A Survey of Sensory Techniques

Strategies for controlling and altering one’s own mental state: An "advanced course" in dealing with sensory issues and environment

Marcie Anne
Stan Provençal

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Strategies for controlling and altering one’s own mental state: An advanced course in dealing with sensory issues and environment

Variations in one’s state of consciousness are normal and healthy. For instance, you would not function for long without sleep.

And yet, we take it for granted that other people have an awareness similar to our own. To a degree, there is scientific evidence for this. For instance, EEGs show that with typical, waking activity, the brain runs on a cycle of 14 to 40 cycles per second. This is known as the beta state.

The Senses and the sense of self

Without sensory perception, a person would not be conscious. Traditionally, there are said to be 5 senses (touch, sight, taste, smell, hearing). However, humans have many more senses than just 5. For instance, the sense of touch is actually composed of pain, light touch, firm touch, heat, cold and probably others. And the traditional 5 senses only include the external senses. People also have internal senses; those include balance, the senses of one’s limbs in space, and hunger, to name a few.

Not only is it true that you would not be conscious without sensory input, but your sensory perception actually creates your state of consciousness. To look at matter from the beginning of life: When people are born, they perceive their environment in a relatively unfiltered sort of way. Structure has to be learned, but until a person absorbs the meaning of culture (whatever culture the person happens to be born into), understanding is purely sensory. Sensory perceptions at their basic level evoke primary emotions, such as happy, sad, etc. As someone grows and learns, however, the emotions become more complex, as perceptions of the world take on more meaning.

Not incidentally, these learned methods of filtering sensory information are also where the sense of self comes from. To quote Donna Williams (from “Autism and Sensing: The Unlost Instinct”): “The capacity to filter information requires some progressively accumulated sense of relative and personal significance and it is from this development of hierarchy that I think a sort of meta-self…is gradually born”.

Being that sensory perception forms your consciousness, any changes in your sensory environment or any changes in how you perceive the senses has the potential to change your state of conscious. Any sensory change can change perceived meaning. For instance, alarms, breaks, exercise, reading, petting an animal, and music, all affect us. Generally, the point of inducing changes in sensory perception is to feel pleasant, and when it feels really good, we tend to call this “getting high”. Of course, this doesn’t tend to apply to the things we have to do in life just to get by, such as going to work. But outside of those necessities, by stripping off layers of meaning, we get down to a more pure sensory level. By varying our state of conscious, we can relax.

Altered State of Consciousness

In terms of brain waves, an Altered State of Consciousness is when the brain frequency goes below 13 cycles per second (or in some cases, above 40 cycles per second). The alpha state, which is 7 to 14 cycles per second, is associated with meditation. 4 to 7 cycles per second is the theta state, in which REM sleep, lucid dreaming, and hypnosis occur. Less than 4 cycles per
second is deep sleep. More than 40 cycles per second is the gamma state, which is a state of high sensory integration, which tends to happen, for example, when a person is in a car accident and events appear to slow down.

LIGHT SENSITIVITIES

Reasons

One study found that autistics tend to have a resting pupil diameter that is greater than neurotypicals.¹ Another study found that close to 90% of autistics have pupils that don’t contract as much and/or as fast as the pupils of neurotypical people². This oddity is in addition to whatever brain-based neurological issues may be present, such as those in related to Irlen Syndrome.³

Types of light sensitivity

Photophobia – This is the most general term for an over-sensitivity to light. It is not an actual phobia. Rather, it refers to discomfort or pain due to light, for either neurological or physical reasons.

Fluorescent lighting sensitivities

Possible causes - Fluorescent lights have “spikes” or peaks in light produced, rather than a smooth curve.

1. Red-blue pupillary flicker or red-blue pupillary flutter -

This is an induced effect in which the brain responds to fluorescent by alternately stimulating dilation and contracting. This is perceived as lighting flutter or flicker.

The effect is aggravated by older magnetically ballasted fluorescent lights⁴, which turn on and off rapidly, at 100 or 120 Hz, depending on the frequency of mains current (50 or 60 Hz). Even 100 Hz is significantly above the human ability to respond to flicker, so it is likely that these illumination cycles stimulate pupillary flutter.

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³ Studies regarding the effects of Irlen Syndrome and the use of colored filters can be found here http://irlen.com/index.php?s=br
⁴ Magnetically ballasted fluorescent lights use a magnetic coil arrangement to ballast the light. The coil is a type of transformer directly responsive to line current. The significant aspect is that the tube is energized at mains current or line current (50 or 60 Hz), resulting in on-off cycles at twice line current (100 or 120 Hz, which is two half-cycles for each mains current cycle).
Electronic ballasts\(^5\) cycle far above frequencies perceived by people. Some, but not all, people who cannot tolerate magnetically ballasted lights are able to tolerate electronically ballasted lights, including self-contained compact fluorescent lights (CFLs).

