Lighting, Sound & Spaciousness –
Creating A Staff & Patient Friendly Operatory Environment

In dental office design, perhaps no area is more poorly understood as dental office lighting and its related elements, sound control and spatial sensation. As a result of errors in lighting design, many dental practices suffer from inadequate lighting, which results in eye strain, a reduction in productivity and, when combined with inappropriate auditory and spatial cues, even results in a poor esthetic atmosphere in the patient's eyes.

Unlike many of the more objective elements of design, such as room numbers, door sizes, etc., room comfort is strongly influenced by subjective cues, such as light quality, intensity and reflectance. These subjective cues, in combination with the physical realities of the office, help form the basis for both the patient's attitude toward the practice as well as influence its staffing success.[1] Poor lighting is a common denominator in a wide range of problems present in the operatory. An example of this may perhaps be found in your office today. Do you have a favorite treatment room in the absence of the room's clear-cut mechanical advantages? Perhaps you feel that you experience greater fatigue when scheduled in a certain operatory for extended periods? Have you ever eaten at a restaurant from which you have enjoyed take-out, but find that dining at the restaurant just isn't the same thing? Conversely, perhaps you have had a meal at a fantastic restaurant, but found that take-out doesn't seem as appetizing? If so, you probably have experienced ambiance differentials influenced by lighting. In this article, I will attempt to break room comfort down into elements that can be analyzed and then – with a little work – synthesize these pieces into a coherent whole.

Let's begin our discussion with the *perception of spaciousness* because, when properly managed, spaciousness has a great deal to do with the subjective responses of comfort a patient feels when placed in the treatment environment. Spaciousness, interestingly enough, is only modestly measured in inches. I'm sure that you can remember unique surprises regarding spatial perception in your life. Perhaps it was a visit to the carnival fun house, or in falling victim to a trick geometry puzzle. As dentists, we must have excellent spatial perception, yet we are still

[1] Eyestrain/worker absence

bound by the physical reality of our genetic code in the manner by which we process information. Patients without our professional level of spatial acuity are even more susceptible to spatial deception.

Scientists calculate that a typical visual field presents the eyes with 126 million bits of visual information. Unfortunately, our neural circuitry is able to process only about one million bits of visual data at one time. Our brains handle this predicament in a most ingenious manner. This data is not merely compressed as in your digital camera – our brains immediately process and profile incoming data in order to establish baseline coherence. It is the reliability of this unique processing pattern that provides both the opportunities and pitfalls for the development of an ideal sense of treatment room spaciousness. The techniques that we will draw upon in order to create the desired esthetic effects will be light, color, texture, sound, ratio and geometry.

The geometric elements of a comfortable treatment room are the most comprehensible and will be discussed first. We can then discuss modifiers such as sound and texture. In a subsequent article, we will deal specifically with lighting in the operatory. In the end, our design must serve the dual purpose of setting the tone for patient comfort while also creating an ideal place for productivity.

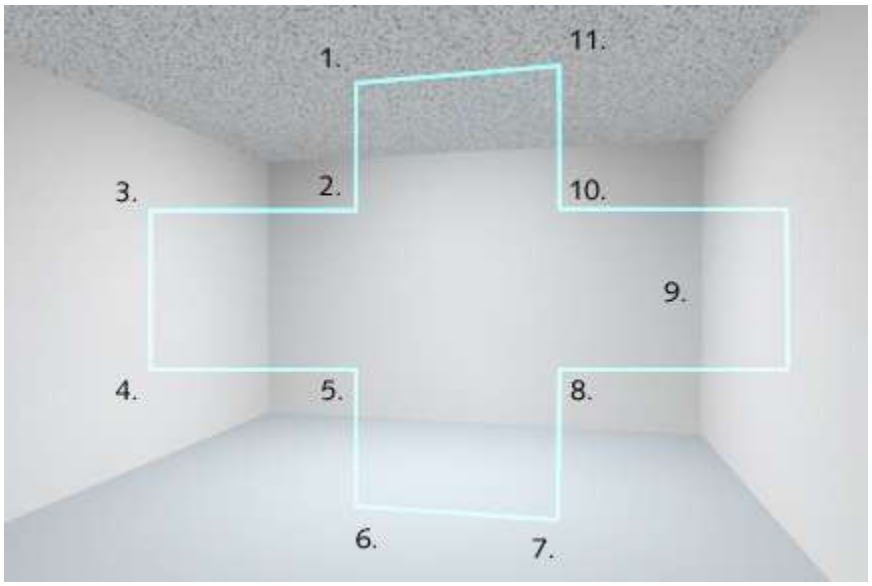

Fig. 1

The human eye rapidly reads a room in a cross shaped pattern instantly upon entry. Operatory design must take advantage of this natural pattern.

