



PROCYON AVS

AUDIO VISUAL SYNTHESIZER



WWW.MINDPLACE.COM

USER'S GUIDE AND MANUAL

REVISION 1.0

READ THIS BEFORE USING PROCYON

Procyon is intended for use as a tool for enhancing consciousness and for personal growth. It is *not* intended for use as a medical diagnostic or therapeutic device, and no medical claims of any sort are made for it.

DO NOT USE THIS PRODUCT without your doctor's specific guidance if you or any family member has ever experienced any form of seizure disorder, such as epilepsy, or if you are or have been taking any form of psychoactive drug, such as amphetamines, barbiturates, etc.

Procyon

Audio-Visual Synthesizer™

User's guide and Reference

I. Introduction

Congratulations! You have just purchased the most advanced personal light and sound system available on the market today. The *Procyon Audio-Visual Synthesizer™* is a powerful tool for exploring a wide range of interesting and beneficial states of awareness, and we think you will find it very helpful when used regularly.

The Procyon includes 50 unique, pre-programmed light and sound stimulation sequences (called *sessions* and sometimes *programs*) within its internal memory, each designed with a specific goal in mind. We suggest that you first work with those sessions which best suit your needs before exploring further. All sessions were designed to support the mental processes required to integrate the lessons of daily life and we believe you will will help make your inner travels more productive.

The Procyon also provides you with maximum flexibility, because you can create your own sessions using our free *Procyon Editor* software for Windows (available from www.mindplacesupport.com).

You can mix your own audio sources (CD's, MP3's, etc.) with the internally synthesized audio tones. And the Procyon is the first light and sound system available that includes compact-disc quality digital audio. Now you can transform the experience of your favorite music, or enhance the effects of learning, personal growth, and imagery-based audio with the powerful effects of light and sound.

Consciousness as art-form?

Procyon's ability to create and fluidly control a palette of millions of colors, and to precisely synchronize this flowing rainbow with music and other audio sources presents the opportunity to create a new kind of consciousness-altering artform. Be sure to check our site (www.mindplace.com) frequently for the latest updates and audio-visual artworks!

Color, mood and awareness

It has long been known that color can have a profound effect on cognition and perception. That's why colors such as blue and green are often used in hospitals and prisons—due to their calming effects. Research has shown that pure colored light can achieve this same goal: for example, red light is more effective at inducing mental and physiological activation, while blue light reduces such activation and can instill a sense of deep calm. Yellow, on the other hand, appears to help the mind focus while studying and can allow access to “peak performance” mind-states. The Lumatron® is an example of a system which uses colored, flickering light in a therapeutic context (though of course we make no medical claims of any sort for the Procyon).

It is possible to use the Procyon to produce pure, jewel-like colors which do not flicker at all. It can also play sequences which unfold gradually, or shift rapidly from hue to hue. When this is done in the range of about 4 to 20 times per second, especially unusual visual and psychological effects can be produced, inducing the illusion of complex, shifting geometrical imagery. This imagery can be so compelling that the mind clears of extraneous thoughts and distractions and the other stressors of daily life. In this way the Procyon is like a form of "accelerated meditation."

Benefits

We've created the Procyon as an experimental tool for the exploration of a wide range of colored light (and sound)-induced alternate states of awareness. And, although we hope you will take advantage of our software tool for creating your own works of "mind-art" and other applications, we've also included a variety of preset sessions to get you started. Sessions are grouped into these general categories:

Tranquility and calming. These sessions use mostly "calming" colors, especially blue and green, but also shades of purple and occasionally other colors for visual variety. They tend to change slowly and are intended to lead the mind towards a state of tranquility.

Before bed. Similar to the calming sessions, but even slower and again focused on blue and green light and their combinations. The goal is to help clear the mind before bed. Some users have reported having unusually vivid dreams with these sessions.

Learning. Most of these are based upon the twilight learning and super-learning paradigm, and are intended to lead your mind into a light trance-like state known as hypnogogia.

Peak performance. Mostly "middle of the rainbow" colors and frequencies associated with the goals of mental activation and peak performance; often used for learning and sports preparation.

Energy/rejuvenation. More active; patterns shift rapidly and are intended to prepare the mind and body for activities such as sports and other physical activities, or before meetings and tests. Perfect for use during breaks from work and for study.

Visualization/artform/entertainment. These sessions demonstrate the more purely aesthetic aspects of the Procyon, and are intended to induce more complex (even hallucinatory) visual imagery, and as preparation for exploring altered states of awareness.

Features

Compact Full-Color Personal Display. Our new *GanzFrames™* design uses state-of-the-art surface-mounted solid-state optoelectronic emitters which generate and mix pure red, green and blue light. With 255 brightness levels for each color, there are literally millions of colors to choose from.

Ganzfeld feature. A *Ganzfeld* is a field of pure color which does not flicker. With Procyon, you can select a favorite color and use it for color meditation, for example. Of course, the colors can transform into another hue at any rate you choose.

Independent color channel programming. Each color channel (red, green, blue) can be assigned its own brightness and frequency, for creation of complex visual effects and mind states.

Large internal program store. More than 1500 segments, which can be divided between up to 250 sessions, stored in internal flash memory..

USB port. Transfer new sessions into your Procyon, update its operating system, and back up your current sessions to your PC. Control the Procyon in real time from your PC or biofeedback system.

Digital audio input/output. Another Procyon first: low-noise, compact-disc quality audio, for more precise control of internal and external audio mixing, and virtual elimination of “clicking” from the lights.

