying to assemble more information for a web-site on this subject and on the related disorder - dysosmia = dysfunctional sense of smell (perceiving smells which are not there, or misinterpreting smells that are there). Meanwhile have a look at [website](#).

Smell and memory

Smell and memory are closely linked. Smell evokes memories. Damage to the temporal cortical region of the brain - the site of memory - does not affect the ability to detect smell, but, rather, prevents the identification of the odour. We must first remember a smell before identifying it.

Memory - odour memory falls off less rapidly than other sensory memory: Miles, C., & Jenkins, R. (2000). Recency and suffix effects with serial recall of odours. *Memory*, 8 (3), 195-206. Odour memory lasts a long time,
 - odour associated with experience; smell is better at this memory cue effect than other senses; Chu, S. and Downes, J.J. (2000) Odour-evoked autobiographical memories: psychological investigations of the Proustian Phenomena. *Chemical Senses* 25, 111-116.

is more sensitive than : threshold for sucrose (taste) is between 12 and 30mM (millimolar) depending upon test used. Strychnine is a very powerful taste (apparently), and can be tasted at 10^{-6} M (one micromolar). As for smell, mercaptan can be detected at 7×10^{-13} Molar. Taking into account the relative volumes needed for taste and smell (you sniff a greater volume of air than you taste a liquid), smell is 10,000 times more sensitive than taste (Moncrieff, R.W. "The Chemical Senses", 3rd ed., Leonard Hill, London, 1967)

Marcel Proust has lent his name to the phenomenon of memory recall in response to a specific smell (after his description of such an event in "Swan's Way") - the "Proust Effect". Whole memories, complete with all associated emotions, can be prompted by smell. This is entirely unconscious and cannot necessarily be prompted voluntarily although countless studies have shown that recall can be enhanced if learning was done in the presence of an odour and that same odour is presented at the time of recall. Useful for exam revision!

Work by Walter Freeman has shown that smell memory is context dependent and can be modified in the light of new experience, implying that our olfactory sense is continuously dynamic, updating as we live and experience new things.

Therapy using smell memory

If we smell (or taste something) before a negative experience, that smell (or taste) is linked to that experience. The memory is very robust. This can be a problem for unpleasant medical treatments, or surgery when the last meal is often associated with the pain or trauma. But this very effect could, in the future, be put to therapeutic advantage; if smell were to be associated with a positive, healing treatment then the smell itself can substitute for the treatment once the link has been reinforced. It works in rats! Some very interesting research was published recently - insulin was injected into healthy male volunteers once a day for four days and their blood glucose was measured (it fell). At the same time, they were exposed to a smell. On the fifth day they were just given the smell, and, their blood glucose fell (Stockhorst & Gritzmann, (1999) *Psychosomatic Medicine* 61, 424-435).

Smell in infants

Babies tested 50 hours after birth sense odours. Yet, at this stage they do not discriminate between pleasant and unpleasant odours. For example, anise (pleasant) and asafoetida (unpleasant) both elicit the same kind of mild startlement. This evidence is certainly counter-intuitive and implies that response to odour must be learned. By about a week a baby can discriminate between a gauze pad worn by his or her own breast-