The “spikes” or peaks in light produced by fluorescent light, rather than a smooth curve, stimulates the red-blue pupillary flicker effect, but the actual effect occurs in the individual's optic neural system. Therefore, red-blue pupillary flicker can occur with electronically-ballasted fluorescent lights and CFLs.

Adaptations

- Avoid fluorescent lighting in areas frequently occupied.
- In areas where fluorescent lighting is prevalent, include non-fluorescent lighting, e.g., over a work area. Tri-phosphor and fluorescent lighting with high quality light output are preferred.
- Since red-blue pupillary flicker is likely associated with other fluorescent lighting effects, selection of low color temperature bulbs will make the lighting more pleasant (see below for definition of color temperature).
- Change magnetic ballasts to electronic ballasts. The cost is approximately the same, although the electrical work (if done by an electrician) must be taken into account.

2. Blue or blue-ultraviolet (UV) sensitivity

Blue or blue-UV sensitivity is a separate effect from red-blue flicker and is related to the color temperature, perhaps in combination with the color rendering index (CRI) of the fluorescent lighting (see below for definition of color rendering index).

Blue light receptors in the eye are connected to the circadian rhythm and wakefulness. People are relatively sensitive to blue and ultraviolet light as infants and usually become less sensitive as the eyes mature\(^6\). If an adult is still sensitive to blue light for physiological or neurological reasons, this can cause problems with tolerating sunlight (e.g. it has been known to cause migraines in otherwise neurotypical people). It can also cause a problem with fluorescent lights that produce a spike in the blue spectrum. Such lights are known as “cool blue” or “daylight” bulbs (as opposed to “warm” lighting). (In Marcie’s experience, blue light sensitivity can cause difficulty in thinking, eye pain, nausea, increased heart rate, and a feeling of being pushed away).

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\(^5\) Electronically ballasted fluorescent lights, which include all compact fluorescent lights with self-contained ballasts manufactured as part of the light bulb, use an electronic circuit to drive the lamp.

There are some older fixtures designed for plug-in CFLs, in which a magnetic ballast is used, just as there are straight-tube fluorescent light fixtures with magnetically ballasted. It is likely that all currently manufactured CFL fixtures are electronically ballasted. Most straight-tube fluorescent light fixtures now use electronic ballasts. The significant part is the lamp is energized at least at 20 kHz.

\(^6\) Maurer, Daphne and Charles Maurer, “The World of the Newborn”. 
Adaptations

Select low color temperature lighting ("warm" lighting) or specialty lighting. In the case of fluorescent lights, specialty lighting includes GE "Reveal" fluorescent and meat display tubes.

Black light sensitivity

There appears to be a distinction between blue-ultraviolet sensitivity and black light sensitivity. The mechanisms of this are unknown.

Definitions

Color temperature - Color temperature in astronomy refers to the temperature of a "black body radiator" (usually a star), which emits a particular color (wavelength of light or color frequency) at a particular temperature. "Color temperature" regarding bulbs describes the color spectrum of the emitted light. The color temperature of common light bulbs varies from yellow to blue-ish violet.

Generally, color temperature is replacing the colloquial descriptions of "warm", "soft", "cool", and "daylight". The color temperature is easy to identify at time of purchase because packaging will often have a chart that looks like the energy rating chart on appliances. The "key" is that incandescent lamps have a color temperature up to 2700°K (warm yellowish lighting); halogen has a color temperature of approximately 2950°K (closer to white); and fluorescents tend to have a color temperatures between 3000°K to 6100°K (yellowish-white to bluish cool lighting).

An every-day example of a "black body radiator" is an incandescent light filament (typically 2700°K) or halogen light filament (typically 2950°K). Incandescent lighting can be modified, such as with niobium glass (e.g., GE Reveal incandescent and halogen), which increase the color temperature slightly.

Color Rendering Index (CRI) - The CRI is a measurement of ability of light to reproduce colors of various objects. CRI is based on black body radiation (incandescent CRI=100). CRI is generally applied to lighting sources up to 5000°K and has limited value as a measurement of lighting quality.

CRI is frequently used to indicate lighting quality, although some quality lighting sources have relatively low CRI. CRI is often useful when comparing similar lighting sources. e.g., an ordinary fluorescent tube at 95 CRI generally produces better quality light than the same color temperature tube providing 85 CRI. Specialty tubes will often have lower CRI but still produce higher quality light. Incandescent and incandescent halogen lights produce CRIs of 100 because they *are* black body radiators.
Alternatives

Incandescent

*Halogen Incandescent* - best light rendering, with possible exception of Philips "L-Prize" LED. Some are available with enhanced efficiency. (Dichroic filters on halogen headlamps create the poor lighting effects associated with faux HID lighting.)

