4. týden – Studium percepce a mediální obsahy

Povinná četba:
- kol.: Psychologie vnímání. Karlova Universita 1985. str. 68-125.
- Barry, A., M.: Visual intelligence. Perception, image and manipulation in visual communication. State University of New York 1997. pp. 16-68.
- Barry, A., M.: Visual intelligence. Perception, image and manipulation in visual communication. State University of New York 1997. pp. 256-300.

Klíčové pojmy: *percepce, zrakový systém, zrakové vnímání prostoru, holistická percepční škola analytická percepční škola, subliminální percepce a její výzkum, percepční zákony podle tvarové (gestalt) psychologie, embeds, subliminální reklama, percepce a politické PR.*

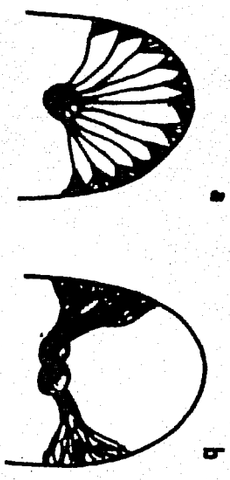
GRAFICKÉ PŘÍLOHY:
Schéma č. 1 Řez mozkem a centra mozková

IV. ZRAKOVÝ SYSTÉM

Zrak umožňuje člověku zachycovat světelné vlny a tím vnímat předměty na velkou vzdálenost. Patří mezi nejdůležitější druhy distantní percepce. Zrakový aparát se ve fylogenezi vyvíjí dosti pozdě. Zatímco u některých bezobratlých ještě celkově zcela zcela chybí a u jednotlivých obratlovců pak ustupuje člověku receptoru významem, začíná se u vyšších savců (vyšších opic) a zvláště u člověka uplatňovat vedoucím způsobem a zrakové odráženi předmětného světla se stává nejdůležitější formou odražení skutečnosti.

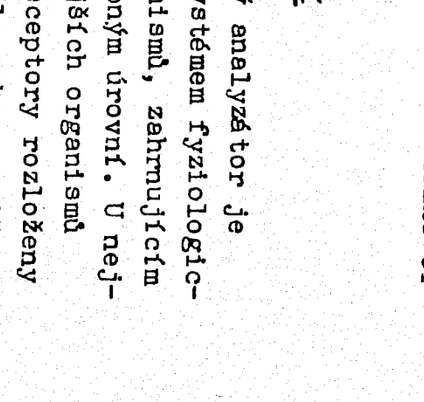
Probereme nejprve stavbu aparátů zrakové percepce, potom přejdeme k detailní analýze hlavních zákonů funkcionální organizace zrakového systému.

1. Anatomicko-fyziologické základy vidění



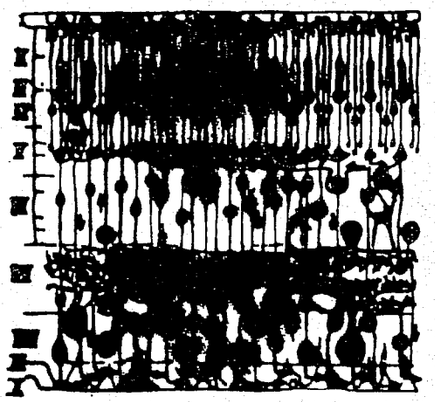
Obr.21: Stadia rozvoje oka

Zrakový analyzátor je složitým systémem fyziologických mechanismů, zahrnujícím řadu postupným úrovní. U nejprimitivnějších organismů jsou fotoreceptory rozloženy po celém těle nebo soustředěny z obou stran předního konce těla a utvářejí světločivé destičky (obr.21, a,b).



Obr.22: Stavba oka

Zrak člověka má podobu pohyblivé polokoule, která je zepředu pokryta blankou - rohovku s nevelkým zornicovým otvorem, kterým pronikají světelné paprsky (obr. 22). Zornice je oddělena od vnitřního prostředí oka průhlednou čočkou. Zakřivení čočky se mění pomocí vnitřních svalů oka, což umožňuje žádoucí lom světla a umožnuje procházejícím paprskům dopadnout přesně na sítnici, která obestírá zadní stěnu oka.



Obr.23: Průřez sítnicí oka

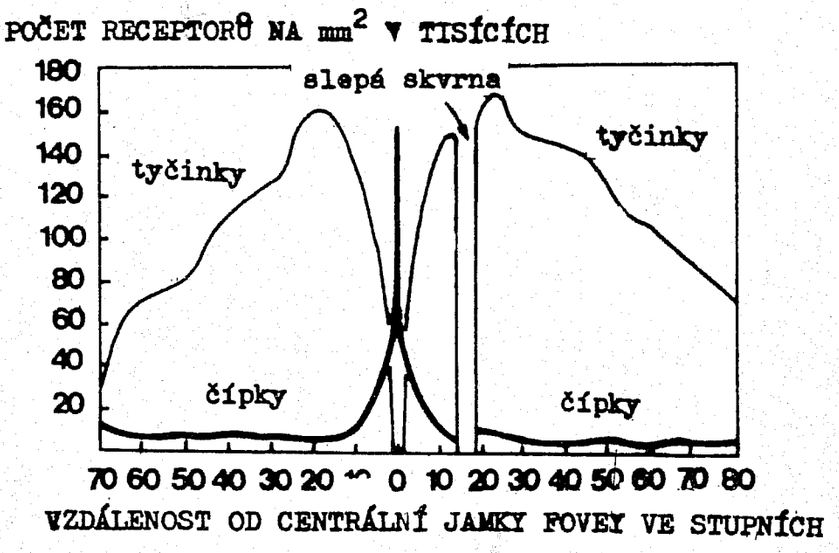
Sítnice oka je složitým aparátem neuronů a skládá se z několika vrstev nervových buněk. Někdy se zcela oprávněně hodnotí jako kus mozkové hmoty, která je vynesena napovrch (obr.23).

Vnější vrstva sítnice se skládá z velkého počtu fotoreceptorů, do jejichž souboru jsou vřazeny zvláštní pigmenty,např. zrakový purpur. Rozkládání těchto pigmentů vlivem fotonů světla způsobuje vznik celé řady fotochemických reakcí, které vedou ke vzniku nervového podráždění.

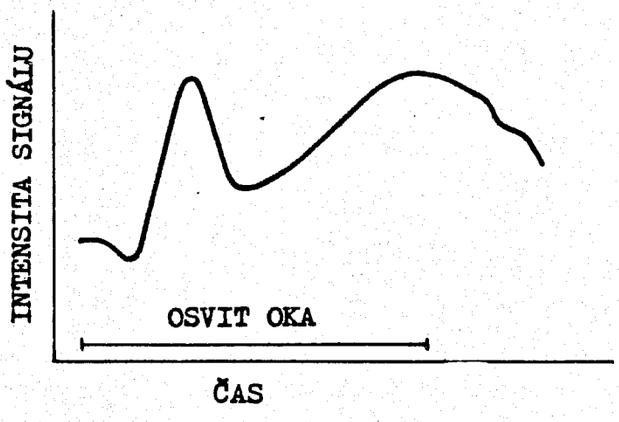
Rozlišujeme dva druhy světločivých buněk: tyčinky (receptory pro vidění ve tmě a v soumraku) a čípky (receptory pro vidění ve dne).

V sítnici je asi 130 miliónů tyčinek, které jsou rozsety po celém jejím povrchu. Jsou vysoce citlivé, neboť pigment rodopsin, který obsahují, je s to jemně reagovat na libovolné světelné paprsky a vyvolávat aktivaci senzorických vláken. Čípky jsou v sítnici v daleko menším počtu; jejich počet nepřesahuje 7 miliónů. Jsou soustředěny ve středních částech a tvoří oblast nejlepšího vidění, čili foveu (obr. 24). Čípky mají poměrně malou citlivost, avšak pigmenty, které jsou v nich obsaženy, mohou výběrově reagovat na světelné paprsky různé délky a zajišťují denní nebo barevné vidění. V důsledku toho, že čípky jsou rozloženy pouze ve střední části sítnice, můžeme rozlišovat barvy pouze ve středních částech zrakového pole, na periferii zra-

kového pole lze rozlišovat pouze různé stupně světlosti, nikoli však barvy předmětu.



Obr. 24: Hustota rozložení tyčinek a čípků na povrchu sítnice



Obr.25: Retinogram člověka

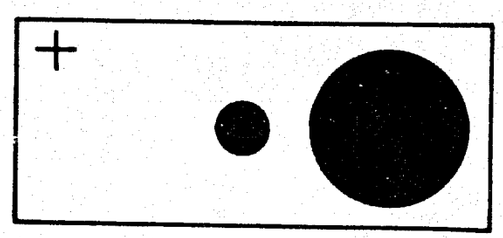
Tyčinky a čípky jsou rozloženy ve vrchních vrstvách sítnice (II-IV). Vnitřní vrstvy sítnice (V-VIII) se skládají z neuronů různého typu a jsou svou stavbou blízké těm, které je možno nalézt v kůře mozku. Zajišťují předávání a prvotní zpracování nervového podráždění, které vzniká v receptorech. Časový rozvoj odpovídajících elektrických procesů je možno zapsat v podobě retinogramu (obr. 25) tak, že se jedna elektroda připevní na rohovku a druhá na spánek.

Neurony vnitřních vrstev sítnice plní různé funkce. Jedny z nich, zvané bipolární buňky (VI), přijímají a dále předávají vzruchy od skupin sousedních receptorů. Množství receptorů, od nichž se vzruchy sumují na jediném bipoláru, čili plocha receptčního pole bipolární bunky, jak se často říká, závisí na jejich

poloze. V oblasti fovey zahrnuje bipolární buňka jeden nebo nanejvýš pouze několik čípků. Na periferii sítnice připadají na jeden bipolár desítky a stovky receptorů. Na rozdíl od bipolárů mají tzv. horizontální buňky (VI-VII) mohutný, vodorovně rozložený aparát dendritů, který umožňuje spojovat a tlumit vzruchy, které vznikají v různých skupinách receptorů a bipolárních buňkách. Neurony třetího typu, gangliové buňky (VIII), nemají bezprostřední styk s receptory. Zajišťují přenos zrakové informace do centrálních částí mozku. Mezi nervovými buňkami sítnice jsou konečně amakrinní buňky (VI-VII), jejichž dendrity jsou obráceny k vnitřním, a axony k vnějším vrstvám sítnice. Vlivem této zvláštní stavby vedou amakrinní buňky vzruchy nikoli od receptorů k vyšším částem nervového aparátu, ale v opačném směru. Proto je lze pokládat za mechanismus, který umožňuje předávání vlivu nastavení (připravení) ústředních částí nervového systému na světločivou periferii.

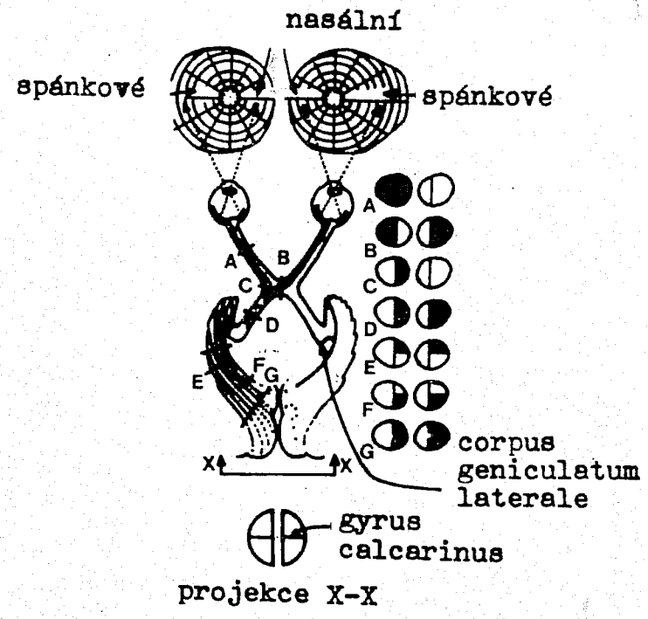
Uvedená fakta dovolují předpoklad, že sítnice oka je složitým reflexním zařízením, zajišťujícím již na periferii prvotní zpracování zrakové informace.

Zraková sítnice je periferním aparátem zrakového systému. Axony gangliových buněk, tím že se sjednocují, utvářejí zrakový nerv. Ten vychází z oka nedaleko jeho střední části. V místě východu zrakového nervu nemá sítnice skutečně světločivé buňky a proto je zvláštní, "slepou skvrnou", která nereaguje na světelné podněty. Není těžké se o tom přesvědčit, jestliže jsme pravým okem soustředěni na kříž zobrazený na obr. 26. V jistém okamžiku si lze povšimnout, že jeden ze dvou kruhů po straně kříže se částečně nebo zcela ztrácí, což znamená, že jeho promítnutí dopadlo na místo východu zrakového nervu - na "slepou skvrnu".



Obr. 26: "Slepá skvrna" (viz text)

Když zrakový nerv opustí zrakovou sítnici, prochází cestou, která je schématicky znázorněna na obr. 27 (viz str.72) (monokulární zraková pole jsou pro názornost na tomto obrázku ukázána odděleně, i když se ve skutečnosti kladou vzájemně na sebe, takže jejich vertikální osy se shodují). Zpočátku jsou zrakové nervy odděleny, potom se křižují. Toto místo se nazývá zkřížení zrakových nervů, chiasma.



Obr.27:

Schéma zrakových vodivých drah jdoucích k levé hemisféře (podle S. Deutsche, 1969).

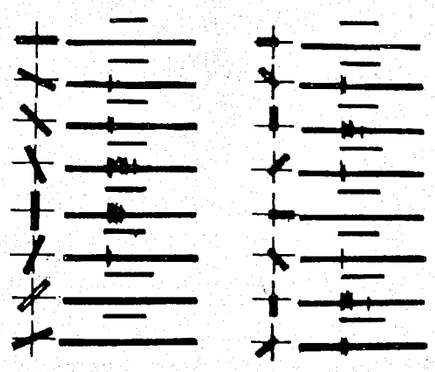
Vpravo jsou černě vyplněny úseky zorného pole, které vypadnou při postižení nervových drah v bodech, označených na schématu odpovídajícími písmeny.
A - úplná slepota levého oka;
B - oboustranná spánková hemianopsie;
C - jednostranná nasální hemianopsie;
D - pravá oboustranná hemianopsie, vznikající v důsledku postižení buď zrakového traktu nebo spojů thalamu s gyrus calcarinus; D a E - hemianopsie pravého horního resp. dolního kvadrantu; G - pravá oboustranná hemianopsie v důsledku postižení rozsáhlé oblasti týlního laloku.

Stavbu tohoto skřížení charakterizuje skutečnost, že vlákna, která jdou od vnější části sítnice obou očí, jdou do téže hemisféry, a vlákna z vnitřní části sítnice obou očí jdou zase do protikladných hemisfér. Proto levá polovina sítnice obou očí (pravá polovina monokulárních zorných polí) je representována na levé, ale pravá polovina sítnice na pravé hemisféře. V důsledku této stavby chiasmatu a dalšího úseku zrakové dráhy, tractum opticum, které u chiasmatu počíná, způsobuje postižení odpovídajících úseků zrakové dráhy (nádorem, krvácením nebo traumatem) zvláštní poruchy zraku. Postižení chiasmatu způsobuje ztrátu obou zevních zrakových polí ("bitemporální" čili spánková hemianopsie),[1/] postižení jedné strany zrakové dráhy způsobuje jednostrannou ztrátu protikladné poloviny zorného pole. Tyto symptomy mají velký význam pro topickou diagnostiku (umístění) mozkových postižení.

1/ Hemianopsie znamená zánik poloviny zrakového pole.

Další úseky ústřední zrakové dráhy mají složitou stavbu. Zpočátku zraková dráha prochází dolními (bazálními) částmi čelního laloku, potom se vrací zpět do hloubi mozku a předává část vláken střednímu mozku. Tato vlákna končí v horních hrbolcích čtverohrbolí, které je základním reflexním centrem zrakového systému. Toto centrum se vedoucím způsobem uplatnuje u nižších živočichů (např. u žáby), u člověka však zajišťuje pouze nejprostší funkce, reguluje změnu průměru zornice a některé okohybné reflexy. Proto při postižení horního čtverohrbolí dochází ke ztrátě zornicového reflexu. Většina vláken zrakové dráhy směřuje k podkorovým zrakovým jádrům: vnějšímu corpus geniculatum laterale, v němž se vlákna křižují a odkud začíná poslední část zrakové dráhy, tzv. radiatio optica. Vějířovitě prochází v hloubce spánkových laloků mozku a končí v corpora calcarina týlního laloku, prvotním úseků zrakové kůry.

Prvotní úseky týlní kůry (pole 17 Brodmana) jsou konečnou etapou zrakové dráhy nebo, podle I.P. Pavlova, korovým jádrem zrakového analyzátoru. Mají zvláštní stavbu, která je výrazně odlišuje od přilehlých korových částí. V tomto úseku je zvláště rozvitá čtvrtá (aferentní) vrstva nervových buněk, v níž končí vlákna zrakové dráhy. Jak ukázaly experimenty amerických fyziologů D.H. Hubela a T.N. Wiesela, vynikají mnohé neurony této oblasti vysokou specifičností, tj. jejich recepční pole reagují na takové konkrétní znaky předmětů, jako zahnuté a rovné čáry, pohyb od středu k okraji a od kraje ke středu atd.(obr.28). Tím je zrakové kůře umožněno vyčlenit značný počet sdělení informací, které do ní přicházejí.



Obr. 28: Detektor orientace Hubela a Wiesela (podle S.Oxe, 1969)
Je vidět, že maximální četnost odpovědí neuronu je při svislém postavení proužku. Vodorovná poloha nevyvolává odpověd a přechodná poloha vyvolává odpověd menší intenzity

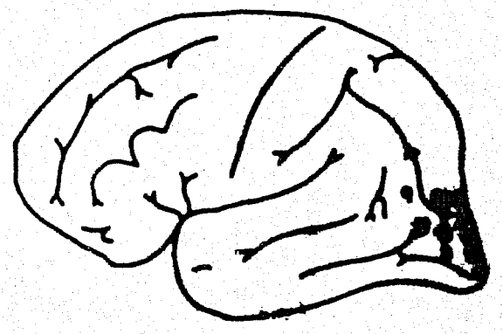
Prvotní úseky zrakové kůry mají i jinou vlastnost, jež se

často označuje jako somatotopika: jednotlivé úseky prvotní zrakové kůry představují jednotlivé úseky sítnice v obrácené poloze. Proto postižení dolních úseků prvotní zrakové kůry vyvolává ztrátu horních částí zorného pole a postižení horních naopak ztrátu dolních úseků zorného pole.

Projekční úseky týlní kůry jsou pouze první a nejprostší etapou korového zpracování zrakové informace. Nad nimi vznikly druhotné úseky zrakové kůry (pole 18 a 19 Brodmana). Výrazná zvláštnost jejich stavby je to, že čtvrtá vrstva buněk zde chybí a vedoucí postavení začíná přijímat druhá a třetí vrstva buněk, jejichž hlavní základ tvoří buňky s krátkými axony, které plní sjednocující, asociativní funkci. Právě tyto struktury jsou mechanismem, který dovoluje sjednotit fragmentární informace, vyčleňované buňkami prvotní zrakové kůry, podřizovat je kontrole vyšších míst mozku a kombinovat je v dynamický obraz předmětů, které nás obklopují.

Tato integrační funkce nejvyšších úseků zrakové kůry je jasně prokazována řadou fyziologických a psychologických pokusů.

Jak zjistil americký fyziolog MacCulloch, vyvolává kousíček papíru namočený ve strychninu a položený na prvotní úseky zrakové kůry podráždění pouze v tkáních, které k němu bezprostředně přiléhají. Naopak podráždění druhotných oblastí zrakové kůry způsobuje bud široce rozložené podráždění, které je možno zachytit na poměrně dalekou vzdálenost (pole 18 Brodmana), nebo útlum v celé přilehlé oblasti (pole 19 Brodmana).
(Tato metoda zkoumání spojů mezi úseky kůry se nazývá neurografií.)



Obr.29: Schéma bodů týlní kůry, jejichž podráždění vyvolává zrakové halucinace (podle O. Pötzla, H. Hoffa aj.)
Číslicemi jsou označeny ty úseky mozkové kůry, při jejichž podráždění vznikaly následující zrakové halucinace:
1 - "Světelné kruhy"
2 - "Zbarvené světlo"
3 - "Bílé světlo"
4 - "Modrý disk"
5 - "Plamen"
6 - "Modrá mlha"
7 - "Tváře, zvuky hlasů"
8 - "Jdoucí člověk", 9- "Osoby",
10 - "Zvířata", 11 - "Osoby a motýli"

Jak ukázala pozorování celé řady neurologů a neurochirurgů (O. Pötzl, 1918, H. Hoff, 1932, W. Penfield, 1950), způsobovalo podráždění prvotních úseků zrakové kůry při operacích u nemocných pouze nedokonale utvářené halucinace (svítící body, koule, jazyky plamenu), zatímco totéž podráždění druhotných úseků zrakové kůry vedlo ke vzniku dokonale utvářených halucinací, mající někdy podobu výstupů (zvířata, lidé, motýli nebo celé scény - viz obr. 29 na str. 74). Tyto skutečnosti ukazují jasně, že prvotní a druhotné zrakové kůry se různým způsobem účastní zajištění percepčních procesů a zatímco prvotní úseky vyčleňují informaci, která přichází do kůry, druhotné úseky skýtají možnost měnit tyto zprávy ve složité struktury zrakového vnímání. Při studiu vlivu jednotlivých úseků zrakové kůry v procesu získávání a přepracování zrakové informace mají velký význam údaje neuropsychologických pozorování, prováděných u nemocných s lokálním postižením mozku.

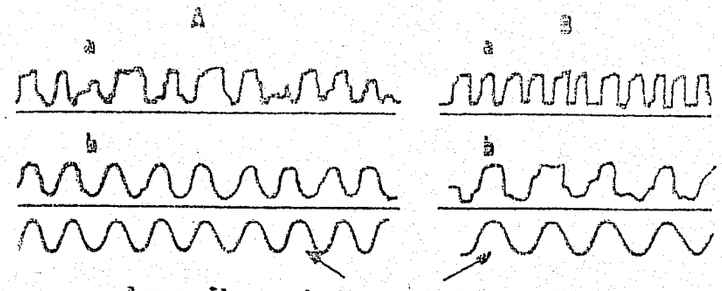
Postižení prvotních úseků zrakové kůry zpravidla způsobuje ztrátu jednotlivých částí zraku, avšak nemusí mít za následek ztrátu zrakového vnímání. Postižení druhotných úseků zrakové kůry nevede naopak ke ztrátě zraku, ale je provázeno rozpadem složitých forem zrakového vnímání. Nemocný s takovým postižením nemůže sjednotit fragmenty obrazu, které vnímá, v jediný celek. Když si např. prohlíží obrázek znázorňující brýle, říká: "Kroužek a ještě kroužek, příčky .... , to je jistě jízdní kolo?" a pokouší se uhádnout znázorněný předmět v těch případech, v nichž normální člověk jej vnímá bezprostředně. Tyto skutečnosti nám přibližují pochopení mozkových mechanismů zrakového vnímání. Ukazují jak probíhá zpracování zrakové informace a které mozkové struktury se tohoto složitého procesu účastní.

2. Zrakové vnímání a typy pohybů očí

Pozorování ukazují, že oči člověka nezůstávají nikdy nepohyblivé. Jak jsme se již zmínili, neustálý pohyb je nutnou podmínkou utvoření adekvátního obrazu. Proto je při analýze zrakového vnímání nutno zvážit fungování jeho motorického článku.

Podobně jako je tomu u senzorických mechanismů zrakového systému centra, která řídí pohyby zraku jsou uložena na různých úrovních CNS. Nejstarší centra jsou v předních hrbolcích čtverohrbolí. Uskutečňují nejprostší okohybné reflexy. Vyšší úroveň okohybného chování, které bere v úvahu charakteristiku předmětu, je umožněna účastí okohybných center, spojených s týlními částmi mozkové kůry. Nejsložitější, volní pohyby jsou uskutečňovány konečně strukturami předních okohybných center, které jsou uloženy v zadních čelních částech mozku.

Neuropsychologické výzkumy provedené sovětskými autory ukázaly, že při postižení zadních okohybných center se podstatně porušují pohyby očí, které sledují pohyblivý předmět, zatímco volní pohyby očí, realizované podle slovních pokynů (co možná nejrychleji přenést zrak z krajní pravé do krajní levé polohy a zpět), se uskutečňují značně lépe. Při postižení předních okohybných center se naopak sledovací pohyby očí uchovávají, ale volní přemisťování očí se výrazně porušuje (obr. 30). Tyto skutečnosti dovolují seznámit se blíže s důležitými mozkovými mechanismy regulujícími pohyby očí a vyčlenit základní činitele, kteří tvoří jejich základ.



Obr.30 : Pohyby očí při volném přenášení pohledu (a) a při sledování rytmicky se pohybující skvrny (b) u nemocných s postižením předních (A) a zadních (B) úseků mozku (podle E.D. Chomské, 1969)

Periferní část okohybného aparátu tvoří vnitřní a vnější svaly oka. Vnitřní svaly jsou uvnitř zrakové bulvy. Z nich ciliární sval mění zakřivení čočky, čímž zajišťuje ostrost zobrazení na sítnici při změnách vzdálenosti předmětu; sval rohovky oka mění průměr zorničky a reguluje celkové množství světla, které dopadá na sítnici.

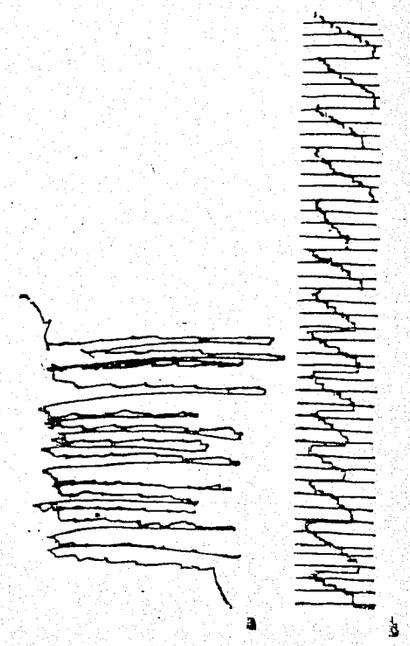
Významným způsobem se uplatňují tři páry okohybných svalů, jejichž společná práce způsobuje změny polohy očí v očnici. Vyčleňují se tři velké skupiny pohybů očí. První skupinu tvoří mikropohyby očí, popsané poprvé již začátkem 19. století J.Müllerem.

Mezi makropohyby patří především rychlé, skákavé, sakadické pohyby. Lze je pozorovat při zrakovém hledání předmětu nebo prohlížení nepohyblivých zobrazení (obr. 1 a 31). Amplituda sakadických pohybů je určována rozměry předmětu a charakterem percepční úlohy. Jejich minimální velikost se rovná zlomkům stupně; maximální je 40 - 60 stupňů. Tak velké pohyby, které

vznikají jako součást orientační reakce při objevení se nového předmětu při periferním vidění, jsou obvykle provázeny pohyby hlavy a těla.

Latentní doba sakadických pohybů je přibližně 150 msec. Samotný pohyb se uskutečňuje rychlostí od 50 do 100 stupňů za sec. O charakteristice sakadického pohybu je rozhodnuto přibližně již 50 sec. před jeho začátkem, takže jestliže během té doby se má změnit postavení cíle, oči potom zprvu skočí na staré místo a teprve potom s obvyklou latentní dobou na nové místo cíle.

V poslední době (viz A.I. Nazarov, 1971) bylo zjištěno, že krátce před začátkem a v průběhu skoku dochází ke zvýšení zrakových prahů. Tento jev, nazvaný sakadickým útlumem, spočívá v tom, že příjem zrakové informace je uskutečňován v intervalech mezi pohyby, kdy zrak fixuje různé detaily předmětu. Oči jsou obvykle ve stadiu fixace od 90 do 95% veškerého času prohlížení předmětu.



Obr. 31: Záznam pohybů očí při čtení a/ na nepohyblivém b/ pohyblivém fotopapíře.

Na obr. 31 je ukázán zápis pohybů očí během čtení. Je patrno, že zrak uskutečňuje sérii fixací a skoků dolů po řádcích a zleva doprava. Po skončení řádku provádí velký skok doleva k začátku následujícího řádku. Nevelký počet zpětných pohybů může svědčit o tom, že čtenář patrá po smyslu textu a vrací se zpět, aby si objasnil to, co nepochopil.