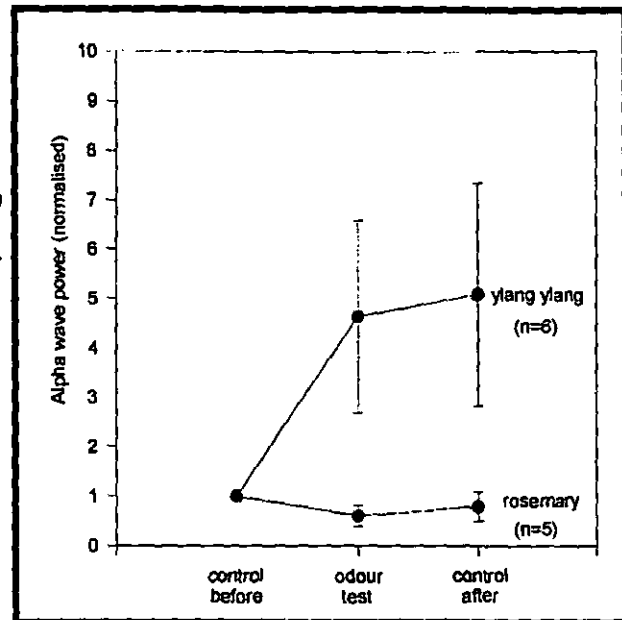
feeding mother and that worn by another mother used as a control. This response is not thought to be specific to the intrinsic odour since babies respond to their mother's perfume but they also respond similarly to control perfumes. However, there is evidence from animal studies, such as the fact that merely washing the nipple of a mother rat will eliminate the attachment of her pup, that supports the idea of the importance of intrinsic odour. It has been suggested that there are semiochemicals (signalling odours) that elicit suckling behaviour in newborn animals and this whole area is one that requires more study.

Alpha-wave content of EEG in response to aromatherapy oils

Aromatherapy - does it work?

Using EEG recording in my lab we have analysed the effect of two essential oils, ylang ylang and rosemary, on the alpha-wave content of the brain activity. The EEG was recorded over the occipital region of the scalp referred to the vertex, with the eyes closed. Alpha wave activity in the brain is associated with the level of arousal; thus "alpha-block" can be caused by anything that gives the brain something to think about! Close your eyes and relax and alpha-activity increases. So, in some respects alpha wave activity is an index of relaxation - more alpha, more relaxed.

The protocol was to pre-relax the subjects, record the EEG for 2 mins and then apply the odour to a face mask, wait 3 mins and then record another 2 mins. The mask was then removed, 3 mins allowed for equilibration and a further 2 mins of control activity was recorded. The alpha-wave component was determined by power spectrum analysis of the data between 8-12Hz.



While there are clear trends (see figure on right) - rosemary depresses alpha-activity while ylang ylang enhances it significantly, a longer recovery period following exposure to the odorant is needed.

In aromatherapy terms rosemary is a well-known stimulant and ylang ylang is a soothing, relaxing aroma.

Conclusion: ylang ylang and rosemary have measureable effects on brainwave activity, and in the direction anticipated from their reputed properties.

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books:



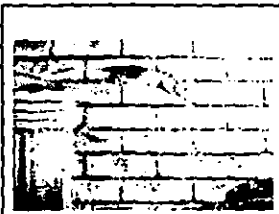
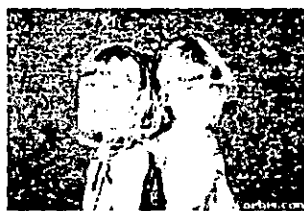
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	moths can smell a single molecule (of the moth pheromone - bombykol)		insect antennae attached to electronic circuits are being used as odour sensors
	- taste is mostly (~75%) smell		- we can smell happiness
	dogs can distinguish non-identical twins by smell - but not identical twins!		some people can't smell skunks - and some can't smell freesias
			bloodhounds can pick up

	all smells are small molecules (less than 350 molecular mass)		a 24 h old trail and identify the person. If a bloodhound comes across a 20 minute-old trail at right angles, sniffing for 2-5 steps will give the direction of the trail.
			- everyone has a unique smell (except identical twins)

Links

Here are some selected interesting links:

- an extended tutorial on smell and more links
- a vaste resource of everything to do with taste and smell, wierd and mainstream
- a commercial site with some useful info
- neuroscience and the senses, plus more links
- serious links to many aspects of smell
- something for the future - programmable smells,

Return to [this page](#), or [my](#) homepage.

Last update 22nd January 2001

Western Mail© Tuesday, 18 April 2000
In Wales' National Newspaper quarterly supplement "HEALTH Wales"

AROMATHERAPY: Website caters for worldwide interest in the art of using essential plant oils

Age-old therapy is the latest 'must-have' on Internet

ALISON WATKINS
Health Correspondent

IMAGINE spending a couple of hours just pampering your tired and aching body.

