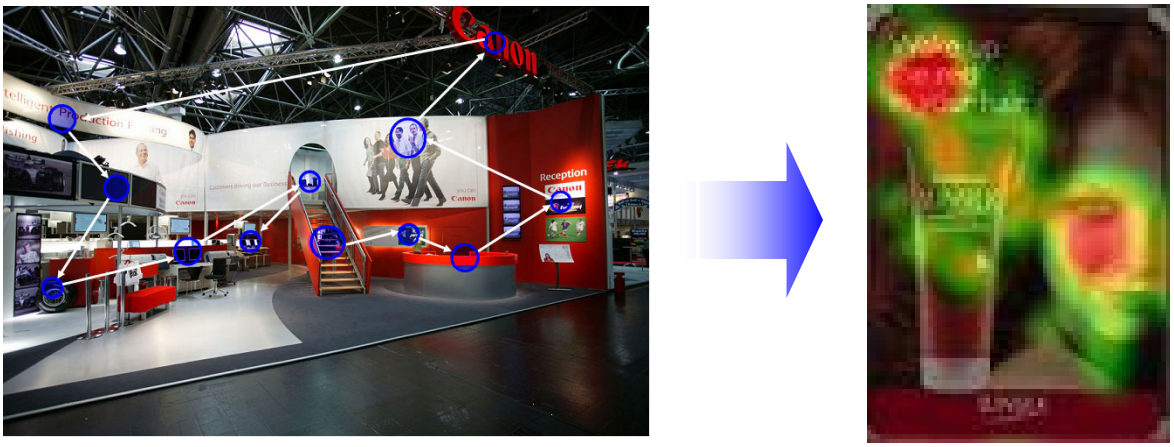
RF|COG™: The Retail Forensics® Framework for Consumer Oculography

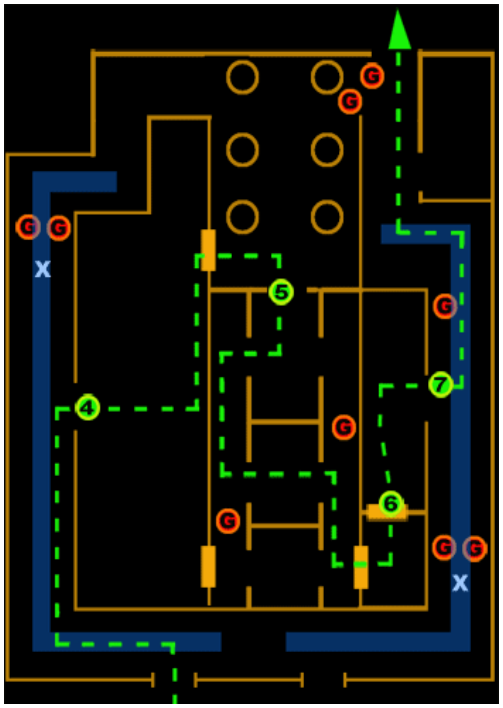
Eye tracking is capable of providing rich data at a level of detail well-suited to matching with advanced in-store behavioral observational data. Head-mounted eye tracking provides continuous data about the point of gaze throughout the shopping trip or product interaction (normally to less than 0.1 degree of viewing angle, or roughly the size of a penny seen from arms length). While eye-tracking is not ideal for all retail merchandising research applications, particularly when deployed in isolation, in consumer research contexts where a key objective is the understanding of visual "search-and-selection" processes, and/or the use of in-store signage and products for visual wayfinding, there is no substitute.

Eye-tracking permits the fine-grained analysis of visual attention to small-scale merchandising elements viewed from a variety of focal distances such as: category wayfinding signage, the manner in which the eye scans static or digital signage, or even individual elements of copy on an in-line display message or logos and icons on a package face. This level of resolution allows the researcher to determine precisely which merchandising or navigation elements 'catch the eye' of the consumer, and even measure degree of engagement from a range of visual contexts.

Data obtained from eye tracking studies include the sequence in which elements were viewed, the sequence in which elements were actively attended to, and the duration of eye fixations on individual elements. These data may then be used to build representations of visual element salience or importance, such as hierarchies of visual attention, the contingencies linking disparate information sources, and the utility of various informational elements to consumers. Such information provides unparalleled insight into the precise sequence of visual search and the relative importance of various store, merchandising or product visual features in both the search and decision (conversion) process.



So, why don't we use eye tracking to address ALL visual merchandising research questions?