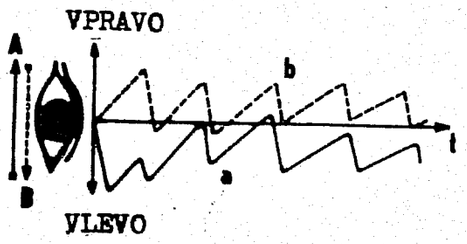
Jestliže předmět, který je nutno si prohlédnout, je blíže nebo dále od pozorovatele, než bod fixace, obracejí se oči tak, aby nový fixační bod byl promítnut do úseku fovey. Makropohyby očí tohoto druhu se nazývají vergentními pohyby. Je-li bod nové fixace blíže k pozorovateli, potom se pohyb oka nazývá konvergencí, a jestliže je dál, divergencí. Latentní doba vergentních pohybů, stejně jako sakadických, je přibližně 200 msec, ale jejich rychlost je poměrně malá - od 5 do 30 stupňů za sekundu. Vergentní pohyby vznikají při vzdálení předmětu ne více než 5-6 metrů, při větších vzdálenostech jsou osy obou očí prakticky paralelní.

Posledním druhem makropohybů jsou konečně plynulé a pomalé sledovací pohyby. Jejich vznik je pouze odpovědí na pohyby předmětů nebo samotného pozorovatele. V druhém případě se sledovací pohyby nazývají též kompenzačními, neboť jsou opačného směru než pohyby hlavy a umožňují uchování fixace předmětu. Sledovací pohyby vznikají v latentní době 80 - 170 msec. a mohou sledovat předměty pohybující se rychlostí do 40 stupňů za sec. V průběhu toho, kdy oko provádí sledování, mohou oči zaostávat za předmětem, zvláště je-li jeho rychlost velká. Vznikající pohyby, které jsou zobrazeny na sítnici, způsobují, že se porušuje rozlišování přesných detailů předmětu. Tento jev byl pozorován psychologem E. Ludwigem (1948) a nazván dynamickou zrakovou ostrostí.

Kombinace periodicky se opakujících sakadických a sledovacích pohybů se nazývá nystagmem. Při optokinetickém nystagmu, pozorovaném při pohybu předmětů stejným směrem v zrakovém poli (např. prohlížíme-li stromy rostoucí podle cesty z okna pohybujícího se vlaku), udržují pomalé sledovací pohyby zobrazení předmětu nepohyblivě na sítnici a rychlé skoky převádějí zas oči do výchozího postavení. Jiným druhem nystagmu je vestibulární nystagmus (viz kap. III,2). Vyvolává se podrážděním vestibulárního aparátu otáčením hlavy a vzniká dokonce v naprosto temné

místnosti nebo při zakrytých očích. Tento druh nystagmu plní rovněž funkci udržení předmětu v oblasti jasného vidění při vlastních pohybech pozorovatele. Na obr. 32 jsou schématicky vyobrazeny oba druhy nystagmu.

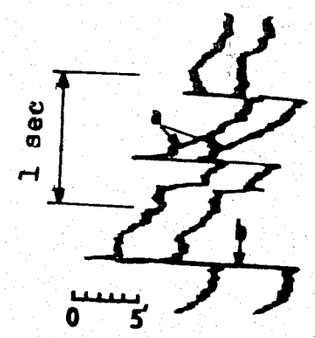
Optokinetický nystagmus, vyvolaný a regulovaný pohybem obrysů po sítnici, se u člověka liší od vestibulárního nystagmu v silně vyjádřené tendenci fixovat předměty, které se objevují na hranici zorného pole. Proto se v tomto případě nystagmus objevuje při rychlé fázi, v níž též pohyb začíná (obr. 32 a). Jak ukázaly výzkumy, závisí charakteristiky nystagmu výjimečně silně nejen na členitosti zorného pole, ale též na stupni pozornosti pozorující osoby. Odvedení pozornosti např. na řešení aritmetické úlohy zmenšuje amplitudu nystagmu (R. Corda, 1926) nebo rychlost sledovacích pohybů, takže sakadické pohyby mohou prakticky zmizet (S. D. Smirnov, 1971).



Obr.32: Optokinetický (a) a vestibulární (b) horizontální nystagmus (podle N. Bishopa, 1966)
A - směr pohybu předmětů
B - směr pohybu hlavy

Druhou třídou pohybů očí jsou mikropohyby, tj. drobné, mimovolné pohyby očí během fixace. Existence mikropohybů byla dlouho předmětem pochyb, neboť člověk má při fixování nepohybujícího se bodu sklon pokládat vlastní oči rovněž za nepohyblivé. S rozvojem citlivých objektivních metod registrace pohybů očí však byla dokázána existence tří druhů mikropohybů očí: tremoru, pomalého pohybu a mikrosakady. Tremorem se nazývá třes očí s frekvencí 20 - 150 herzů a amplitudou řádově 10^{o} za sec. Více vyjádřeny jsou pomalé pohyby s rychlostí asi 10 úhlových min za sec a rychlé mikrosakady, jejichž amplituda je průměrně 7 úhlových min. Má se za to, že hlavní funkcí pomalých pohybů je destabilizace retinálního zobrazení a mikrosakady že ho vracejí do oblasti nejlepší viditelnosti. Kombinace pomalých pohybů a mikrosakad se nazývá fyziologickým nystagmem.

Třetí skupinou pohybů jsou tzv. zástupné (vikární) pohyby



Obr.33: Fyziologický nystagmus a) rychlá fáze b) mikrosakady

(viz I,3). Byly zjištěny v relativně nedávné době a jejich vlastnosti a funkce jsou dosud málo prozkoumány. Podle charakteristik amplitudy mají zástupné pohyby střední postavení mezi mikro- a makropohyby očí. Mezi ně patří pohyby očí při stabilizaci zobrazení vzhledem k sítnici, posttychystoskopické pohyby očí, rychlé pohyby očí v průběhu snění a při halucinacích. Byl vysloven předpoklad, že pomocí zástupných pohybů se uskutečňují nejen transformace informací, nahromaděných senzorickým článkem zrakového systému v podobě stop podnětu, ale též manipulování obrazy zrakové paměti.

Pohyby očí jsou tedy zahrnovány mezi vlastní mechanismy vidění a zajišťují jak řešení pomocných úloh (např. akomodace, konvergence, destabilizace), tak i procesy vyčleňování podstatných znaků vnímaného předmětu a utváření aktivního zrakového obrazu.

3. Vnímání barvy

Zrakový systém člověka je citlivý na elektromagnetické vlny, jejichž délka vlny leží v rozsahu od 280 do 720 nanometrů (miliontina milimetru). Tato oblast elektromagnetických vln se nazývá viditelnou částí spektra.

Přijetí spektra, které dopadá na sítnici, je pouze prvním stupněm složitého řetězu procesů, jež vedou k zrakovému odrazu obklopujícího nás, světa. Struktura procesu vnímání barvy mění se podle optických vlastností povrchu předmětů, které mají být pozorovatelem vnímány. Tyto povrchy mohou svítit, odrážet více světla než na ně dopadá; odrážet pouze část dopadajícího světla a konečně být průzračné, tj. nestavět světlu podstatnou překážku.

Značná většina předmětů, které nás obklopují, patří ke sku-

pině těles, která částečně pohlcují a částečně odrážejí světlo, které na ně dopadá z umělých nebo přirozených zdrojů světla. Barva předmětů je objektivně charakterizována jejich schopností odrážení. Pro vnímání barvy předmětu musí zrakový systém proto registrovat nejen světlo odrážené povrchem předmětu, ale též charakteristiku světla, které tento povrch osvětluje.

V případě, že však povrch svítí anebo znaky jsou zvláště vyloučeny, určující, ke kterému předmětu povrch patří, může být vnímání barvy založené pouze na analýze světla, které je bezprostředně vyzařováno povrchem. Tato situace nastává, jestliže se úsek povrchu prohlíží otvorem ve velké temné nebo šedé stěně. Vlivem stěny se zastírá vzdálenost k povrchu a je vnímána difusní barva, která zaplňuje otvor celkem rovnoměrně. Barvy tohoto druhu se nazývají aperturními. Aperturní barvy jsou vlivem poměrné jednoduchosti procesu jejich vnímání prozkoumávány v současné době více než vnímání ostatních barev. Výzkum vnímání aperturních barev má důležitý praktický význam, neboť s nimi přicházejí nutně do styku operátoři, kteří pracují se soudobými indikátory. Široké využití barev pro kódování informace je spojeno s poměrnou snadností rozlišování aperturních barev.

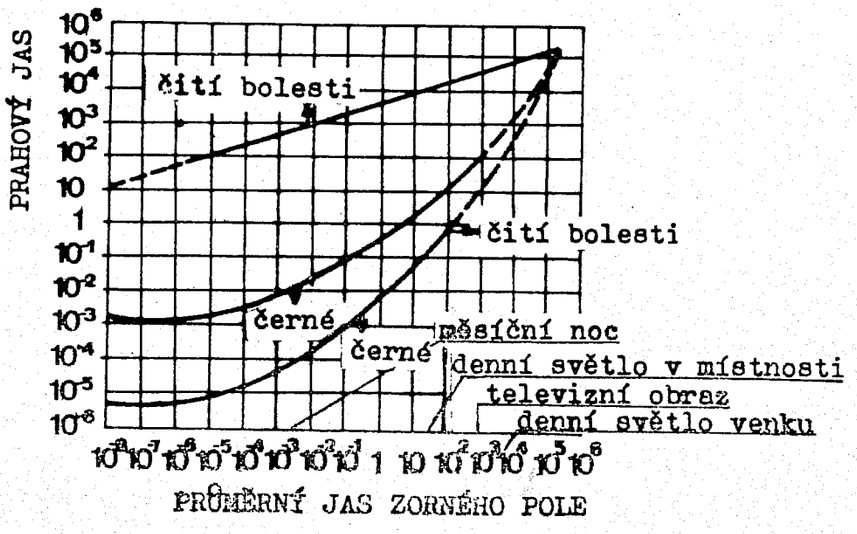
Počitky barev, které vznikají při vnímání aperturních barev, lze zcela popsat třemi charakteristikami nebo vlastnostmi. Patří k nim světlost, barevný odstín a sytost.

První z těchto charakteristik, světlost, se též někdy nazývá viditelným jasem. Světlost je především určována fyzikálním jasem světla. Jak ukázaly psychofyzikální výzkumy, může zrakový systém reagovat na velmi nepatrné změny jasu světla: diferenciální práh je pouze 0,01. Jak již bylo řečeno, zvětšuje se viditelný jas se zvětšováním fyzikálního jasu pomalu. Exponent, který odpovídá stupňovité funkci, je 0,33 (viz kap. III,2).

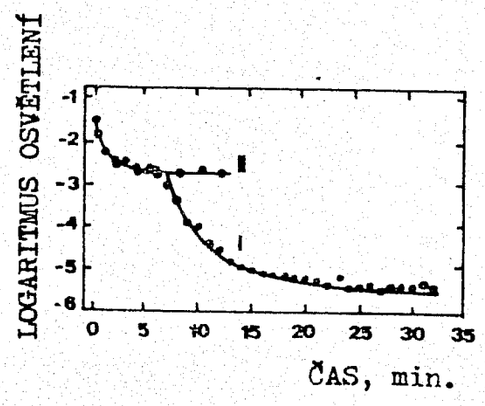
Na velikost absolutních prahů jasu má rozhodující vliv stav adaptace zrakového systému. Celý rozsah vnímaných jasů od zcela temné barvy k barvě oslepující jasnosti zahrnuje díky adaptaci nesmírnou oblast od 10^{-4} do 10^{6} nit.[1/]

1/ Nit - jednotka jasu, při níž je síla světla vyzařovaného z 1 m^2 povrchu rovna jedné svíci.

Na obr. 34 jsou ukázány změny dolního a horního absolutního prahu v závislosti na průměrném osvětlení pozadí určujícího adaptaci.



Obr. 34: Hranice oblasti správných počitků v závislosti na jasu zrakového pole, na něž je zrak adaptován



Obr. 35: Změny dolního absolutního prahu jasu v průběhu zrakové adaptace na tmu.
I - testování bílým světlem
II - testování červeným světlem

Fyziologické mechanismy adaptace zraku na světlo a tmu jsme probrali již dříve (viz kap. III/3). Analýza dynamiky citlivosti na světlo při adaptaci na tmu umožňuje stanovit okamžik přechodu od čípkového k tyčinkovému vidění. K tomu je osoba adaptovaná na denní světlo umístěna do úplné tmy a periodicky je měřen její dolní absolutní práh jasu. Výsledky měření ukazují, že zpočátku práh rychle klesá a stabilizuje se na stálé úrovni za 8 - 10 min, ale pak začíná druhotné silné snížení prahu, které se zastavuje teprve za 30-40 min po začátku adaptace (obr.35).

Takovou "dvoustupňovou" podobu má křivka adaptace na tmu pouze tehdy, když se testuje práh bílým světlem. Je-li užito červeného světla, na něž jsou tyčinky necitlivé, je křivka adaptace pouze jednostupňová. Svědčí to o tom, že bod zlomu na křivce adaptace na tmu odpovídá přechodu od čípkového k tyčinkovému vidění.

Proces adaptace na světlo obyčejně trvá celkově pouze zlomky sekundy.

Viditelný jas se též mění podle délky vlny podnětu. Při denním osvětlení připadá maximum spektrální citlivosti na délku vlny 555 nm, v temnotě stoupá do krátkovlnné části viditelného spektra k délce vlny 510 nm (obr.19). Tento jev se nazývá Purkyňovým jevem, o němž již byla řeč v souvislosti s multidimensionalitou psychofyzikálních škál (viz kap. III; 2).

Mezi činiteli, kteří ovlivňují světlost, je třeba připomenout rozměr a čas působení podnětu. Tyto činitelé jsou zvláště důležité ve vztahu k podnětům, které nejsou velké a působí jen krátce.

Vliv rozměrů se projevuje tak, že s růstem plochy světelného terče zvyšuje se i detekce nebo viditelnost jasu. Tento účinek se nazývá prostorovou sumací. Vyplývá z něho, že světlost podnětu zůstává neměnnou, jestliže se zmenšováním jasu L se současně určitým způsobem zvětšuje jeho plocha S:

$$L \cdot S^n = \text{const.}$$

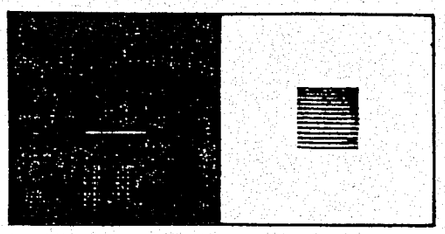
Exponent n obsažený ve vzorci se nazývá koeficientem prostorové sumace. Oblast, v níž n si uchovává největší hodnotu rovnou jedné, se nazývá oblastí úplné prostorové sumace. Ve tmě je velikost oblasti úplné sumace při prohlížení zdroje světla při centrálním vidění rovna 15 minutám stupně. Psychofyzikálními výzkumy bylo zjištěno, že velikosti oblasti úplné sumace je určována rozměry recepčních polí sítnice. Proto se zmenšuje v průběhu světelné adaptace a zvětšuje při prezentaci podnětu při periferním vidění.

Analogická souvislost existuje mezi jasem a trváním prezentovaného podnětu:

$$L \cdot T^m = \text{const.}$$

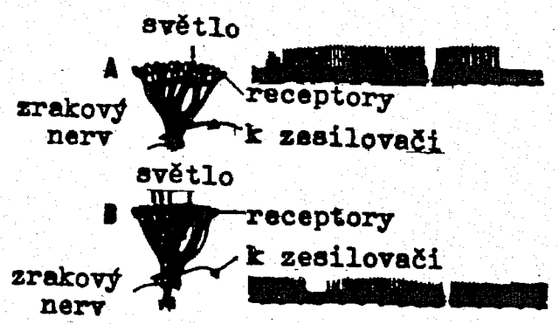
Úplná časová sumace (m = 1) nastává v expozicích trvajících 50 - 100 msec.

Velmi zajímavé jsou jevy zrakového kontrastu. Současný nebo prostorový kontrast jasu spočívá v tom, že zrakový systém zvýrazňuje rozdíly jasu mezi sousedními úseky zrakového pole. Šedý čtverec na černém pozadí se např. zdá světlejším než tentýž čtverec na světlém pozadí (obr. 36).



Obr. 36: Kontrast jasu

Američtí badatelé H.K. Hartlim a F. Ratlinl zjistili elektrofyziologickými metodami existenci vzájemně tlumivého vlivu mezi receptorními elementy oka sladkovodního ráčka limulus. Tlumivým vlivem, kterým receptor A působil na receptor B, bylo úměrné osvětlení A a prostorová blízkost obou elementů. Tento jev obdržel název laterální útlum (obr. 37).



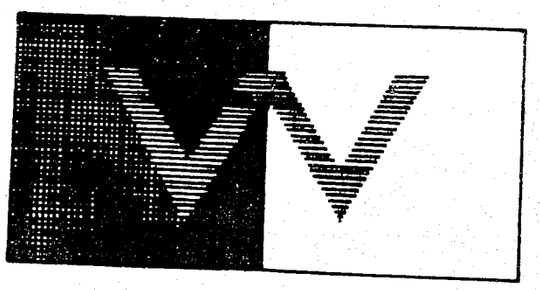
Obr.37:
Laterální útlum (podle T.Ratlinla, 1960)
Osvětlení receptorů vyvolává vznik rytmických výbojů v odpovídajícím senzorickém vláknu (A). Boční osvětlení sousedních receptorů způsobuje útlum odpovědi (B)

Receptor položený na okraji slabě osvětlené oblasti bude v důsledku laterálního útlumu, který je působen sousedními jasně osvětlenými elementy, drážděn s menší frekvencí než elementy právě tak slabě, ale položené dále od hranice dvou světelných oblastí. Receptor, který leží naopak na okraji jasně osvětlené oblasti, bude drážděn s větší frekvencí než receptory, které jsou uloženy ve středu této oblasti. Obraz podráždění elementů sítnice zdůrazňuje tak vlivem laterálního útlumu hranice mezi oblastmi různého jasu.

Vzájemné útlumové vlivy v zrakových systémech byly zjištěny u vyšších živočichů včetně opic. Současně existují podklady pro značně složitější, centrální původ jevu kontrastu.

Na kontrast např. působí vědomé zaměření pozorující osoby. Má-li být znak, zobrazený na obr. 38 (viz str. 85), vnímán jako dvě latinská písmena, pak se pozoruje kontrast jasu, tj. levé písmeno se jeví světlejší než pravé. Má-li tento znak být vnímán jako jediné písmeno, pak kontrast mizí.

Kromě právě popsaného současného kontrastu je rovněž znám postupný kontrast jasu. Vzniká ve formě následných obrazů, zrakových počitků světla, jejichž působení pokračuje po nějakou dobu po skončení expozice podnětu.



Obr.38: Vliv zaměření pozorovatele na kontrast jasu (podle K. Koffky, 1935)

Rozlišují se záporné a kladné následné obrazy. První vznikají, jestliže si při normálním osvětlení přibližně 30 sec. prohlížíme jasně osvětlený předmět, který pak rychle zaměníme za rovnoměrnou plochu neutrální barvy a s menším jasem. V tomto případě vidí zkoumaná osoba před sebou temnou skvrnu, která tvarem připomíná vzdáleně předmět. Je-li předmět osvětlován ve tmě záblesk světla, vzniká pak kladný následný obraz. Ten se zpravidla ztrácí mnohem rychleji než záporný.

V posledních letech se neurofyziologům podařilo určit souvislost mezi vznikem a změnou následných obrazů a změnami aktivity neuronů v projekčních částech zrakové kůry (R. Jung, 1969).

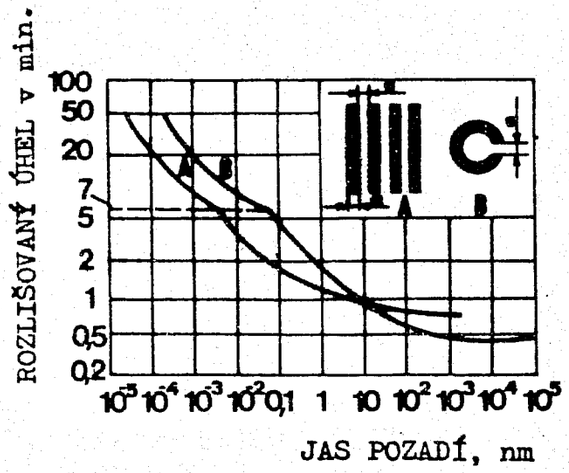
Vlivem kontrastu je zrakový systém schopen rozlišovat nejjemnější prostorové změny jasu v zorném poli. Schopnost vidět dva blízko sebe umístěné předměty jako rozdílné se nazývá zrakovou ostrostí.

Zraková ostrost, při níž lze postřehnout mezeru velikosti jedné minuty stupně, se pokládá za normální. Za příhodných podmínek může však zraková ostrost člověka dosáhnout velikosti 0,5 úhlové sec. V tomto případě vzdálenost mezi projekcemi hranic předmětů na povrchu sítnice je desetkrát menší než činí průměr čípku. Proto dávají někteří badatelé tak vysokou zrakovou ostrost do souvislosti nikoli se senzorickými procesy na sítnici, ale s mikropohyby očí (viz kap. IV,2).

Zraková ostrost se mění spolu se stavem adaptace. Při nízkém stupni osvětlení je menší než při velkém. Na obr. 39 je ukázána změna zrakové ostrosti pro dva standardní předměty podle jasnosti pozadí. Zvláště často se užívá jako předmětů testování Landoltových kruhů. Zkoumaná osoba má ukázat polohu přerušení kruhu.

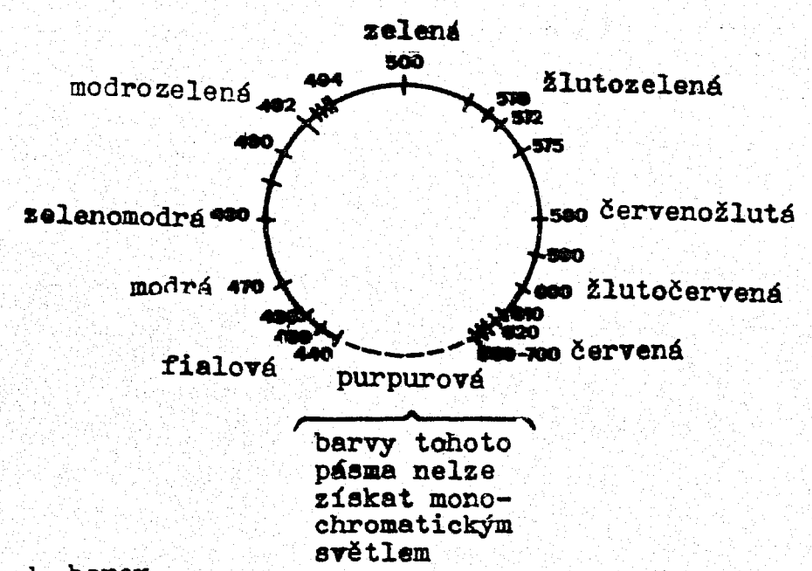
Změny zrakové ostrosti v průběhu adaptace odpovídají změně průměru recepčních polí.

Druhou charakteristikou aperturních barev je barevný odstín. Monochromatické barvy, tj. ty, které jsou vyvolány světlem s jedinou vlnovou délkou, červené, zelené, žluté a jiné barvy stejně viditelného jasu, se rozlišují právě podle svého barevného odstínu. Tato vlastnost počitků barvy souvisí především s vlnovou délkou podnětu.



Obr.39: Změny zrakové ostrosti v závislosti na jasu pozadí a typu testových předmětů

Při přechodu od krátkovlného elektromagnetického kmitání k dlouhovlnému mění se barevný odstín tímto způsobem: podněty s krátkými vlnovými délkami jsou vnímány jako fialové, potom následuje úzký úsek čistě modré barvy, který je zakončen modro-zelenými odstíny, dále je úzký proužek zelené barvy, za kterou následují žluto-zelené odstíny, pak se objevuje čistě žlutá barva a konečně v dlouhovlném pásmu jsou žluto-červené barevné odstíny.



Obr.40: Kruh barev

Monochromatické barevné odstíny přecházejí takto vzájemně do sebe a vytvářejí nepřerušenou řadu. Tuto řadu je možno přeměnit v uzavřený kruh barev tím, že se k ní přidají purpurové (fialovo-červené) barevné odstíny, které nejsou monochromatické (obr.40).

Zrakový systém je schopen rozlišovat velmi jemné odstíny barev. Celkový počet různých odstínů monochromatických barev dostihuje počtu 150-200. Nejmenší relativní práh, rovný 1 nm, byl shledán v modro-zelené (485 nm) a zeleno-žluté (575 nm) části spektra.

Zatímco délka vlny jednoznačně určuje barevný odstín, obrácené tvrzení neplatí. Jednomu a témuž barevnému odstínu odpovídá nekonečné množství různých kombinací monochromatických podnětů. Zákony míchání barev byly odkryty I. Newtonem již na konci 17. století. Jejich správnost však byla plně dokázána teprve v století minulém. Jsou známy tři takové zákony:

1. Každému barevnému odstínu odpovídá doplňkový barevný odstín; smíšení s ním v určitém poměru dává počitek jednoho z odstínů šedé (neutrální) barvy:

červená (660 nm) - modro-zelená (497 nm)
oranžová (610 nm) - zeleno-modrá (494 nm)
žlutá (585 nm) - modrá (485 nm)
žluto-zelená (570 nm) - fialová (430 nm).

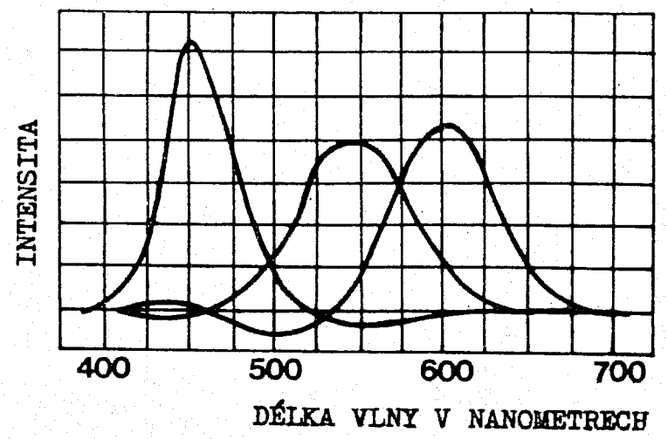
Lze snadno nahlédnout, že doplňkové barevné odstíny jsou rozloženy přibližně na opačných koncích průměrů kruhu barev.

2. Při smíchání dvou barev, které na kruhu barev jsou blíže než doplňkové, je barevný odstín vzniklý sloučením rozložen mezi smíšenými barvami na přímce, která je spojuje.

3. Stejně vyhlížející barvy dávají při smíšení, nezávisle na jejich spektrálním sestavení, barevné odstíny stejného barevného odstínu.

Nejdůležitějším důsledkem míchání barev je, že pomocí libovolných tří barev, které nejsou doplňkové, lze dosáhnout libovolného barevného odstínu. Trojice barev, které tomuto požadavku odpovídají, se nazývají základními barvami. Patří k nim např.

barva červená, modrá a zelená. Na obr. 41 je ukázáno, v jakých poměrech je nutno brát monochromatické odstíny červené, zelené a modrá, aby bylo možno dosáhnout všech ostatních barevných odstínů viditelného spektra.



Obr. 41: Poměr červené (650 nm), zelené (530 nm) a modré (460 nm) barvy, nutný k získání všech barevných odstínů spektra

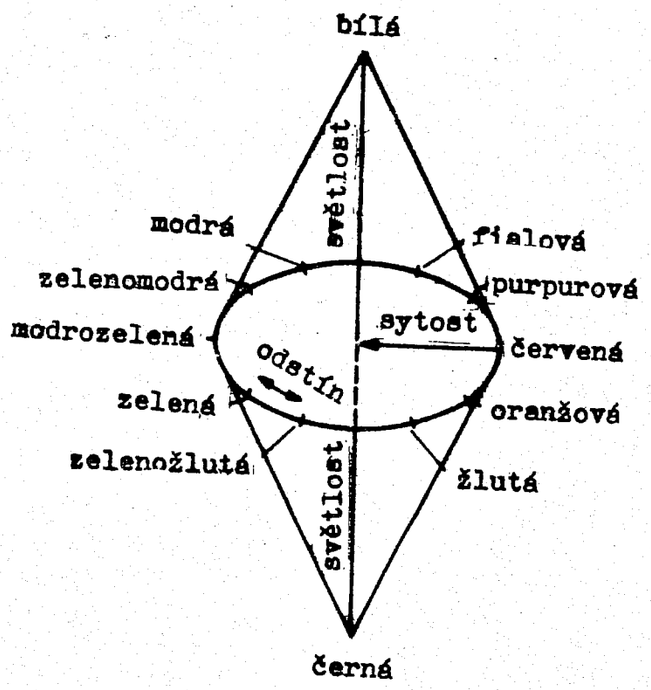
Stupeň odlišnosti některého barevného odstínu od neutrálního tónu stejné světlosti určuje třetí a poslední charakteristiku barevných tónů, jejich sytost. Fyzikálním korelátem sytosti je "zastření" spektrálního složení světla elektromagnetickým kmitáním jiných vlnových délek.