Not just diving in and out of the shower in seconds, but actually lying back and drifting off to sleep as fragrant oils are massaged into knotted shoulders.

To most of us, sacrificing time for personal care smacks of sinful indulgence, the type of ethos promoted by glossy magazines.

But it needn't be.

Aromatherapy is fast becoming one of the most popular ways to unwind and pamper a tired body and mind. The art of using essential oils extracted from aromatic plants to enhance health is age-old, but has been adopted as one of the most modern, must-have therapies.

Pick up any magazine and there will be a health expert expounding the virtues of ylang ylang and camomile.

Walk into your local supermarket and there along with the traditional bath foams, will be a plethora of mind-boggling aromatherapy products, promising to relieve stress, soothe dry skin and ease aching limbs. Essential oils are regularly recommended for stress-related diseases and the list of remedies is endless; such as camomile for inflammation, galbanum for rheumatism, mandarin for digestion and tea tree for acne.

Oils can also be used to help more serious ailments, such as heart problems, pre-menstrual problems, arthritis and migraines.

Aromatherapy is big business, so much so that it has found its niche on the Internet.

Just ask Graham Sorenson.

Four years ago he launched a website devoted to the world of aromatherapy.

Today, it is visited by 16,000 people each month.

Not bad for something which started as a hobby.

Mr Sorenson, 48, said, "I have always been interested in complementary medicine and after doing a massage course in Cardiff became interested in essential oils.

"I spent months reading everything I could find on the subject and as I was into website design anyway decided to launch his own site. It's nice because it was only a hobby but now has really taken off.

"For the first few weeks the site only got three to four hits, and I wondered if I had chosen the wrong subject.

"Then interest suddenly escalated and in the past few months it has been visited

by about 16,000 people each month."

Mr Sorenson who spent much of his life in the RAF, has designed websites for other people, but says the most success has come from his own.

He said that he believed the main reason for the interest was the apathetic attitude of the general public towards the NHS.

He said, "Aromatherapy has certainly become something of a boom field as have many holistic treatments I think that many Patients have become dissatisfied with the service they receive from their GP.

"Usually doctors are far too loaded down with work to spend more than four minutes with a patient and people look elsewhere for help, advice and treatments.

"There are so many side-effects from conventional drugs yet side effects from herbal medicines are very rare.

"This is not to say that they should replace vital medication but they can certainly aid and abet many health problems in a natural way.

"It is difficult to get the medical profession to support alternative therapies, but slowly and surely some GPO are coming round to the idea."

The website is easy to navigate and the information updated regularly.

Mr Sorenson is aware of the need to keep up with trends and in 1998 he went to the World of Aromatherapy conference, organised by the National Association for Holistic Therapy, in the USA.

He said, "Aromatherapy should become an integral part of life.

"It's not just about massage, but about smell.

"Each oil has its own healing property and there is something for every problem whether with the body or the mind and emotions.

"It has always been a favourite with women, but I am noticing more and more men taking an interest and it looks set to become even more popular."

HIT MAN: Graham Sorenson with his Internet website on aromatherapy. It is attracting 16,000 visitors a month

There's the rub - and the bath and inhaler

APART from the physical benefits, aromatherapy can have benefits on the mind and emotions.

Pure essential oils are extracted from all kinds of plants.

Some come from the flower, others from leaves, stems, roots, barks or any part of the plant.

Carrier oils are used to carry essential oils, diluting them so they can be applied straight to the skin.

People shouldn't worry about overdosing on oil - it should never be used neat. Most bottles have pipettes so it's impossible to overdose anyway.

It is most commonly used in massage, when oils are diluted with an odourless oil such as grapeseed, sweet almond or peach kernel.

A dilution of 3 per cent essential oil is a recommended starting point.

The other common usage is in a bath. It is a simple, effective way, to relax and receive the therapeutic effects - add six to 10 drops of essential oil to the surface of the water which has already been run then immerse yourself and inhale the vapour

Compresses can also be used.