High Pressure Sodium and Low Pressure Sodium

Metal Halide

*HID Lighting* - HID (high intensity discharge) lighting of various types are common in large area illumination, such as street lights, high bay lights in public areas and some outdoor lighting. HID lighting is very efficient, but tends to have a narrow frequency output and is costly.

*LED Lighting* – LED (light emitting diode) lights are available in a variety of color temperatures, with varying lighting quality. Like fluorescents, they use phosphors to fluoresce down to visual colors, but have a broader light output than fluorescents. Whether LED lighting solves the problems caused by fluorescent lighting is unclear. While LED lighting uses the same types of phosphors as fluorescent lighting to fluoresce ultraviolet light to visible frequencies, the source light of LEDs has a broader spectrum. Therefore, the light output spectrum is less likely to be "spikey". Still, there is a light quality issue with LEDs and many transmit at higher color temperatures, which may not be preferable.

LEDs used for environmental illumination typically range from 2700°K to 4000°K, with 4000°K being more common. Many of the higher quality LED lamps do produce light in the range of 2700°K to 3000°K, which can be more comfortable for some. Some of the newer developments, e.g., the Philips "L-Prize", provide superior lighting.

One promising technology is remote fluorescing LED. Remote fluorescing LEDs have an external fluorescing material, typically yellow. One example is Philips "L-Prize", which combines blue and red LED devices for a rich color rendition.

The Future

Incandescent lights have been replaced by fluorescent lighting and to a lesser extent halogen lighting. Halogen lighting is still an intermediate step, as they are only 70% more efficient than ordinary incandescent lights, or perhaps 50%, if light quality is taken into consideration. Many commercial locations have elected to not use fluorescent lights because of perceived poor lighting. CFLs also have problems with mercury content.

LED lighting is seeing extensive use in commercial spaces, ranging from multi-bulb theatre entrances to spotlight applications.

For home use, we are starting to see LED lighting. Newer developments, such as remote fluorescence with mixed color LED elements appear to provide improved lighting.
What can be done/ “treatments”

**Tinted eyeglasses** - Many, if not all, shops that sell eyeglasses also offer tint for the eye glasses. Some optical shops do this for free; others have an extra charge. All stores will only tint glasses that they have sold. (Note: In Marcie’s case, eyeglasses make her see “too well” and cause her to squint in daylight conditions, possibly causing a headache. A light brown tint on the glasses helps to prevent this problem.)

**Sunglasses** – “wrap around” sunglasses may be particularly useful, as they are designed to block out light from the sides.

**Colored sunglasses** – Sunglasses with colored lenses can be used to create specific effects. For instance, amber or red lenses can filter out blue light. The effect of red light is opposite that of blue light. While blue light activates the nervous system, red light helps to calm it down.

According to one source (speaking in regards to children with autism), “If the child has an angry or emotional reaction to loud noises such as a dog barking, color may help. If there is just emotion and no anger, red seems to help most. However, if there is anger, orange or yellow seem to work better”.

**Irlen Syndrome, Filters, and Irlen Lenses** – “Irlen syndrome” (sometimes used interchangeably with “Scotopic sensitivity syndrome”) is a perceptual issue, in which the brain reacts inappropriately to certain wavelengths of light. This causes a sort of double exposure in the brain. Irlen syndrome often causes issues with reading (e.g. it blurs words on a page or makes them appear to move), but can also be present with “good readers” (i.e. people who don’t appear to have reading problems). This syndrome can cause eyestrain, headaches, nausea, visual stress due to busy patterns, and difficulties seeing ones surroundings as a whole (among other issues).

Two techniques are used to treat Irlen syndrome. 1) Colored filters/over lays, which are placed over the page the person is reading. 2) Colored lenses, which are used to screen out the troublesome wavelengths, thus “correcting” the light. (Contacts are also available, but are not used immediately after evaluation for Irlen lenses, since the color needed may change as the brain changes and adjusts with the wearing of the lenses.) Note that the color used for over lays is **not** usually the color used for filtered glasses.

Note: Someone being evaluated for colored over lays and lenses may first need to be evaluated by one person for the over lays and then see a different specialist for the lenses. The second evaluation is more expensive.

**ChromaGen lenses** – These are filtered lenses designed to assist people with dyslexia and color blindness. ChromaGen lenses are available in much fewer colors than Irlen lenses. And even though the initial evaluation is less expensive than an evaluation for Irlen lenses, the ChromaGen lenses cost much more (Irlen lenses are about $250, whereas Chromagen lenses start at $800). However, ChromaGen screeners are more readily available than are doctors qualified to perform an evaluation for Irlen lenses.