Sytost záleží rovněž na jasu podnětů. Je maximální pro střední hodnoty osvětlení a klesá jak při zvětšení, tak i při zmenšení jasu až do úplné ztráty barevnosti podnětů. Modrá, červené a purpurové barvy jeví se jako silně syté a zůstávají sytými dokonce i při nízké úrovni jasu; žluté a zeleno-žluté stávají se poměrně sytými při velké jasnosti.

Stejně jako v případě viditelného jasu existuje barevná adaptace a barevný kontrast. Projevuje se celkovým nebo místním zmenšením vnímané velikosti sytosti barevných tónů při jeho dlouhém prohlížení a v současném růstu sytosti doplňkové barvy.

Světelný následný kontrast projevuje se v podobě barevných následných obrazů. Dlouhé fixování červeného čtverce vede např. k tomu, že pozorovatel potom vidí před sebou zelený čtverec, kte-

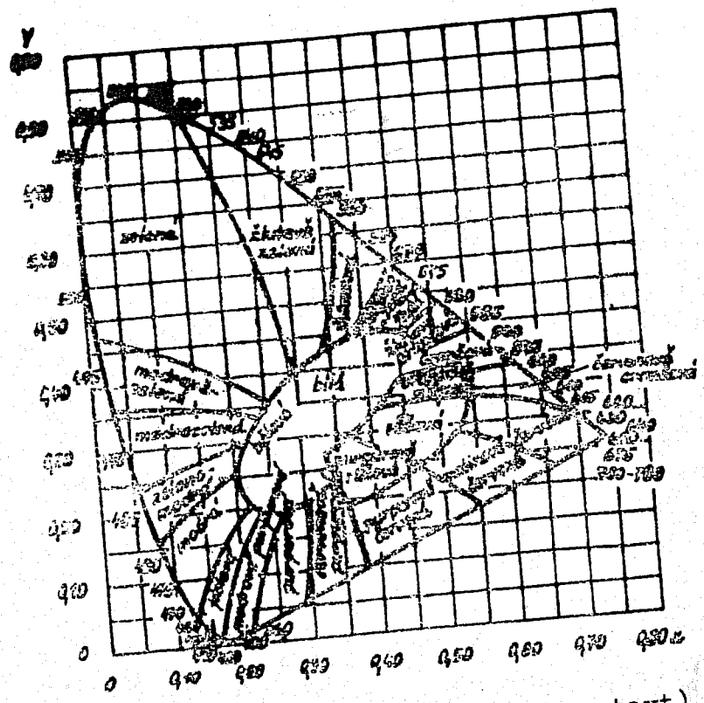
rý se přesouvá spolu s pohybem očí. J.W. Göthe si též povšiml, že barvy následných obrazů se poněkud liší od doplňkových, na rozdíl od nichž jsou posunuty k okrajům spektra.



Obr. 42: Těleso barev (viz text)

Celou mnohost aperturních barev, určovaných třemi probranými charakteristikami, je možno znázornit v podobě prostorového modelu tělesa barev (obr. 42). Jde o dvojitou kuželovitou pyramidu, podle jejíž svislé osy nastává zvětšování světlosti barev. Každý vodorovný řez tělesem je kruhem barev pro daný stupeň viditelné světlosti. Sytost barevného tónu se snižuje při pohybu podle obvodu kruhu barev, v jehož středu je neutrální šedivá barva. Zmenšení obvodu barevných kruhů na koncích tělesa barev se vysvětluje sytostí barev při nízkém a vysokém stupni viditelného jasu.

V důsledku toho, že všechny barevné tóny včetně neutrálních mohou být získány smíšením tří základních barev, užívá se v praxi k popisu barev geometrického tělesa barev, jehož řezem není kruh, ale trojúhelník. Na vrcholcích tohoto trojúhelníka barev jsou tři základní barvy: červená, zelená a modrá.



Obr. 43: Trojúhelník barev (viz text)

Na obr. 43 je ukázán trojúhelník, který byl přijat Mezinárodní osvětlovací komisí (MOK) jako vzorový. Dohodnuté koeficienty na ose X a Y určují koordináty každé barvy uvnitř trojúhelníka barev. Uvedeme souřadnice barevnosti některých barev:

	X	Y	
červená	0,67	0,33	
zelená	0,21	0,71	
modrá	0,14	0,08	
modrá	0,16	0,31	atd.

Existují dvě základní teorie počitků barev, třísložková teorie a teorie opačných barev.

První myšlenky o barevném vidění založeném na třech složkách vyslovil M.V. Lomonosov v práci o vzniku světla v r.1756. Tato teorie byla detailně rozpracována v 19. století anglickým fyzikem T. Jungem a H. Helmholtzem.

Tato teorie je založena na předpokladu, že počet různých receptorů barev v sítnici nemůže být příliš veliký. Kdybychom předpokládali, že pro každý námi vnímaný odstín skutečně exi-

stuje speciální receptor, potom při monochromatickém osvětlení by bylo v činnosti méně než 1% receptorů a vidění by se muselo silně zhoršovat. Prosté pozorování však ukazuje, že tak tomu není.

Protože všechny barvy mohou být získány smícháním tří základních barev, předpokládalo se, že na sítnici existují tři typy receptorů, citlivých k modré (fialové), zelené a červené barvě.

Alternativní teorii vyslovil E. Hering (1878). Základem teorie opačných barev staly se údaje o jevech kontrastu, které podrobně zkoumal, a dále pak některá psychologická pozorování. Většina lidí vyčleňuje např. jako "hlavní" barvu, kromě barvy červené, zelené a modré, též žlutou. E. Hering se domníval, že na sítnici jsou tři substance citlivé na barvy. Jejich rozklad vede k vnímání barvy bílé, zelené a žluté a opětovný vznik k vnímání černé, červené a modré barvy.

Obě teorie byly dlouhou dobu ve vzájemném protikladu. Jednou z oblastí, v níž jejich zastánci hledali potvrzení svých názorů, byl výzkum různých odchylek barevného vidění.

S poruchami barevného vidění se setkáváme přibližně u 8% mužů a 0,5% žen. Tyto poruchy jsou alespoň částečně dědičné. Nebylo by správné nazývat tyto lidi barvoslepými, neboť pouze jediný, výjimečně vzácný druh poruchy barevného vidění je spojen s neschopností rozlišovat kvality barev. Lidé trpící tímto nedostatkem se nazývají monochromaty. V tomto případě se všechny délky vln a jejich kombinace rozlišují pouze na podkladě jejich světlosti.

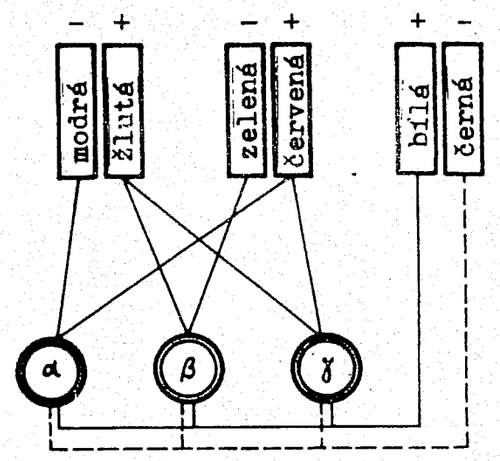
Značná část poruch barevného vidění souvisí se ztížením rozlišování červené a zelené barvy. Zvláštní těžkosti mají tito lidé při rozlišování barev jako je modrá a růžová. Třísložková teorie, která vychází z existence tří prvotních druhů receptorů, vysvětluje tuto odchylku ztrátou receptorů citlivých na červenou nebo zelenou barvu. Bylo též skutečně zjištěno, že existují dvě varianty červeno-zelené slepoty. V pokusech na získání žluté barvy potřebovaly jedny osoby s odchylkou barevného vidění daleko více červené a druhé osoby s toutéž odchylkou více zelené barvy nežli lidé s normálním zrakem. První varianta, necitlivost k červené barvě, byla nazvána protanopií, a druhá pak, necitlivost k zelené barvě, deuteropií.

Trojsložkovou teorii podporuje opět existence slepoty na modrou barvu, která se v tomto případě zaměňuje za zelenou. Tato porucha se vyskytuje právě tak zřídka jako úplná barvoslepost.

Deitailnějšími výzkumy současně bylo zjištěno, že červeno-oranžovo- žluto-zelená část spektra se přetváří během vnímání u osoby s odchylkou barevného vidění nikoli v odstíny zelené barvy (protanopie) nebo odstíny červené barvy (deuteropie), ale v odstíny barvy žluté. Je tak možno předpokládat, že červeno-zelená slepota je dichromatickým žlutošedým viděním. Tento poznatek odpovídá do značné míry teorii opačných barev E. Heringa.

Argumentem pro teorii opačných barev jsou poznatky získané u normálních lidí o pořadí zmizení barevného tónu při přenesení předmětů na okraj zrakového pole. V tomto případě se ztrácí nejprve červené a zelené barvy, z nichž zůstane pouze žlutý odstín. Žlutý a modrý barevný ton je vnímán v daleko širší oblasti zrakového pole. Tyto účinky je třeba mít na mysli při užívání barevného označování.

Četné důkazy jak pro třísložkovou, tak pro teorii opačných barev umožnily D.A. Orbelimu předpoklad, že obě teorie jsou oprávněné. Každá z nich však popisuje zákonitosti zpracování informací o barvě na různé úrovni zrakového systému. V posledních letech byl tento názor detailně zdůvodněn americkými badateli L.M. Gurvichem a D. Jamesonem. Na obr. 44 je uvedeno jimi vypracované schéma vztahů mezi třemi světločivými látkami a třemi zpětnými procesy, jež jsou základem barevného vidění. Nedávno byly získány přímé neurofyzilogické důkazy oprávněnosti této modifikované teorie.



Obr. 44: Zjednodušené schéma vzájemných vztahů mezi světločivnými látkami a třemi páry protichůdných procesů: modrožlutým, červenozelených a bíločerných (podle L.M. Gurwiche a D. Jamesona, 1966)

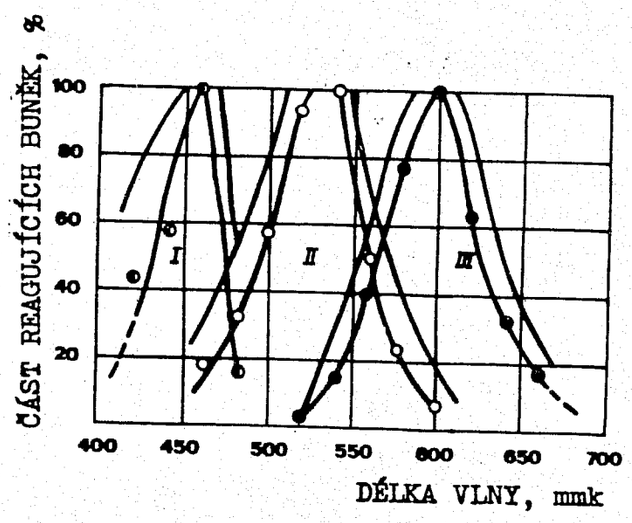
Podařilo se především zjistit, že na sítnici existují opravdu tři světločivé látky. Jeden z nejpřesnějších pokusů v této oblasti byl proveden anglickým badatelem P.K. Brownem a G. Waldem.

V jejich experimentu se miniaturní svazek monochromatického světla projikoval zornicí na jednotlivé čípky sítnice zkoumané osoby a pomocí mikrospektrofotometru se měřilo množství světla,

které bylo odraženo a vrátilo se zornicí. Bylo zjištěno, že existují tři druhy čípků, které mají maxima pohlcení při 450, 525 a 535 nm.

Elektrofyziologické pokusy s mikroelektrodovou registrací aktivity gangliových buněk sítnice naznačují rovněž existenci tří typů barevných receptorů. Švédský fyziolog R. Granit zjistil, že vzrůst aktivity neuronů vzniká jako odpověď na osvětlení sítnice modrým, zeleným nebo červeným světlem (viz obr. 45).

Zatímco výzkumy mechanismů barevného vidění na úrovni sítnice třísložkovou teorií potvrzují, výzkumy na vyšší úrovni corpus geniculatum laterale svědčí pro teorii opačných barev. Celá řada prací, z nichž je možno si povšimnout výzkumů amerického fyziologa R.L. de Valois a E.N. Sokolova, dává možnost nahlédnout, že na této úrovni jsou zjišťovány reakce protichůdných typů.



Obr.45: Registrace impulsů jednotlivých gangliových buněk sítnice (podle R.Granita, 1955)
Po výběrové adaptaci k odpovídajícím doplňkovým barvám byla zjištěna přítomnost receptorů pro modrou (I), zelenou (II), červenou (III) barvu

Byly např. nalezeny neurony, které zvětšují aktivitu v odpověď na osvětlení sítnice červeným světlem a zmenšují ji v odpověď na zelené světlo. Zároveň s těmito "červeno-zelenými" elementy byly nalezeny též "žluto-modré"a "bílo-černé" neurony.

Klasické teorie barevného vidění se takto nevylučují , ale vzájemně doplňují.

Vše, co bylo výše řečeno, vztahuje se k vnímání aperturních barev nebo barev, které nepatří určitému předmětu. Zvláště důležitý je rovněž výzkum vnímání jasu a barvy předmětů.

Z fyzikálního hlediska je barva předmětu určována jeho odrážecí schopností a spektrem pohlcení. Odrážecí schopností je nazýván vztah mezi odráženým povrchem a na něj dopadajícím světlem. Spektrem pohlcení se nazývá vztah rozložení pohlceného a dopadajícího světla podél celého viditelného spektra frekvencí. Obě tyto charakteristiky zůstávají stále při změnách osvětlení. Pro správnou orientaci v okolí má velký význam ta okolnost, že i zrakový systém vnímá tyto charakteristiky jako poměrně neměnné konstantní vlastnosti.

Probereme nyní problém vnímání barvy podrobněji. E.Hering rovněž zjistil, že úhel v slunečním dni odráží daleko více světla než kousek křídy za soumraku a proto úhel vnímáme jako černý a křídu jako bílou. Konstantnost vnímání barvy nelze pochopit, budeme-li se opírat o poznatky vnímání aperturních barev určovaných světlem, které je vyzařováno povrchem. Probrané mechanismy vnímání aperturních barev by mohly být s úspěchem použity v lokální analýze spektrálního složení světla odráženého povrchem, nemohou však rozlišit např. žlutý předmět osvětlený modrým světlem nebo zelený předmět, který je osvětlen přímým slunečním světlem, neboť rozložení energie v odráženém světle může být v obou případech stejné. Na druhé straně tytéž předměty odrážejí za různých podmínek osvětlení (denním, přirozeném světle, při elektrické svařovací lampě, při oranžově červeném západu slunce) světlo různého spektrálního složení.

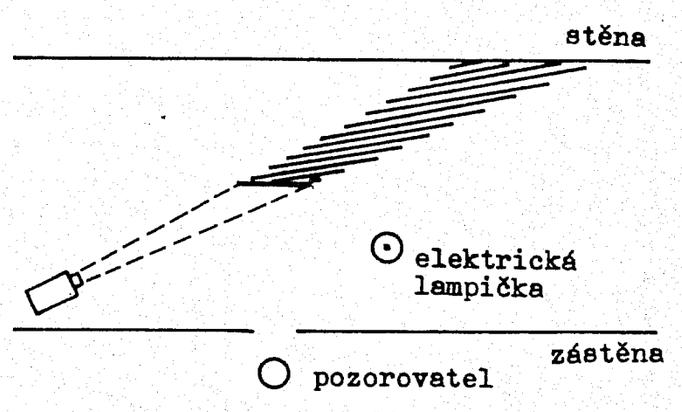
Nejednou byly prováděny experimenty, jejichž cílem bylo kvantitativně změřit velikost konstantnosti barev. Autorem jedněch z prvních experimentů tohoto druhu byl rakouský psycholog E. Brunswick (1929). Schéma pokusu a způsob prezentace dat, kterých bylo v práci E. Brunswicka užito, jsou dosud typické nejen pro výzkum konstantnosti barvy, ale též pro studium jiných druhů konstantnosti.

V určité vzdálenosti před zkoumanou osobou, která sedí zády k oknu, byla dána kartička šedé barvy, jež sloužila jako vzor. Potom byla na velkou vzdálenost ukazována série kartiček, jejichž zbarvení bylo pozměňováno od světle šedé do tmavošedé. Mezi nimi měla zkoumaná osoba najít kartičku s tímtéž zbarvením jako u vzoru. Protože osvětlení předmětu se mění v obráceném poměru čtverce vzdálenosti od zdroje světla, v daném případě okna, pak při objektivně stejné odrážecí schopnosti vysílal vzdálenější předmět nazpět značně méně světla než vzor.

která byla skryta před zkoumanou osobou. Stín kruhu padal mimo hranice zrakového pole zkoumané osoby. V tomto případě viděla slabě osvětlený bílý kruh na pozadí temné stěny. Postačilo však dát do prostoru, který byl ozářen obloukovou lampou, proužek bílého papíru a slabě osvětlená bílá barva kruhu se okamžitě změnila v silně osvětlenou barvu černou. Jestliže proužek byl vzat nazpět, nastalo opět vnímání bílého kruhu. Na vnímání barby nepůsobilo tedy ani zapamatování barvy, ani možný úsudek.

K pochopení výsledků tohoto pokusu je třeba si uvědomit, že rozsah možných hodnot odrážecí schopnosti různých povrchů je poměrně malý. Velmi černá barva např. odráží 3% světla, které na ni dopadá, a nejlepší běloba 80%. Proto maximální odrážecí schopnost předmětů v zrakovém poli nepřevyšuje nikdy poměr 30:1, zatímco poměr jasů může dosahovat hodnot 1000:1 i více. V podmínkách pokusu A. Gelba nemá zkoumaná osoba bezprostřední údaje o rozdílu osvětlení místnosti a kruhu, které by bylo možno získat spatřením obloukové lampy nebo stínu kruhu. Jestliže proto kruh odrážel přibližně 30krát více světla než stěny místnosti, byl potom vnímán na horním amístnost na dolním okraji nejvyšší možné vzdálenosti mezi bílou a černou barvou.

Když se v zorném poli zkoumané osoby objeví proužek bílého papíru, vzniká nový poměr jasů. Jelikož při témže osvětlení je proužek přibližně 30krát jasnější než kruh, vidí zkoumaná osoba jasně osvětlený bílý a černý povrch. Pokud jde o stěny místnosti, ty odrážejí téměř 30krát 30 méně světla než proužek papíru a jsou vnímány jako bílé při slabém osvětlení.



Obr. 46: Schéma pokusu A. Gelba (podle G. Kanizze, 1966)

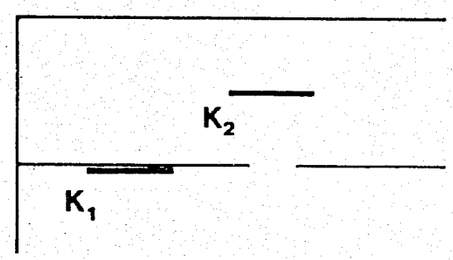
Z tohoto výsledku vyplývá, že kdyby skrytá lampa osvětlovala nikoli černý, ale bílý kruh, poměr jasů v zrakovém poli by nebyl větší než 30:1 a kruh by tudíž vyzařoval více světla než to z hlediska zrakového systému posuzujícího umožnuje celkové osvětlení okolí. Jak ukázaly pokusy, kruh se pak jeví jako svítící.

Vnímání předmětů v souvislosti s jejich odrážecí schopností je umožnováno vlivem odhadu poměrného jasu povrchů v zrakovém poli pozorovatele. Velký význam pro konstantnost vnímání

barev má rovněž schopnost zrakového systému vyčíst ze světla odráženého předměty jejich celkovou světelnou charakteristiku. Obvykle tato charakteristika odpovídé barvě osvětlení. Základem podobného "vyčtení" jsou mechanismy barevné adaptace a kontrastu barev. Vlivem jejich působení ztrácí převládající barva zrakového pole postupně sytost, přibližuje se k neutrální a přiměřeně vzrůstá sytost doplňkové barvy. Odhady místních barev se uskutečňují ve vztahu k této nové, neutrální úrovni.

Struktura percepční činnosti dohadování barvy předmětu zpravidla způsobuje, jak jsme ukázali, konstantnost vnímání. Stejně jako v případě jiných druhů konstantnosti mohou však tyto operace způsobit za zvláštních podmínek vznik iluzorního vnímání barvy. Příkladem mohou být experimenty K. Koffky (1935).

Na stěně místnosti osvětlené zbarveným světlem je upevněn šedý kruh K_1 (obr. 47). Otvorem ve stěně je vidět druhý stejný kruh K_2, který je v místnosti s normálním osvětlením. Za těchto podmínek je K_1 vnímán jako šedý a K_2 pak jako zbarvený barvou doplňkovou k barevnému osvětlení v první místnosti. Barva prvního kruhu je tedy vnímána konstantně, ale druhého nikoli. Vztahy mezi barvami se obrátí, jestliže se oba kruhy pozorují otvorem v šedé zástěně osvětlené neutrální šedou barvou: K_1 připadá jako zbarvený barvou svého osvětlení a K_2 neutrální šedí.



Obr.47: Schéma pokusu K.Koffky

V prvním případě (bez použití zástěny) je celková barva osvětlení určována barvou odráženou stěnami místnosti. V důsledku barevné adaptace ztrácí tato barva svoji sytost a je vnímána jako šedá. Proto kruh K_1, který odráží totéž světlo, je rovněž vnímán jako šedý, tj. odpovídá svému pravému zbarvení. Působí-li odrážená barva, pak je kruh K_1 vnímán jako neutrální. Potom kruh K_2 odrážející achromatické světlo, musí být vnímán jako zbarvený. Přitom barva K_2 se musí tak lišit od šedé, jako šedá barva K_1 se liší od barvy svého osvětlení. To znamená, že barva K_2 musí být doplňkovou k barvě osvětlení v první místnosti.

V druhém případě je obecná charakteristika barevného uspořádání viditelných předmětů udávána neutrální barvou zástěny. Proto K_2, odrážející neutrální barvu, je vnímán jako šedý a K_1, který je pak osvětlen chromatickým světlem, je vidět v barvě svého osvětlení.

Zásadně stejné vysvětlení lze zřejmě dát i při konstantním

vnímání zbarvených předmětů. Při červeném osvětlení odráží např. zelený předmět na šedém pozadí přibližně totéž světlo jako šedý předmět při achromatickém osvětlení. Připomeňme si však, že v důsledku současného barevného kontrastu je šedá skvrna obklopená červeným polem vnímána jako nazelenalá. Proto v probíraném případě bude předmět vnímán nazelenale, tj. bíle vzhledem ke svému skutečnému zbarvení.

Analýza vnímání barvy předmětu ukazuje, že působení poměrně jednoduchých mechanismů adaptace a kontrastu je podřízeno základní úloze vnímání, tj. předmětnému odrazu nás obklopujícího světa.

4. Zrakové vnímání prostoru

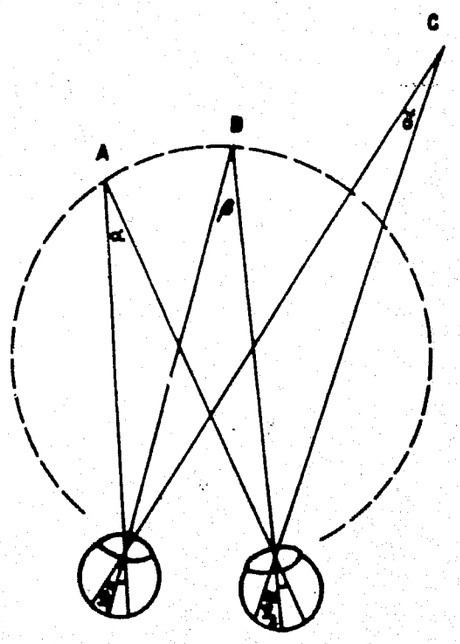
Zrakové vnímání by nemohlo plnit orientační funkci, kdyby vnímané předměty i sám pozorující se nelokalizovali více méně přesně v okolním prostoru. Spolu s jinými druhy citlivosti účastní se zrak jako nejvyšší epikritická forma citlivosti odrážení prostorových vztahů mezi předměty.

Neměnnost základních rysů vnějšího prostoru vysvětluje ten poznatek, že některé mechanismy prostorového vidění jsou zřejmě vrozené. To se především týká fyziologických mechanismů splývání, které tvoří základ binonulárního vidění. Splýváním je chápáno sjednocení obrazů, které jsou projikovány na různé sítnice, jediný obraz. Sjednocení je umožňováno pouze v případě, kdy předměty jsou promítány přibližně na centrální jamky fovey obou očí nebo na body vzdálené od středu centrálních jamek ve stejné vzdálenosti a ve stejném směru. Tyto páry bodů se nazývají korespondujícími. Všechny ostatní páry bodů sítnice se nazývají disparátními a jestliže jsou na nich promítána monokulární zobrazení, nenastává zpravidla jejich splývání a viditelné zobrazení se rozdvojuje. Většina autorů vysvětluje splývání tím, že anatomicko-fyziologické korové reprezentace sítnice levého a pravého oka jsou párové.

Mechanismus splývání se může současně uplatňovat pouze v součinnosti s vergentními pohyby očí, které zajišťují binokulární fixaci předmětů. V opačném případě by binokulární zraková pole odpovídala různým úsekům okolí a jejich sjednocení by bylo přirozeně nemožné. Množství bodů v prostoru, které se v daných úhlech promítají na korespondující body sítnice, se na-

zývá horopter. I. Müller poprvé ukázal, že horopter je kružnice, která prochází středem obou očí a bodem fixace (obr. 48). Nezbytnou podmínkou binokulárního vidění je koordinace senzorického mechanismu splývání s vergentními pohyby očí.

Binokulární fixace, jak dotvrzují výzkumy M.N. Denisové a N.L. Figurina, se vyvíjí v průběhu prvních tří měsíců věku dítěte. Nehledě tudíž na to, že řada mechanismů prostorového vidění je vrozená, nastává jejich koordinace v průběhu postnatálního vývoje. Výše uvedené poznatky o vývoji vnímání při senzorické izolaci a při optickém zkreslení ukázaly, že se přitom důležitým způsobem uplatňují pohyby člověka (viz kap. I,3).

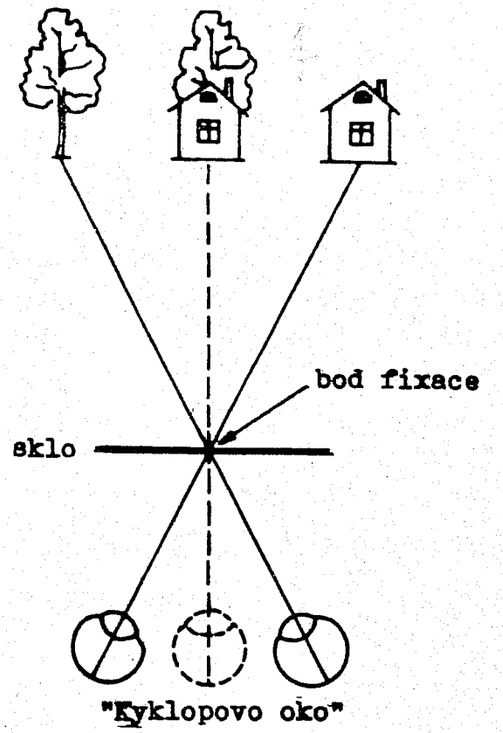


Obr. 48: Teoretický horopter I. Müllera.
Úhly a jsou rovny, ale a nikoliv

Zrakem lze určit všechny základní prostorové charakteristiky předmětu: jejich směr, vzdálenost a velikost.