Add five to 10 drops of essential oils to 1 00ml of warm water then soak a piece of clean cotton in the water and place the cloth on the affected part.

Alternatively, you can obtain the same effect by inhaling or using vaporisation.

Add five to 10 drops of essential oil to a bowl of steaming water, place a towel over head and inhale the vapours for a few minutes or use different oils to create different atmospheres.

Graham Sorenson's website is at www.fragrant.demon.co.uk

Underneath this was an A to Z list of oils, Basically the oils to symptoms part of

Sundials on the Internet

For a full overview [click here](#)

Sundials on the Internet - Introduction to Sundials

When we were planning **Sundials on the Internet**, in 1996, I met someone socially for the first time. They were very glad to meet someone interested in sundials. "I have been working for some time on a sundial, but I can't get it to tell the time consistently." He explained that he had a vertical post in his garden, and wanted to make a sundial with it. I thought back to how my own interest in sundials started, when I put a stout bauk of timber vertically in the ground to support one end of a bench, and then thought I might use it for a sundial. So I cast some paving stones with the numbers 9, 10, 11 and so on which I laid around it where the shadow fell. I was so cross when it became more and more inaccurate as the days went by. And it must have been five years later that I came across a book by AP Herbert about sundials which clarified why it hadn't worked. After that, I started making some sundials which did work, and once you start getting interested in sundials, it is very difficult to stop!

These two experiences are a microcosm of the story of sundials from time immemorial. Everyone has noticed shadows moving round during the day. Someone unknown in the past found out that if the shadow was cast by a sloping object pointing to the celestial pole, it would cast a consistent shadow which would be in the same place at the same time every day. Though it has been suggested that this may have been 2000 years ago, it is more likely that it would have been around 500 years ago; before the development of clocks, it would have been difficult to determine what "the same time each day" meant, and anyone such an innovation would probably have been dismissed as impractical and useless.

Practically everybody knows what a sundial is. Most people have a residual idea that, if they had to, they could make one. But most people's practical knowledge of sundials is confined to having seen some standard brass horizontal dials on plinths in gardens. They may even have one in their own garden, or perhaps in their garden shed because they don't know how to set it up.

And there is a widespread - though totally wrong - general impression that sundials are not very good at telling the time. This has been well put by Hilaire Belloc who produced a number of sundial mottos including:

I am a sundial, and I make a botch
Of what is done far better by a watch.

The poor reputation of sundials is ill-deserved, and has arisen mostly because we have all accepted "watch time" as an absolute standard, without devoting any thought to the nature of the time it is measuring.

Sundials measure time as it is. Noon is when the when the sun is highest in the sky (when it crosses the meridian). Watches measure time as we would like it to be, with noon tomorrow exactly 24 hours, 0 minutes and 0 seconds away from noon today. But noon on 26 December

is actually 24 hours, 0 minutes and 29 seconds away from noon on Christmas Day. And noon on 15th September is only 23 hours, 59 minutes and 39 seconds away from noon on the following day.

Mechanical watches obviously cannot be made to run in this way. (Electronic watches could be made to do so, though the manufacturers would probably not find a very large market for them). So Mean Time was invented, an artificial construct in which all days are assumed to be exactly 24 hours long.

The sundials seen above church doors are a reminder of a time when sundials were the standard. Until about 200 years ago, public clocks could not be made sufficiently accurate to run for more than a few days without being reset, and the only way of resetting them was from a sundial.

Until the railways came, there was no particular reason why people in, say, Bristol should keep the same time as people in London. And, of course, at that time there was no practical way of communicating information about time over a distance. When the telegraph made such communication possible, it became necessary for people living in one area to agree that they would not keep their own local time, but would all keep a time based on the local standard meridian. Bristol is at $2^{\circ}35'W$ of Greenwich, so noon there is just over 10 minutes later than in London. There is still a relic of this change - the clock over the old Corn Exchange in Bristol has two minute hands. One shows Greenwich Mean Time like all the other clocks in England, and the other, 10 minutes behind it, shows Bristol time!