Internal audio synthesizer. Creates binaural beats, locked to the frequency of one of the three color channels.

SynchroMuse™. This powerful new function synchronizes audio content on encoded compact discs with internally stored sessions. The experience is similar to AudioStrobe®, only in full color.

AudioStrobe® compatible. Play your legacy AudioStrobe-encoded CDs by selecting this function.

Multiple visual waveforms. Choose from pulse, sine, triangle.

Multiple visual effects. *Phase-shifting* creates a constantly changing, complex range of colors, while *pulse-width-modulation* creates "hard-edged" visual effects. Mix flicker with ganzfeld for subtle "shimmering" effects!

II. Setting your system up

Your Procyon package should include the following items:

- Procyon console
- *GanzFrames™* personal display
- Stereo headphones
- USB "mini" to standard USB cable
- Stereo audio patch cord
- Carry case
- Manual

You will also need three "AA" alkaline batteries, not included, for standalone operation. If you connect it to a PC, then your Procyon will be powered via the USB cable.

Please refer to the illustration below while setting your system up.

Step 1: Install the batteries

- Remove the sliding battery cover from the back of the Procyon
- Install three alkaline "AA" batteries. Be sure to observe proper orientation.
- Replace battery cover.

Step 2: Connect the GanzFrames and headphones

- Plug the GanzFrames gently into the top of the console. Notice that the plug fits in only one way.
- Plug the headphones into the correct jack on the right side of the unit.

Step 3: Select and run a session

- Turn the unit ON by pressing the on/off button. The LED display will briefly flash the word "on" and then show 000. This is the "random" session.
- Press the Up/Down key to select a session. See pages 18-22 for a description of internal factory sessions. While holding the key the session number will initially advance slowly, then accelerate (like setting a clock radio). To cause the session number to decrement, press the Up/Down and Start/Stop button at the same time.
- Press the Start/Stop button once to start a session. The display will briefly flash the word "run", then display the session number again.
- Use the dials at the top of the unit to adjust the audio volume and light brightness. We recommend starting at low settings and gradually increasing them to optimum levels.
- To stop the session, press the Start/Stop button once. The display will flash "End" one time, then the session number.

CAUTION: Do not open your eyes while wearing the GanzFrames. The LEDs are very bright! Do not start a session at high brightness levels unless you are certain that you will find it comfortable.

III. Using your Procyon

How to have a perfect session

Finding a comfortable and quiet setting is an important ingredient for having an ideal session with your Procyon. It can also help to loosen any tight clothes, belts, etc.

- If your goal is to unwind during your session, then lying down can also help, but is not essential.
- If you think you might fall asleep during your session, turning the light out helps, since some ambient light would normally make its way to your eyes from the sides of the GanzFrames and slightly wash out the intensity of the colors. Choose a session with a slow pulse rate and mostly blue-green hues is especially pleasant and helpful in this case. Using just the GanzFrames alone while listening to your stereo (or to nothing) would probably be most comfortable, unless you wanted to use binaural beats; you can use loudspeakers if your head is between them.
- If your goal is a short relaxation break, then sitting in a comfortable chair is ideal. If you are taking a break at work, short sessions seem to give the best results, around fifteen minutes. A longer period could put you to sleep, if you are at all tired, by removing the environmental cues which would normally keep you awake.
- To experience a clear-headed, meditative state, use one of the "meditation" sessions.
- If you are feeling tired, try an "energize" session. Their accelerating tempos function in a manner similar to listening to music with similar tempo changes.

On/off and power-saving

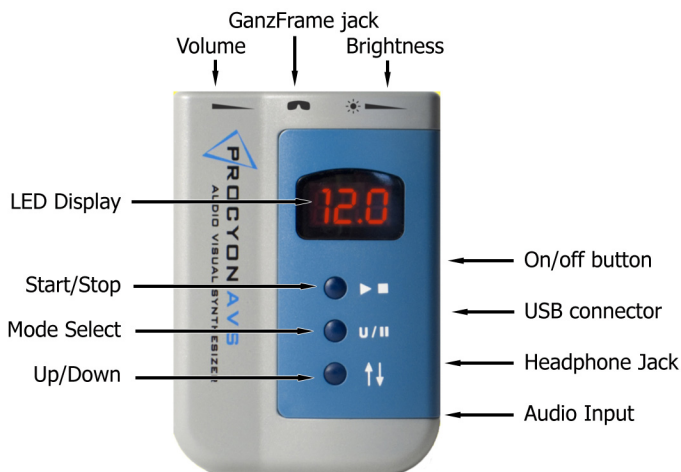
The system is turned on and off via the button on the right side of the console. In order to save power in case you forget to turn it off, it will automatically turn off in the following manner:

- In Session mode (display shows three digit session number): after three minutes of inaction.
- In PC, dL1 or dL2 modes, after 20 minutes.
- In AS or DAS modes, after 80 minutes (allowing time for a full CD to play before shutting off).

Buttons, connectors, and display

The three buttons on the front panel have the following functions:

The TOP button is the START/STOP button. Just press and release the button once, briefly, to operate.



The MIDDLE button is for selecting a *mode* (see page 13). When you turn the system on it automatically sets itself to SESSION mode, which displays a three digit session number. Each time you press it, it steps to the next mode, displaying the following sequence:

Session (SES) > PC > dL1 > dL2 > dAS > AS > SES.