Teorie binokulárního vnímání směru byla vypracována I.Müllerem a E. Heringem, kteří vyslovili zákon identických zrakových směrů. Všechny předměty, které jsou promítány na totéž místo sítnice, jsou podle tohoto zákona vnímány ve stejném směru, i když třeba i v různých vzdálenostech. Při binokulárním vnímání jsou ve stejném směru viděny předměty, které jsou promítány na korespondující body sítnice. Pro centrální jamky sítnic tento směr souhlasí s přímkou, která je vedena bodem fixace a středem přímky, která spojuje obě oči, tj. bodem, který je v oblasti kořene nosu.[1/]

1/ Toto myšlené centrum, ke kterému se scházejí binokulární směry, je někdy nazýváno "okem Kyklopovým".



Obr.49: Zákon identických zrakových směrů E. Heringa

Smysl zákona identických zrakových směrů je možno vysvětlit pomocí prostého pokusu, který navrhl E. Hering.

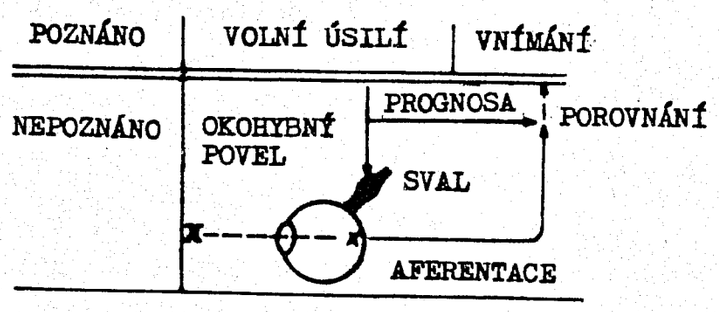
Je třeba postavit se přibližně půl metru od okna, které vede do ulice, zakrýt pravé oko a levé zamířit na libovolný předmět vpravo od sebe, např. na izolovaně stojící strom. Při fixaci stromu je třeba udělat na skle bod tak, aby byl s ním ve stejném směru. Potom se zakryje levé oko a pravé oko fixuje značku na skle a všechny předměty, které jsou v tomtéž směru, např. dům. Potom je možno otevřít obě oči a zamířit je na značku, která nyní překrývá částečně strom i dům. I když ne vždy současně, přesto dosti snadno se podaří vidět dům, značku a strom v jediném směru (viz obr. 49).

Pro odhad směru mají velký význam nejen vergentní, ale též sakadické pohyby očí. Pomocí sakadických pohybů očí lze hodnotit, jak ukázali američtí psychologové L. Festinger a L.P. Canon (1965), polohu předmětu v zrakovém poli značně přesněji než pomocí pomalých sledovacích pohybů. Pokusy těchto autorů se uskutečňovaly v úplné tmě. Zkoumané osoby měly v polovině úloh sledovat v průběhu minuty pohyby svítícího cíle a ukázat místo, na kterém zmizel. V druhé polovině úloh pokusu zableskl se cíl na krátkou dobu v jednom z úseků zrakového pole a zkoumané osoby jej fixovaly sakadickými pohyby očí. Bylo zjištěno, že lokalizace cíle v druhém případě byla značně lepší než v prvním.

Zrakové vnímání směru je charakterizováno vysokou konstantností a nemění se při pohybech očí a přemisťování pozorující osoby. Tomuto druhu konstantnosti se dostalo názvu stabilita viděného světa (viz kap. I,3). Jeho základem je odraz stability a nepohyblivosti našeho předmětného okolí - stromů, domů, obzoru apod. Tato stabilita, zjišťovaná v průběhu vývoje a předmětné

činnosti, uchovává se pak v průběhu vlastních pohybů pozorovatele. Je charakteristické, že konstantnost směru se uplatňuje při aktivních pohybech. V případě, kdy se oči pasivně odsunují na stranu, např. při tisknutí na oční bulvu palcem, je pozorovám zdánlivý posun viditelného okolí v opačném směru.

Tato okolnost je jedním z argumentů tzv. aferentní teorie (Ch. Sherington, 1906) proti výkladu stability viděného světa. Podle této teorie obsahuje propriocepce zrakových svalů informaci o postavení očí v očnicích, jež umožňuje CNS ignorovat změny zrakové stimulace, které byly vyvolány pohyby očí.



Obr.50: Schéma možného mechanismu zajištění stability viditelného světa v průběhu pohybu očí (podle E. Holsta, 1950)

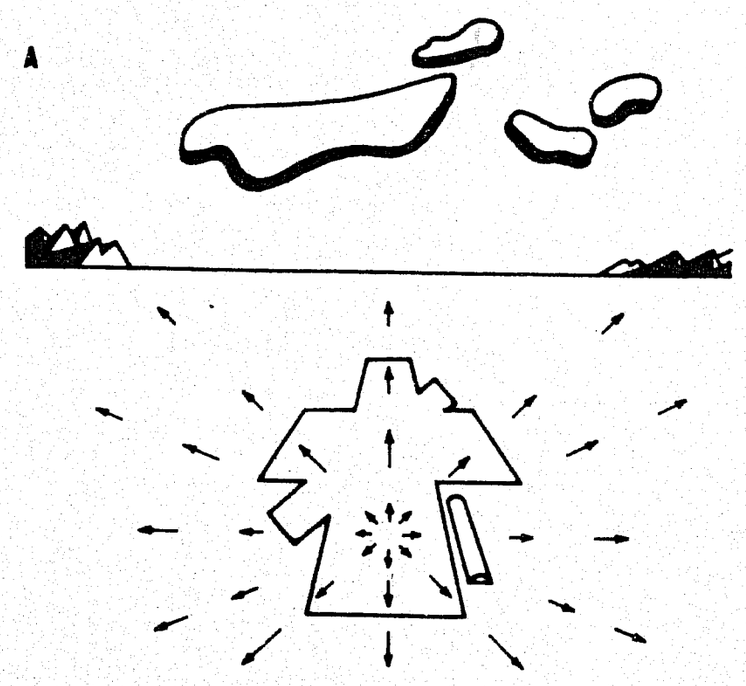
Nejúplnější výklad těchto jevů dává inervační teorie, kterou poprvé předložil H. Helmholtz (1894) a E. Mach (1885). Tato teorie vychází z předpokladu, že každý okohybný impuls je provázen prognózou možných změn zrakové stimulace. Jestliže prognóza a faktická změna souhlasí, pak žádný pohyb není vnímán. Na obr. 50 je ukázáno schéma předložené v r. 1950 německým fyziologem E.F. Holstem pro znázornění této teorie. Inervační teorie vysvětluje vznik zdánlivých pohybů viditelného okolí u nemocných, u nichž v nedávné době vznikla obrna očních svalů. V těchto případech jsou všechny pokusy pohybovat okem na stranu provázeny vnímáním skoku předmětů v témže směru. K tomu dochází snad proto, že centrální prognóza, spojená s motorickým povelem, se v důsledku obrny nekompenzuje odpovídající reaferentací,[1] k čemuž v obvyklých podmínkách dochází pouze při pohybu viditelných předmětů spolu se zrakem.

Třetí možný výklad stability viditelného světa souvisí s důrazem na úlohu relativní lokalizace v odhadování polohy předmětu. Vzájemné rozložení předmětu v zorném poli zůstává skutečně neměnným nejen při pohybech očí, ale i při přemisťování

1/ Reaferentace je změna stimulace, vyvolaná vlastním pohybem organismu (E.F. Holst).

pozorovatele. Vyčlenění této informace je dostatečné pro vytvoření invariantního obrazu okolí. Jedním ze zastánců tohoto hlediska je anglický kybernetik D.M. Mackay (1956).

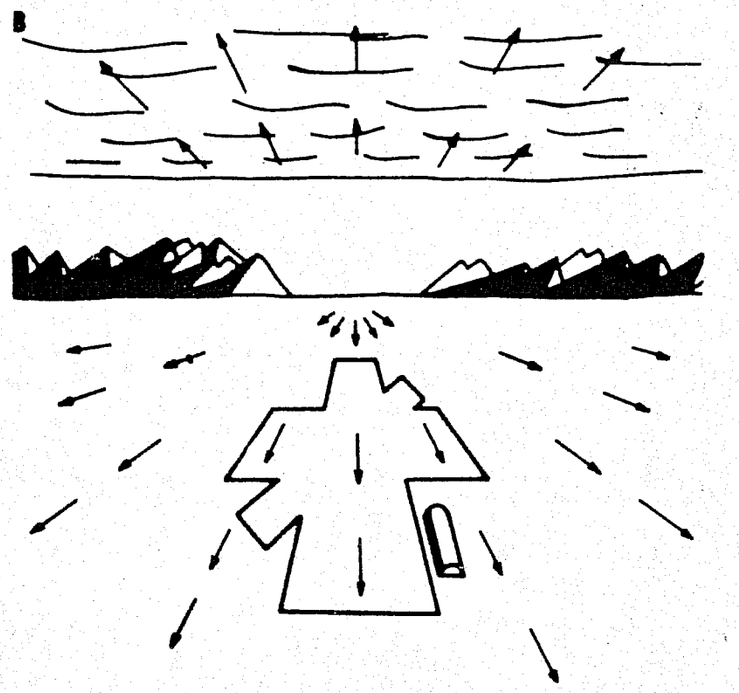
V nedávné době byly získány neurofyziologické důkazy, které podporují obě výše uvedené teorie. Bylo přitom zjištěno, že inervační teorie předpovídá správně fyziologické procesy na úrovni vrchních hrbolků čtverohrbolí a corpus geniculatum laterale, tj. na poměrně nízkých úrovních zrakového systému. Několik desítek milisekund před začátkem aktivních pohybů očí je zde registrováno posunutí úseku maximální aktivity neuronů, stimulovaných při dané poloze očí ve vztahu k neuronům, které mají být aktivovány teprve podstatně později po uskutečnění samotného pohybu (Wurtz, 1972). Na druhé straně však korové neurony reagují stejně jak na pohyby očí v strukturovaném okolí, tak i na analogickou změnu zrakové stimulace. To znamená, že na úrovni mozkové kůry jsou nositelem základních informací o pohybech očí, která umožňuje zaznamenat jejich vliv na vnímání celostní změny zrakové stimulace (Wurtz, 1971).



Obr. 51: Zraková kinestezie (podle G.L. Teubera, 1961)
A - přistávání

Transformace projekcí nepohyblivých předmětů na sítnici v průběhu pohybu organismu přivádějí mu informaci o těchto pohybech a plní tak funkci zrakové kinestezie (viz kap. II,2). Význam zrakové kinestezie zvláště stoupá v těch případech, kdy se pozorující osoba nepohybuje z místa na místo jednoduše, ale relativně nepřirozeným způsobem, např. automobilem, letadlem

nebo družicí. Vlastní kinestetická a vestibulární informace bývá v tomto případě zpravidla porušena (viz kap. VIII,3) a proto zraková kinestezie zůstává jediným zdrojem spolehlivých zpráv o poloze těla v prostoru. Ráz změny zrakové stimulace někdy umožňuje určit druh vlastního pohybu. Na obr. 51 je např. schématicky zobrazena změna vnímání letce při přistání letadla (A) a při nízkém letu (B).



Obr.51: Zraková kinestezie (podle G.L. Teubera, 1961)
B - nízký let

Spolu s určením směru má pro prostorové vnímání rozhodující význam vnímání třetího rozměru, tj. hloubky. V ontogenezi se zrakové vnímání hloubky objevuje velmi brzy, již v prvních měsících života dítěte. Je však možno předpokládat, že obdobně jako v případě vnímání směru se vznik a koordinace vnímání vzdálenosti uskutečňuje v souvislosti s prvními praktickými činnostmi dítěte, jež předpokládají vyčlenění prostorových vztahů. Příkladem těchto činností může být uchopování předmětu.

Originální výzkum rozlišování hloubky u dětí ve věku od 6,5 do 14 měsíců byl proveden americkými autory E. Gibsonem a R. Walkem.

Byly provedeny tyto experimenty, kterých se účastnilo 36 dětí; dítě bylo umístěno ve středu stolu, jehož povrch byl pokryt tlustým sklem. Zvláštní vybrané osvětlení působilo, že sklo bylo prakticky neznatelné. Pod sklem bylo linoleum pomalované velkými jasnými kostkami. Na jedné straně dítěte bylo linoleum bezprostředně pod sklem a na druhé bylo přímo na podlaze, o 1,5m níže než povrch stolu.

Obr.52: Dítě zkoumá zrakové rozmezí (podle E. Gibsona a R. Walka, 1960)

Matka dítěte přicházela ke stolu občas z jedné i z druhé strany, podávala dítěti hračku a v průběhu dvou minut je k sobě vzala. 75% dětí lezlo k matce, když je zvala ze strany, kde linoleum bylo pod sklem. V případě, že matka přistupovala ze strany, kde byl výškový rozdíl, kde barevný povrch byl na podlaze, usilovalo dítě dostat se k matce pouze v 8%, 62% dětí zůstalo na místě a 30% lezlo v opačném směru (obr. 52). Autoři výzkumu dospěli k závěru, že děti, které se mohou samostatně přemisťovat, jsou rovněž sto odhadnovat zrakově hloubku.

A.V. Zaporožec vyslovil předpoklad, že dítě v těchto pokusech nereaguje na hloubku, která vzniká na místě výškového rozdílu, ale reaguje na novou situaci, která je spojena s nutností přemisťovat se na nový povrch. Tento předpoklad je potvrzován výsledky kontrolních pokusů, kde za hranicemi stolu byla dána pod sklo lesknoucí se folie. Dítě i v tomto případě zůstávalo na hranici dvou různých povrchů.

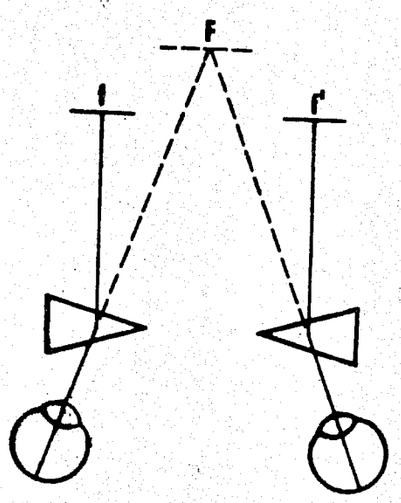
Vnímání vzdálenosti předmětu je percepční úkon, který lze provádět pomocí velkého počtu různých operací. Rozlišují se především binokulární a monokulární mechanismy vnímání hloubky.

Základem binokulárního vnímání vzdálenosti je binokulární paralaxe, rozdíl v projekčních zobrazeních předmětu na sítnici levého a pravého oka, jenž vzniká v důsledku prostorové polohy obou očí. Mírou binokulární paralaxe pro daný bod prostoru je

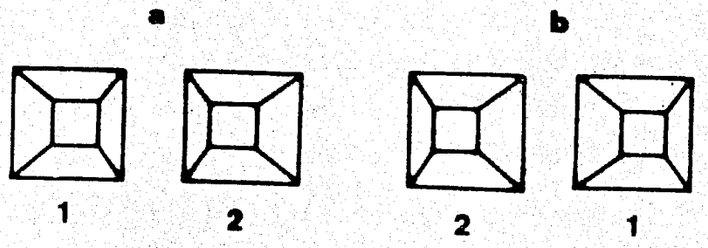
rozdíl v úhlech, pod nimiž je bod vidět pravým a levým okem. Tato míra se nazývá disparitou. Předměty promítané na korespondujících bodech sítnice jsou vnímány jako jednoduché a umístěné v rovině, která je rovnoběžná s čelem . Disparita se v tom případě rovná nule. Libovolný bod, který leží mimo horopter, jako je např. bod C na obr. 48, je promítán na disparátní body sítnice. V tomto případě se disparita určuje rozdílem úhlů $1^a 2'$, pod nimiž je bod C viděn levým a pravým okem.

Nejlepším důkazem významu disparity ve vnímání hloubky jsou experimenty, v nichž se tento faktor mění a které jsou prováděny pomocí optického přístroje stereoskopu a jeho variant.

První stereoskop byl zkonstruován v r. 1838 anglickým fyzikem Ch. Whitstonem. Jedna z jeho posledních modifikací je ukázána na obr. 53. Toto zařízení umožňuje prezentovat nezávisle pro každé oko několik různých vyobrazení téhož předmětu, která se nazývají stereodvojice. Pozorovatel přitom vidí jediný trojrozměrný předmět. Jsou-li naopak stereodvojice identické, je vnímán pouze plochý obraz. Zaměníme-li vzájemně pravý a levý obrázek stereodvojice, části trojrozměrného předmětu, které vystupují dopředu, se pak jeví jako umístěné dál a naopak (obr.54).



Obr,53: Schéma prismatického stereoskopu (podle R.S. Woodwortha a H. Schlosberga,1956)

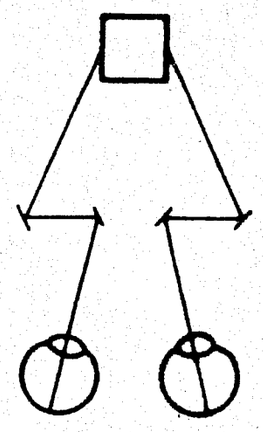


Obr.54: Stereodvojice. V případě "a" je vnímán useknutý hranol
V případě "b" je vnímána chodba vedoucí do dálky

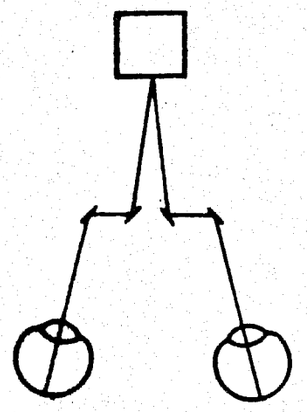
Telestereoskop a ikonoskop jsou varianty stereoskopu Ch. Whitstona, které umožňují vidět jeden a týž předmět pod různým zrakovým úhlem. Jsou-li tyto úhly veliké (obr. 55), pak se disparita jeví jako větší. Odpovídá to prohlížení předmětu, který je dál a více protáhnutý do hloubky. Telestereoskop takto přehání skutečné rozdíly ve vzdálenosti.

V případě ikonoskopu se disparita uměle snižuje a objemný předmět vypadá ploše jako ikona (obr. 56).

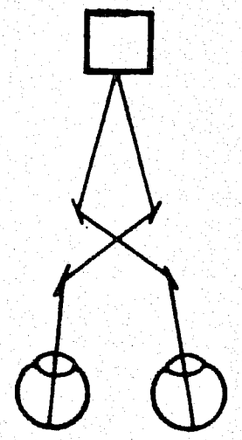
Pseudoskop umožňuje prezentovat levému oku to, co obyčejně vidí pravé oko a naopak (obr. 57). Přitom vzniká disparita opačná, takže vzdálené podrobnosti předmětu se nutně vnímají blíž a blízké dál. Jak jsme již poznamenali (viz kap. I/3), neuplatňuje se tento účinek vždy (B.N. **Kompanijskij**, 1940, A. Pieron, 1955).



Obr.55: Zrcadlový telestereoskop



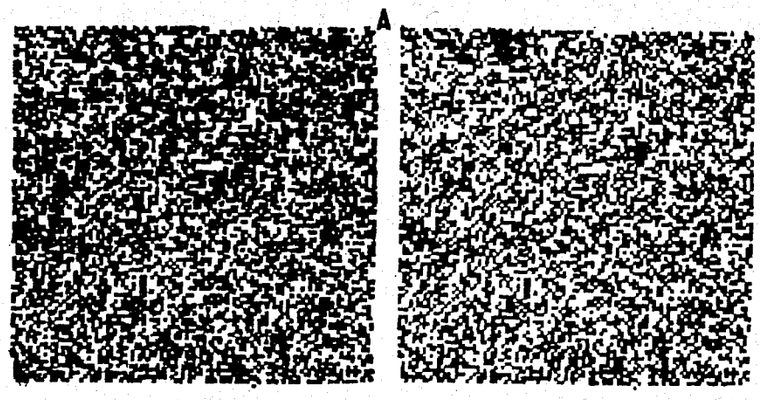
Obr.56: Ikonoskop



Obr.57: Pseudoskop

Podle vzdálenosti disparity lze pozorovat tyto různé kvalitativní účinky: Jestliže není disparita veliká a předmět se promítá prakticky na korespondující body sítnice je pak vnímán v téže vzdálenosti jako fixovaný předmět. Minimální disparita, která vede k vnímání rozdílů vzdálenosti, představuje stereoskopickou zrakovou ostrost. Obvykle je přibližně 15 úhlových sekund. Až do 15-30 úhlových minut velikosti disparity je předmět vnímán jako jediný a jeho vzdálenost roste se zvětšováním disparity. Tato oblast hodnot disparity se nazývá Panumovou oblastí, podle

německého fyziologa P. Panuma, který ji r. 1853 určil. Při ještě větších hodnotách disparity stává se splynutí nemožným a vzniká zvláštní jev, nazývaný binokulárním soutěžením. Projevuje se v střídavém vnímání jednoho a druhého zobrazení nebo jejich částí. Vnímání se v tomto případě stává neobyčejně labilním a na dobu, po kterou trvá vidění jednoho ze dvou obrázků, mohou působit takové faktory, jako poměrná jasnost, množství detailů, významnost, stupeň pozornosti apod.



Obr. 58: Vzory B. Juleshe (viz text) (podle G. Hochberga ,1965)

Jediný trojrozměrný obraz není prostým sjednocením disparátních obrazů vnímaných monokulárně. Na obr. 58 A, přejatém z práce amerického psychologa B. Juleshe (1964), není vidět jakýkoli tvar na žádném z obrázků, nejsou též patrny rozdíly mezi nimi. Jestliže se však tyto obrázky prezentují jako stereodvojice, vzniká jasně viditelný předmět, který poněkud vystupuje z plochy kresby. Dochází k tomu proto, že na jednom z těchto vzorů teček, které byly připraveny samočinným počítačem, je neznatelně posunuta stranou celá oblast a v důsledku toho vzniká

účinná disparita (obr. 58 B). Posunutí tohoto úseku zůstává zcela nepovšimnuto, dokud se zobrazení neprezentují ve stereodvojici, protože výchozí kresba byla nahodilá. Tyto pokusy ukazují, že binokulární vidění je nanejvýš citlivé na prostorové rozdíly v stimulaci obou očí, a to dokonce tehdy, když při monokulárním pozorování pozorovatel rozdíly nepozná.

V poslední době byla vyslovena hypotéza, že binokulární stereovnímání je podmíněno nikoli disparitou jako takovou, ale mikropohyby očí v Panumově oblasti (H. Rohracher, 1971). Přitom se postupně dráždí jednou korespondující, po druhé disparátní body sítnic. Lze dosud těžko říci, nakolik je tato hypotéza správná, její experimentální ověření však nyní probíhá současně v několika laboratořích.

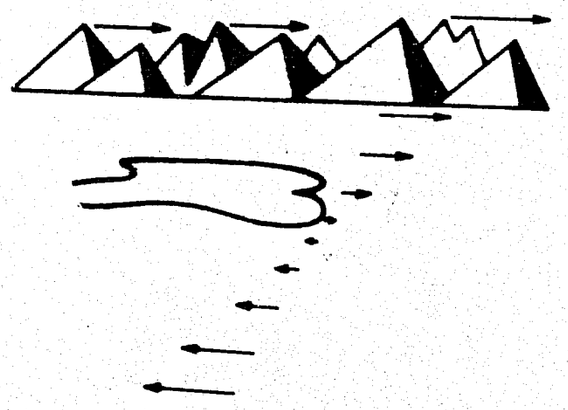
Disparita není, podle všech známek, jediným činitelem a binokulárním znakem hloubky. Podle názoru mnoha badatelů působí při binokulárním vidění hloubky neméně vergentní pohyby očí (F. Klix, 1971, W. Richards, 1971). Význam vergentních pohybů při vnímání hloubky se dříve odmítal z toho důvodu, že člověk v úplné tmě nepozná úhel konvergence svých očí. Nyní se má za to, že konvergence reguluje mechanismus disparity. Fixuje-li pozorovatel vzdálený předmět, znamená určitá disparita větší rozdíly hloubky než v případech, kdy zrak při vnímání blízkých předmětů konverguje. Kdyby se přitom nebral v úvahu úhel konvergence, potom vzdálené předměty by připadaly vzájemně blíž než předměty blízké a stejně od sebe vzdálené.

Vliv vergentních pohybů na mechanismus odhadu hloubky podle disparity je možno dosti lehce pozorovat, změníme-li konvergenci a zachováme předchozí disparitu. To je možno učinit zrcadlovým stereoskopem. Je-li sestrojen tak, že k prohlížení blízkých předmětů je třeba divergovat oči, zaměřit je na nekonečno, potom se předměty vnímají zvětšené a protáhlé do hloubky. Tentýž stupeň disparity se tudíž odhaduje jako znak větších rozdílů hloubky. Tento příklad ukazuje na existenci jediného vergentně disparitního systému odhadu hloubky (R. Gregory, 1966).

Do velké skupiny monokulárních znaků hloubky patří všechny znaky vzdálenosti, jejichž užití je možné i při monokulárním vidění. Význam monokulárního zrakového vnímání se obvykle nedoceňuje. Jestliže však přihlédneme k tomu, že přesný binokulární odhad vzdálenosti je možný pouze na vzdálenost do několika desítek metrů, takže na vzdálenost 500 m může chyba činit 100 m, potom jistě pochopíme, že počet každodenních vjemů, při nichž viditelná vzdálenost a trojrozměrnost předmětů je spoje-

jena s monokulárními znaky hloubky, je neobyčejně veliký.

Nejdůležitějším monokulárním znakem vzdálenosti je monokulární paralaxa pohybu. Spočívá v tom, že při pohybech pozorující osoby do stran, je v jejím zorném poli úhlová velikost posunů předmětů v opačném směru nepřímo úměrná jejich vzdálenosti. Je-li přitom fixován předmět, který je ve střední vzdálenosti, pak vzdálenější předměty se začínají pohybovat ve směru k pozorovateli, čehož příkladem jsou kruhové pohyby krajiny pozorované z okna vlaku (obr. 59).

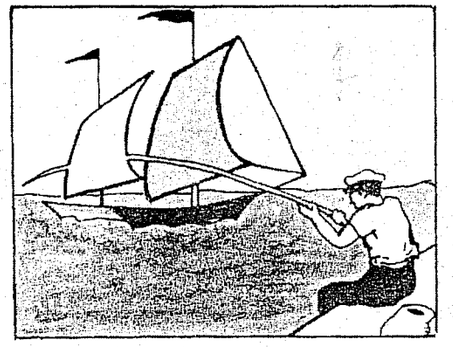


Obr. 59: Monokulární paralaxa pohybů při fixaci předmětu (podle F. Klixe, 1965)

Pomocí monokulární paralaxy pohybu je možno odhadnout vzdálenost předmětů právě tak přesně, jako při binokulárním vidění. V případě, kdy nejsou možné aktivní pohyby pozorující osoby, zhorší se přesnost monokulárních odhadů hloubky přibližně dvacetinásobně.

Vztah mezi aktivními pohyby pozorujícího, paralaktickým posunem předmětů a jejich viditelnou vzdáleností je natolik určeno, že umožňuje vznik iluzorního odhadu vzdálenosti. Stačí k tomu sloučit určité reálné pohyby předmětů s pohyby pozorujícího. Předmět bude vnímán jako ještě bližší, jestliže v důsledku zobrazení blízkého předmětu se předmět bude posunovat větší úhlovou rychlostí než by tomu bylo při jeho objektivní vzdálenosti.

Důležitým znakem hloubky je rozmanité překrývání předmětů, kdy jeden z předmětů zakrývá druhý, takže viditelná zůstává pouze nějaká jeho část. V tomto případě se první předmět zdá blíž než druhý. Pomocí tohoto znaku je ovšem možno určit pouze pořadí vzdálenosti a nelze říci nic o jeho velikosti. Zvláště silný prostorový účinek vzniká v případě mnoha překrytí, jako např. při pohledu na horské hřebeny, které vyvstávají jeden za druhým (V. Metzger, 1966 a). Nemají-li předměty zřetelné obrysy, vystupuje dopředu předmět s širším povrchem. Jak je vidět na obr.60, je to rovněž účinný znak vzdálenosti, tj. pro pozorujícího je



Obr.60: Paradoxní kresba, Rybářský prut prochází plachtou loďky (podle W.Metzgera, 1966 a)

obtížné zbavit se dojmu, který odporuje zdravému rozumu, že rybářský prut prochází plachtou loďky.