Later on, another artificial change was made with Summer Time, which arbitrarily adds one hour to all clock times during the summer.

So, in the summer, there are 3 good reasons why your watch will be telling a different time from the sundial. They may be up to 15 minutes different because your watch is assuming that all days are equal in length. Then it will be 4 minutes different for every 1° you are east or west of your standard meridian. (This can be quite substantial; Vigo in Spain, for example is $8^{\circ}44'W$ of Greenwich, but is on Central European Time, for which the standard meridian is $15^{\circ}E$ of Greenwich, so the correction for longitude in Vigo will be 1 hour 34 minutes and 56 seconds). Lastly, it will be exactly 60 minutes different because your watch, if you live in England, has been arbitrarily altered to tell the time in Prague for the duration of the summer!

With all these artificial difficulties to contend with, it is quite a surprise that interest in sundials continues at all. But interest is in fact growing. Sundial societies exist in Britain and many other countries, and their membership is expanding. You are very welcome to join too.

We hope that **Sundials on the Internet** will give you some idea of the world of sundials - its complexity and its fascination. Sundials are unique in that Science (in the form of accurate calculations), Art (in the form of pleasing design) and Craft (in the form of good workmanship in the making) all have to come together to create a good sundial. Getting all of these right is quite a challenge! Good luck.

(This page is based on an article "Is that really the time?" by Piers Nicholson which appeared in "The Valuer" of August/September 1992)

For a full overview of Sundials on the Internet click here

www.sundials.co.uk/intro.htm first posted April 1997 last revision 3 January
2000

Comments/ suggestions/ problems, please get in touch with the Webmaster

BW0442 OCT 03, 2000

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(BW)(CA-DIGISCENTS) DigiScents Wins Edward De Bono Medal; iSmell Voted Most Practical and Effective New Technology at 2000 Saatchi & Saatchi Innovation in Communication Awards

Business Editors

OAKLAND, Calif.--(BUSINESS WIRE)--Oct. 3, 2000--DigiScents, Inc. (www.digiscents.com), the pioneer of digital scent technology, won the Edward de Bono Award for the most practical and effective new idea of the year. The award was given as part of the Saatchi and Saatchi Innovation in Communication Award 2000, a global competition that recognizes innovations that have the potential to revolutionize communications. Dr. De Bono, who coined the phrase "lateral thinking," is the world authority in the field of Creative Thinking.

"This is an exciting endorsement of iSmell technology from one of the leading creative firms," comments Joel Bellenson, CEO of DigiScents. "The power of scent will have a major impact on communications and advertising."

Quote from Saatchi's Worldwide Creative Director, Bob Isherwood.: "Societies evolve as innovations from the edge become part of the mainstream. At Saatchi & Saatchi we love exploring new ways of thinking and new ideas. The Innovation in Communication Award is one way that we help bring the best ideas from the edge to the world's centerstage."

About Saatchi & Saatchi

The 2000 Saatchi & Saatchi Innovation in Communication Award is a unique program designed to provide revolutionary ideas with the visibility and marketing support necessary to have world-changing impact. For more information about the Saatchi & Saatchi Innovation in Communication Award, visit the Saatchi & Saatchi Web site at www.saatchi-saatchi.com.

About DigiScents, Inc.

DigiScents (www.digiscents.com) has developed a complete hardware and software platform for incorporating scent into all forms of media, including movies and music, interactive games, advertising, e-commerce, and educational software.

Top tier national retailers at RetailVision 2000 voted the iSmell(TM) peripheral device, which can recreate thousands of scents on demand, the "Best New Technology" of the year. The company's ScentWare(TM) Developers Program has attracted 2,700 applicants since the launch of the ScentWare Developers Kit (SDK) in March 2000.