The BOTTOM button is for selecting a specific session, while in Session mode (the display shows three digits).

The ON/OFF button is located on the upper part of the right side of the console.

There are two dials on top of the console. The LEFT one is AUDIO VOLUME, and the RIGHT one is LIGHT BRIGHTNESS. The audio volume affects only internal audio, not external audio; use your CD/MP3 player's volume control to set the proper balance between the two.

We recommend that you set the dials to a low level before starting your session, and increase them slowly until you find the most comfortable setting.

There are four connectors on the Procyon:

On the TOP of the unit is the GanzFrame connector. Note that this socket is keyed to fit in only one way with the GanzFrames plug. Like all miniature connectors, it is somewhat delicate; do not attempt to force the GanzFrame plug into it. If it doesn't seem to fit in one orientation, flip it over and plug it in the other way.

On the RIGHT SIDE of the console, just below the start/stop button is the USB jack. Use the included (or any standard to mini USB) cable to attach it to your PC (but do not do so until you have installed the Procyon driver and software). This connector is also used to communicate with the PreSage biofeedback system using a

special cable.

Below the USB jack is the HEADPHONE jack. Plug the included phones into this. You can use other headphones as well, though the Procyon may not have sufficient power to drive larger, "studio" style headphones.

The BOTTOM jack is for audio input. Use the included stereo mini (3.5 mm) cable to connect the output of your CD or MP3 player to this if you would like to mix your music with a session, or if you are using AudioStrobe or SynchroMuse encoded CDs. You can also plug the line output of your stereo into the system here, though you will need a stereo phono-to-3.5mm stereo cable (Radio Shack, for example, usually carries these).

Selecting a session

Your system has been pre-programmed with a number of sessions of various lengths and suggested applications. You can find a list of these on pages 18-22.

- Choose a session from the session list at the end of this manual, noting its associated number.
- Turn the Procyon on and use the up/down button to select that number.
- Press the Start/Stop button to begin your session.

The 'random' session

Session "000" is random—that is, the sequence and length are different every time you run it. Use this for pure entertainment, and to gain a sense of some of Procyon's color-mixing capabilities.

Brightness and volume

The function of these controls should be clear. Note the symbols printed on the case next to the dials: headphone on the left and brightness on the right. The long thin triangles printed next to these symbols indicate level: moving the dial towards the thin part (to the right) will reduce audio volume and light brightness.

Modes

There are several different "modes" in which your system can function. When you turn Procyon on, it is automatically in SESSION MODE (**SES**) and displays the currently selected session number. Each time you press the mode button, it will step through the others in sequence; their functions are as follows:

PC. Use this mode when creating your own sessions, or experimenting with color mixing. Normally, you would use our Procyon Editor software for Windows, which may be downloaded from the Procyon section at <http://www.mindplacesupport.com>. For more information about how to create sessions, see the Procyon Editor Programming Guide (also available on our site).

dL1 This is for transferring sessions or albums (collections of sessions) to the Procyon's internal memory. It is selected automatically when transferring this information via the Procyon Editor software and is provided for use with potential future open-source software.

dL2 Choose this mode if you are transferring sessions from a compact disc; this is useful when a user does not have a PC available but would like to update their system. Also used with SynchroMuse-encoded compact discs.

dAS (Digital Audio Synchrony) Used when listening to SynchroMuse® encoded compact discs.

AS AudioStrobe® compatibility mode; use when playing AudioStrobe or other high-frequency encoded compact discs.

Connecting to a PC

We've included a USB cable so you can connect Procyon to your PC. Before doing so, be sure to download the USB driver from the Procyon section of <http://www.mindplacesupport.com> and install it before connecting your system. In addition, you will need to download and install the Procyon Editor software and its associated User's Guide (the zip'd file Procyon Package includes all three).

Connecting to the PreSage® biofeedback system

It is possible to control the Procyon using the PreSage biofeedback system; in order to do so, you will need a special adapter cable, available from www.mindplace.com or your Procyon dealer. In order to use this feature when it becomes available, you will need to install the latest Procyon firmware from our support site www.mindplacesupport.com.

What happens during a session

Sessions are made up of a number of *segments* of varying lengths. During a session, these play back sequentially. A segment includes beginning and ending values for all of the parameters that can change during that segment.

For example, the first segment may last for ten seconds, have only blue light selected, and the light may start by being turned completely off (brightness=0) and end the segment turned completely on (brightness=255). During the course of the segment, you will notice that the light gradually grows brighter. The frequency may be set to ramp from 14.0 Hz down to 8.0 Hz, and will be perceived

to start relatively quickly and gradually slow down. All such ramps are linear—that is, straight lines.

Color, mind and mood

Color is known to have a strong effect on mood and consciousness. For example, red light tends to be stimulating and activates the mind and body, while blue and green light are soothing. For this reason, pale blue and green light are often used in hospitals and prisons to help calm the inmates. Yellow light is associated with "peak performance" activities, and is useful for achieving a relaxed yet alert state of mind.

Colored light has sometimes also been used therapeutically (though of course we are not suggesting that you use this system for medical applications) in the form of color therapies, such as the Luma-tron® colored strobe system.

Mandala imagery

Most people notice and enjoy the complex, shifting, mandala-like imagery they see behind their closed eyelids during flicker stimulation. Even single-color flicker stimulation can generate more than one "virtual" color. But the use of more than one color dramatically enhances this effect, and with all three primary colors now present, the effect can be remarkably beautiful, helping to transport you to a splendid inner world.