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FL-41 tinted glasses – These pinkish tinted glasses were designed to reduce migraines in people who are prone to them due to a sensitivity to light, particularly blue light. This tint is suitable for working at a computer.\(^8\)

Blu blockers – These glasses have an orange amber tint. They block blue and UV rays. They are sometimes used for relief from insomnia. The method of treatment involves the affected person wearing them several hours before bedtime.\(^9\)

Z1 tinted glasses – These blue tinted glasses help to prevent seizures in people with epilepsy who are sensitive to light. However, obtaining them in the US can be difficult.

Full spectrum bulbs – Full spectrum such as Ott lights and niobium glass incandescent lights (Reveal incandescent and halogen) may produce a more balanced and less “spikey” light.

AUDITORY ASSISTANCE

Acoustic entrainment music – Entrainment is the tendency of the body and mind to sync up with the rhythms of incoming sensory stimulus. Intentionally altering your brain waves via music that has been selected because the music has a particular rhythm (hertz) or has been designed to have a particular rhythm is called “acoustic brainwave entrainment”. CDs can be purchased with such music and some websites also offer it for free.

Binaural beats – Binaural beats are a type of acoustic entrainment that relies on two different rhythms (hertz) entering each ear. The brain interprets only one rhythm, which is the difference between the two. For example, if a beat of 300 hertz goes in one ear and another beat of 310 hertz goes in the other, then the brain entrains to the difference of 10 hertz. Typically, headphones must be used for this effect to work.

White noise for sleep – “White noise”, which can be defined as a noise that is produced by combining sounds of all different frequencies together, tends to have a sedating effect on people and is often used for assistance in sleeping. Machines can be purchased that specifically create the white noise effect (e.g. on Amazon, search for “white noise machine”). Sounds can also be found for free on-line or can be produced by using a fan. Amazon also has a range of noises entitled “white noise”, “brown noise”, and “pink noise” (among others) that are available for just a dollar each.

Noise Cancelling or ANR Headphones - Noise cancelling headphones, also called Active Noise Reducing (ANR) headsets, generate sound waves which are (ideally) 180° out of phase with detected noise. This cancels unwanted auditory input, rather than relying on the acoustic properties of the earpieces.

Most ANR headsets have audio inputs, which are used for music or other communication (e.g., aviation). ANR headsets vary in quality, although different price levels within a particular series is generally directed to music reproduction or physical features. ANR headsets are available in full noise-attenuating earcup (pilot's or shooter's headsets), lightweight full earcup, earpad, and earbud. Almost all ANR headsets have music inputs because the audio circuitry is already present.

The device must say "noise cancelling" in a description of the earpiece or "ANR". Note that most microphones are "noise cancelling" but that means something else (typically a back vent that physically does what ANR headsets do electronically). If it has a microphone and doesn't specifically state the earphone is "noise cancelling", it is not. ("ANR" generally applies to the earphone, but that description is usually found on specialty equipment, such as pilot's headsets.)

Ear plugs – When all else fails, foam ear plugs are cheap and readily available.

TACTILE STIMULATION

The Wilbarger Deep Pressure and Proprioceptive Technique (DPPT) – Formerly known as the Wilbarger-Brushing protocol. The DPPT is a method of dealing with tactile defensiveness. This involves brushing the arms, legs, and back (but never the chest or stomach) with a soft, plastic surgical brush (this are inexpensive and available on-line). The brushing is followed by compressing of the joints. An occupational therapist should probably be consulted before trying this on someone else.

Weighted gear – General pressure tends to be soothing. Weight gear for creating pressure on the body includes weighted blankets, weighted vest, lap pads, and lap wraps. Salt of the Earth Weighted Gear (http://www.saltoftheearthweightedgear.com/) offers these in a variety of colors and probably has the most reasonable prices that you’ll find on-line, but there are many other companies that sell these also (including http://www.sensacalm.com/, http://www.weightedwearables.com/ and http://www.cozycalm.com/).

Body togs – Body togs are weights that wrap around the forearms and calves. Originally designed for exercise, they can also be worn as a method of feeling “grounded”. They are available at http://www.bodytogs.com/ or on Amazon.

Body sox and body unitards – These are fabrics that cover the entire body. Available from Amazon, among other places.

Squeeze machine – Temple Grandin has the specifications for her squeeze machine on-line at http://www.grandin.com/inc/squeeze-10.html. Of note, she cautions that it should only be used under the supervision of an occupational therapist and should not be modified without consulting her.

Silicone bracelets – These can be used to gain a better sense of one’s arms in space.

Exercise

Bean bags – Bean bags, including “comfy sacks”, are reported to be calming to autistic children.

Body work (Massage and similar therapies) – There is information available on body work in autism in the book “Therapeutic Massage and Bodywork for Autism Spectrum Disorders: A Guide for Parents and Caregivers” by Virginia Cowen. We have not read this book, but it has very good reviews on on-line. Also, the book “Too Loud, Too Bright, Too Fast, Too Tight” (Chapter 15) by Sharon Heller surveys some of the types of body work that may be useful in dealing with sensory defensiveness.
**TENS** - Transcutaneous electrical nerve stimulation (TENS) is the use of electric current produced by a device to stimulate the nerves for therapeutic purposes. It involves small, adjustable electrical currents applied through skin electrodes. TENS units are medical devices which, with some exceptions require a prescription in the US.