DigiScents has announced a strategic research alliance with Procter & Gamble (NYSE: PG), and the company recently acquired SenseIT Technologies, a digital scent company located in Israel. Through its partnership with Hong Kong-listed Pacific Century CyberWorks ("PCCW", SEHK: 0008), DigiScents technology will be available across all of the Asia-Pacific via NOW, PCCW's enormous Internet, e-commerce, and interactive television network.

DigiScents is a privately held corporation headquartered in Oakland, California. The company was founded in February 1999 by Dexter Smith and Joel Bellenson. Bellenson and Smith also founded biotech leader DoubleTwist (www.doubletwist.com), formerly Pangea Systems Inc., the first company to annotate the entire available draft of the human genome sequence.

DigiScents(TM), iSmell(TM), and ScentWare(TM), are trademarks of DigiScents, Inc. All other companies or products listed herein are trademarks or registered trademarks of their respective owners.

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GAMES/MULTIMEDIA HARDWARE SOFTWARE

Discover hot new products



DigiScents (smellable Internet) coming to the Mac

by Ben Wilson, bwilson@maccentral.com

September 15, 2000, 7:00 am ET

One of the most innovative, and undoubtedly head-turning (or should that be nose turning?) devices to hit the hi-tech industry will soon be making its way to the Macintosh platform. DigiScents, a hardware/software combination, that actually generates physical scents based on programmed web content, will soon be compatible with the Mac OS.

"Yes, we plan on making our iSmell technology compatible with the Macintosh platform," Brian Nelson, Public Relations Associate for DigiScents Inc. told MacCentral. However, Nelson could not confirm a definite date for shipment of a Macintosh version.

The DigiScents solution uses a device called iSmell, a "personal scent synthesizer." The iSmell attaches to the serial or USB port of your computer and plugs into a standard electrical outlet. The iSmell emits naturally based vapors into the user's personal space. The device is triggered either by user activation (like a mouse click) or a timed response (as is the case with a DVD ScentTrack).

According to Nelson, the technology will allow users to send scented mail, to smell 'n shop, to watch scented DVDs and play scented-games.

What kind of smells can be emitted by the iSmell device? "Just about anything you can imagine," says Nelson.

The device works by using small cartridges with various scented chemicals. Like an inkjet printer, the cartridges are simply removed and replaced when the chemicals have been depleted. Nelson claims that the cartridges contain natural materials commonly found in the cosmetics, foods and beverages.

DigiScents is currently offering a ScentWare Developers Kit, which includes the tools required to create scent-enabled content and media. The SDK includes ReminiScents Database of ScentObjects, iSmell API and Drivers, and ScentStream Player and Server.

Once the product is available on the Mac platform, consumers will be able to use the ScentMixer Scent Creation Software, which allows you to create your own scents.

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Watch for more information soon regarding tentative release dates for the Macintosh version of the DigiScents solution.

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THE INDUSTRY STANDARD MAGAZINE

Follow Your Nose

By Alice Hill

Issue Date: Oct 09 2000

DigiScents says a compelling olfactory experience is the missing link to successful online commerce and entertainment.

The idea came to Dexter Smith and Joel Bellenson on a beach in Florida last winter. Bathed in the heady aromas of surf and suntan lotion, the vacationing business partners had an idea: If you could capture smell and encode it like images or music, then the Web might someday be a place where anyone could download and conjure up their favorite aromas.

"Smell is perhaps the most effective sense in terms of memory. It's incredibly powerful and yet totally underused," says Smith. So convinced were Smith and Bellenson that they had stumbled onto the next big thing, they incorporated DigiScents in February 1999 and immediately began to work on encoding smells and developing a prototype hardware "sniffer" they call iSmell. Busier than ever, the Oakland, Calif.-based company is preparing to announce some major alliances at Comdex this November and to show the world that smell and success just may find each other on the Web.

To get the smell out of the computer, DigiScents developed the iSmell hardware scent "player" and scent cartridge. The cartridge - modeled after an inkjet printer cartridge, is made up of scent-creating materials similar to those used in the cosmetic and food industry. The iSmell device attaches to your computer, like audio speakers do, and "plays" small amounts of scent based on a specific game scene (think musty dungeon) product (think scented candles). The scent is designed to be slight, not cloying and overpowering, and can be disabled at any time (just as you can turn off sound on your PC).