Red, green and blue light waveforms

Most of the light/sound systems on the market today use a single visual waveform, the *pulse* waveform. This switches from maximum brightness to off almost instantly. Although this can induce more vivid imagery, it can also tire the eyes. In addition to pulse waveforms, the Procyon also offers pure *sine* (which gently and smoothly moves from on to off), and *triangle* (which moves more briskly from on to off) modulation.

Mixing colors: phase shifting, pulse width modulation

A broad range of color-mixing effects possible with additional features of the Procyon. *Phase-shifting* means that the way in which each colored wave of light mixes with the others changes over time. For example, if red and green are “waving together” the colors mix and produce a perceived yellow color. Now imagine that the red starts first, followed by the green: the overall perceived color starts out as red, then transforms first to yellow, then to green. Now, imagine this happens multiple times each second, and you can begin to visualize the color-mixing potential of the Procyon.

From flicker to ganzfeld

A *ganzfeld* is a field of light which fills your visual field. Best known for its use in parapsychological studies (where typically half of a ping-pong ball is placed over each eye, then illuminated by a steady red light), our ganzfeld feature allows the creation of such fields in a wide variety of colors.

Flicker can also be mixed with the steady light-field, creating a range of subtle, easy-on-the-eyes shimmering effects—perfect for those with sensitive eyes or who otherwise cannot tolerate the intense flickering produced by most light/sound machines.

Internal audio synthesis

The internal audio synthesizer is currently preset to create binaural beats, which lock onto any one of the three color channel frequencies.

Audio mixing

You can mix external audio with Procyon's internal synthesizer. Use your CD or MP3 player, or any other audio source with a headphone output. The audio volume control on top of the unit is used to change the internal volume; use your player's headphone

volume control your source. In this way you can mix the two in an optimum manner.

Advanced: external control

The Procyon can be controlled in real-time from a PC or other devices via its USB port. The Procyon Editor controls in in real-time (“PC”) mode when you test segments or sessions from your PC. We’ve also written a beta Active-X control which is available on www.mindplacesupport.com for those interested in developing PC applications to control it.

Online resources

Be sure to visit www.mindplacesupport.com for the latest documentation, sessions, tutorials, etc.

A Guide to the Procyon preset sessions

The internal sessions fall into a number of general categories, associated with suggested use. These include: learning, peak performance, tranquility, night voyage, energizing, rejuvenation, visualization, and “mind art”. The tables on the following pages list the sessions and include a brief description.

Session Number	Length (Min.)	Name	Category
0	varies	Random	Random
This session is different every time you run it, with frequencies ranging from			
1	15	Relax before Exams	Learning
A meditative mind-clearing period to clear your mind; concentrates mainly on 9 to 13 Hz frequencies.			
2	15	Accelerated Learning 15	Learning
Traditional “superlearning” approach, intended to help achieve hypnogogic state. Frequencies ramp mainly in the 4 to 8 Hz range.			
3	60	Accelerated Learning 60	Learning
Similar to above, but longer and slower. Good for accessing deep states; also used by some for light trance induction.			
4	35	Accelerated Learning 35	Learning
Similar to above; designed to be used with 30 minute tape, CD or other audio sources, especially for language study.			
5	10	Quick Alertness	Learning
Intended to bring your mind into sharper focus in a short period of time, especially for use prior to study.			
6	15	Concentration	Learning
A good means for helping focus the mind for study, with primarily 13 to 14 Hz “performance peaking” frequencies.			
7	15	Attention Booster 15	Learning
Alternates between 12 and 18 Hz, with pauses between each. Good for mental activation applications.			
8	20	Attention Booster 20	Learning
Alternates between 12 and 18 Hz, with pauses between each. Good for mental activation applications. Longer version of above.			
9	15	Quick Break	Peak Performance
Includes both quick relaxation and re-activation sequences, for study and athletic preparation.			

Session Number	Length (Min.)	Name	Category
10	17	Athletic Warm-Up	Peak Performance
A more complex sequence of frequencies, intended for use before sports, to concentrate mind and body.			
11	15	Power Recharge	Peak Performance
A more stimulating session, to help clear your mind of thoughts.			
12	30	Peak Composure	Peak Performance
Ideal for use with positive affirmations or guided visualizations, recorded by yourself or others, for boosting athletic performance.			
13	18	Performance Intensive	Peak Performance
Fast-paced, mood-boosting session, which can be used with fast music as well.			
14	25	Mind Sauna	Peak Performance
Ideal for use with deep breathing and muscle awareness exercises.			
15	15	Quick Work Break	Tranquility
Great daily relaxation session, which can be used before stretching, yoga, etc.			
16	35	Regeneration 35	Tranquility
A medium-length relaxation session; good choice for after returning home after a day's work.			
17	45	Regeneration 45	Tranquility
A somewhat longer version of the above session.			
18	60	Quiet Hour	Tranquility
A long, gentle session, with much time spent in the 8 to 12 Hz range.			
19	60	Deep Meditation	Tranquility
A deeply refreshing session, with much time spent in the 4 Hz to 13 Hz range			