The prescription is fairly easy to obtain; however, there are also D-I-Y instructions available on the web, typically using audio amplifiers from computer speakers, which have the added advantage of being computer controlled.

TENS can be used for:
- muscle stimulation and relaxation
- pain blocking
- stress relief and pain distraction, e.g., during dental procedures
- erotic stimulation

**State of Mind, Altered States of Consciousness, and Spirituality**

Any change in the sensory environment can produce a change in consciousness. Small changes can sometimes produce huge effects, but more obvious changes are often used to produce altered states. Altered states are a natural way to help people relax and can be utilized even if one is not overtly religious. Altered states are also utilized in many religions, and some techniques for religious ASC overlap with autistic behaviors. The following are some examples of the uses of sensory input in altered states:

Shamanism, an old religious technique geared towards either gathering information or manipulation of the spiritual environment, cannot happen without an altered state of consciousness. Sometimes, drugs are used, but commonly there are other techniques for inducing an altered state, such as drumming. The drumming is between 4 to 7 beats per second, which matches the brain’s theta state. A sort of revival of shamanism has occurred through the work of anthropologist Michael Harner (see the book “The Way of the Shaman”). CDs are available with drumming.

Whirling dervishes are Sufi practitioners who are able to spin without falling. They always spin to the left (counter-clockwise) with the left hand down and right hand up.

Speaking in Tongues (glossolalia) is a practice found among certain Christian sects. As explained by Wikipedia, “speaking in tongues is the fluid vocalizing (or less commonly the writing) of speech-like syllables that lack any readily comprehended meaning, in some cases as part of religious practice”. Practitioners often recalled that during incidents of glossolalia that they feel a loss of control and that they are speaking with angels or with god. Brain scans show a decrease in blood flow the prefrontal cortex, which is in charge of cognitive control, and an increase of blood flow to parietal lobe (which is responsible for sensory integration) and the amygdala (which is heavily involved in emotion). (Of note: Wiccans sometimes use “barbarous words”, which are chants that don’t mean anything).

Zen Buddhist meditation is simply paying attention to the breath – and nothing else. To practice Buddhist meditation, pick a point of the body like the lungs, throat, or tip of the noise, and focus on that for a few minutes to an hour. Brain scans show a decrease in blood flow to the parietal lobe (which is the actually the opposite of what happens with speaking in tongues).
Voodoo is a syncretic religion, which blends Catholicism with indigenous African religion(s). A significant practice is Voodoo involves rituals in which people are possessed or ridden by spirits (though the person being “ridden” does not usually remember it happening). Dance and drums are some of the methods used to induce a trace state.

Spiral dance is a Wiccan practice. Everyone involved holds hands in a line and then follows the leader in a series of enclosing circles. As the leader comes near the center of the circle, he or she turns around and begins moving in the opposite direction while facing the rest of the dancers, thus unwinding the spiral.

Shucklen is a Jewish practice of swaying or rocking during recitations of prayer (davening). It is mainly the practice of European Jews and allows the person praying to dissociate from distractions.

The main thing to remember is this: *Anything* you do will alter your state of consciousness. So pay attention.
Strategies for controlling and altering your own Mental state

An advanced course in dealing with sensory issues and environment

Marcie Anne
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SETTING THE STAGE – THE MIND & THE SENSES
Variations in one's state of consciousness are normal and healthy.

E.g., you would not function for long without sleep.

To what degree are people’s state of mind similar?

Some uniformity in the electrical activity of the brain

E.g., EEGs show that with typical, waking activity, the brain runs on an electrical cycle of 14 to 40 cycles per second. This is known as the beta state.
The Senses

• Your sensory input is your reality
• There are more than 5 traditional senses
  • External sense of touch includes pain, light touch, firm touch, heat, and cold.
  • Internal senses include balance, the senses of one’s limbs in space, and hunger.
• Prior to learning cultural meaning and filtering out “unnecessary information”, a person’s understanding of events is purely sensory, along with the emotions evoke by sensory perception.
Sense of Self

- A person gradually learns to filter sensory input and a “sense of self” is gained.