But who will buy such a product, and will scent even play on the desktop?

NOSE CANDY

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technology will not only appeal to consumers shopping on its Web site, but it will also give eCandy a way to work with manufacturers directly to develop new candies. Jim Griffin, president of eCandy, explains, "The risk of launching new products is huge. Any tool a manufacturer can have that will access more input during development and hold down costs is huge."

Griffin and co-founder Rani Aliahmed are positioning eCandy as the industry's confectionery home on the Internet. "The candy business has the most convoluted channel," Griffin says. "Manufacturers are very eager to get information back about their products, use technology to access heavy users and get their feedback on new and different smelling candies."

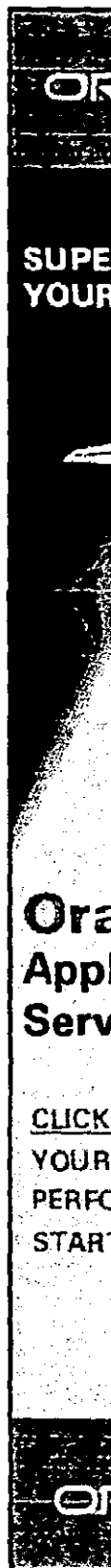
Using DigiScents technology, eCandy imagines sending customers who eat a lot of candy (at least 30 pounds a year) and major confectionery resellers DigiScents scent samples long before a candy is fully developed through its iSmell. Based on customer comments, the manufacturer can fine-tune a candy before it hits store shelves. "Manufacturers have a lot of latitude creating a product, but it usually comes after the fact - like the surprise success of Banana [scented] Laffy Taffy. They want to know more about what will appeal to people beforehand."

To appeal to people directly, DigiScent's Smith is betting that scent will also be a pivotal add-on to consumer products like videogames and shopping sites. "So much of commerce and entertainment goes through the PC now," Smith says. "We can add smell to a broad range of applications. What we think will drive people is entertainment applications."

Others are more skeptical. "Frankly, I don't want to smell the bad guy's B.O. in a game. Audio and visual cues, if done well, are more than sufficient to provide feedback to the gamer," says John Marrin, GamePro.com senior editor. "If DigiScents can convince a few key developers working on good software titles to implement it, then the market will provide an answer. The burden is on DigiScents to show programmers how it can measurably improve the game-play experience and how it can be integrated into games, not just added as an afterthought."

To date, no major game manufacturer has announced an alliance with DigiScents, but the company has gotten requests for its scent programming kit from more than 1,600 software and Web developers. On the commerce front, manufacturing giant **Procter & Gamble (PG)** announced an alliance a few months ago to work on Web-based scent research, while most recently **RealNetworks (RNWK)** announced that it would include DigiScents' ScentStream software in its media players. Currently there are no iSmell devices available to test or purchase, and pricing has not been set.

The biggest hurdle to the success of digital scents may be



overcoming precedents of failed scent experiments from the '50s like Scratch 'n' Sniff and "smell-o-vision." Dexter Smith loves to take on the past mistakes of history: "Scratch 'n' Sniff was a failure because it wasn't automated. Sound wouldn't go very far if the audience had to do something to make it happen."

ECandy's Griffins agrees. "Scratch 'n' Sniff is hard to get through the [real-world] channel. It gets contaminated easily on the exterior of the packaging. You put something next to dog food and it smells wrong."

Clearly, both companies are betting big on smell. But at this early stage, it's an idea that has yet to be proved, and detractors are happy to laugh at a company that calls its Web site a "snortal." But Smith is unfazed by the unknowing. As he puts it, "We'll let them get a whiff of it this fall."

If seeing is believing, then to Smith, come autumn, smelling is telling.

Alice Hill is a freelance writer in San Francisco.

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