Session Number	Length (Min.)	Name	Category
20	15	Meditative Mind 15	Tranquility
A brief, refreshing stroll through the 9 to 13 Hz range, with medium-paced color sweeps. Good range of colors.			
21	60	Meditative Mind 60	Tranquility
A long, leisurely voyage through the 9 to 13 Hz range, with gradually shifting colors.			
22	60	Deep Tranquility	Tranquility
An hour's visit to the land of Hypongogia—mostly slow, deeply peaceful frequencies interspersed with unflickering baths of color.			
23	15	Night Voyage 15	Night Voyage
A short descent into slow washes of color, with emphasis on blues and greens.			
24	25	Night Voyage 25	Night Voyage
A somewhat longer version of the above session, with slower changes.			
25	35	Night Voyage 35	Night Voyage
Deeper still into the dream-realms inhabiting the edges of sleep.			
26	45	Night Voyage 45	Night Voyage
Especially useful for shifting your consciousness to very deep levels.			
27	60	Night Voyage 60	Night Voyage
Our deepest and most trance-like session.			
28	10	Quick Energy 10	Energy
A short, intense burst of rapid energy, with frequencies in the 13 to 21 Hz range, emphasis on reds, yellows. Purples.			
29	15	Quick Energy 15	Energy
Same as above, but a bit longer. You may not need that second cup of coffee after this one!			

Session Number	Length (Min.)	Name	Category
30	25	Full Energy 25	Energy
Same as above, but 25 minutes long, and a bit larger frequency range.			
31	35	Full Energy 35	Energy
Good one to use if you haven't been getting enough sleep but need energy for the day.			
32	45	Full Energy 45	Energy
This one is pretty intense, best to work up to it if you think you need it at all!			
33	60	Total Alertness	Energy
A broad range of shifting states, curving up and down the energy ladder but leaving you in an energized, refreshed state.			
34	22	Afternoon Break	Rejuvenation
35	15	Rejuvenation 15	Rejuvenation
This pair of sessions provide a gentle "mind massage," with a range of both relaxing and energizing frequencies and colors.			
36	25	Rejuvenation 25	Rejuvenation
37	35	Lunch Break 35	Rejuvenation
This set of two sessions are the perfect "dessert" following your lunch, leaving you refreshed for the rest of the afternoon!			
38	45	Lunch Break 45	Rejuvenation
39	60	Middle Mind Centering	Rejuvenation
Accenting light meditation to focused awareness, with frequencies primarily within the 9 to 18 Hz range.			

Session Number	Length (Min.)	Name	Category
40	10	Creative Visualization 10	Visualization
These sessions are designed for the visualization of goals of various sorts. Use the longer ones with external audio if you have any.			
41	15	Creative Visualization 15	Visualization
Frequency range for these sessions is primarily in the 4 to 14 Hz range.			
42	25	Creative Visualization 25	Visualization
We suggest that you start with the 10 minute session, working your way gradually towards the longest you have time for.			
43	35	Creative Visualization 35	Visualization
44	45	Creative Visualization 45	Visualization
45	60	Creative Visualization 60	Visualization
 46	10	Fast Trip	 Mind-Art
A rollicking, inventive segment-system, with much color and variety			
 47	15	Symbol Spaces	 Mind-Art
A more surreal set of color changes and multicolored lightscapes			
 48	20	Kaleidoscopic Mind	 Mind-Art
Complex imagery, with an emphasis on Mandalas, vortexes, and spin-spaces			
 49	30	Pyromania	 Mind-Art
A pull-out-the-stops romp into full-blown mind art!			

Glossary

Some of the words defined below are used to describe aspects of the programming of Procyon sessions in the following Appendix.

BioConnect² – A serial data protocol for controlling various parameters of the Artvision with biofeedback equipment, allowing for real-time control of the system. We intend to publish this specification and to support its use under the GNU Public License.

Clipped Waveform – A waveform which is attempting to exceed its maximum allowed amplitude and in consequence is *clipped*, or set equal to the maximum possible amplitude.

Color Channel – A single color from the three available (red, green and blue), and all of its associated parameters. Each channel is completely independent of the others and can be set to its own frequency, brightness, phase, etc.

DC offset – This controls the amount of steady (ganzfeld) light is mixed with the flicker component. A setting of 127 allows each pulse of light to vary between completely off and completely on, while a setting of 255 completely eliminates flicker. Intermediate settings generate gently pulsing or flickering output, which is generally quite pleasant. Settings in the range 140 to 230 or so produce a nicely balanced mixture of flicker and steady light.

Flash memory – Nonvolatile memory, which may be reprogrammed. Both the Procyon operating system and data storage utilize this type of memory, which may be programmed and erased up to 100,000 times.

Frequency – The number of waveform cycles per second. Also referred to in this document as *Hertz* (Hz for short). The frequency range for the Procyon is 0.1 Hz to 75.0 Hz.

Ganzfeld — a field of light which glows steadily, without flickering. We've extended this definition to include fields of light which can change from one hue to another.

Hertz (Hz) — Also known as cycles per second; this is a measure of how many oscillations (for example, binaural beats or flashes) occur each second.

Phase — The relationship between two or more waveforms, relative to the start of the waveform. If two sine waves are moving together, they are said to be *in phase*; if one starts before the other, they are *out of phase*.

Phase Shift — The degree by which two waveforms are out of phase. One complete cycle of a waveform is equal to 360 degrees; when programming the Procyon, it varies in the range 0 to 255, so there are about 1.41 degrees per 1 unit Procyon phase change.

Programmable Parameter — Any aspect of a Procyon session which can be altered (or “programmed”). For example: light waveform, phase shift, frequency, brightness, etc. See the Procyon Programmer’s Guide for more details.