Dental operatories are room environments far smaller than the typical room confines of daily life. Whether fully enclosed, semi-enclosed or open plan in their typical manifestations, they still create visual cues which tell the patient's brain, in effect, *"This is a confined space for a strange purpose, certainly not your living room."* To better understand this, we must refer back to the work of the late John Flynn, who is considered by many to be the founder of spaciousness research. Flynn and his colleagues discovered that in the western world, rooms are universally read by the entrant in a cross-shaped manner. We do this instantly and without thought. During this processing, our brains compare a massive amount of data in order to form a *perception* about the room. Is it large or small? Friendly or threatening? Cozy or cold? For our purposes, our patients create immediate sensory impressions about whether or not this is an okay place to be. Errors created here form an important impediment to treatment.

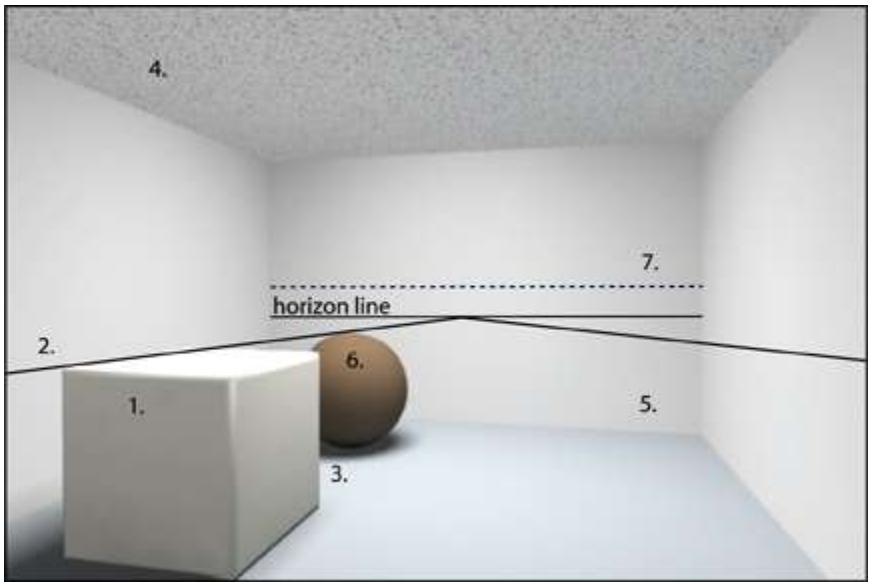

Fig. 2

Object size and overlapping visual planes provide visual cues to our perception of room size and can be utilized to make treatment rooms appear more spacious.

Distance is an easy element of the spatial cues to understand. Scientist Julian Hochberg stated that the development of a visual framework is the first order of business in the process of getting to know a room. In the first assessment of room size, the patient's initial opinion is simply an emotional response; it lacks the visual specifics that will eventually be realized as he or she walks into the room and has a bit of time to create an objective opinion. However, in developing the initial framework, the size and shape of the space are estimated from fairly gross

visual cues. These cues received by the patient as he or she makes an initial survey of the room are:

1. The decreasing size of objects and surfaces that are farther away;
2. Increasing overlay of surface planes and other linear perspective cues;

Jen help!

3. Increasing overlap of features, furnishings and spatial intervals;
4. Increasing blur of details, textures and other gradients;
5. Increasingly muted colors, shadows and contrasts;
6. Surfaces farther from the viewer become dimmer; and
7. Higher perceived horizons.

Spatial volumes are measured by distance cues that are embellished by two kinds of impressions of enclosure. Research by Thiel et al. suggests that for a domestically scaled space in the apparent form of a rectangle (such as an operatory), the *sense* of relative spatial enclosure can be predicted from the positions of five of the six room surfaces (the entrant does not use the head wall to measure the room size). Usually, the overhead distance to the ceiling is judged the most potentially enclosing and the floor surface the least enclosing. It appears that the newcomer will also formulate impressions of spaciousness based on the number, size and prominence of the impediments to his movement throughout the floor space, no matter how large. Dental operatories are often littered with impediments. To summarize, the effective cues to enclosure – our second aspect of spaciousness, include:

Fig. 3

1. Awareness of ceiling height;
2. Apparent distance to the outside wall;
3. Rate of convergence of side walls;
4. Apparent size of the floor; and
5. Lack of clutter of the floor area.