- “The capacity to filter information requires some progressively accumulated sense of relative and personal significance and it is from this development of hierarchy that I think a sort of meta-self...is gradually born”. - Donna Williams, “Autism and Sensing: The Unlost Instinct”

- Much of altering sensory input and inducing altered states involves becoming enraptured in sensory experiences and stripping way layers of cultural meaning. This often involves a temporary change in the state of brainwaves.
Brain Waves and Altered States

- **Beta state**
  - 14 to 40 cycles per second
  - typical waking state
- **Alpha state**
  - 7 to 14 cycles per second
  - associated with meditation
- **Theta state**
  - 4 to 7 cycles per second
  - REM sleep, lucid dreaming, and hypnosis occur
- **Delta state**
  - less than 4 cycles per second
  - deep sleep
- **Gamma state**
  - above 40 cycles per second
  - a state of high sensory integration, which tends to happen, for example, when a person is in a car accident and events appear to slow down
In Summary

- Since sensory perception forms your consciousness, *any change in your sensory environment or any change in how you perceive the senses has the potential to change your state of conscious.*
- Other than the things we do just to get by, we tend to change our sensory perception for pleasant reasons.
  - E.g. taking breaks, reading, petting an animal, listening to music
- By stripping off layers of cultural meaning, we get down to a more pure sensory level.
- By varying our state of conscious, we can relax.
LIGHT AND SEEING
**Autistic Eye Differences**

- One study found that autistics tend to have a resting pupil diameter that is greater than neurotypicals.

- Another study found that close to 90% of autistics have pupils that don’t contract as much and/or as fast as the pupils of neurotypical people.

- These differences are in addition to whatever processing oddities are going on in the brain.
Types of light sensitivities

- Photophobia – This is the most general term for an over-sensitivity to light. It is not an actual phobia. Rather, it refers to discomfort or pain due to light, for either neurological or physical reasons.

- Specific Sensitivities include:
  - Red-blue pupillary flicker or flutter
  - Blue or blue-ultraviolet (UV) sensitivity
  - Black light sensitivity
Red-Green Pupillary Flicker or Flutter

- Older magnetically ballasted fluorescent lights cycle at 100 or 120 Hz.
- Newer electronically ballasted lights cycle at a higher frequency (20,000 – 40,000 Hz).
Autistic s commonly report being able to see fluorescent cycling as flicker or flutter, even though 100 Hz is significantly above the human ability to respond to flicker.

This perceived flicker may be an induced effect in which the brain responds to fluorescent light by alternately stimulating dilation and contracting. But the actual effect occurs in the individual's optic neural system.
Fluorescent lights produce “spikes” or peaks in the visible spectrum, rather than producing a smooth curve.
Color Temperature...

...is independent of the Color Rendering Index.

incandescent bulbs render all colors equally well

fluorescents render some colors stronger, some weaker than others
**Bulb Color Temperature Chart**

<table>
<thead>
<tr>
<th>Color Temperature (Kelvin)</th>
<th>2700K</th>
<th>3000K</th>
<th>3500K</th>
<th>4100K</th>
<th>5500K</th>
<th>6500K</th>
</tr>
</thead>
<tbody>
<tr>
<td>Atmosphere</td>
<td>Warm</td>
<td>Neutral</td>
<td>Cool</td>
<td>Daylight</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mood Created</td>
<td>Inviting, Comfortable, Relaxing</td>
<td>Efficient, Balanced</td>
<td>Bright, Clean, Lively</td>
<td>Crisp, Refreshing, Energetic</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: “Mood Created” in the above chart applies mostly to neurotypicals.
COLOUR TEMPERATURE CHART

1800K
match flame

1930K
candle flame

3500K
quartz lights

7500K
sky overcast

2900K
sunrise / sunset

5400K
sun direct at noon

8000K
outdoor shaded areas

3000K
Tungsten lamp 500W - 1KW

6500K
sun through clouds

10000K
partly cloudy sky
Blue or blue-ultraviolet sensitivity

- Blue or blue-UV sensitivity is a separate effect from red-blue flicker and is related to the color temperature.

- Blue light receptors in the eye are connected to frontal lobe activity, the circadian rhythm, and wakefulness.

- If someone is sensitive to blue light for physiological or neurological reasons, this can cause problems with tolerating sunlight, e.g. causes migraines.

- Blue light sensitivity can also cause a problem with fluorescent lights that produce a spike in the blue spectrum, i.e. “cool” or “daylight” bulbs.
Blue-ultraviolet sensitivity - Adaptation

- Select low color temperature lighting ("warm" lighting) or specialty lighting (e.g., 2700-3000 K).

- In the case of fluorescent lights, specialty lighting includes GE "Reveal" fluorescents and meat display tubes.

- E-Readers that have an inbuilt light that is of a bluish color temperature. Shop carefully.
Black Light Sensitivity

- There appears to be a distinction between blue-ultraviolet sensitivity and black light sensitivity.
- The mechanisms of this are unknown.
Various alternative artificial bulbs are available, including incandescents, halogen incandescents, metal halide, HID lighting, LED lighting, and full spectrum bulbs.

LEDs vary significantly in quality.
Fluorescent Lighting Adaptations

- Change magnetic ballasts to electronic ballasts. Some, but not all, people who cannot tolerate magnetically ballasted lights are able to tolerate electronically ballasted lights, including self-contained compact fluorescent lights (CFLs).