Pulse Width — One of the Procyon light waveforms is a pulse waveform. That means that the light turns on and off more or less instantly. Pulse width is a measure of how long it remains on before turning off, and this is a number between 0 (always off) and 255 (always on). For example, if the pulse width is 25, then the light will turn on briefly and remain off for the remainder of the waveform period—which in this case is equal to $(255-25=) 230$. In other words, in this case the light remains on about ten percent of the time and is off the other ninety percent. Pulse widths in the approximate range 20 to 80 seem to produce the most interesting visual effects.

Pulse Width Modulation — The pulse width can change over the course of a segment, from an initial value to a final value. This shift is called *pulse width modulation*.

Segment — The basic unit of structure for a session. It can have a variable length, typically is in the range from a few seconds to a few minutes. Programmable parameters always have starting values and ending values, which are defined by the beginning and end of a segment. For example, if a one minute segment starts at 5 Hz and ends at 10 Hz, the speed will gradually increase (in a linear way) during the segment.

Session — The sequence of one or more segments constituting a programmed Procyon audio-visual experience.

Wavetable — A series of numbers representing a waveform. In the case of Procyon, there are both visual and audio waveforms; in both cases, they are 255 numbers long.

Appendix: Procyon®: Features and Programming

The following section includes a brief review of the technical features of the Procyon, followed by an introduction to how sessions are constructed and the various programmable parameters. If you wish to author sessions, you should download the Procyon Editor guide from www.mindplacesupport.com and review available tutorials.

Features

The Procyon incorporates the following unique features:

- Create millions of colors, including pastels, with our **Procyon Visual Effects Engine™**
- Colored ganzfeld option—create nonflickering fields of light which shift in hue and brightness
- Hybrid ganzfeld/flicker capability (i.e., variable brightness intensity instead of on/off).
- 16/24 bit audio codec for audiophile sound quality.
- 30+ kbytes of flash memory for session storage.
- USB port.
- The ability to control external devices, such as LED arrays. Turn the entire room into a shifting, kaleidoscopic visual sculpture!
- **BioConnect²** feature allows real time control of light via bio-sensor input (implemented in an OS release to come).

In the first part of this document I will discuss the programming model we've developed for the creation of visual effects; this is followed by a brief introduction to session programming.

Visual Effects Programming: Basics

Here is a summary of the capabilities of our Visual Effect Engine:

- Four simultaneous color channels (red, green, blue, white).
 - 255 shades of each color (plus "off").
 - Light modulation via wavetable (sine, pulse, triangle).
 - Variable phase control of light waveforms, including real-time phase shifting.
 - Lights may be modulated to 75 hz, unmodulated (ganzfeld), or variations between them. Each color channel may be set to its own set of frequencies, color ramps, etc.
- Lights may be intensity modulated, meaning they vary in brightness rather than turning from on to off. We call this effect *shimmer*.

I will discuss the technical details of this system in the context of the *Procyon Editor* software tool we've developed for session creation.

Segments and session format.

A **session** is made up of a number of a number of **segments**.

Segments may vary in length from 0.5 seconds to 10.0 minutes, in half to a tenth of a second increments.

For each segment, the author determines a **start value** and a **finish value** for each programmable parameter; those values then change in a linear manner from segment start to finish.

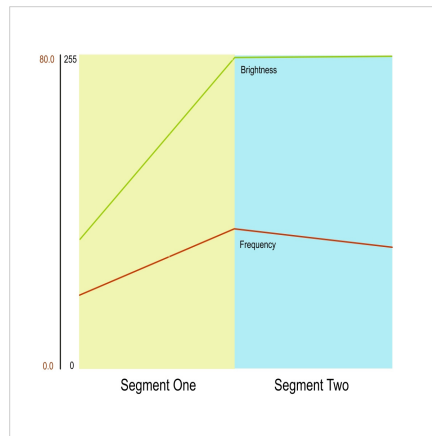


Figure 1.

The illustration above shows the first two segments of a session; only brightness and frequency from a single color channel are displayed for the sake of clarity. Frequency starts in segment one at about 15 hz and ends at about 35 hz, while brightness starts at about 110 and ends at 255 (the maximum setting).

The main segment edit screen looks like this:

RGBW project : Editing ... scratch.avw

File Session Tools Serial Communication Utilities About

Port 3 19200

	Red		Green		Blue		White	
	Start	Finish	Start	Finish	Start	Finish	Start	Finish
Frequency	1	75	2	1.2	3.3	7.5	6	3.7
Amplitude	255	128	255	255	128	255	128	0
DC offset	127	127	127	127	127	127	127	160
duty cycle	85	170	127	32	127	127	127	127
Phase	0	127	0	0	75	0	0	0
wave table	Square		Square		Triangular		User	
	☒ Red LF active		☒ Grn LF active		☒ Blu LF active		☐ Wht LF active	

Send data to GB60

Adjust Sound Parameters

Run Segments

Pause and Get Status

Stop Session

	Start	Finish	Start	Finish
Pitch Left	60	300	Pitch Right	255
Volume Left	255	6	Volume Right	64

Current Seg # 1

Run to Seg # 1

Segment Time 60.00.0

Figure 2.

Programmable parameters for visual effects include the following items, which may be set independently for each of the four color channels:

Frequency – The rate at which lights are flickering. This may range from 0 to 80 Hz, in 0.1 Hz increments.

Amplitude -- This sets the brightness level, and ranges from 0 (off) to 255 (maximum).