Odhad vzdálenosti se opírá i o rozdíl v úhlových rozměrech blízkých a vzdálených předmětů.

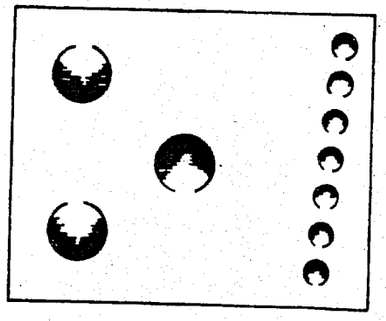
Jeden z posledních výzkumů toho, jak závisí viditelná vzdálenost předmětu na jeho rozměrech, byl proveden americkým psychologem B. Epsteinem (1963). Ten prezentoval zkoumaným osobám v úplné tmě při monokulárním vidění obratmě zhotovené padělky amerických mincí. Vzdálenost prezentací byla stálá, avšak velikost mincí se mohla několikanásobně měnit. Výsledky ukázaly, že zdvojnásobení rozměrů mince způsobilo zmenšení viditelné vzdálenosti dvakrát a zmenšení pak zase způsobilo, že vnímaná vzdálenost vzrostla odpovídajícím způsobem.

Nejsilnější a nejurčitější účinek hloubky vzniká, když rozdíly ve velikosti současně vnímaných předmětů a vzdáleností mezi nimi nejsou náhodné, ale podřizují se jedinému pravidlu přírůstku od jednoho konce povrchu k druhému (obr. 3). Sbíhání paralelních čar, které přecházejí do dálky, a libovolné perspektivní zmenšení rozměrů předmětů jsou pouze konkrétními příklady gradientu velikosti a hustoty (viz kap. I,2). Pro vnímání prostorové hloubky je velmi důležité vnímání povrchu země, reprezentované např. trávou na louce nebo brázdami na zoraném poli. Vzdálenost k jednotlivým předmětům se určuje místem, na němž se dotýkají skloněného povrchu nebo na něm např. stojí.

Z dalších monokulárních znaků vzdálenosti si je možno povšimnout poměrné výšky postavení předmětu v zorném poli. Užití tohoto znaku k odhadu vzdálenosti souvisí s tím, že vzdálené předměty jsou v přirozených podmínkách umístěny výš nežli blízké.

Na vnímání vzdálenosti působí rozdíly v barvě, jasu, rozdíly ve vztahu k pozadí, stupni ostrosti obrysů a detailů předmětu. Působení těchto znaků je spojeno se vzdušnou perspektivou, která zmenšuje nejen jas a kontrasty vzdálených předmětů, ale přidává jim též modravý odstín.

Vliv rozložení světla a stínu na vnímání hloubky není dosud zcela prozkoumán. Podařilo se však zjistit jednu charakteristickou zákonitost: pozorovatel stále předpokládá, že zdroj světla je u horní části povrchu, takže stíny, které jsou odráženy vypuklými reliéfy, zakrývají jejich dolní stranu. Tuto zákonitost lze snadno sledovat pomocí obr.61: jestliže obrátíme stránku "vzhůru nohama", vypuklé části se stanou vydutými jamkami a naopak vyduté části vystupují dopředu.

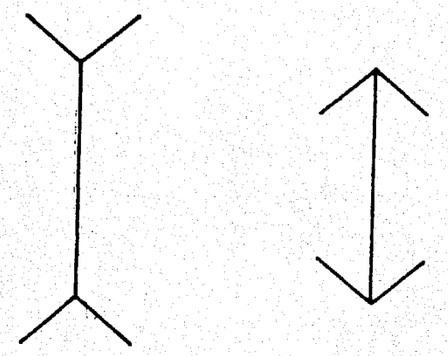


Obr.61: Vliv předpokládaného směru osvětlení na relief hloubky (podle K.F. Findta, 1938)

S vnímáním prostorové hloubky je těsně spojeno vnímání rozměrů předmětů, které je charakterizováno vysokou konstantností. Objektivní odraz rozměrů předmětu umožňuje vidět ho jako neměnný, zatímco projekce na sítnici se mění několikrát. Vlivem působení mechanismu konstantnosti velikosti se předměty při zvětšení jejich viditelné vzdálenosti zvětšují.

To lze ukázat již pomocí gradientu G. Gibsona. Jednotlivé části na obr. 3, které jsou vnímány jako prvky stavby povrchu, který ubíhá do dálky, zdají se být stejné velikosti. Kdyby se na různých úsecích gradientu umístily dva předměty stejné velikosti, byly by jejich rozměry vnímány s odpovídajícím zkreslením.

Podle názoru řady psychologů umožňují tyto poznatky vysvětlit mnohé z tzv. "opticko-geometrických" iluzí. Z tohoto hlediska se mohou dvě části klasické figury Müller-Lyerse (obr.62) interpretovat jako trojrozměrné předměty, řekněme jako roh dvou stěn místnosti a roh dvou stěn domu. V prvním případě se "stěny" jakoby vzdalují od pozorovatele a velikost střední vertikály na obrázku se přeceňuje. V druhém případě střední přímka, jako část vyobrazení "bližší" k pozorovateli, se naopak podceňuje. R.L. Gregory prověřoval tuto hypotézu na světélkujícím modelu figury Müller-Lyerse v úplné tmě a zjistil vysokou korelaci iluze se zdánlivou vzdáleností středních přímek figury.

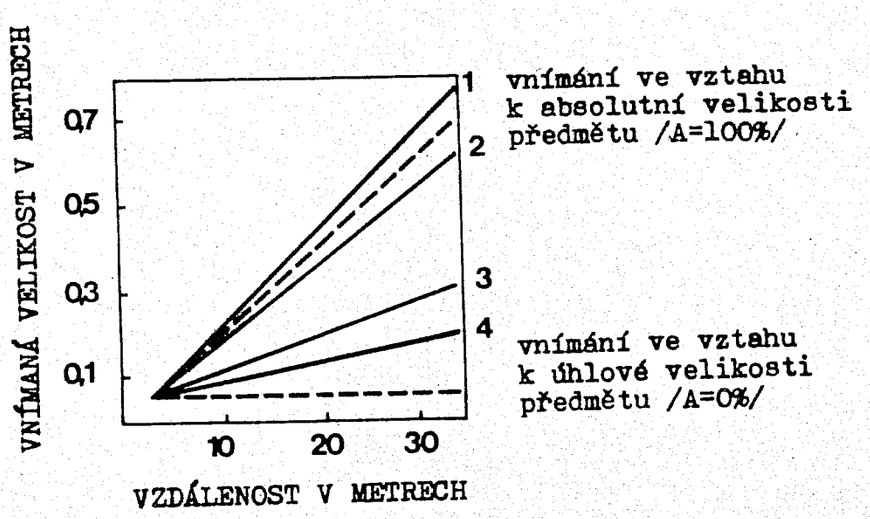


Obr.62: Iluze Müller-Lyera

Vliv uvědomění si vzdálenosti předmětu na vnímání jeho velikosti působí též v tom případě, kdy zkoumaná osoba pozoruje jeho následný obraz. Již v polovině minulého století zjistil E. Emmert, že velikost následného obrazu vzniká úměrně vzdálenosti od promítacího plátna, na němž se pozoruje ("Emmertův zákon" viz kap. IV,3).

Jaký význam má přítomnost znaků hloubky pro vnímání velikosti předmětů bylo ukázáno v klasických experimentech amerických psychologů E. Boringa a Hallawaye (1941).

Zkoumaná osoba byla na křižovatce dvou chodeb. Na jedné z nich byl ve stálé vzdálenosti (3 m) umístěn svítící kotouč, jehož průměry bylo možno podle přání měnit. V druhé chodbě byl umístěn druhý kotouč, jehož vzdálenost se měnila od 3 do 36 metrů. Experimentátor měnil rozměry druhého kotouče tak, aby úhlová velikost byla nezávisle na vzdálenosti od zkoumané osoby 1°. Zkoumaná osoba srovnávala velikost prvního kotouče s velikostí druhého. Pokusy byly prováděny ve čtyřech různých podmínkách: 1. při binokulárním pozorování; 2. při monokulárním pozorování; 3. při monokulárním pozorování štěrbinou rozmanitého tvaru, která zakrývala před zkoumanou osobou stěny chodby; 4. při monokulárním pozorování štěrbinou zorničového tvaru a při pokrytí stěn černým materiálem, který odstraňoval jakékoli probleskování světla.



Obr.63: Vliv znaků vzdálenosti na vnímání velikosti (podle E. Boringa a A. Hallwaye, 1941)
V závorkách vpravo je uvedena velikost koeficientu konstantnosti E.Brunswicka pro odpovídající přerušované čáry

predators, our eyes, set in the front of our heads, are particularly good at judging depth and distance. Because binocular vision helps us to see in three dimensions by giving a slightly different viewpoint to each eye (separate images that are combined in the brain and interpreted as depth), we exist in a world of space and movement. Preyed-on species, however, exist in a different world. Because they must be eternally vigilant, their eyes are placed at the sides of their heads to allow for an almost total view of their surroundings. Where these nonpredatory species have limited depth vision as a result of this anatomy, we have limited peripheral vision and rely on our superior sense of depth to orient ourselves.

This may account for why people who have never seen photographs before may have to learn how to read them.[60] What makes reading traditional two-dimensional (2-D) X-rays so difficult for their readers, for example, is their lack of depth, a problem complicated by poor contrast resolution and visual "noise." Radiological training to read them effectively involves a finely tuned discrimination between the normal patterns and textures of the body and the typical patterns and textures of abnormal conditions, because the details—such as small nodules of diseases like emphysema—are easily lost and may not, or cannot, be seen. Even though digital imaging enhancement and subtraction techniques can improve detail and contrast, even though "smart machines" can read a safe Pap smear, identify a high-risk loan applicant, and interpret a handwritten zip code, it is unlikely that machine readings will ever fully supplant human diagnosis. Human vision is still the most powerful means of sifting out irrelevant information and detecting significant patterns.[61]

This human perceptual ability to recognize patterns and to select relevant data has proven, in fact, to be the most perplexing obstacle in creating Artificial Intelligence (AI), which sees the mind as a computer that processes strings of data in symbols of 0 or 1. After a series of early AI failures which did not attempt to repeat the human processing of information at all, but rather focused on achieving the same outcome, "connectionist" researchers in the 1970s turned to human models in mental processing of experience, that is, to neural net processing and to "fuzzy logic" as the key to understanding intelligence. Rather than the computer approach of storing data and searching through it all to make a match, neurocomputers work like brain networks, learning patterns by clustering data from a number of samples or examples. Researchers like Bart Kosko at the University of Southern California have developed networks that imitate the brain's ability to make connections in the performance of simple tasks.[62] Results have been successful but limited in

scope, however, imitating the brain only in a small way by creating discrete neural patterns paralleling up to only a few hundred neurons.

In other words, neurocomputers can "learn," but only to a limited degree. What the brain does that machines cannot do is to utilize billions of synapses to access the whole of memory and to instantly recognize invariance, integrate it, generalize from it, and extend itself through analogy. Although neurocomputers can perform a variety of tasks that are beyond human capability because of speed, complexity, or dangerous environment, some of the simplest patterns immediately recognizable to the eye are still elusive to machines.

There is as yet nothing that can replace perceptual process on so grand and efficient a scale. Our automatic complex image processing allows not only for the detection of invariances within the ambient optical array, but also for the recognition of gray states where identities bleed into one another, outside of linear logic. Perception corrects judgments, reduces and compresses complex information, filters out irrelevant information, alters memory, recognizes patterns, extends learning through analogy, and does it all instantaneously. As R. L. Gregory has pointed out, "It is just those aspects of control and the selection of relevant from irrelevant data which are the most difficult to mechanize—though they were the first problems to be solved by organisms."[63] Whatever success "smart machines" have had is due to their mimicry of our own neural brain networks, but as physicist Roger Penrose has noted, the "quality of understanding and feeling possessed by human beings is not something that can be simulated computationally."[64]

Neurology of Perception

R. L. Gregory has posited that vision developed only after our sense of touch, taste, and temperature. In all probability, he suggests, visual perception developed out of the sense of touch "in response to moving shadows on the surface of the skin—which would have given warning of near-by danger—to recognition patterns when eyes developed optical systems."[65]

This optical system represents an interface between the brain and the environment. Characterized by cells responsive to minutely differentiated and specialized aspects of the environment, the optical system is a symphony of millions of nerve cells firing in particular patterns, responding to each of the component parts of the final image such as direction, degree of slant, shape, and color through the activation of specialized areas within the visual cortex. No neural response ever achieves its complete meaning alone, however. Within the visual system, cells

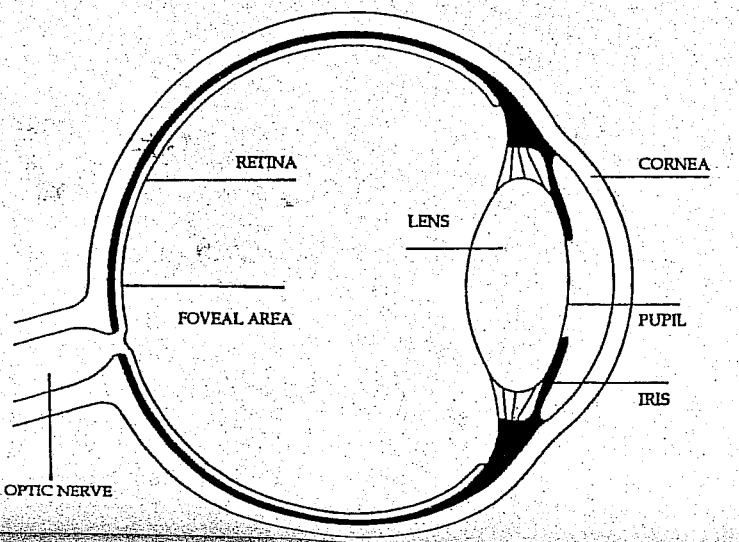
work separately and in concert with one another to activate and to inhibit certain responses, and there is continual feedback among the parts. Perception is a dynamical system that utilizes the input from the body's sensory systems, synthesizes this with memory and understanding, and creates from both an integrated sense of self and mind.

Perceptual process begins first of all as light that bounces off objects in the environment. The process of vision (Figure 1.4) begins when the optic array is focused by the cornea and lens onto the 126 million receptors of the retina—120 million rods and 6 million cones—which line the back of the eye. As the visual system seeks and acts on information from the environment, retinal inputs lead to ocular adjustments and then to altered retinal inputs as the eyes actively engage the environment. Receptors in the retina transform and reduce information from light into electrical impulses ("transduction") that are then transmitted by neurons via the optic nerve, to the lateral geniculate nucleus (LGN) in the brain.

The LGN contains six layers of cells. Cells in the four uppermost, called the parvo-cellular layers, which branch again into two pathways,

FIGURE 1.4

The Eye. Information in light from the ambient optic array passes through the pupil, is focused by the lens onto the foveal area. It then passes along the optic nerve to the brain, first to the LGN and then to the visual cortex.



are responsible for perception of color, some contrast, and spatial resolution. The two lowest layers, called the magno-cellular layers, are responsible for perception of movement, depth, and some spatial resolution. Because the "parvo" layers most probably developed from the more primitive "magno" layers, they share some common functions despite their specialization. From the LGN, the two visual systems link to the striate or primary visual cortex, also known as area V1. V1 is separated from other specialized cortical areas by an area called V2. Together V1 and V2 act "as a kind of post office, parceling out different signals to appropriate areas."[66]

Researchers have delineated four parallel systems involved in the different attributes of vision—one for motion, one for color, and two for form.[67] Color is perceived when cells specialized to detect wavelength in "blob" regions of V1 signal two other specialized areas, V4 and the "thin stripes" of V2, which connect with V4. Form in association with color is detected by a circuit of connections between V1 "interblobs," V2 "interstripes," and V4. Perception of motion and dynamic form occur when cells in layer 4B of V1 send signals to areas V3 and V5 and through the "thick stripes" of V2.[68]

Thus, in the visual cortex, the electrical data sent from the retina is processed in thousands of specialized modules, each of which corresponds to a small area of the retina. In this process, data are reduced and compressed, so that the "image" that the cortical stimulus represents, although stimulated by the outside environment, nevertheless has no physical counterpart in external reality. What it contains, however, is a representative map of the entire visual field.

As Goldstein reminds us, "perception is based not on direct contact with the environment, but on the brain's contact with electrical signals that *represent the environment*. We can think of these electrical signals as forming a code that signals various properties of the environment to the brain."[69] In this process, vision is not a truthful recording sent in a one-way delivery of sensory data to the brain, but an active exploratory process that is cyclical and in which there is continual feedback and interaction throughout the visual system.[70] The visual system, in other words, has its own "intelligence." Because all external data is essentially chaotic and ambiguous, the eye—as an extension of the brain that interfaces directly with the environment—works to detect change and nonchange, and to create meaningful sense out of the rush of stimuli from the external world.

What we see, then, is not a direct recording of what's out there, but a mental configuration that we interpret as an image—the end result of a highly exploratory and complex information-seeking system. In the

visual system, parts interact synergistically in an instrumentalized arrangement that plays very much like a symphony, where neurons simultaneously fire in different areas to produce a stable mental image. In the production of this image, multiple structures become involved: after the visual cortex filters and codes information, it is then sent to as many as thirty-two different locations for further processing. As the brain continues to build on what it learns, these separate bits of information are broken down and efficiently stored in different places, ready to be reconstructed again. When we see, we not only utilize invariance in the ambient optical array but also call on our past experience to make it meaningful.

Perhaps nothing makes this interrelationship clearer than cases of newly sighted people, such as patients whose long-standing cataracts have been removed, who must learn how to interpret the new visual stimuli bombarding them but can draw only on experience rooted in a different sense mode, primarily of touch. As neurologist Oliver Sacks has observed, "When we open our eyes each morning, it is upon a world we have spent a lifetime *learning* to see. We are not given the world: we make our world through incessant experience, categorization, memory, reconnection."[71] Because of this, Virgil, one of Sacks's patients, blind for fifty years since early childhood, found himself more disabled after cataract surgery than before it. Because there is no automatic connection between sight and touch to translate one into a map that can be read by the other sense, Virgil's perceptual map was experientially blind. Without visual learning to establish the visual templates necessary to make visual impressions meaningful, his vision had no perceptual coherence, and everything ran together.

As a result, he lost his confidence and ease of movement, found walking "scary," and was unable to recognize objects without touching them. This extended into the abstract as well, so that to understand the orientation and layout of the house, which he could now see but not comprehend, he had to touch a model of the house. He had difficulty recognizing faces, yet could recognize letters fairly easily because he had learned the alphabet by touch in school. Space, which is an essential aspect of sight perception, was extremely confusing to him, and he could not grasp concepts of size or perspective. Because the sightless live in a linear world of sequence and time where sense impressions are built up in sequence, their perceptual maps give them no useful information in perceiving simultaneous space and depth.

Richard Gregory tells a similar story of S.B., a patient who was blinded in his youth and whose sight was restored by a corneal transplant when he was fifty-two. He, too, understood that the blur he saw

was a face only because he could recognize a voice and knew that voices come from faces. Having lived in the sequential and material world imposed by blindness, he could make no sense of a two-dimensional photograph, seeing only patches of color. Visually immature, he did not perceive the usual optical illusions which so interest Gregory, such as those associated with figure-ground reversal, ambiguous figures, apparently bending parallel lines or apparent movement. Without well-established visual experience, he could truly see only what he could first feel. As he discovered that some of the things he loved and found beautiful by touch were visually ugly, that he could not make up his deficit in visual learning, and that socially he could not fit in this new world, he became progressively more depressed and eventually died within two years of his corneal transplant.[72]

While both men had learned to become fully competent in perceiving the world through sound and touch, both their sense of wholeness and their competence were shattered in a perceptual transition they were powerless to make. Ill equipped to perceive the world visually without a developed visual cortex, they could see but not perceive in a visual mode. The difficulties experienced by both men point up both the essential perceptual wholeness sought and developed by the psyche, and the importance of the role played by visual learning and memory in visual perception.

Contemporary visual theories generally assume that the visual memory in sighted people holds a set of representative shapes that capture invariant properties of objects in their various orientations, and that it is these invariant patterns that were lacking in both men. As experience in the visual world grows, these patterns become templates that allow us to recognize basic shapes and to approximate the in-between shapes of various positions. In the process of visually recognizing something, it is fairly well agreed that the retinal image is checked against an experiential template held in long-term memory, and that the memory representation that provides the closest match is selected as the object seen.[73] Hand shadows on a wall, which can be made to imitate rabbits or any number of other characteristic animal profiles, provide simple yet clear examples of such template shapes.

Although it is tempting to assume generally that memories are true in the sense of constancy, however, like the rabbit profile cast on the wall, memory is probably never the exact same shape twice, but only a pattern which remains flexible despite fluctuations and changes over time. Gerald Edelman, for example, sees memory as something that is continually shifting and changing under the influence of new experience. He stresses an open, dynamic and reciprocal relationship between percep-

tion and experience, viewing memory not as fixed, but as ever-evolving and re-creating itself within an open system.[74]

Neuroscientist Bessell van der Kolk also postulates that cognitively processed thoughts and traumatic experiences are recorded and stored separately in different parts of the brain. When people consciously remember traumatic events, blood flow increases to the amygdala and the visual cortex may be stimulated at the same time, resulting in intense visual flashbacks. Routine thoughts, however, stimulate the Broca's area, which is involved in verbal language. Van der Kolk and others speculate that because the Broca's area is not stimulated when traumatic memories are recalled, traumatized people may have great difficulty in verbalizing what has happened to them.[75] This may indicate that when the brain represses the anxiety-provoking experience, it is stored differently from ordinary memories, and may therefore be less accessible to conscious thought and verbalization.[76]

In the process of normal perception, exactly how much preprocessing is done in the retina to match the memory-shape and how the retinal input and memory representations are transformed to bring them into correspondence for perceptual recognition is another area of speculation. Models for shape recognition vary widely and range from the whole shape to simple geometric feature detection such as vertical and horizontal lines, curves and angles; to Fourier models in which the optic array is decomposed into a trigonometric set of components sensitive to intensity, orientation, and spatial frequency; to structural descriptions in which shapes are represented symbolically.

Holistic versus Analytical Perceptual Views

Current schools of thought on perception generally fall into one of two groups. J. J. Gibson's view of perception, which has its roots in early Gestalt theory, supposes that perception is a holistic, direct interpretation of the environment, a natural mechanism for detecting ecologically significant information. The other is essentially analytical, following a computerlike model of information gathering and the build-up of meaning from pieces of separate information gleaned from scanning the environment.

From Newton up to the point of Gibson's publication of his ecological optics theory in 1960, it had been assumed that the essential stimulus properties of light lay in its content—that is, the energy manifested in wave-length and intensity—and that it was this content which resulted in vision. Gibson, however, placed the emphasis on relationship, positing that it was the *transitions* in the natural optic array, not the energy content of the light beam itself, which signal objects as "out there." It is

primarily the *differences* "between spots or patches of light, not the spots or patches themselves"[77] which we see. It is therefore *change* that signals vision and *relationship* that carries meaning.

In this view, as we move about within the ambient optic array, those aspects of the environment which remain constant suggest the forms of objects and people as well as the scale of things. The visual system actively explores and detects information directly from the environment.[78] We can tell size and distance, for example, without elaborate mathematical calculations by sweeping the environment as if it were a grid, with the size of its squares diminishing proportionately into the distance. We recognize shapes by what stays constant, and we see movement by recognizing what aspects remain true while others change. It is not surprising that the impetus for Gibson's theory of Ecological Optics began in his work during World War II with pilots, particularly with the difficulty of landing airplanes on aircraft carriers.

What the brain does, then, is to extract the invariant features of objects from the ever-changing flood of information it receives from the environment, actively constructing a working image of the world. To do this, the brain utilizes an incredibly complex organization of interrelated specialized functions which continually send electrochemical messages back and forth, and which ultimately combine to give us a unified view of the world.

One of the foremost researchers working from a computerlike model of perception, David Marr, has suggested that perception is a three-stage process built in much the same way a computer program is structured and organized: First, a "primal sketch" is formed in which intensities and major features such as the location of edges, corners, bars, and blobs of different size and orientation are discerned. Next, the more subtle characteristics of surface texture and depth are referenced to the viewer in a "$2^1/_2$-D sketch" that is viewpoint-specific. Finally, a three-dimensional mental model emerges which is centered in the object itself.[79]

Irving Biederman has focused on component recognition of three-dimensional objects through analysis of basic volumetric components termed "geons." These geons are basic configurations—like cylinders, cubes, bricks, curved macaroni, flat topped pyramids, megaphones, and so on—which act like short-cut templates for perception. We recognize these as invariants within three-dimensional shapes, so that perceptual process is speeded up. Objects composed of two or three of these basic configurations can, he believes, be differentiated easily from others by the way the various geons are put together.

Other researchers have directed their attention to texture analysis, which involves the most basic lines and directions within perception.

Anne Treisman, for example, has identified what she calls "primitives" of movement, curve, tilt, color, and line end. In a two-stage process these belong to an automatic and unconscious stage of processing which she calls the preattentive stage. In the subsequent stage of consciously focused attention they are combined to form integrated objects.[80]

Julesz has also identified line segment terminations and crossings, which he terms "textons," as part of the preattentive-level as well.[81] Written language provides an easy illustration of such shape detection. Because letters are symbols that consist of a variety of basic yet distinctive endings and lines, proofreaders can rapidly catch spelling errors because they can detect what does not belong almost instantly. Because we read the shapes of words rather than their individual letters, the way letters are crossed and how letters are serifed or ligatured immediately cues us to whether the letter should be there or not. This is also the way radiologists read X-rays: first internal inconsistencies are spotted; then they are consciously examined to determine the exact nature of the irregularity.

The question, however, is not so much which approach is correct, as it is how they fit together to suggest more comprehensive models of perception. LeDoux's research on emotional processing, for example, incorporated apparently contradictory research into a model of coincident neural networks. Like the recognition of a dual visual system of "magno" and "parvo" pathways that divide gross and detailed functions in visual processing, a recognition of dual networks allows for both larger recognition and detailed building by implying "a physiological rationale for distinguishing two ways [in which] meaning can be achieved cognitively, one that is primitive and rapid, the other more complex and deliberate."[82]

Gestalt Roots

The dynamic principles that organize perceptions into the meaningful wholes were first effectively explored by the Gestalt psychologists Wertheimer, Köhler and Koffka early in the twentieth century. Emphasizing the inherent and the innate over learned experience, they studied how spontaneous forces combined and separated elements to form different entities and how wholes were created out of perceptual parts. Although the concept of the "gestalt" is often described as the whole being different from (or, even more ambiguously, as "more than") the sum of its parts, it may be more accurate to say that a gestalt implies a configuration that is so inherently unified that its properties cannot be derived from the individual properties of its parts. It was the Gestalt

psychologists who first focused on relationship as the key to meaning, and it is this body of theory to which Gibson's ideas are most closely related. Music provides a ready example of how the gestalt works, as well as a simple metaphor of how the brain functions neurologically.

For example, Christian von Ehrenfels, who introduced the term "gestalt" into perceptual psychology, observed an essential parallel between perception and music that revealed the inherent unities of both.[83] Melody, von Ehrenfels believed, must be a function of *relationship*, since when it was transposed into another key, where all of the notes were subsequently different, it was still perfectly recognizable as the same melody. Today several researchers have theorized that in this neurological symphony there may in fact be no central conductor, but rather a kind of democratic synchrony among parts. Gestalt thinking prefigures this thought and places stress on the shape of the internally interactive whole and the synergy created by it.

Erich von Hornbostel in his 1927 essay, "The Unity of the Senses," too, likened perception to the unifying principle in art. In art, he observed, "what is essential . . . is not that which separates the senses from one another, but that which unites them . . . It is the same organizing principle which calls forth organism from mere substance, and which binds the stream of happening into wholes, which makes the line a melody which we can follow, and the melody a figure which we can see in one glance. . . the unity of the senses is given from the very beginning. And together with this the unity of the arts."[84] From the mere substance of the notes of a song or the brush strokes of a painting arise an organic whole imbued with life and wholeness. This is the same essential unity which Aristotle saw as a fundamental principle both in "common sense" and in well-constructed drama.

Gestalt theory at its inception represented the first revolution in thought to break away from the empiricist view of a straight-arrow connection from sensation to brain, to proclaim in vision the inherent sense of unity that the hologram implies, and to recognize the importance of relationship in perceptual meaning. Gestalt primary principles—of simplicity, regularity, symmetry and good continuation—have provided the foundation for more current explorations in perceptual processing.