- Use halogen lighting and high quality, low color temperature LEDs
In areas where fluorescent lighting is prevalent, include non-fluorescent lighting. LEDs, Tri-phosphor and fluorescent lighting with high quality light output are preferred. Outside light is more preferred.

Select a different color temperature light.
What Can Be Done/ “Treatments”

- **Tinted eyeglasses** - Many, if not all, shops that sell eyeglasses also offer tint for the eye glasses. Some optical shops do this for free; others have an extra charge. All stores will only tint glasses that they have sold.

- **Sunglasses** – “wrap around” sunglasses may be particularly useful, as they are designed to block out light from the sides.
What Can Be Done/ “Treatments”

- **Colored sunglasses** – Sunglasses with colored lenses can be used to create specific effects. For instance, amber or red lenses can filter out blue light.

- “If the child has an angry or emotional reaction to loud noises such as a dog barking, color may help. If there is just emotion and no anger, red seems to help most. However, if there is anger, orange or yellow seem to work better”. - http://www.colorglasses.com/Color-Therapy-Medical-Benefits/Autism-and-Color/
What Can Be Done/ “Treatments”

- Specific types of tinted lenses include:

- **FL-41 tinted glasses** – These pinkish tinted glasses were designed to reduce migraines in people who are prone to them due to a sensitivity to light, particularly blue light. This tint is suitable for working at a computer.
What Can Be Done/ “Treatments”

- Specific types of tinted lenses include:
- **Blu blockers** – These glasses have an orange amber tint. They block blue and UV rays. More appropriate for wearing several hours before bedtime for relief from insomnia. (picture at bottom left)
- **Z1 tinted glasses** – These blue tinted glasses help to prevent seizures in people with epilepsy who are sensitivity to light. However, obtaining them in the US can be difficult.
What Can Be Done/ “Treatments”

- **Irlen Syndrome, Filters, and Irlen Lenses** – “Irlen syndrome” (sometimes used interchangeably with “Scotopic sensitivity syndrome”) is a perceptual issue, in which the brain reacts inappropriately to certain wavelengths of light. This causes a sort of double exposure in the brain.

- Irlen syndrome often causes issues with reading (e.g. it blurs words on a page or makes them appear to move), but can also be present with “good readers” (i.e. people who don’t appear to have reading problems).

- This syndrome can cause eyestrain, headaches, nausea, visual stress due to busy patterns, and difficulties seeing ones surroundings as a whole (among other issues).
Two techniques are used to treat Irlen syndrome.

1) When treating reading issues, colored filters/over lays are placed over the page the person is reading.

2) Colored lenses are used to screen out the troublesome wavelengths, thus “correcting” the light.

The color used for over lays is not usually the color used for filtered glasses.
SPECT Scan
With Irlen Colored Filters
Showing decrease over activity

Scotopic Sensitivity with Irlen Lenses
SPECT SCAN

Before

After

Red areas show increased blood flow in subject with lesion. Lesion is not.

Shows subject with lesion. Decreased red area shows that brain is normal.

Lesion is overestimated, has calmed considerably and is experiencing less stress.
What Can Be Done/ “Treatments”

- Someone being evaluated for colored over lays and lenses may first need to be evaluated by one person for the over lays and then see a different specialist for the lenses. The second evaluation is more expensive.

- Irlen lenses are available as contacts. However, contacts are not suggested immediately after evaluation for Irlen lenses, because the exact color needed may change over the first year.
What Can Be Done/ “Treatments”

- **ChromaGen lenses** – ChromaGen lenses are filtered lenses designed to assist people with dyslexia and color blindness.

- ChromaGen screeners are more readily available than are doctors qualified to perform an evaluation for Irlen lenses.

- ChromaGen lenses are available in many fewer colors than Irlen lenses. Plus, even though the initial evaluation is less expensive than an evaluation for Irlen lenses, the ChromaGen lenses cost much more.
AUDITORY
ASSISTANCE
Foam Ear Plugs – available at pharmacies
White noise for sleep

- White noise is produced by combining sounds of all different frequencies together and tends to have a sedating effect on people.
- Machines can be purchased that specifically create the white noise effect.
- Sounds can also be found for free on-line or can be produced by using a fan. Amazon also has a range of noises, such as “white noise”, “brown noise”, and “pink noise” that are available for just a dollar each.
Noise Canceling Headphones

- Also called Active Noise Reducing (ANR) headsets.
- Generates sound waves which are (ideally) 180° out of phase with detected noise, in order to cancel unwanted auditory input.
- Most ANR headsets have audio inputs, which are used for music or other communication (e.g., aviation).
- ANR headsets vary in quality, although different price levels within a particular series is generally directed to music reproduction or physical features.
- ANR headsets are available in full noise-attenuating earcup (pilot's or shooter's headsets), lightweight full earcup, earpad, and earbud.
- The device must say "noise cancelling" in a description of the earpiece or "ANR". If it has a microphone and doesn't specifically state the earphone is "noise cancelling", it is not. (Almost all microphones are “noise cancelling”.)
Aesthetic Entrainment Music

- Entrainment is the tendency of the mind and body to sync up with the rhythms of incoming sensory stimulus.