DC Offset – Used to set the level of “shimmer” in a light channel. The default setting is 127, which would modulate normally between “on” and “off” as determined by the selected waveform. A setting of 250 for example will barely be flickering. Setting this to a value below 127 will cause the waveform to *clip* at top and bottom, which can generate additional interesting visual effects.

Duty Cycle – This determines the ratio of “on” to “off” time for the Square waveform. Ranges from 0 (off always) to 254 (on almost always).

Phase – Determines when a waveform starts, relative to the start of a segment. If this is set to 0 for each color channel, all colors would be aligned, turning on and off at exactly the same time. However, very interesting effects are obtained (especially at low frequencies) by offsetting the phases of the various colors. *See Color Channel Advanced Concepts, below.*

Wavetable – Use this popdown menu to select sine, square, triangle or user waveforms.

Notice also that there are check boxes below each color channel which allow you to turn a channel on or off in each segment.

Introduction to Session Creation

A **session** consists of a series of segments; you build a session one segment at a time. When you first open the RGBW Project editor,

it will load a default segment.

When you've finished editing this segment, insert another after it using the **F3** key (or: *Session Tools/Insert Segment*). At this point, a slider bar appears in the lower right portion of the edit window, which looks like this:

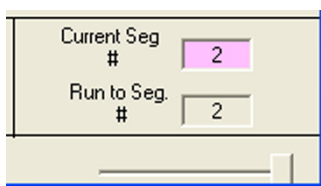


Figure 3a.

Use this slider to toggle between the segments you are editing. Be sure that the Current Seg. # box is purple in this case, rather than the Run To Seg. # box.

You can also use the slide control to choose which segments to preview from the current session. For example, suppose your session includes 8 segments, and you wish to preview numbers 3 to 8. First click in the “Current Seg #” box and adjust the slider to “3”. Then click in the “Run to Seg #” box and adjust the slider to “8”. The results will look like this:

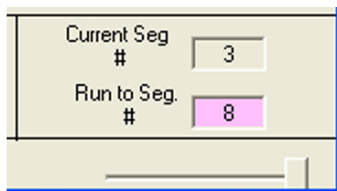


Figure 3b.

When inserting segments (which may be done at any point within a session), the default values displayed in the newly inserted segment

will be identical to those of the segment preceding it. This is intended to make the process of session creation faster and easier, since that newly inserted segment “remembers” for you what the previous segment settings were.

Testing segments and sessions

You can test an individual segment or a group of segments (including the entire session you are editing) by doing the following:

1. Click your mouse pointer in the **Current Seg. #** box; it will confirm selection by turning purple.
2. Use the slider to select the first segment you wish to test.
3. Click your mouse pointer in the **Run To Seg. #** box, and
4. Use the slider to select the last segment.

Click the **Run Segments** button on the right side of the screen.

Sometimes you may find, while running a segment, that a certain special color appears which you would like to capture and reproduce for a longer period. To do so, click the Pause and Get Status button, which will produce a list of current parameters on the left side of the screen. To preserve this information:

1. Right-click on the text area and choose Select All.
2. Right-click on it again and choose Copy.
3. Open Notepad or Wordpad [Start/Accessories/...] and paste the text into it for future reference.

Manually enter the values in a new segment.

For complete session creation instructions and tutorials, see the Procyon section at www.mindplacesupport.com.

Color channel advanced concepts.

In this section we'll discuss the color channel programming options

in more detail.

Figure 4 (below) illustrates the effect of shifting the *phase* of the red, green and blue lights relative to one another. In this case, a *sine wave* is being used.

One full cycle of a waveform occurs over 360 degrees, and if there is no phase shift, it starts at 0 degrees, rises and falls in a half-circle, intersects the X-axis at 180 degrees, and completes the lower (negative) half circle at 360 degrees. In the example below, this is illustrated by the color red. Notice that blue is exactly the opposite of red and so they are 180 degrees out of phase with one another.

This means that when red is at maximum brightness, blue is off and vice versa.

Green is shifted by about a quarter of a full wave to the right, a 90 degree phase shift. So it starts to turn on just as red reaches its

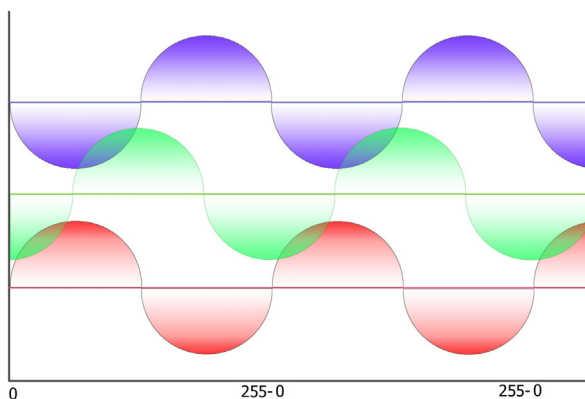


Figure 4.

maximum brightness, and reaches its maximum brightness as red is just turning off. So the red and green are changing brightness rela-

tive to one another, producing a range of intermediate colors.

Green reaches its maximum brightness level as blue is starting to turn on, so although red and blue are not on at the same time, they both are on while green is on and mix with it.

In the next example, we'll examine pulse width, using the “square” waveform.

The square waveform is more accurately a *pulse* waveform since its width may be varied. it turns from off to maximum brightness (and vice-versa) almost immediately. The pulse can have a variable width; if it is 50%, then it is a true square wave. In the example pictured below, both blue and green have a width of about 40%, while the red is narrow, about 10%.