Traditional operatories often do not take advantage of techniques which would permit smaller spaces to appear larger and sterile spaces to have a more comforting feel.

The next major category of spatial perception includes the non-geometric cues that help complete an occupant's opinions regarding space. These elements include light as well as sound input and spatial complexity. Of these three cues, spatial complexity is the most contradictory. In a larger space, increased complexity appears to *add* to the size of a composition. This is a principle that photographers have used for decades in their work. Want to make a composition appear to be more than it is – add features. In confined spaces, unfortunately, added complexity has the tendency to violate the rules regarding how we read wall and floor space cues. Thus, in a normal treatment room it is certainly best to minimize clutter in order to increase the sense of spaciousness. This principle is constantly ignored in dentistry!

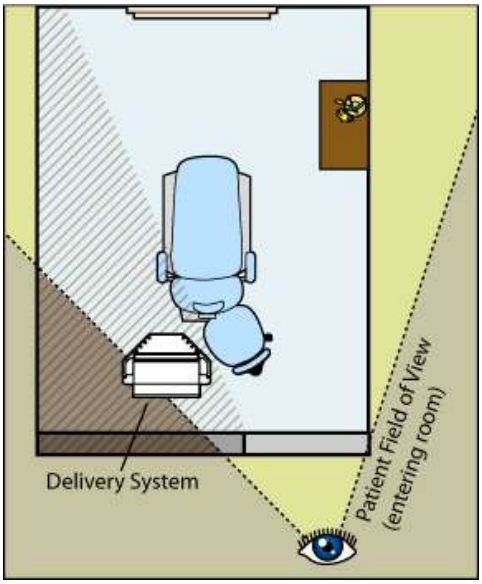

Fig. 4

Place technology outside the patient's view.

Sound input is another critical, but commonly overlooked, input to our space perception. Think about it for a moment, lost at night in the great wilderness? The fact is that the sense of space isn't related so much to the wide-open space (it's dark!), but rather to its eerie silence. In contrast, we interpret a room with more noise as a smaller space. Barrooms want reflective walls to create more noise so that patrons feel that they are 'in with the crowd'. Libraries want silence for contemplation. The problem here is that dental equipment companies ignore this fact in designing cabinet room dividers. The rationale of cabinet room dividers is that you are able to cut down the number of x-ray heads purchased (true), and even use these to make rooms smaller (false). (Fig.5) The increased cabinet costs are far greater than the cost of the additional x-ray head and the room size reduction claim is untrue because it is based on the *assumption* that you need side cabinets – you don't. Summarized simply – I doubt that your patients are hoping for that bar room feel in your practice! Keep it quiet.

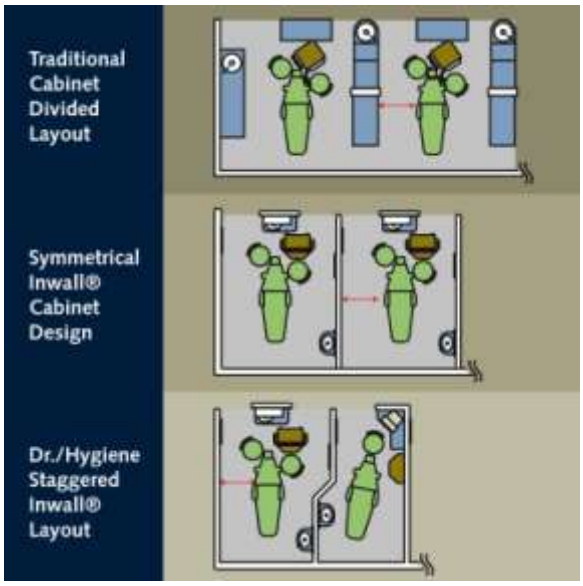

Fig. 5

Claims that room dividers are based upon the assumption that you need full width side cabinetry – you don't.

Lighting is the frosting on the operatory cake. Lighting is the method by which adjustments can be made to both finalize the illusion of greater spaciousness in the compact treatment environment and maximize the high performance of your clinical practice. Lighting techniques can be used to allow already existing small rooms to look bigger and even make cold and impersonal spaces feel more cozy. Our article next month will make the case for a new and different look at how we illuminate our treatment space. For, as you will discover, much of what we have come to know about how we light the typical dental operatory may be wrong.