In early perceptual experiments with light at Frankfort-on-Main,[85] about the time of World War I, Max Wertheimer found that by illuminating two slits in a screen separated by a brief distance within a fraction of a second apart, he was able to produce the effect of movement. Calling the effect the "phi phenomenon," Wertheimer, together with Köhler and Koffka who observed the experiments, began to evolve the revolutionary theory that the key to perception lay in relationship—in something

different from what is found in separate sensations. Up to this point, the focus had been on the sensations themselves. These were considered as content, and the predominant idea was that to understand them, one had to break them down further.

What the phi phenomenon seemed to say, however, is that scientific dissection could never yield adequate answers, because the principles of perception lay in the spaces *between* the elements rather than *in* them. Meaningfulness was to be found in the reaction among the elements and in the relationship which formed a unified whole, not in the separate parts themselves. Focusing on relationship, the Gestalt group sought, according to Koffka, an isomorphic theory of perception that would "lay the foundations of a system of knowledge that [would] contain the behavior of a single atom as well as . . . a human being, with all the latter's curious activities which we call social conduct, music and art, literature and drama."[86]

Today the focus in the study of perception is again on relationship, primarily in terms of how the specialized areas of the visual cortex work together to create a unified perception. It is clear, for example, that reentrant connections allow information to flow both ways between different areas of the visual cortex, that a kind of temporal synchrony is achieved among firing cells, and that some kind of multistage integration occurs simultaneously among specialized parts. "It is no longer possible," comments neurological researcher Semir Zeki, "to divide the process of seeing from that of understanding . . . nor is it possible to separate the acquisition of visual knowledge from consciousness."[87]

From Phi to AM

Through the work of Zeki and others, earlier Gestalt ideas about phi phenomenon have now been considerably nuanced. From an example of the whole as different from the sum of its parts, the phi phenomenon has been recast to reveal the existence of two distinct systems, one responsible for perceiving movement between brief flashes and the other for perceiving movement between long flashes.

As a result of revisiting Gestalt psychologists' experiments with "phi" we have come to understand that the lower level "magno" system quickly detects movement, depth cues and contrast in borders, while the "parvo" system more slowly detects color, shape, and orientation.[88] In Apparent Movement (AM), "the impression of movement from two actually stationary stimuli," according to Gregory, "stems from processing early in the visual system or even in the retina . . . the cortex does not receive signals first from one stimulus, then from the other; rather it

receives a single signal from the motion processor."[89] Phi phenomenon occurs because the brain interprets short-range apparent motion and real motion in the same way.

In the detection of real motion (RM), all the cells in the prestriate area called V5 are responsive, and most are directionally selective,[90] but these areas are attuned to detecting real motion as it occurs normally in nature. When we watch a film, some researchers speculate, because short-range motion detectors in the brain cannot neurologically distinguish between real motion and apparent motion, the flashing of images in rapid succession on the movie screen results in the illusion of continuous motion.[91] Short-range AM itself is merely a consequence of the fact that cells designed to respond to real motion, respond equally well to other stimuli with the proper spatial and timing characteristics.[92] Film changes in luminance are detected in the same way we detect real motion in nature.

Although today the progression from one frame to the next in film is standardized and apparently seamless, early film, which was recorded at speeds between sixteen to twenty-four frames per second, often was seen as "flickering" on the screen as the eye became slightly aware of the time when the shutter was closed and the film mechanically advanced another notch. When film was stabilized at twenty-four frames per second with the advent of synchronized optical sound tracks, the flicker disappeared—even though the idiomatic expression of "seeing a flick" for "going to the movies" didn't.

Frame movement is also responsible for many perceptually convincing filmic special effects, such as when miniature models are used to substitute for elaborate land or cityscapes in disaster films that require convincing footage without the expense of full-scale production. When miniatures are filmed at high speed ("overcranked") and played back at standard speed, the effects of normal gravity, size, and weight are simulated, and we see the event as if it were happening in full scale, in actual time.

Originally limited in speed by the mechanical movement required in pin-registered cameras, today's ultrahigh speed cameras move light past the film, rather than the film past the light, achieving astonishing resolution and realistic special effects. In contrast, films which are undercranked at fewer than twenty-four frames per second but are played back at standard speed have action which looks artificially fast. When action is slowed down and undercranked, as in a choreographed martial arts sequence, it appears normal when played back at regular speed. This effect can also be used to advantage for deliberate special effects which require slow and careful choreography—such as sword fights—but which gain in action and suspense when played back at normal speed.

Event Perception, Media, and Logic

Movement perception is so essential to our being that, like color, it is registered immediately and automatically by the perceptual system. The theory of "event perception," evolved from the work of Gunnar Johansson and Gibson's Ecological Optics theory, which recognizes movement as the key to an "event." Because the visual system has evolved to alert us to danger or to the presence of potential food, we respond to movement first of all as a signal of potentially positive or negative change. An event, then, is something that "happens." When changes in the visual field occur, they demand our notice because through movement, we are better able to understand the object's structure and to resolve ambiguities in the environment. Movement reveals three-dimensional form and separates figure from ground. This is why animals that depend on camouflage for survival freeze when threatened. When they move, they reveal their characteristic shape, size, and direction of action. In fact, whatever moves in any apparently meaningful way in our environment gets our attention.

This simple fact of perception has had reverberating impact in terms of media as entertainment. This is why, despite the fact that we may recognize a film or television show as inane, we may continue to watch it anyway. As McLuhan insisted, part of the reason we watch television is simply because the picture moves. And action films are the easiest way to get and keep our attention.

Because rapid advancement in computer abilities have made spectacular special effects possible, we often see more time, energy, and money spent on action sequences than on script development, and often films are strung together as visual events rather than as artistic wholes. The box office success of films like *Terminator II: Judgment Day* (U.S.A., 1991) attests to the ability of action alone to distract attention from weak plot and inane dialogue. It may, in fact, be only *after* the experience of the film, *if* we analyze the action, that we realize that events did not really make *intelligent* sense at all.

The effect, however, can also be seen in older classic films as well, such as Howard Hawk's mystery thriller *The Big Sleep* (U.S.A., 1946). Based on Raymond Chandler's novel, the film is composed almost wholly of a rapid series of violent outbursts, powerful sensual interactions between the charismatic duo of Bogart and Bacall, and dialogue too quick to analyze. Things happen so fast and the images are so seductive that it may be only after the film is over that we realize that we never really understood what was going on or why. (With Bogart and Bacall on the screen, it probably doesn't really matter anyway.)

Events which occur closely together in time not only get attention but may also become endowed with an inherent cause-effect logic as well. According to Albert Michotte, in fact, close timing of events may, in fact, *force* the impression of causal relationship on our perception despite their mere chronology.[93] This loose perceptual "logic" further explains why action films, despite lack of plot or unified theme, *seem* to tell a story where none essentially exists. Steven Seagal's popular film *Under Siege*, for example, is typical of this kind of "plotting": the take-over of a Naval ship by evil men bent on extortion is merely the set-up for a series of events involving increasingly violent stunts and a series of special effects.

This common and basic error in abstract reasoning may derive from the perceptual phenomenon of relationship derived through proximity and similarity. In perceptual process neighboring points do not have to touch to appear to be logically connected as part of a larger meaningful pattern, in the same way astronomers first perceived constellations in the scattering of night stars. Figure 1.5, for example, shows how similarity and proximity can work to connect separate units. This perceptual tendency may also be factor in such logical fallacies as the nonsequitur (it does not follow) and post hoc ergo propter hoc (after this therefore because of this) simply because perceptual "logic" seems to indicate cause-effect sequence automatically. The reason for this, again, lies in experience.

Gestalt theory was the first to clarify in perception the unconscious and automatic processes at work to organize sensation into experience, suggesting that the process of compression and reduction of visual information pares perceptual elements to their simplest, most efficient form.

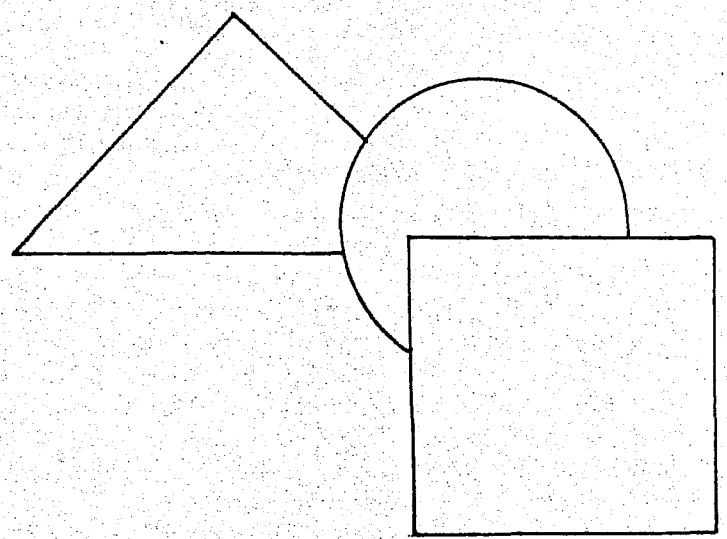
The "Law of Prägnanz," which is the first principle on which all other gestalt principles are based, states that a "psychological organization will always be as 'good' [i.e., simple, regular, symmetrical] as the prevailing conditions will allow."[94] As the principle which unifies perceptual elements into a single harmonious whole, this Law of Prägnanz is the early twentieth-century counterpart of Aristotle's concept of "common sense," the gestalt essence of which is efficiency achieved through simplicity, regularity, and symmetry.

Perceptual Principles and Artistic Manipulation

This efficiency begins with stress and with simplicity as a stress reducer. We see an incomplete near-circle as a circle, for example, because the internal stresses of a simpler figure are less. The closer and more like the parts, the greater the attraction among them; the greater

FIGURE 1.5

Gestalt "Good Communication." According to this law of perception, the eye will complete lines according to the simplest, "best" shape suggested. These shapes are perceived as a square in front of a partially obscured triangle and circle.



the distance and inequality, the less stability and the less the pull toward unification. Likewise, an open-lined figure, even a series of dots, will be seen as a single triangle, a circle, and a square if, when adding "missing" lines or dots, the resultant mental figures approximate those basic shapes. For the average person, the process is never even noticeable: the eye-brain simply naturally groups elements and "fills in" space to create the "best" and most symmetrical forms (Figure 1.5).[95]

The nineteenth-century Impressionists and Pointillists recognized this before perceptual psychologists did and used it to great advantage to capture the "impression" of reality. Through patterns of light on canvas they seized the moment: artists like Cézanne, Renoir, Monet, and Manet used elongated blobs and round dots of paint distributed in varying densities on the canvas to induce the viewer's eye to create familiar shapes out of simple dots and strokes. Variations in color and texture, rather than specific line edges, are interpreted by viewers as the boundaries of objects, separating them from their backgrounds, and like areas combine to form the shape of familiar objects and people. If impressionistic paintings are viewed close-up, this sense of edges blurs

because the forms and textures of the paint become isolated from each other. At a distance, however, the edges emerge, as larger areas begin to "pull together" perceptually and edges are created by differences in color or brightness. In Pointillism, the effect is even more pronounced since its technique relies on single dots of uniform color and brightness.

The effect of edge boundaries is also enhanced by the subjective perceptual phenomena known as "Mach bands," named after their discoverer Ernst Mach. These are bright and dark strips that appear at the edge of bright and dark areas respectively, accentuating pattern contours. A part of the natural functioning of the visual system, Mach bands appear in any distribution of light and dark as a result of perceptual "lateral inhibition" when photoreceptors in the retina mutually inhibit one another at the boundary between light and dark fields. The same phenomena can also easily be seen in newspaper halftone images where line screens are coarse enough to enable viewers to see the break-up of images into different sized dots within uniformly sized spaces. The smaller the dot and the more white space which then surrounds it, the lighter the area appears. The larger the dot, the darker the area appears. At a distance, as with impressionist paintings, the visual system will discern patterns that create the image, and contours will be enhanced by the Mach band effect.

Other artists, rather than capturing the external patterns of light, have experimented with zones of vision to create experience. Proxemics researcher Edward T. Hall points out, for example, that if viewed by a fixed stare at the appropriate close distance, Rembrandt's paintings can become three-dimensional because he utilized the three sight zones of foveal, macular, and peripheral vision. When the eye of the observer rests on the most detailed center of the painting (comparable to the area that the fovea of the eye can discern in great detail), the other areas around it with less detail will coincide exactly with the viewer's three sight ranges, and a three-dimensional effect will be reproduced. Hall also observes that the same thing is true of other artists such as the Dutch landscape painter Hobbema, whose large detailed canvases, when viewed from a distance close enough to place the outside of the canvas just outside the field of vision, give the impression of actually viewing the countryside. One can look straight ahead into the distance, up to the trees, or down to a brook.[96]

Conversely, much of the impression of distance in perception is due to a progressive loss of contrast in areas of bright and dark as distance increases, primarily as a result of atmospheric perspective. The more particles—such as dust or water molecules in mist—through which the object is seen, the more distant it will appear. On clear morn-

ings particularly after a night rain, for example, far away objects such as houses can seem close enough to count the windows. By late in the day, however, the accumulation of smog from car traffic or industrial waste can make the house itself barely discernible. Experience tells us the house remains in the same location but is obscured by the atmosphere, but in unfamiliar circumstances, we tend to use the gauge of the atmosphere to which we have become accustomed. For this reason, city dwellers are often confused by apparent distances in open spaces such as the desert where there is little air pollution. Distant mountains appear deceptively close, and many tourists have walked for hours toward a destination they believed to be only a short walk away.

This phenomenon is exploited extensively in film to create or extend sets in order to avoid the time and cost of building or traveling. The impressive sets of *Gone with the Wind* (U.S.A., 1939), for example, which so powerfully recreates the antebellum South and the tragic destruction within the Civil War, are mostly matte paintings, with the action filmed in Culver City, California. The "latent image matte painting" technique used in the film involves blocking out part of the image during shooting so that it remains unexposed. In the studio, a painting is done on glass by a matte artist to the size and specifications of the missing scenery, and this is then exposed onto the original film. Sometimes called "photo-impressionism" by practitioners, the art of matte painting is to know exactly how much detail to include in the painting to create the impression that if the camera looked closer, it would indeed find full-scale reality. Over a hundred matte paintings were used in the production of *Gone with the Wind*, including those showing Tara itself.

In the tendency toward efficiency, Gestalt theorists observed, too, that a system left to itself will lose its asymmetries and become more regular as it approaches a time-independent state.[97] This regularity is organized by forces of cohesion and segregation. Equality of stimulation produces cohesion or unification through similarity; inequality or difference produces segregation. This is the principle behind the perceptual associationistic logic discussed earlier. Lines placed closer together and similar colors or shapes tend to form units that are segregated from an apparently receding background. Camouflage can successfully fool the eye by simply repeating in the foreground object the background pattern—which tends to be more unformed and without definitive contours—causing it virtually to disappear. Gestalt psychologist Kurt Koffka explains that foreground shapes are seen as separate only when forces that segregate the figure from its field and hold it in equilibrium are brought into play.[98] In recent visual textures studies, Bela Julesz has found that connectivity detection is involved in preprocessing the image, even before form recognition itself can occur.[99]

FIGURE 1.6

Gestalt Face or Vase? In this classic Gestalt illustration, figure and ground reverse as the vase and the profiles alternately assert themselves as figures.

A classic example of the phenomenon of figure-ground formation is the Rubin drawing of two faces in profile (Figure 1.6), which alternatively transforms itself into a vase, depending on which we see as figure and which as ground. When the forces for segregation and cohesion are equivalent, ambiguity results: figure and ground alternate as each asserts itself to become the dominant figure. The vase/faces illustration is ambiguous because it vacillates between two interpretations and cannot be resolved conclusively into one or the other. In the illustration (Figure 1.7), which was first published in *Puck* in 1915 as "*My Wife and My Mother-in-Law*,"[100] whether we see the old woman or the young woman first, we are not only likely to stop looking after we find the first figure, we are also likely to have some difficulty locating the second one. Once we see both, they tend to alternate, and it is difficult to fixate on one.

This is also how perceptual principles imply expectation. Just as we create defined shapes from ambiguous sketches, or read them into clouds

FIGURE 1.7

Wife or Mother-in-Law? First published by Hill in 1915, this classic figure alternates portraits of a young woman turned away and an old woman in profile. The nose of the older woman doubles as the young woman's jaw line.

or night stars, we also tend to extend any suggested continuing pattern along the direction previously established, since this also lends stability and creates meaning. A curve, for example, "will proceed in its own natural way, a circle as a circle, an ellipse as an ellipse, and so forth."[101] The suggestion of a shape continues that shape until it is complete, just as the suggestion of a pattern implies its continuance. This "Law of Good Continuation" suggests how we close and continue symmetrical patterns. These in turn become more stable the longer they are maintained.

If as Gregory suggests, perceptual patterns provide the foundation for abstract thought and reasoning, then it is possible to see in this basic

principle of good continuation the roots not only of legitimate generalization but also of negative stereotyping as well, together with the strong level of conviction which some concepts gain over time. On the most basic level of perceptual good continuation, Julesz has found that a person can be influenced by a stimulus not even consciously perceived and that the content of an initial image may impress itself on a subsequent ambiguous image undetected.[102] In this same way, in true subliminal advertising (discussed further in Chapter 6), the likability of the images that surround the product become associated with the nature of product itself.[103]

In the expectation inherent in this concept of good continuation, the Gestalt approach emphasizes inherent perceptual principles rather than learning and experience, but later constructivist psychologists have tempered this view considerably in their own approaches. Although Gibson's ecological optics stays within the Gestalt tradition, for example, stressing that there is enough information directly available in the optic array to discount further processing, the constructivist approach stresses the role of experience in the active observer in mentally processing the whole image. Hochberg, for example, has proposed that saccadic eye movements are part of an active process of mental mapmaking in which parts are pieced together to form an integrated whole. In Biederman's theory mentioned earlier, too, it is primarily our experience which allows us to recognize the shapes of objects from geons, even when they are occluded or partially masked. In the cognitive approach to perception, stress is placed on the role that expectations, memory, and reasoning play in completing the whole.

Interestingly, however, recent research has identified major anatomical subdivisions at the earliest stages of vision, lending credibility to the concept of "visual intelligence" prior to the influence of experience on perception. Discrediting memory-based high-level cognitive explanations for depth perspective, for example, Harvard researchers Livingstone and Hubel have found that simple interactions initiate automatic interpretation of a two-dimensional image into three-dimensional information at a very early point in the visual system, not at higher levels of cognitive processing. Having confirmed and traced the presence of the "magno" system which perceives movement before processing form, and the "parvo" system which is influenced by cognitive factors and perceives form, for example, the researchers "were struck by the similarity between the list of functions ascribed to the magno system and the Gestalt psychologists' list of features used to discriminate objects from each other and from the background."[104]

Whether the stress is on the initial whole or on the processing of parts to build that whole, however, the principle of good continuation

focus, which equalizes the clarity of the two figures, the two appear to be different sizes, but right next to each other. Without such cues as a gradually diminishing landscape or blurring of the remote figure, the two people seem to be in the same location.

Such filmic special effects and contrivances like the Ames room remind us that "the map is not the territory," and that, as art and perceptual theorist E. H. Gombrich states, "What we see through the peephole does not directly and immediately reveal to us 'what is out there'; in fact, we cannot possibly tell 'what is there'; we can only guess, and our guess will be influenced by our expectations."[107] This is also one of the reasons J. J. Gibson's theory of Ecological Optics stresses that perception should be studied within a natural environment, where people move about within the ambient optic array. As the perceiver moves through the environment, the light reflected from textured surfaces provides information on size and layout directly through invariants—those aspects that do not change within the changing viewpoints. If, for example, the peephole in Ames's room or the camera in *Attack of the Fifty Foot Woman*, were to be moved just slightly to the left or right, the whole of the illusion would be destroyed. This, according to Gibson, is how we perceive in reality: by moving about in an ever-changing environment.

Multisensory Surrounds and Virtual Reality

Recently, special effects have broadened into attempts to overcome the limitations of stationary perspective altogether by developing multisensory surrounds, in which the whole perceptual environment is manipulated in terms of sight, sound and movement. Expensive to produce and most generally accessible to the public in "theme parks" such as Florida's Disney World or Universal Studios, these simulated environments, usually in the form of film rides, move the viewer up, down and sideways in a choreographed computerized program that is coordinated with high resolution film images on a wide-angle, full peripheral view screen. The sense of forward movement is created by manipulating the gradient of optic flow in the visual field while providing enough hydraulic movement in the seat platform to fool the viewer into feeling that he or she is actually experiencing the ride. A similar ordinary experience occurs when, if we are seated in a stationary train and the train next to us begins to move backward, we have the distinct feeling that it is our train that is moving, and that it is moving in a forward direction. In this example the visual alone creates the illusion of motion. In the film ride, when the visual is combined with high-resolution sound that grows and fades in appropriate directions as if things

were rushing by us, and the platform is coordinated to the screen action, the illusion is almost total.

Universal Studio's "Back to the Future," an IMax® simulated ride, is typical of the genre in its devices and masterful engineering. Developed as a thematic off-shoot of the 1985 film written and directed by Robert Zemeckis, the "ride" utilizes a simulated DeLorean car mounted on a four-axes motion base which can move fore and aft, up and down, pitch forward and back, and also roll. Sound waves injected into a highly sophisticated hydraulics system create the sensation of surface texture as you "ride" over rough surfaces. As one of the car's occupants, you feel you are actually moving and participating in a real event, not merely viewing one on a screen. The effect is a recreation of experience and, like perception itself, involves the coordination of the other senses within a perfect synthesis. Perfectly timed coordination is the key: sixty computers operate two giant screens and twelve ride vehicles. They also synchronize the 10,000 watt multichannel surround sound system and IMax high resolution image to the car's movement to within 1/24 of a second, stimulating several senses simultaneously.

Part of this illusion is, of course, based on anticipation. As the illusions created by Ames suggest, we recognize a chair in a disjointed set of wires because we know and understand a chair; likewise, simulated environments rely heavily on suggestibility and prior experience to determine exactly how much and how many sensual stimuli are necessary to satisfy and sustain the illusion.

The trick for theme parks—as for matte paintings in film—is to find an appropriate balance between the lowest costs and the most convincing experience. Like the Impressionist painters of the nineteenth century who used minimal stimulus, so too today, visual technologists have found that sometimes less is sufficient. High-definition television (HDTV), for example, was expected to be instantly a high-demand consumer item in technologically conscious Japan when it came on the market. Surprisingly, however, it was found that only one aspect of HDTV—its wider screen—was sufficient to ensure purchase, and that a satisfactory sense of higher resolution could be obtained by affordable technology that simply doubles the lines. As of this writing, HDTV is seen as not as the most probable next step in television viewing but as the one after. As consumers become used to the level of verisimilitude within this format and exposed to other more fully simulated environments, they will then demand the more sophisticated resolution of true HDTV.

Other efforts to change passive 2-D media into fully interactive 3-D experiences have resulted in the illusion dubbed "Virtual Reality" (VR)

may be said to imply a completion along previously established lines, whether of form or of experience. If, for example, we are led to anticipate what we are about to perceive, any ambiguous stimulus tends to be seen as a reflection of what we expect. This is graphically illustrated in the example from Fisher[105] which progressively modifies the face of a man to become the body of a woman (Figure 1.8). In the ambiguous stimuli at center, a person beginning to read from the left will see the face of a man, and a person reading backwards from the right will see a woman. What is true for the illustration is also true for perception in general: as a sensually derived and mentally completed process that gives meaning to what we see, hear, feel, taste, and smell, perception actively utilizes past experience and current values, attitudes, and needs to anticipate and to interpret the world around us.[106] We are often reminded by perceptual psychologists that we do not see what is there, but rather—preconditioned by need or prior experience—we see what we want or expect to see.

Expectation can also lead to misperception in situations that seem incontrovertibly unambiguous as well, where perception may lead us to thoroughly false conclusions as a result of "built-in" perceptual bias. Artist Adelbert Ames, for example, has designed a number of trompe l'oeil pieces that are absolutely convincing from a particular perspective, but which when seen from other points of view reveal a totally different reality. One Ames "chair," for example, observed through a positioned keyhole shows a regular chair, but seen from another perspective reveals that this illusion is created by carefully hung but unconnected bars suspended in space at different distances and at odd angles, with a rectangle representing the seat painted on a backdrop. The equally famous Ames room illusion also effectively convinces us that men of different sizes are close to one another in a normal room, while in reality, they are the same size but positioned far apart in a room in which the left corner is twice as far away and lower than the right corner. The same effect can be achieved by showing two figures at different distances yet in clear focus, against a background with no depth clues.

This is essentially the same device often used in film "special effects," especially in horror films, where the camera becomes the controlled peephole through which the action is perceived. In the horror classic *Attack of the Fifty-Foot Woman* (U.S.A., 1958) and its 1993 remake for HBO television, for example, special effects create the sense of a woman who grows to fifty feet as a result of an encounter with aliens by simply manipulating perspective: she is positioned well in the foreground, surrounded by miniatures, while her husband is placed a good distance away, within a normal environment. With the use of depth of

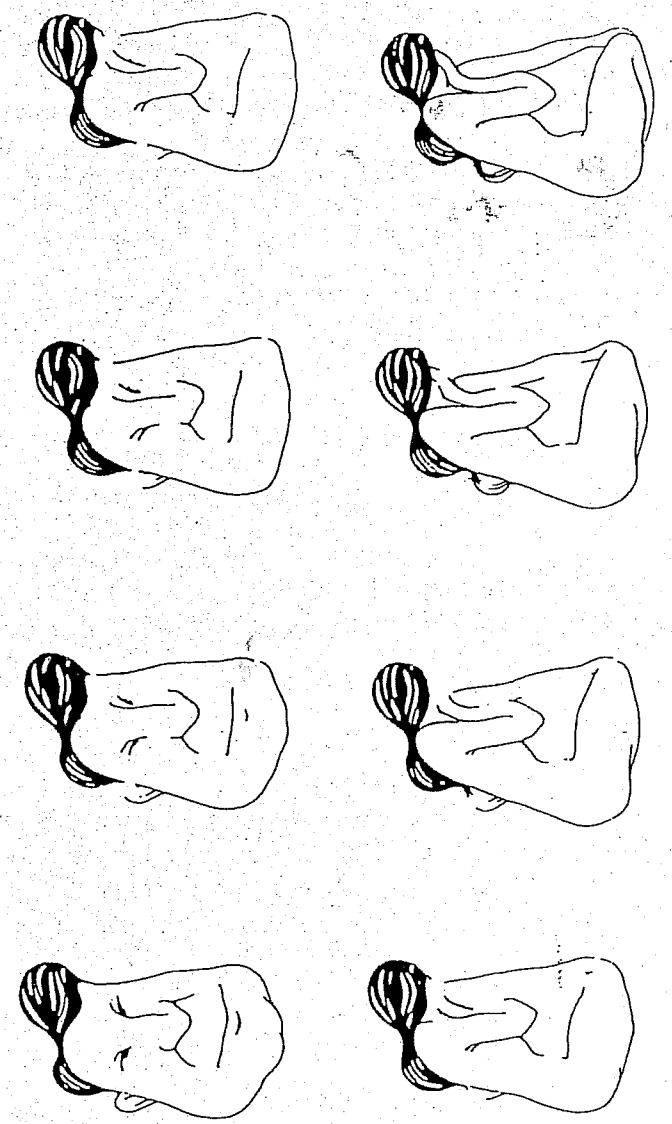


FIGURE 1.8
From Man to Woman. The last figure on the right in the top line and the first figure on the bottom line may be seen as metaphors for the ambiguity of experience, into which either a man or woman may be visually read.

Illustration by G. H. Fischer. Reprinted by permission of the artist and Psychonomic Society.

by Jaron Lanier in the mid-1980s. First pioneered by the National Aeronautics and Space Administration (NASA) as a way to simulate extraterrestrial flight experience, VR was soon shown to be relatively inexpensive.[108] Lanier was the first to develop head-mounted stereo screen displays, the "dataglove" and the "datasuit" to deliver multisensory (sight, sound, and touch) information within interactive artificially engineered environments. In VR as it is usually understood, an image is perceived via an optical headset, or by direct projection onto the retina, and sensors in gloves or suits can stimulate contact with objects that exist only as pixels in a computerized virtual surround. VR head gear is worn over the eyes and wired to a computer that is attuned to head movement and simulates what the isolated wearer would perceive within an actual optic array by capturing varying vectors of the ambient optical array mathematically and then smoothing them.