- Acoustic brainwave entrainment intentionally alters the brain waves via music that has been selected because the music has a particular rhythm (hertz) or has been designed to have a particular rhythm.

- CDs can be purchased with such music and some websites also offer it for free.
**Acoustic Entrainment subtypes**

- **Monaural tones** - two sounds are combined and the perceived frequency is the difference between the two (e.g. 400 Hz is combined with 410 Hz sounds like 10 Hz).

- **Isochronic tones** – produced by a single beat. Reported to be have a greater effect than monaural tones.

- **Binaural tones** – different beats enter each ear and the perceived frequency is the difference between them. Must be used with headphones.
TACTILE INPUT
The Wilbarger Deep Pressure and Proprioceptive Technique (DPPT)

- Formerly known as the Wilbarger-Brushing protocol.
- The DPPT is a method of dealing with tactile defensiveness.
- It involves brushing the arms, legs, and back (but never the chest or stomach) with a soft, plastic surgical brush (these are inexpensive and available on-line). The brushing is followed by compressing of the joints.
- An occupational therapist should probably be consulted before trying this on someone else.
Weighted Gear

- General pressure tends to be soothing.
- Weight gear for creating pressure on the body includes weighted blankets, weighted vest, lap pads, and lap wraps.

- Salt of the Earth Weighted Gear offers these in a variety of colors and probably has the most reasonable prices that you’ll find on-line.
Body Togs

- Body togs are weights that wrap around the forearms and calves. Originally designed for exercise, they can also be worn as a method of feeling “grounded”.

- Available at http://www.bodytogs.com/ or on Amazon.
Body Sox and Body Unitards

- Body sox and body unitards are fabrics that cover the entire body. Available at Amazon and other places.
Squeeze Machines

- Temple Grandin has the specifications for her squeeze machine on-line. She cautions that it should only be used under the supervision of an occupational therapist and should not be modified without consulting her.
Silicone Bracelets

- Silicone bracelets can be used to gain a better sense of one’s arms in space.
Exercise

- Main thing is to find something you enjoy doing.
Bean Bags

- Bean bags, including “comfy sacks”, are reported to be calming to autistic children.
Body Work

- “Too Loud, Too Bright, Too Fast, Too Tight” by Sharon Heller discusses some of the types of body work that may be useful in dealing with sensory defensiveness.
- “Therapeutic Massage and Bodywork for Autism Spectrum Disorders: A Guide for Parents and Caregivers” by Virginia S. Cowen
- “Qigong Massage for Your Child with Autism” by Louisa Silva.
Transcutaneous nerve stimulation (TENS) is the use of electric current produced by a device to stimulate the nerves for therapeutic purposes. It involves small, adjustable electrical currents applied through skin electrodes.

TENS units require a prescription in the US. The prescription is fairly easy to obtain; however, there are also D-I-Y instructions available on the web, typically using audio amplifiers from computer speakers, which have the added advantage of being computer controlled.

TENS can be used for:
- muscle stimulation and relaxation
- pain blocking
- stress relief and pain distraction
STATE OF MIND, ALTERED STATES OF CONSCIOUSNESS, AND SPIRITUALITY
Altered States

- Any change in the sensory environment can produce a change in consciousness and help you to relax.

- Many types of altered states are religious in nature, but one doesn’t have to be overtly religious in order to use certain techniques.

- Some techniques used in religious practices overlap with autistic behaviors.
Shucklen and Whirling

- Shucklen is a Jewish practice of swaying or rocking during recitations of prayer (davening). It is mainly the practice of European Jews and allows the person praying to dissociate from distractions.
- Sufi Whirling Dervishes are able to spin around without falling.
Verbal Stimming

• Speaking in Tongues (glossolalia) - a practice found among certain Christian sects, during which practitioners feel as if they are in speaking with angels or God. It involves “the fluid vocalizing (or less commonly the writing) of speech-like syllables that lack any readily comprehended meaning”.

• Buddhist chants

• Wiccans – sometimes use “barbarous words”, which are used specifically because they don’t mean anything
The List Goes On

- Zen Buddhist meditation – focusing on the breath
- Shamanism – typically using auditory entrainment through drumming
- Holotropic breath work, sensory deprivation tanks, bio-feedback devices, lucid dreaming devices, etc.

The main thing to remember is this: *Anything* you do will alter your state of consciousness. So pay attention.