Also illustrated is the effect of *phase shift* on the mixing of pulse-width modulated color. Notice that blue and red turn on together, starting at 0 phase. The color would be purple until red turns off, then blue until green turned on, then blue-green.

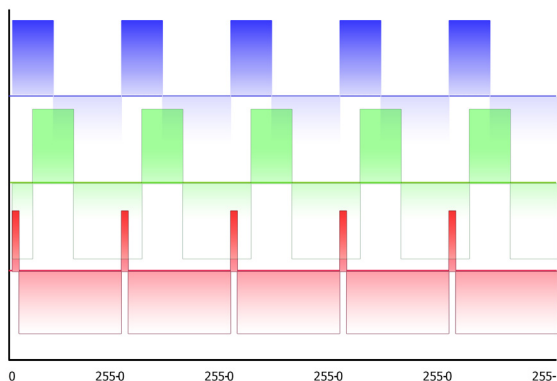


Figure 5.

This combination of pulse width modulation and phase shifting can create spectacular visual effects—allowing you to present entire

sections of a rainbow in each pulse period.

Pulse width is set by an integer value ranging from 0 (not on at all) to 255 (on all the time); these are the equivalent of 0% to 100%. A pulse width of 127, then, would be about 50%--a square wave.

For single colors, our experience indicates that pulse widths in the 20-40% range produce the most interesting visuals, but this should only be taken as approximate guidance, since the effect of mixing colors with a variety of pulse widths is a new area for research.

Notice that a fundamental difference between the pulse, sine and triangle waveforms is that, while the pulse waveforms turn on and off instantly, sine and triangle waveforms increase from minimum to maximum in a smooth manner.

Try experimenting with the sine and triangle waveforms when the pulse rates are low, especially in the 1 to 8 hz range, and pulse waveforms when the pulse rates are in higher ranges (8+ hz).

Example approximate pulse width settings			
Pulse width %	Setting	Pulse width %	Setting
10	25	60	153
20	51	70	178
30	76	80	203
40	102	90	229
50	127	100	255

How phase shift affects color mixing

So far we have considered only the cases of static pulse width and phase shift. However, you can also choose to vary either or both across a segment. When the phase of one color is changing at a different rate than another, the resulting colors are constantly changing. We call this dynamic phase shift, illustrated in the example shown below.

For simplicity, only the first and last pulses from a segment are shown. The phase shift is programmed as follows:

Color	<i>Start</i> phase shift	<i>Finish</i> phase shift
Red	0° (degrees)	90°
Green	90°	0°

In other words, the phase of the *red* sine wave is moving slowly forward, while the phase of the *green* sine wave is slowly moving backwards. This causes the amount of each color to mix slightly differently in each cycle, producing a range of yellow/gold colors as well as green and red. Using this effect with low frequencies can produce some especially interesting effects.

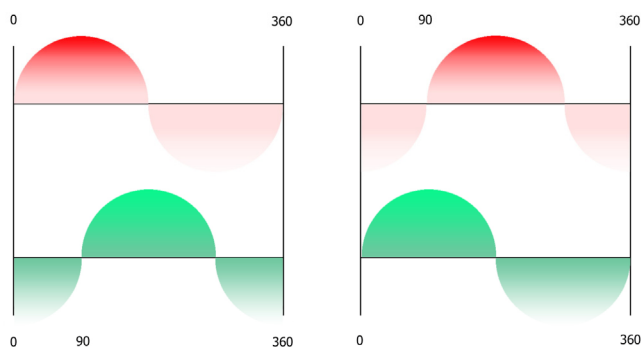


Figure 6

How to create a Ganzfeld

The easiest way to create a Ganzfeld display is as follows:

1. Set the amplitude of the color channel(s) to 0.
2. Set duty cycle and phase to 127, and the frequency to a low value (frequency is not used in a Ganzfeld, and a low value minimizes processor load).
3. Vary the the DC offset between 127 (minimum brightness) and 255 (maximum brightness).

You can also create a pseudo-ganzfeld by setting the frequency to its maximum value, which appears unflickering to most people, and varying the brightness. The triangle and sine settings provide the best results in this case.

DC Offset: Creating waveforms that flicker and clip

DC Offset allows you to mix unflickering (ganzfeld) light with flickering light. The normal setting for this is 127; setting it to a higher value moves the waveform “upwards”, meaning that as the setting grows larger (up to 255), the light remains on at what would normally be the “off” part of the waveform. The closer to the maximum value of 255 you set it, the more ganzfeld-like the lights will be.

Though space does not permit a further treatment of this topic in this User’s Guide, we cover it in detail in the documentation for the Procyon Editor software, available at www.mindplacesupport.com.

You can also post any comments, suggestions etc. on the Procyon User’s Forum at that site.

May your Procyon experience be blissful!

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1. Procyon is guaranteed to be free from manufacturing defects for a period of one year from the date of purchase. Any defective parts will be repaired free of charge (exclusive of shipping costs) during that one year period. Damage caused by a purchaser's misuse or accident, or by fire, flood or natural disaster is not covered by this limited warranty.

When returning Procyon to the Manufacturer, purchaser should be sure to include name, address, telephone number and description of the problem. PURCHASER MUST CONTACT MANUFACTURER FOR AUTHORIZATION BEFORE RETURNING UNIT FOR ANY REASON. Visit <http://www.mindplace.com/support.htm> for online service.

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