Eye tracking is different from, though complementary to, allocentric behavioral observation and quantitative attitudinal assessment in several meaningful ways. Importantly, while eye tracking *does* tell you what was deliberately, directly viewed (or 'centrally foveated,' referring to the small, central portion of the retina where vision is in full color and at its highest acuity), it does *not* provide a complete picture of the holistic visual 'scene' that reaches the consumer brain, nor can it, alone, account for how the consumer internalizes (understands) or utilizes (responds) information obtained.

Despite the claims of eye-tracking technology companies in their marketing materials, eye-tracking fails to provide the breadth of information necessary for a comprehensive understanding of consumer behavior with respect to larger-scale environmental and social influences on behavior ever present in retail settings.

Several phenomena limit the ability of eye-tracking to explain behavior in the absence of correct application, integration, and expert analysis, such as:

Context effects and congruity…

Eye-tracking in isolation is well-suited to examining viewing behaviors in isolation—e.g. assessing how users sitting in a sterile laboratory *read* a single sheet of newspaper, or interact with a website. But once placed into the real-world, 3-D environment of the store, eye tracking begins to show its limitations. For this reason, it is critical to deploy eye tracking in real-world or mock environments, rather than virtual environments.

In other words, only an experimental context which is *congruous* with the real-world settings in which insights taken from it are to be applied can provide the desired *ecological validity* necessary to make decisions that affect the conduct of business in those settings. While the virtual setting is perfectly appropriate to studying how consumers shop online, valid insights regarding consumers' interactions with 3-D environments depend on an experimental context which is as close to the real-world as possible.

Seen but not looked at…

The neuroscientists at Merchant Mechanics are well aware that the brain collects, interprets, and makes decisions about an enormous amount of visual stimuli that are either marginally foveated or fall in the visual periphery, outside of the fovea. Such stimuli are particularly relevant to spatial navigation in confined spaces (e.g., when was the last time you deliberately focused your visual attention on a door frame before walking through it?), and while attention to them is implicit in behavior, they frequently do not appear in eye-tracking data.

In addition, the brain integrates a broad range of multisensory information with both central and peripheral visual inputs, such as the proximity of peripherally-viewed edges and forms, the texture and solidity of flooring surfaces, the location of audio sources, the presence of air currents, odors, etc. So, while eye tracking

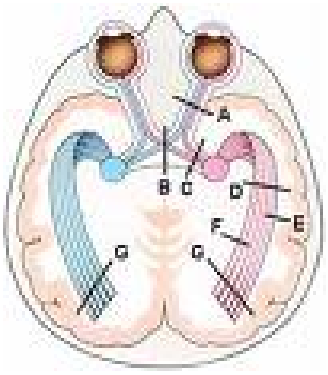
can tell you much about the current focus of attention, it cannot, for example, tell you many of the *causes* of shifts in attention from one region to the next.

A record of eye position vs. proximal visual stimuli provides an impressive amount of data, but it cannot tell you, for example, that a shopper's attention was redirected to an area directly behind them by the playing of a recorded song, or by the brush of another shopper's coat against theirs. Only rigorous videographic or direct observation can uncover the causes of many such events.

Seeing without knowing…

A well-studied result of certain head injuries and brain traumas is the phenomenon of blind sight, where individuals with complete loss of function of the primary visual cortex, and who have no conscious awareness of "seeing" anything in their environments whatsoever. Nevertheless, are able to navigate through an obstacle course, accurately identify colors, or even recognize faces.

How is this possible? It's possible because the primary visual cortex is not the *only* pathway that visual information takes through the brain—rather, several alternative (if relatively smaller) pathways exist between the optic nerve and subcortical and cortical brain regions that do not require passage through the primary visual cortex along the way. These alternative pathways do not normally lead to conscious awareness of visual stimuli represented in them, but they are critical in the coordination of motor responses, as well as the generation of both positive and negative affective responses to environmental stimuli, most of which we are not aware of, but which exert large influences on our behavior.



In fact, we can avoid obstacles, fit pegs into holes and mail through slots, and even *recognize emotions* without the benefit of a functioning visual cortex, and without even directly foveating any of these stimuli, but rather viewing them only peripherally, with or without awareness! This tells us that we need to pay attention to more than what consumers are viewing directly or intentionally—we must assess what, of all the stimuli viewed, are actually reaching the consumer's consciousness or exerting subconscious effects on their behavior.

Seen but not internalized / remembered but not seen…

In many routine daily activities, as well as deliberative novel activities, much is seen by the eyes that is not internalized or remembered in any conscious manner. Such phenomena occur at multiple levels, giving rise to a major category of psychological investigations concerning *automaticity* and *errors in memory*. Consider the example of driving without consciously attending to the act: A common experience for most drivers is of getting from point A to point B without recalling or being aware that they were paying any attention whatsoever to the road or the scenery, but rather mechanically executing the driving task while attending internally to other subjects. Certainly, the act of seeing is implicit in accomplishment of the task, yet the driver can recall nothing of the scenery, traffic, or events that occurred during the period of "automatic behavior."