Current commercial VR entertainment games work by utilizing two ocular liquid crystal displays (LCDs) mounted in the head gear to provide stereoscopic vision and a sound source that is accurately placed by the computer as it senses movement. A polarized magnetic field surrounds the game participant, and a receiver mounted in the helmet reads variations in the field. This feeds back the information to the computer so that the visual and aural environment changes precisely as the person moves. Pneumatic data gloves with sensitive pads at the finger tips and in the palms are also tracked by computer and give sense impressions of virtual objects in the environment. A full body sensor suit is now in the commercial works to allow for complete sensory feedback.

The person *feels* present in the fabricated computerized surround and negotiates it in the same way he or she would move through the real world. Just as in Universal's "Back to the Future" ride, sound can be added to enhance the effect. In experimentation with air traffic controllers, in fact, it has been found that sound vector manipulation is the most helpful in locating the position of aircraft most effectively. By anticipating the vectors present in eye and body movement and providing coordinated sense data to all the senses, this computerized world provides a powerful simulation of real experience.

Although VR is still relatively primitive, its outer limits can be defined only by the principles of perception within the mind, and by the capacity of ever-advancing supercomputers to manipulate vast amounts of data at lightning speed. Usually envisioned as existing in the realm of "cyberspace" (a term coined and developed by William Gibson to describe an elaborate global computer network and the virtual environment that it has created, in his novels of the mid- to late 1980s), VR can only model reality. As Rheingold suggests, "No map can ever be as

detailed as the territory it describes," and though the map may be realistic, this does not imply that it is *truthful*.[109] Probably the most important aspect of VR, however, lies in the fact that it is an active experiential medium, directly perceived. This makes its application as a learning tool invaluable, for VR provides what textbooks and instructors, limited primarily to verbal communication and limited visual illustration cannot: people learn more effectively and enjoyably by reasoning and solving problems through *experience* than by being told about them indirectly.

This is why VR has found such great practical popularity in design areas, like simulated architectural environments in which one can virtually walk through plans to test design flaws, and more important, in areas where mistakes cannot be tolerated, but where practice is essential. One medical use of VR, for example, is in the area of avatars (simulated computerized "stand-ins" that interface with the patient in 3-D), which allow surgeons in training to practice delicate operations and to cope with complications which can be programmed into the procedure. VR interfaces with semi-autonomous robots, it is speculated, may be the only possible way to construct space stations in outer space.[110]

Current VR stock market computer programs now also regularly help analysts understand market trends and fluctuations by rendering complex quantitative data into color and three-dimensional schematics on their personal computers. Analysts can move around in 3-D space and time, absorb information faster, and respond more quickly to sudden market spurts. Prospective customers can tour production plants and visit with concrete manifestations of future ideas as part of the company's integrated marketing efforts. Chemical molecular engineers in search of new drugs and DNA secrets, can move with molecules in VR environments with visual and tactile feedback searching for molecular "docking" sites. At least one California psychologist uses VR simulations to treat phobias in his patients by desensitizing them through simulated experience.[111]

The Pentagon's Defense Advanced Research Projects Agency sees VR as playing an essential role in war games training as a smaller number of military will be expected to perform a wider variety of skills in combat situations,[112] while in Japan, couples plan kitchen layouts and cabinetry in VR store set-ups in the morning and the next day see them installed in their own homes. VR has also found a variety of other applications: from recording "the subtle relationships between speed, position, flex and other variables" in a pitch by Roger Clemens to help understand and avoid repetitive stress injuries,[113] to the simulation of murder scenes in judicial trials. In one California trial in 1992, for example, a VR simulation produced on personal computer by a ballistics

expert was considered to be substantially responsible for a manslaughter conviction.[114] Such legal uses have also raised inevitable controversies, however, many of which are perceptually based.

In terms of ultimate illusionary sensory surrounds (such as in VR situations when military trainees sweat, swear, and in general show emotional responses and behavior similar to military in real combat), it is easy to see how both illusion and reality might become confused, but implications may be broader. As a medium of perceptual experience rather than of verbal codes, virtual reality, critics say, may ultimately alter ways of perceiving and thinking beyond even what McLuhan envisioned and warned us about in his writings in the mid-1960s. Whenever a medium is relied on intently, becoming an integral part of the culture, the way people live and perceive their world, McLuhan observed, radically changes.

Jaron Lanier himself points out that perception does seem to change with individual sallies into VR experience, but often in a positive way: because in a synthetic world you adapt to a lower level of detail while at the same time being made aware of your own personal consciousness to an extraordinary degree, he claims, when you return from the simulated world, you tend to experience "the physical world as being hyperreal" and appreciate anew the "existence of consciousness, which is not necessarily apparent in everyday experience." Because there is less of a separation between ourselves and our real environment than there is in virtual worlds, Lanier believes virtual reality "provides an opportunity to sensitize people to the subtlety of the physical world . . . [by] forc[ing] you to notice that you are experiencing things."[115] In this sense, VR is the reverse of what Lanier calls the "dangerous television stupor" of TV and of a computer-dominated consciousness: "With a virtual reality system," he explains, "you don't see the computer anymore—it's gone. All that's there is you."[116]

Yet Lanier does worry about the potential for children to become lost in the VR environment and suggests that there be an age-restriction placed on VR experience.[117] Others also take very seriously the idea that the appeal of nonreality may be destructively strong, especially for children and adolescents who require a variety of escalating challenges in order to mature and function effectively in the real world as adults. Like Salinger's Holden Caulfield who escapes into the movies to find a world where corruption and death do not exist, today's youth, some fear, may become addicted to a synthetic world where sensually exciting entertainment and immediate gratification make the real world seem inadequate by contrast.

Already VR theme parks have spread widely throughout the world, offering a variety of virtual experiences, especially indulgence in some

form of gratuitous violence. Even what seems ordinary everyday experience can turn nightmarish by implication when VR makes it eminently desirable and immediately obtainable. Very early on in VR development, for example, virtual sex became an imminent probability, and the spread of pornography and sexual manipulation a serious concern. Commercial manipulation also started early as Saatchi and Saatchi, then the world's largest advertising agency, began to study the feasibility of transporting students in the classroom via VR to a "hypermall" where they could purchase goods electronically. Given the current pervasiveness of advertising in public schools under the guise of educational programming, particularly as part of "Channel One,"[118] this type of exploitation may be more generally acceptable than might at first be thought.

Despite the disturbing prospect which the preference of living in a VR world and the manipulation of desires suggests, however, VR may prove to be the educational catalyst to involve children and adolescents in true reality by making chemical molecules come alive in chemistry class and allowing students to walk on Venus or through rain forests, explore the pyramids, and move back and forth in space and time to answer questions on geography, climate, history, and other academic areas. It may also become the experiential salvation of people who are physically disabled as well as a positive boon to the mentally ill whose vision of reality may be retrained and normalized through VR therapy.[119] Unlike the repetitive formulas of television programs or the continual looping of video games, VR, fully realized, opens up to people all the possibilities that individual choice ultimately implies within digitally captured or synthetic environments.

But how will perception and consequent judgment function in a world where sophisticated sensual stimulation by media can be used to create and manipulate perceptual experience? Some VR critics warn that the line between illusion and reality may become perceptually nonexistent, even in everyday life. But the central issue of illusion in perception is more basic, and it is wise to remember that with only minimal audio stimulus, Orson Welles's radio broadcast of H. G. Wells's "War of the Worlds" fooled a number of people into believing in 1939 that the Martians really had landed in New Jersey. In studying how the illusion affected people's judgments in this situation, Cantril found that those only minimally affected were well founded in dramatic tradition and therefore were not fooled by format. They picked up on the large number of time and distance cues that would have been impossible if the situation were real. Those most convinced by the radio drama were fooled by the format and dramatic content and made no attempts to check its reality.[120]

Memory, too, can complicate the process of judgment when real experience mixes with mediated vicarious experience in memory. Accumulated memories from media drama may then eventually influence the way current physical reality is perceived when memory is used to judge present situations—particularly in children whose initial judgments are weakened both by a lack of general knowledge about the way the world works and by immature information processing. But adults are also susceptible to memory mixing, particularly when we identify with fictionalized objects, people, and situations because they are familiar within our own life contexts, and especially when decision making must be immediate or is accompanied by stress.[121] "Any medium," McLuhan warned, "has the power of imposing its own assumption on the unwary."[122] Even direct perception itself also has the power of imposing illusion on otherwise intelligent adults.

In the 1950s, in Seattle, Washington, for example, people began discovering small pitted areas in their windshields. As one person told another of the phenomenon and local broadcasts repeated it, a general mild panic ensued as people discovered one after another that their windshields, too, had been pitted. Although those who made the discovery seemed certain that their windshields had been perfectly smooth prior to the mass event, what the event ultimately revealed—after toying with a variety of theories ranging from acid rain to extraterrestrial influences—was that in the course of everyday use, car windshields will always become pitted on the outside. Prior to the scare, people had been looking at their windshields from the smooth inside-out. During the scare, they were looking from the pitted outside-in.[123] Gombrich reminds us in *Art and Illusion*, "Illusion consists in the conviction that there is only one way to interpret the visual pattern in front of us. We are blind to other possible configurations because we literally 'cannot imagine' them."[124]

Brain Wiring

How the mind utilizes information from the visual system to image the external world and to create meaningful experience is still a mystery, even though in the last ten years science has learned as much about the inner workings of the brain as we knew prior to that time. In the center of it all is the recognition that although the brain's neural architecture and the level of chemicals that either accompany or determine how we perceive, think, and act are fairly well determined within our first ten years, the brain itself is an amazingly flexible and programmable mechanism.

The brain's ability to adapt its own areas for necessary use, for example, is evident in cases where because of injury or surgery, part of the brain is missing. Because certain parts of the brain have been associated with particular abilities, it would be reasonable to assume that without these sites, the brain could not function. Yet cases have shown that often knowledge and functional capacity migrates from one area into another, even in cases of stroke in elderly brains. The brain has enormous adaptability. It is however, temporally limited, since there also appears to be a time-clock mechanism for the burgeoning of certain skills. Although a second language may be acquired at any time, for example, learning second languages in childhood makes the acquisition easier and fuller than later in life when the peak learning period for language is over. The windows for development have a limited time frame.

Neurobiologist Carla Shatz explains that there are two broad stages in brain-wiring, an earlier one where experience isn't requisite and a later one when it is.[125] Each perceptual ability has a first critical period in which development must occur. If it doesn't, the ability may be forever impaired or entirely lost. The circuit for vision has a growth spurt at the age of two to four months, peaking at eight months, when each neuron connects to about 15,000 other neurons. If a baby has cataracts at birth and these are not removed until it is past this period of development, it will never learn to see.[126] Connections, which are promoted by activity, will never form. This is why people who have never seen before or who, like Sacks's patient Virgil and Gregory's S.B., have experienced sight only briefly in early childhood encounter what can be insurmountable difficulty in making sense of what their new eyes see.

In language, auditory maps are formed within the first six months. By twelve months, the window closes and infants lose the facility of discriminating sounds not in their own language. Before it is spoken, language is constrained by the pattern of sounds used in native language, so that even when babies babble, they do so in the sounds and rhythms of the language they have heard. Although we retain the capacity to learn other languages, similar languages are easier for us to learn—like the romance family of languages for French or Spanish speakers—and after the age of ten, we will probably never learn to speak a second language like a native.

The same is also true for cognitive abilities. If they are not exercised after their formation, they are lost. Once our neurological systems are established, they become more rigid and less susceptible to change, although they may continue to grow throughout life. The more repetitive our thinking patterns are, the more firmly entrenched they become—like a practiced piano sonata which the more often it is played,

the more fluent and automatic the play becomes. Cortical maps of musicians, however, are less influenced by the number of hours of practice on an instrument than by the age at which the musical instrument is learned: the younger the child is when learning an instrument, the more cortical area becomes devoted to the activity. In a blind child, large visual areas of the brain are reallocated for use by touch and the other senses.[127]

After the initial crucial stage of development is established, variety and repetition become key. Even though we pass beyond primary development stages, however, the brain continues to learn throughout life, making new connections when those areas are used. Even "broken circuits" can be enhanced or even rewired. Some experiments in higher-order thinking, for example, have revealed what has been dubbed the "Mozart Effect," in which listening to classical music has been shown to increase spatial ability. In the strengthening of these circuits, mathematical ability is also enhanced.[128] Experiments with language-based learning disabled children, approximately 7 million nationally, have led some researchers to suspect that chronic middle ear infections may cause faulty auditory maps in children, which then cause reading problems because certain sounds like "b" and "d" go by too fast to recognize. Training children to hear these sounds by playing them slowly enough to recognize has produced astonishing results: with neural rehabilitation, children two years behind in language ability have been able to catch up in four weeks.[129]

But even as neural circuits can be expanded, they can also be shut down. Just as the more languages a person knows, the easier it is to learn others, so also, the more open and flexible a person's abstract thinking remains, the more open the person is to new learning and to change. With repetition, however, perceptual reasoning becomes fixed into patterns, just as verbal language becomes fixed within the parameters of cultural expression and dialect. In the visual artist, we see the perceptual logic of interconnectedness and gestalt formation kept open and alive to new influence. In the television "couch potato" we see a perceptual logic stymied by repetition and lack of challenge, rigidified into patterns of thought and behavior by messages repeated over and over again in media.

As neurological circuits become overused, they tend to become more "hard-wired" and less flexible. The more often a neural pathway is used, the stronger it becomes, and the easier it is to trigger. As disused circuits fade away, and with them the promise of more diverse thoughts and talents, the more likely we are to see things in a particular way, resolving ambiguities according to limited preestablished notions, filling in details according to the set of our own personalities.

It is as if we begin by learning to put together different notes into meaningful melodies, gradually building a musical repertoire on which we come eventually to rely for all performances. For people with limited thought repertoires, whatever the occasion, they think the same tune. (A steady perceptual diet of horror films, cartoons, or media violence in childhood, for example, may have enormous implications in the later development of values, attitudes, and behavior.) Individuals with large thought repertoires who continue to practice new compositions will retain a flexibility lost to those who settle early merely for a few basic ideas. Thus, despite the trend toward hard-wiring over time and the developmental windows open and closed within natural time clocks, our perceptual maps are also extraordinarily plastic, capable of enormous reorganization and revision when stimulated.

What we "see," then, is a combination of the processing of external stimulus by the visual system, of the simultaneous firing of particular neurons in patterns which make us conscious of what we see, of learning appropriate perceptual skills at the right time, and of prior learning which is brought to bear on present perception. Perception is a process which utilizes not only the retinal image but also the whole of a person's being as well.

Conclusion

To summarize, the stimuli that experience provides the senses is always incomplete or ambiguous, and perceptual process is still understood only in partial increments. We do know, however, that what we see is at least partially what we expect to see and is as much the product of inner-derived meaning as it is a reflection of what's "out there." As the twentieth-century counterpart of Aristotle's concept of "common sense," a quality that unifies sensual information into a single holistic perception, the Gestalt Law of Prägnanz and other subsequent perceptual theories suggest that while perceptual process is efficient in the extreme, it nevertheless is a process that reduces reality to its simplest shape and that fills in empty space with something that isn't really there. Under ordinary circumstances, perception and judgment are highly susceptible to illusion, especially in intensely pressurized and emotional situations.

Most perceptual theorists accept that perception is largely confined by individual consciousness, and that it is subject to differing sensory abilities—such as color blindness or shortsightedness. They further agree that perception is continually affected and often substantially altered by memory and emotion. Even in hindsight, particularly in a perceptual

phenomenon called "backmasking," we can alter earlier perceptions according to later ones.

Moreover, it appears that because vision is the result of a number of subsystems at work and not just a direct line to the brain from the senses, many of these subsystems function independently of each other and are beyond all introspective understanding.[130] Not only is our perception liable to distortion, it is also highly susceptible to emotional manipulation on an unconscious level, which in turn affects our conscious thinking. Lighting, shadow, and color can be changed to produce a more positive or negative emotional impact; context can be subtly suggestive enough to alter our conscious opinion of the subject within it. All of this can happen before we consciously form a judgment that we believe to be informed, objective, and unbiased—in other words, "intelligent."

This is why it is essential that we use our cognitive analytical abilities to throw the rational "off switch." It is not enough to be "visually literate." In a society in which advertising images can lure people into a sense of emotional security while undermining their health, in which political images can affect emotional response before critical analytical abilities are invoked, and in which mass media entertainment images of violence can have devastating arousal effects, the nature of our battle for survival has changed considerably since our current brains have evolved from primal environmental-response patterns.

What has evolved as a survival mechanism, therefore, can prove a detriment if, as LeDoux states, "Aggressive responses are indiscriminately elicited by thalamic signals and allowed to run their course unchecked by more detailed perceptual analyses."[131] Even associations learned through specific situations may later be generalized and activated in stressful situations. Such research conclusions have profound implications for cross-overs between mass media and real-life learning, and for the long-term potential of media response to stimulate heightened states of physiological arousal in inappropriate situations.[132]

The concept of visual intelligence therefore implies a critical appraisal of conscious perceptual information; an understanding of the emotional affect that accompanies it; and the tapping of creative problem solving ability that begins in perception. The exercise of this intelligence begins first, with a basic understanding of the highly complex process of perception: how light from the environment stimulates photoreceptors and is transformed chemically and electrically into signals in the brain; and second, with a grasp of the organizational principles which transform information into meaningfulness in higher abstract thought as well.

When reality is mediated in print photography, television, and film, what we see not only is *not* reality, but a synthetic reality highly

susceptible to manipulation. Furthermore, if it is true as hypothesized that media-induced vicarious experience may later mix with actual occurrences in memory and render them indistinguishable from one another, then media fare may play a substantial role in developing mental maps that blend media and reality together as a single mental experience, which in turn directs our interpretation of the present, further revises memory, and affects the direction of our thoughts and actions.

The essence of "visual common sense" is the first degree of "visual intelligence." It tells us that because perception is an internal, creative, problem-solving process, we may never know what is really "out there." It also tells us that good judgment (like the perceptual process that it parallels and from which it derives) is really only efficient, never sufficient, for survival—and then only in the most rudimentary of circumstances. Even on the most basic level, our susceptibility to illusion should give us pause—especially since in understanding our environment today we have come to rely so heavily on media as extensions of our senses.

It is most important, however, not merely to recognize our inherent tendency toward illusion as a basic part of perceptual process in our everyday lives, particularly as we interact with media. We must also understand that the principles of perceptual process are the keys to creative thinking as well—to reaching out beyond our past and into the future, and in doing so to recognize in relationships implied in analogy, metaphor, and symbol the means to penetrate the mysteries of the universe. If perceptual theorists are correct that the development of vision led to "strategic planned behavior and ultimately to abstract thinking,"[133] then vision is truly the gateway to advanced intelligence. Those who have the wisdom and insight to see far-reaching implications are true "visionaries."[134]

With perceptual development, however, also comes a liability to illusion and to erroneous judgment that may ultimately forsake us in our own well-being. Visual intelligence thus also implies an understanding of exactly how far we can trust our perception to tell us the truth, and an appreciation of how perceptual process can be manipulated through various media to alter our attitudes and behavior. When we are ready to be fooled by perceptual process, we are heir to manipulation by those who understand its nuances and are ready to take advantage of it. There is a story of a mason who became so disgusted by people not paying his bill when his work was completed that he built in a sheet of glass across the chimney as he was constructing it. If the people paid when the work was completed, the mason broke the glass. If not, he let them continue to puzzle over why the smoke would not go up the flue since they could

see with their own eyes that there was no obstruction. Visual intelligence implies not only recognizing that what we see may not be reality, but also breaking through the merely apparent to understand that what we see may have been engineered as well.

If Spinoza's model of the mind is correct, as current neurological thinking suggests it is, and we are doomed to first accept what we see as reality and to believe what we are told as true, it is only by deliberate thought and active higher reasoning that we can move into a wider circle of intelligence and truly appreciate what we see and understand how we come to believe.

2

The Nature and Power of Images

The Soul Never Thinks without a Mental Image.

—Aristotle

Defining the Image

The *American Heritage Dictionary* gives ten definitions of the word *image*, ranging from a reproduction of the form of a person or an object to an apparition. In between, the definition includes specialized uses of the term in physics, mathematics, and computer science, as well as more general meanings for the term that embody both its pictorial and mental aspects—including vivid description, literary metaphor and symbol, opinion or concept, and the character projected by a person or an institution, especially as it is interpreted by the mass media. The range of meanings for the verb "to image" runs likewise from external representations to internal ones, from the production or reflection of a likeness to mental visualization. What is common to all images, however, is the perceptual logic by which they are formed and the nature of the coherent whole.

Neurologically all images are by nature gestalts, made up of fragments of visual experience processed modularly and then coordinated through perceptual process into what Walter Lippmann called "pictures in our heads." They are stories, always implying more than their parts, always in process and actively seeking meaning. Because vision developed before verbal language, images are a natural part of our primal sense of being and represent the deepest recesses of ourselves. As the breadth of dictionary definitions suggests as well, images are tied to the full range of human experience and expression, ranging from practical affordance to symbolic myth. This is why an understanding of the nature and power of images begins with perceptual process but ultimately ends with the abstract picture of the world that we carry in our heads.

6

Advertising Images: Seduction, Shock, and the Unwary

> Advertising is the art of arresting the intelligence long enough to get money out of it.
>
> —Stephen Leacock

Ads as Gestalts

For many people, as Jonathan Price put it in his book title of the late 1970s, advertisements are still "the best thing on TV." Advertising has, in fact, become so entertaining and so highly targeted that even in print media, many people read ads as avidly as the editorial content of their magazines. It has also been so successful at what it does, that in discussions of visual literacy, advertising is often the first topic on the agenda. How it achieves this success is a matter of careful perceptual strategizing and structuring. Lighting, colors, camera angles, tone, every detail of every item shown, the placement of elements, every word—each of these is scrutinized, discussed, tested for its impact. In a national ad campaign nothing is left to chance.

The concept of visual intelligence in advertising therefore implies the ability to understand, first, that the industry spends billions of dollars each year not to entertain, or even to inform, but to sell. If an ad doesn't sell the product or the idea, it is not doing its job. Second, it implies that messages are framed in the most subtle and effective way possible to reach the target audience (someone in a position to buy the product or act on the idea), to make them receptive to the message, and ultimately to act on it. Like the poet T. S. Eliot, every art director and copywriter in advertising is searching for the perfect objective correlative—the string of images in illustrations and words that will serve as a metaphor for the product experience.

This is why the perceptual gestalt has significance for advertisers: the way elements are combined to create a total effect or impression is

more important than fact or rational logic: "Most readers," the advertising guru Bill Bernbach has observed, "come away from their reading not with a clear, precise, detailed registration of its contents on their minds, but rather with a vague, misty idea which was formed as much by the pace, the proportions, the music of the writings as by the literal words themselves."[1] The key to an ad's significance, he recognized, lies in the way the relationship creates meaning—in how the form and structure of each element contributes to single, stable message. Impact is achieved by the appropriate synthesis of primary visual and secondary verbal elements mutually reinforcing each other; the perceptual reception of the message is determined by the set of thoughts and emotions that are part of the consumer, and the ability of the advertisement to reach both. Ads that don't achieve an emotional resonance do not succeed.

As Less and others have noted, the history of advertising in the twentieth century has been characterized by the steady movement away from function ("What does the product do?"), with its emphasis on rational copy, to the identification of the consumer and the nature of the social meaning ("What does the product mean in terms of the type of person I am and how I relate to others?").[2] As a result, personal and social image have become the stuff of which advertising is made, and advertising's visual language has come to play an integral role in the way our culture is defined and in how people interact with one another in it.

In both print and television advertising, this means that the advertisement functions as a metaphor. The consumer identifies with the advertising image, and the product within that image becomes intimately linked with the satisfactions inherent in the scenario. Without directly stating a causal relationship between Newport cigarettes and an active young lifestyle, for example, the advertiser uses the associative perceptual logic of the viewer to make the product seem an essential part of visual story, and the product a metaphor for the socially rewarding experience depicted. Linear logic cannot achieve this; rather the success of the ad depends on the formation of a gestalt in which all of the parts become inseparable within the whole. This type of approach, which is often called "image advertising," establishes goods as pictographic symbols linked holistically with positive social experience through perceptual logic.

As Gestalt psychologists first realized, ambiguity is also a powerful ally in drawing us into the image depicted, completing it with our own needs and desires. This is the "amplification of ambiguity" that Scott McCloud described as characteristic of the cartoon image. In advertising, this means that the image is structured specifically enough to attract the

appropriate audience, and ambiguously enough for consumers to read themselves into it. It must also, however, suggest a promise of something better by increasing the number and type of associations that can be generated from the image. The perceptual logic or visual grammar of these associations may work on a number of levels, from personal meaning to social sharing. As meanings become shared through repeated exposure in mass media, individuals can then use product-image associations as vehicles for priming attitudes and behavioral associations in other consumers.

Advertising, then, has both deep personal and broad social implications. Not only does it appear to speak to our personal needs, preferences, and fantasies, but it also becomes a means of social discourse as well, providing a common reference of meaning. As an integral part of social language and therefore of the cultural system, it confirms self-identity and helps to define the normative values of the target-group-as-subculture. As the shared vocabulary of advertisements grows, advertising images may then become vehicles for self-expression, as when people sport clothes with designer labels or logos on the outside, or part of the vocabulary of social or political discourse, as in the famous "Where's the beef?" fast-food slogan cum presidential campaign slogan. As John Berger has emphasized in *Ways of Seeing*, advertising has moved in to fill a void in the democratic society that class-structured societies do not share, providing people with ready-made and easily understood labels with which to communicate their own social status, personality, and lifestyle. Some anthropologists believe that the very first evidences of body ornamentation served the purpose of delineating social roles, and that this in turn increased the "ability to think in and communicate by means of specific visual images."[3] Compared to brand recognition and overt logos and labels today, only T-shirts represent a more obvious means for sending social messages.

As both propagandists and advertisers realize, and as Münsterberg first suggested about the impact of film, images are also the surest route to the emotions, and therefore a primary means of influencing attitudes before critical thought is engaged. LeDoux, Zajonc, and others have shown, too, that affective impact can be achieved even before product recognition is consciously registered, and these effects can be retained for a considerable time.[4] Advertising has also long recognized the need to speak to human emotions first. Bill Backer, one of the most successful creatives in advertising, for example, in stressing the necessity of freshness and originality in coming up with an abstract solution to the consumer's perceived needs, says he has "never been afraid of portraying decent, honest emotions as long as they are not being used to manipulate people toward a point that isn't true."[5] Whatever the message, it must

achieve an emotional resonance in order to become integrated into the self. Tony Schwartz, who first articulated advertising "resonance" as a theory of communication, comments that the "viewer's brain is an indispensable component of the total communication system [of advertising]. His life experiences, as well as his expectations of the stimuli he is receiving, interact with the communicator's output in determining the meaning of the communication."[6]

The most effective advertising communication is therefore one that achieves a matched layering of basic self-image, manufactured and mediated image, and product image—whatever the product may be, from clothing to political figures. In such messages, the sense of the self becomes bonded with what is sold, so that in the loosest association, they just seem to "fit," while at the deepest and most profound level of association, they seem inseparable from one's own identity. Thus certain brands of clothing seem to be "just right" for us, or we become emotionally biased toward political ideas or figures that seem to represent what we are and care about. Without emotional commitment or the affectively integrative "common sense" that emotional synthesis implies, there is no motivation to change attitudes or behavior.

To achieve an impact which will move the consumer from liking to buying a product, ad directors and copywriters, as the two essential parts of the advertising creative team, know that the first step is to gain attention; the second, to gain interest and likability through involvement; the third, to persuade by connecting a consumer problem with the product as its solution; the fourth, to motivate movement in attitude or action. Advertising techniques used to persuade consumers to buy are similar to those exploited in film by Pudovkin and Eisenstein; that is, they utilize the natural perceptual process of good continuation to complete a message along the lines laid down by the creative elements, so that the consumer sees the product use as fitting naturally within the setting, or they set up a cognitive dissonance that the consumer will resolve in favor of the product as the solution to the tension precipitated by the ad.

When the whole comes together to create a single impression, tension is relaxed and a stable memory trace is formed. Ads where all the elements work toward a common resolve tend to be remembered, while ads where elements are vague, unrelated, or leading off into different directions go unnoticed or are easily forgotten.[7] Repetition is also a major factor in the "sell." As Zajonc and others have shown, almost any element repeated often enough will achieve acceptance and likability. The more we see an ad, the more disposed we become toward the product.