Investigations by major auto companies and academic human-machine interaction laboratories have shown that, despite the lack of conscious recall of these events, drivers' eye movements and visual attention to road hazards, traffic, and signage remains normal. In other words, what was seen was

attended to at a level necessary and sufficient for the control of behavior and recall of visuospatial memories necessary to generate appropriate context-dependent and goal-oriented behaviors, but this degree of attention fell short of what was necessary for the generation of explicit memories of the event.

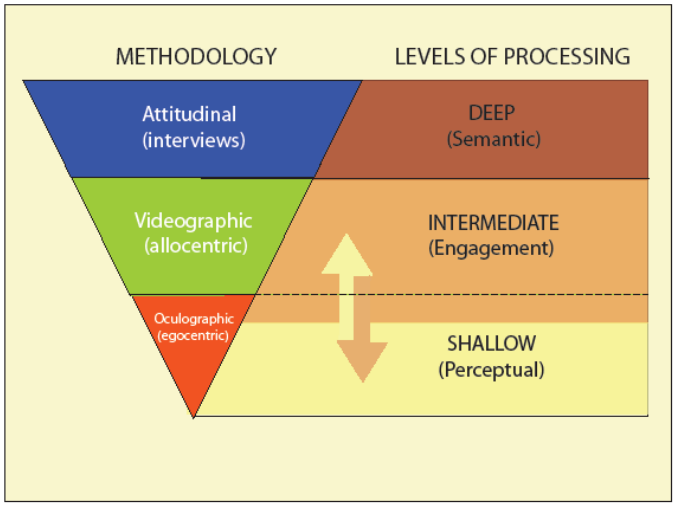
A complementary example is the phenomenon of *attribution*: First recognized during the study of split-brain patients, it is now well-documented that all of us routinely generate "false memories" or add false information to otherwise true memories in order to generate a complete, logical 'story' about an object or event which 'makes sense,' and aids detailed recall of important event or object components. That is, if the various elements of a single memory are incomplete in a manner which necessitates the "filling in" of incomplete information in order to form a complete mental representation of the event or object, we "fill in" this missing information with logically consistent but often factually incorrect information. This phenomenon is related to illusory contours—visual illusions created by incomplete shapes, where, for example, the eyes "see" a complete triangle when the only information actually printed on the page is three corners of a triangle, with interrupted sides.

In fact, "false memories" regarding merchandising elements, copy content, and products that are "remembered" by respondents, but were not actually present in the store, are a common occurrence in studies in which behavior is matched to shopper interviews. For the above reasons and others, there are frequent mismatches between what consumers *remember* seeing during a shopping trip and what they *actually* saw, and these errors can take the form of omission *or* fabrication.

AN INTEGRATED APPROACH

The limitations of studying eye movements in isolation are significant, and can lead to faulty conclusions, the dangers of which go beyond incomplete information. But these drawbacks are not insurmountable. Following the reasoning and examples above, it becomes clear that the approach most likely to yield correct, actionable insights, and to overcome the caveats and inherent shortcomings of studying eye-movements alone, is one which measures and accounts for variables across the range of oculographic, behavioral, and declarative (self-report) data, in order to account for all of the critical *levels of processing*.

That is, what enters the brain through the eyes can be evaluated using (1) eye-tracking. However, because what is seen is not always processed further, we must (2) examine overt behaviors to determine what shoppers are responding to.



The Retail Forensics® framework for Consumer Oculography (RF|COG™) recognizes that eye movements are only the tip of the iceberg. What is *seen* must be understood in the context of what consumers *do* (as recorded by careful observers or videographic methods) and what consumers *recall* about their experience and the specific content of the shopping trip (as evaluated with CriticalPoint™ Interview methods). This holistic approach allows us to build a complete picture of not just what was passively *perceived*, but what actually *engaged* consumers' attention sufficiently to spur behavior, and what elements from the entire shopping trip were salient enough to be included in consumers' internal, lasting, *semantic* representations of the experience.

Finally, behavior and eye movements do not tell us what is *consciously* perceived and remembered by shoppers, and what is remembered is often at variance with reality in ways that can be informative about subtle cues provided by in-store elements or overwhelming suggestions carried in with shoppers from out-of-store elements. Therefore we must (3) interview consumers, and *ask* what they remember, feel, and believe about their shopping trip and the brands and products they interacted with.

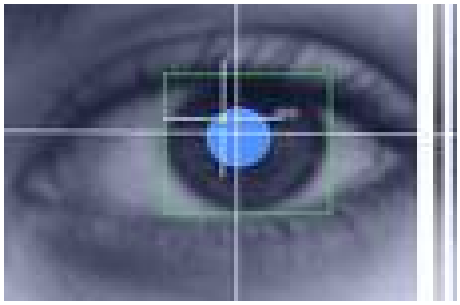
CAPABILITIES & BENEFITS OF EYE-TRACKING

- ✓ Absolute precision in the determination of where consumer's eyes are focused. What sign was *seen*? What product features do consumers actually *look at* before making a purchase decision?

- ✓ Deep insight into not just what the consumer is seeing, but also what they are *attending* to. What sign was *read*? What product features are *most interesting* to the consumer? These types of information can be inferred from eye movements.

- ✓ Limited insight into emotional reactions. For strongly emotional reactions to foveated objects or text, the pupillometric capabilities of eye-tracking systems can provide some indications as to the strength of the reaction. When controlled for changes in ambient light and reflectance of foveated objects or surfaces, pupil size observations serve as a reliable index of autonomic arousal. However, most strong pupil reactions are related to strongly negative stimuli or highly arousing stimuli.

  Merchant Mechanics' experience has shown that most shopping environments are designed to elicit few strongly negative emotional reactions, and few shoppers are sufficiently emotionally engaged with the context or object of normal shopping trips to elicit strong pupillometric readings, either positive or negative. (The *dotted line* in the figure above indicates that certain engagement information is available from this data type.)



- ✓ Complete information regarding the visual search hierarchy. What are the *most important* information sources, and *how are they used* by the consumer to locate products of interest and to make purchase decisions? What are the next most important informational elements? What proportion of attention is allocated to each information source?

- ✓ A guided tour of the consumer's shopping trip, as seen through their eyes. The *egocentric* data from these records are analyzed in much the same way as the *allocentric* data provided by videographic or direct observation records.

The same rigorous approach, unmatched expertise in consumer psychology and behavior and depth of understanding of brain function, and the same quality and depth of analysis and consideration that Merchant Mechanics brings to the interpretation and utilization of observational behavior records is applied to your eye tracking data, to produce the richest possible understanding of not only the particular events, but also the underlying processes surrounding browsing and purchase decisions.

CHALLENGES & LIMITATIONS OF EYE-TRACKING

- ✓ Does not provide complete, usable data on the physical movements of consumers through the store. Such information represents approximately half of the information necessary to understand navigation, and must be obtained by other means.

- ✓ Does not provide attitudinal or subjective experiential data. Self-report data (what the consumer herself perceives about her own attentional or search strategies and her overall impressions of the trip) must be obtained by other means.

- ✓ Low *n*. Eye tracking is time consuming and generates very large amounts of highly detailed data. It is generally considered impractical or too costly to generate data on large numbers of subjects. In addition, opt-in rates are lower than for, e.g. CPI respondents.

- ✓ "Spotlight effects." Consumers participating in eye-tracking studies will be wearing an unavoidably conspicuous device on their heads while shopping. Although we employ the least obtrusive eye-tracking equipment available today, there remains the possibility that consumers may alter their normal browsing behavior due to psychological factors such as feeling awkward or embarrassed about wearing this equipment. In addition, volunteers will be self-selecting to a greater degree than, say, intercept interviewees.

  Finally, because consumer/participants are acutely aware that they are being observed in detail, consumers may alter their behavior in a conscious or unconscious effort to please or displease the researcher or client (elements of what is called generally "the observer effect").

  This stands in contradistinction to the goals of covert observational studies, in which these effects are deliberately minimized as a primary goal of the research. For this reason, covert observational techniques (applied to a larger sample of shoppers) remain critical to the success of the study, as they provide an objective background against which to evaluate the data obtained from and about eye-tracking participants.

- ✓ Incentive bias: Unlike CPI respondents, eye-tracking subjects must be recruited and incentivized *before* their shopping trip. In addition to knowing that they are being observed, they are also shopping with, in some sense, "free" money, through the incentive. While certain tactics can minimize this effect, it remains the case that these subjects are likely to shop more freely and with fewer budgetary concerns than they might otherwise, and may, for example, be less selective in their purchasing behavior.

For all of the above reasons, Merchant Mechanics believes that the integrated package of covert videographic observation combined with attitudinal assessment and eye-tracking (as RF|COG™) provides a synergistic value proposition that results in insights significantly more powerful than the sum of each method's independent outputs. Independent, correlated observations from these complementary research methods strengthen and deepen the findings of each other.