Tension and Closure

The perceptual tendency to complete the gestalt is what actively involves the viewer in the formation of the commercial message. Marlboro cigarette outdoor billboards, for example, sport a close-up of the head and shoulders of a rugged cowboy next to the large, red, vertical letters "b o r o." The association of the cowboy with Marlboro cigarettes, begun by Leo Burnett in the 1950s, is such a long-standing one that the reader easily fills in the "Marl" portion of the brand name mentally, and the passive reader is instantly turned into an active participant in making the message. J & B Scotch several years ago began utilizing a similar advertising device around Christmastime when it took clever advantage of both its trademark colors—red and green—and popular Christmas carol lyrics to link seasonal gift giving and party consumption to its brand. On a trademark green background are only two words, in bright red, with a brief sentence beneath connecting them to "holiday cheer":

ingle
ells
The holidays aren't the same without J & B.

This is the essence of what Marshall McLuhan meant in his controversial theories on "hot" and "cool" media. "Hot" media allowed for little filling in, where "cool" media forced viewer participation in the completion of meaning. In art, McLuhan tells us that "spectator becomes artist in oriental art because he must supply all the connections."[8] In literature, the interaction of words and consequent mental images may be the result of similarly intricately planned designs: out of a seemingly infinite number of exacting choices, authors can produce exactly the right effect through suggestive imagery at the same time they evoke and utilize the experiential background of the perceiver to identify with characters and to amplify vicarious experience. This is the essence of Hemingway's "iceberg" theory of writing, where the author depicts only the top eighth of the iceberg. The art, of course, hinges on the ability to maximize reader response through the most minimal of stimuli—that is, omission. In *A Moveable Feast* Hemingway commented that "you could omit anything if you knew that you omitted, and the omitted part would strengthen the story and make people feel more than they understood."[9] McLuhan, too, observed that we always perceive more than we understand.

Because emotions tend to be diffused easily through the limbic system, in response to ads that force the viewer to make the connection

between the visualized gratifications and the advertised product, people may confuse the purchase of things with emotional satisfactions sought in other parts of their lives, and even feel better when they buy something. When the overall image of the ad is powerful enough, it generates a gestalt "insight" in which the product is seen as the solution to the suggested problem. Thus when we go on to purchase the product, we actually *do feel* better about taking a step toward a solution, even if in reality it is an unproductive one.

Creative advertising strategy therefore implies effective psychological targeting, tight artistic control of elements first to generate and then to relax tension, and a "hook" for emotional involvement. As the ad comes together perceptually, the forces at work form meaning interwoven with the needs of the consumer. The effective ad reaches out, taps the consumer cognitively and emotionally, and seduces him or her into identifying with the product user. Each ad tells a story in which the product-as-hero transforms the consumer in some desirable way—such as being more competent, intelligent, or attractive—and projects the imagination into a desirable social context—usually one where the person using the product is sexually or socially desirable, personally at ease, and self-confident as a result of product use.

Although such scenarios are often seen as manipulative, it is also important to recognize that advertising has no subversive monopoly on them. All effective communication reaches the individual both emotionally and cognitively in much the same way: the first rule of rhetoric is to win goodwill; the first step for motivating a person to any action is to invest them personally in the cause, subject or problem. One of the reasons advertising is so powerful an influence within the society is that it never forgets or takes for granted the emotionally involving side of the message and because its main tool is the visual image.

Advertising at its most effective is therefore humanistic, speaking directly to people about the things they care about, showing them simply and clearly how the represented product or service will help them solve a particular problem or serve a particular need. The best ad people in the business have always understood both this and the value of honesty and down-home integrity, and they have respected the intelligence and dignity of their target audiences. And for the most part, people have appreciated this, turning to advertisements ranging in scope from high-image consumer ads, to yellow page listings, to trade ads for information about new products, absorbing advertising into their lives as part of personal discussions and political campaigns. Consumers have even found some campaigns inspirational—like the serialized New England Telephone campaign beginning in July of 1988, which featured

episodes of an estranged father and daughter who gradually overcame their differences and spoke to each other at Christmas; or Bill Backer's now classic Coca-Cola "Hilltop Campaign," which expressed the multicultural ideal "to teach the world to sing in perfect harmony." Bill Bernbach, who was responsible for the best of the early Volkswagen ads, also understood this. "Nothing," he said, "is so powerful as an insight into human nature."[10]

The Big Idea

Some ads like Backer's Coca-Cola ad hit you right away: they capture the imagination through a brilliantly executed Big Idea—the advertising counterpart of the archetypal image. Although a "Big Idea" is difficult to define, we know it when we see it. David Ogilvy, founder of Ogilvy & Mather who himself generated a number of big ideas when he actively headed his own agency including the images of Manhattan Shirts' "Man with the Eye-Patch" and the Pepperidge Farm horse-drawn wagon, suggests that a Big Idea is one that is unique, makes other art directors and copywriters wish they had thought of it first, is in full accord with the product's marketing and creative strategy, and can last for thirty years.[11]

Of the two divergent schools of thought about advertising, these men represent the ideal that advertising is an invaluable source of product information for the consumer, that creativity in advertising comes through knowledge of and respect for the product and consumer, and that advertising is the primary lubricant that keeps the economy moving in response to consumer needs—promoting intelligent choice and spurring production efficiency through competition. What all of these three creative admen have had in common besides their communication expertise is their refusal to misrepresent the truth or to use cheap shock value simply to call attention to their products. Ogilvy, for example, resigned the lucrative Rolls-Royce account when the company sent five hundred defective cars to the United States.[12] Bernbach refused to take on cigarette advertising clients even though they would be clearly lucrative accounts because the product killed people. "All of us who professionally use the mass media," Bill Bernbach said, "are the shapers of society. We can vulgarize that society. We can brutalize it. Or we can help lift it onto a higher level."[13]

Yet advertising has a dark side, too. At its worst, it may use any and every device to call attention to its product—such as when Levi Strauss recently placed a pair of $55 "Dockers" khaki pants under plastic shields in Manhattan bus shelters to kick off a new campaign. The

message included along with them was "Apparently they were very nice pants." Levi Strauss, according to *Ad Age* had even factored the cost of the expected vandalism into its campaign, they were so sure that the pants would be stolen. Gannett finally removed the Docker ads after accusations that Levi Strauss was deliberately trying to provoke criminal behavior.[14]

Advertising may exploit basic human needs by indirectly promising human fulfillment through use of a product that may have the reverse effect in reality—as in beer ads where everyone at the bar is apparently well liked by everyone else, having a wonderful time, and engaged in witty repartee—a myth that anyone who has refrained from alcohol for only one evening in barroom can dispel. Because the romantic images in liquor and cigarette advertising have such little basis in fact, advertisers go to even greater lengths to sanitize them. Rarely does anyone in a liquor, wine, or beer ad seem to *already* have drunk what is in front of them, even though we seem to join them in the middle of the party, and cigarette ads today rarely, if ever show smoke at all.

Occasionally, advertisers borrow from a popular interest or from an exciting or deeply evocative human situation, exploiting sincere emotion in the service of banal goods. Or they may attempt to cash in on some of the most significant or profound aspects of our lives by associating them with comparatively trivial product benefits. Under the guise of social protest, for example, Luciano Benetton has for years exploited free media publicity to subsidize Benetton in-house advertising through what it calls "social awareness" campaigns which deliberately provoke controversy by deliberately flouting convention and by tapping fears associated with violence, death and disease. In 1991, for example, Benetton ran ads featuring a baby girl right after her birth with umbilical cord still attached, a priest and a nun kissing, and an angelic white girl with blonde ringlets next to a black boy with his hair shaped like two horns. These images sparked controversy; however, controversy turned to outrage when Benetton ran ads around the time of the Gulf War that showed several rows of crosses in a cemetery and then showed a soldier's bloody uniform as a commentary on the war in Bosnia in 1994.

When the company sued several German retailers for nonpayment of merchandise and franchise fees, retailers countersued claiming that Benetton's controversial ad campaigns had destroyed their business, which they say had plunged 30% to 50% since 1992. One group of retailers estimated the number of Benetton outlets as dropping by almost one-third as a result of the "tasteless ads."[15] One German retailer posted a sign stating: "No Benetton—because we too condemn the scandalous ads with war, disease and death" after the windows of his four stores were spray-painted with slogans like "No ads with dead soldiers."[16]

While other suits against Benetton have been initiated worldwide, including in the United States, in France a court awarded damages to an AIDS support association that claimed Benetton had exploited the disease by showing an actual AIDS victim surrounded by his grieving family at the moment of his death. In the United States, where Benetton has 150 outlets and does roughly $100 million of the $2 billion worldwide business,[17] the company has reduced prices and changed their attitude toward a more conservative one. In the process, their advertising copy clearly reveals a lingering iconoclastic adolescent appeal. Copy for one ad, for example, reads: "Your best dress . . . the one your mother really hates, the one you wish you had in six other colors, the one you sometimes think you love more than your boyfriend. But let's not get started on that one."

Such examples give credibility to the view that advertising is really a potent economic force without a social conscience, which employs effective communication tools to sell products people do not need; is dedicated to artificially creating consumer demands; and is amorally adept at substituting consumerism and product choice for meaningful social action and critical decision making. Without the creative ability to get the product noticed in legitimate ways, advertisers often resort to borrowed interest and cheap psychological closure, hoping to perceptually associate their products with the basic needs they exploit.

Embeds and Subliminal Advertising

Perennially one of the most interesting and controversial subjects has been "subliminal advertising." Several authors have in fact built careers on trying to convince people that mind control through images projected and perceived below the level of their conscious awareness not only works but also is widely practiced. Advertisers, it is claimed, modify ice cubes to suggest little breasts and phalluses, or embed sexual orgies in plates of clams. For the most part, the public has been receptive to the idea: A 1985 study by Block and Van den Bergh, for example, found that although consumers are generally skeptical of subliminal techniques used for positive ends like self-improvement, they are nevertheless "confident of subliminal advertising's effectiveness to sell products."[18]

Historically, the public's concern dates primarily from a now discredited study by James M. Vicary—the person who claimed that as part of a six-week research experiment he tachistoscopically flashed on the screen of a New Jersey movie theater the words "Drink Coca-Cola" and "Eat Popcorn" below the level of the audience's awareness (for 1/3,000th of a second every five seconds) during the screening of the film *Picnic*. At

intermission, he claimed, patrons then rushed to the refreshment stand to consume statistically significant amounts of Coke (a 57.6% increase) and popcorn (an 18.8% increase). As a result of this claimed success, Vicary formed the Subliminal Projection Company whose purpose was to project "invisible commercials on TV and movie screens."[19]

Although Vicary's claims were questioned at the time, a number of advertising agencies—much to their later embarrassment—initially hired him as a consultant. The study has since been labeled as patently fraudulent, however, as has his conviction that subliminal advertising would have its greatest impact on TV, since as researchers Smith and Rogers have observed, current electronics make it "technologically impossible to project a television image faster than the human eye could perceive."[20] The standard television video display is refreshed 60 times per second, with only half the lines refreshed on each scan. This means that the minimal presentation interval of 33.3 ms would considerably exceed tachistoscopic times in most laboratory experiments, making the message detectable. As with print ads, if a message is added in such a way as to make its presence undetectable, either the message doesn't motivate the consumer or does so by only a fraction of the success of supraliminal messages.[21]

Advertisers, too, have decided that they are much more interested in getting people to keep their messages *consciously* in mind while they are contemplating a purchase; they consistently deny using subliminal devices, even while researchers like Bryan Key continue to find the letters SEX on Ritz crackers and in Norman Rockwell paintings. But if advertisers and artists really are not using subliminal embeds, how does Key continue to find such sexual images in a variety of ads? Psychologists have asserted that if and when suggestive images and words do appear, they are likely to be the result of either the image producer's subconscious asserting its needs unbeknownst to the artist, or the consumer's imagination finding "faces in the clouds."[22]

Despite generally positive results from subliminal research studies in general as discussed in Chapter 1, it appears that for advertising, subliminal effects have limited usability. Positive effects in research studies utilizing subliminals have generally been of small magnitude, and in advertising-specific studies, completely supraliminal messages (messages above the awareness threshold) have proven significantly more effective than subliminal ones. In one study, for example, the use of subliminal advertising alone achieved an increased in sales of 1 percent; a mixture of subliminal and supraliminal advertising achieved an increase of 282 percent; and supraliminal advertising alone achieved a sales increase ranging from 1,802 percent to 3,383 percent.[23]

To be considered effective in advertising, researcher Sid Dudley suggests, messages "must induce not just action, but the desired action from a significant number of consumers."[24] And it is just this that subliminal advertising studies have failed to do in terms of influencing choice, increasing sales, and promoting brand recall. The preponderance of research has shown no evidence that subliminal stimulation can directly influence goal-oriented behavior[25] or that various subliminally embedded, sexually oriented stimuli in print materials influence consumer product preference.[26]

One area where *supraliminal* advertising "embeds" have been particularly effective is in the planting of products within films, so that they become a natural affordance of character, as with the Ray-Ban Aviator sunglasses in the film *Top Gun*. Earlier, in 1984, when Cruise starred in *Risky Business* wearing 1952-style Ray-Ban "Wayfarers," sales increased twenty times. Ray-Ban now places its glasses in 160 films and TV shows each year.[27] Camel cigarettes are featured in Disney movies *Who Framed Roger Rabbit* (U.S.A., 1988) and *Honey, I Shrunk the Kids* (U.S.A., 1989). In 1989, Philip Morris paid $350,000 to have Lark cigarettes featured in the James Bond film *License to Kill* (U.S.A., 1989), but the tobacco industry agreed to stop the practice in 1991 after the Federal Trade Commission began investigating whether the product placement violated a 1971 ban on broadcast tobacco advertising, since the film was also shown on television.[28]

In other countries where cigarette advertising has been banned, more and more tobacco names have appeared on gear in films, and even on items such as record album covers. In the United States, the practice began as early as the 1930s,[29] but the power of such commercial product embeds became obvious only when, in *E.T.—the Extraterrestrial* (U.S.A., 1982), the film's protagonist Elliot shared some of the candy with the alien "E.T." Sales of Reese's Pieces candy subsequently soared 70 percent. *MAC & Me* quickly capitalized on the phenomenon, telling the story of an alien who befriends a crippled child and lives off Coca-Cola. In 1990, in *Ghost*, Patrick Swayze carries Reeboks; in *Pretty Woman*, Julia Roberts drinks Diet Pepsi; in *Home Alone* the family flies American Airlines and Nestlé's "Juicy Juice" is featured.[30]

In an ironic and unintentional reversal, in *It Happened One Night* (U.S.A., 1934), when Clark Gable took off his shirt to reveal a bare chest, men's undershirt sales reportedly dropped 40%.[31] Clearly, star appeal and image have extraordinary power in influencing not only the psychology of viewers but also their pocketbooks as well. Advertisers today regularly pay for the privilege of having their products "hyped" in film.

Effective manipulation in advertising therefore seems to come primarily through supraliminal perception coupled with lack of general

consumer awareness that products are embedded in the storyline as ads. As Bargh has argued, however, the true significance of subliminal effects lies in our lack of critical awareness of the ways in which we may be affected unconsciously by biases, whether subliminally induced or not and then misattribute the source of our attitudes by assigning them to the person or thing itself rather than to our own feelings. In the process, we further justify prejudices as if they were trustworthy judgments, and these judgments in turn affect subsequent perceptual processing.[32] If, as some researchers have indicated, subliminal perception is a visual, right-brain activity inconducive to verbal experiments, we may be particularly susceptible to prejudice through visual processing.[33]

Ultimately, true subliminal conditioning may be achieved not through tachistoscopic flashings or pictorial embeds, but rather through supraliminal additions of products into the storyline or through visual manipulations such as color, camera angle, size, and distance. These impact our feelings about the subject without our necessarily being fully aware that the characteristics we seem to see in the person or product are really contained in the way the medium is manipulated.

Advertising and Color

Because color speaks immediately to our emotions and has such an intense effect on us, it, too, has become of primary interest to researchers, medical doctors, psychologists, and, of course, to advertisers searching for the most persuasive appeal. Merchandisers who wish shoppers to stay longer and buy more are particularly interested in the subliminal effects of color. A blue retail environment, for example, has been found to stimulate the inclination to shop, to browse and eventually to purchase, while red invokes tension in shoppers and has the opposite effect.[34]

Because yellow is also the color the eye registers most quickly, it has been found to be a good choice for taxis and school buses—and it also makes heavy things seem and feel lighter. But too bright a yellow decor can cause anxiety, and in restaurants it can lead to more complaints to the chef. In restaurants decorated in red, people tend to eat faster than in blue-decorated ones, since bright red stimulates glandular activity and induces hunger. It is no coincidence that fast-food restaurants are characteristically red and yellow. Green is relaxing, but ill-advised in restaurants because a green environment makes food look less appetizing unless it is in the form of natural plants. In packaging, however, it tends to connote freshness.[35] Chartreuse seems to be the most universally disliked shade of green, associated with sickness and slime.

In buying decisions, color becomes especially important because people tend to read the immediate image of the product as a whole rather than the words on the label—culturally, for example, green and orange colors on a carton have come to signify "orange juice"; a red and white carton signifies whole milk, and a blue-and-white carton skim milk.[36] When a milk carton is designed in green and orange, there will very likely be a number of disappointed shoppers at home. Similarly, red and white cartons in the juice section of a supermarket are unlikely to sell well. Most shoppers go by color codes, especially in logos and package designs that instantly signal the product in a kind of visual shorthand. Any marketer who doesn't understand this shortly "pays the price" in loss of sales.

This is why package designers like Alvin Schechter say that "Color isn't the most important thing; it's the only thing. . . . color goes immediately to the psyche and can be a direct sales stimulus."[37] When Canada Dry sugar-free ginger ale changed from a red to a green-and-white can, for example, sales increased more than 25 percent. Presumably the green and white signaled a product with a more natural, laid-back taste.[38] When Barrelhead Sugar-Free Root Beer cans changed from blue to beige, people in taste tests insisted that the new stuff was more like good old-fashioned root beer in frosty mugs than the stuff in the blue can, even though the root beer was exactly the same.[39]

Such examples show clearly that the selection and experience of a product can be as much a result of mental image as of product content, and that much of this stimulation comes from color association and past experience. This is why package design is such an important part of marketing: it acts as point-of-purchase advertising that works its effect at precisely the point when the consumer is making a product choice. This choice, it seems, has very little to do with whether a person generally likes or prefers a particular color or design. Rather it has to do with how well the package design and color communicate an idealized image of the product experience contained within the package. Corona beer provides an excellent example of the nuances of this aspect of product image.

In the early 1980s, Corona beer, which had been the leading brand in Puerto Rico began losing its market share. Research into the product and package showed that years before, the brewery had had a problem with leakage in its steel cans, and the image of the product as flat persisted long after the problem had been solved. In addition, as more United States products flooded the Puerto Rican market, the Singing Farmer logotype that graced the label tended to mark it as provincial, something that apparently made it seem less desirable. Even though in

blind taste tests the beer was rated extremely high, sales sagged. The marketing solution was to change the beer's overall image by switching to aluminum cans and redesigning the package to give it a more upbeat look. It worked, and record sales were achieved for the local brew.

Three years later, however, as the market changed and sales flagged, a new round of testing revealed that U.S. beer was being perceived as more full-bodied than Corona—despite the fact that, again in blind taste tests, drinkers still preferred Corona. The problem, it seemed, was not to give the beer but the can more "body." To do this, package designers added a deep red color to the basic design. The result was that in comparative taste tests—which included Corona beer in the old can, Corona beer in the new can, and the major U.S. competition—drinkers were amazed at the improvement in the native beer: it was now just as full-bodied as the competition, and tasted much better than before.[40]

This is why color, as one of the most important aspects of brand image, has come to be recognized as so important in packaging. Some companies, in fact, have been able to claim exclusive rights to colors and color combinations in their product categories—such Owens-Corning's pink insulation and Eastman Kodak's combination of yellow, black and red for film packaging.

The Sex Sell: Women's Bodies and Normative Images

Because the primary source of an ad's power lies in the perception of the viewer, exploitative advertising sometimes utilizes deep-seated fears or needs to sell products through evocative sexual or violent images. This technique is especially used in relation to parity products—that is, products that have little or nothing to differentiate them from the competition in the marketplace—or when the product has little or no tangible benefit to the consumer. By taking advantage of our perceptual tendency to translate association into cause and effect, advertisers can tap the power of this imagery by presenting their products as an integral part of the solution to basic physical needs or social anxieties, even when such an association violates rational logic. When the target audience is in adolescence, when sexual and social insecurities are peak, self-confidence low, and peer pressure high, the approach appears to be particularly effective.

Thus a product that seems to relieve the anxieties surrounding puberty, and at the same time enhance a natural egocentrism and emotional excitability, can exploit the adolescent's lack of experience simply by melding the product, ego, and sexual and social acceptability at the center of the ad's artificial world. "Jeans," for example, which were

originally rather unromantically called dungarees and used as heavy-duty work wear, have become associated through effective advertising with sexual gratification, and are primarily targeted to adolescents. Calvin Klein was the first to fully exploit this approach on a large scale when it launched a campaign for designer jeans in 1980 with Brooke Shields as its celebrity attractor. In the ad, the seductive nymphet looks into the camera and asks: "Do you want to know what comes between me and my Calvins? Nothing." Sales response was immediate. So effective was the approach that Klein launched a new fragrance, Obsession brand perfume, five years later using totally nude models and ambiguous group sex motifs in ads that returned $30,000,000 within ten months.

Thereafter, such advertising became commonplace, and the ability of the innuendo sex sell to break through the clutter diminished proportionately. This meant that Calvin Klein would have to escalate the sex and celebrity or find an alternative strategy. It chose to escalate. By 1992, for example, in the new *New Yorker* magazine Calvin Klein was running ads using music idol Markey Mark in Calvin Klein briefs and unzipped jeans straddled by a topless model also in Calvin Klein briefs and unzipped. But then the competition escalated, too. Diesel Jeans ran an ad of a model lying on a zebra skin, wearing only a black bra and jeans with fly flap fully open and no briefs, with the headline "How to control wild animals." Request Jeans launched a series of ads including a man and woman in bed together, and a fully nude woman in profile just clutching a pair of jeans to her naked breasts. Guess Jeans meanwhile were showing models in haystacks with full cleavage with no jeans in the picture at all. Thus, all of this "sex sell" not only changed the jeans image to one of sexy attire, it also firmly established a sex image competition among brands.

Inevitably by the time total nudity had been reached, this meant that the only place left to escalate into was perversity, and by 1995 Calvin Klein print and television ads had begun to take on the overt appearance of child pornography, with images of scantily clad adolescents in suggestive poses. In Calvin Klein print ads, young girls were shown seated in short skirts with legs spread open or with hands cupped ready to apparently reveal already partially exposed breasts; in television ads, an off-camera voice asked a model to take off a shirt or a pair of pants. Although by this point public tolerance of the sex-sell in general had increased simply by virtue of its ubiquity, public ire was kindled by the use of sets typical of child pornography magazines and films and models who either were teenagers or looked like them. A variety of public voices, including citizen groups and a major column by Jeff Greenfield in *The New York Times* decried the attempt to invoke the cheap

lasciviousness of pornography; and threats by child welfare and religious organizations to boycott stores finally caused Calvin Klein to cancel its campaign.

The Campaign, originally slated to run through October, was canceled in August of 1995, having run less than two months in print, on TV and on city buses. Shortly after its cancellation, the Federal Bureau of Investigation announced plans to investigate the campaign, but dropped them when all models were shown to be within legal age range, and Klein ads proved to be just shy of the legal prohibition forbidding the actual display of genital and pubic areas. Calvin Klein had expected it all, including the fact that the controversy also predictably spurred product awareness. The extra publicity enhanced the product's iconoclastic aura, and therefore the psychological appeal to its young target market, sufficiently to boost sales considerably. In contrast, another less successful act of desperation to break through the clutter led Lee Authentic Clothing to introduce a spot in 1995 showing a young woman peeling off her clothes in front of her boyfriend and then diving into a lake. Because this was now run-of-the-mill stuff, however, they decided to run it in reverse action in order to get attention.

The significance of such images lies not only in their lack of ethical creativity and their exploitation of psychological and social needs, but also in the normative power that the images exert on society as a whole and on adolescents in particular. Perhaps nothing makes this clearer than the steadily declining differences between "glamour" images in fashion photography and the images that adolescents choose for themselves in photographs. In a study of the contrasting images between fashion magazines and class photographs for high school yearbooks in the Minneapolis–St. Paul area, for example, photographer/professor Charles Lewis has found that from the mid-1980s onward—parallel to the introduction and growth in popularity of MTV—there has been a radical shift in the kinds of images that teens have requested of themselves in high school yearbooks—from the traditional full-face close-up to a three-quarter or full-body pose, often in recline, surrounded with "their stuff"—like football helmets—around them. The focus of their eyes, he observes, has shifted from a straightforward, open look to a sideways glance suggestive of fashion glamour poses, and for the first time in class pictures, gels are being use to achieve a certain "look."

He also points to other trends: the increasing digital placement of children into photographs with their favorite cartoon characters, and portrait photography for adult women, mostly in their twenties and early thirties, as a kind of total experience involving complete "make-overs" of hair and make-up, with alcohol served during sittings. The final photographic product, achieved with the sale of lingerie by photographers themselves, resembles what has been traditionally viewed as "boudoir photography," a kind of "soft-porn" approach to portraiture. He concludes not only that consumers are taught what they should want to look like and be by images in the marketplace, but also that there has been a steady increase in the commodification of the self as well, in themes characterized by raw eroticism, focus on opulence, and fantasy.[41]

Such objectification and the placement of things and people as parts in relation to one another, together with the "blocking" or position of these elements within a given scene, are characteristic of the growing trend toward integration of the artificial image into personal lives. These images suggest both a social and cultural context in which "things" are of great importance, and a merging of traditional roles and personal images into commercially driven media templates. Erving Goffman was one of the first to define the variety of codes derived from gender display. These codes, he believes, both reveal power characteristics such as competence and control and also conventionalize them through mass distribution. Women in advertisements, for example, are often found in "canting" positions (lowered head, lying prostrate with feet stretched out) such as dogs might assume to signal recognition and acceptance of others' dominance, a position that Lewis finds increasingly creeping into high school graduation photos. Any position that removes a person from readiness to act may be used to signal submission as well, and where Goffman notes that women are often shown in product advertisements as leaning on men, standing precariously with knees bent, lying prone, or in positions lower than men, Lewis finds that this now characterizes yearbook photos as well.

Goffman notes that women are also shown more often wearing less serious expressions (smiling, covering the face, laughing) and attired in less serious costumes, indicating that they are playing at roles—not wearing clothes as part of a functional identity, which is characteristic of men. Like children, women are often shown sucking things, putting strange things in their mouths, and hanging on, while men usually have both hands free to maneuver and stand or sit firmly. While traditionally, for example, soldiers and workers as images of power and authority are typically shown in low angle with eyes steadfastly fixed on a distant goal and feet solidly planted, ready for action, American advertisements of women rarely if ever portray them in this fashion. Women's hands tend to caress; men's to grasp firmly. Men teach, act, and show; women listen, languish, and appear to drift mentally.[42] All of this, Goffman's argument implies, adds up to a commercially manufactured image that is so culturally pervasive that it becomes not only an internalized mental

measure of normative role behavior for the society but also a kind of gender propaganda to perpetuate it as well.

Marxist critic John Berger suggests, too, that advertising images have a solid historical foundation in the world of art where typically "men act" and "women appear."[43] "This unequal relationship," he states, "is so deeply embedded in our culture that it still structures the consciousness of many women."[44] So much so, in fact, that they assess their own worth as people by how men perceive them and incorporate the perspective of the male gaze into all that they survey and see in themselves. "The 'ideal' spectator," Berger says, "is always assumed to be male and the image of the woman is designed to flatter him."[45]

According to Naomi Wolf, advertising imagery is largely responsible for this by creating a generalized atmosphere that is both absorbed by women from their earliest age and reinforced by judicial process. Although the feminist movement did much to improve awareness of the situation, the boomerang rebound against it (discussed extensively by Susan Faludi in *Backlash*), Wolf believes, has resulted in an oppressive mood and a reemphasis on beauty that has political overtones as well. According to Wolf, "The backlash is all the more oppressive because the source of the suffocation is so diffuse as to be invisible,"[46] but its presence is keenly felt. Research shows, for example, that women's self-esteem is appreciably lowered after repeated exposure to idealized images in fashion magazines. These images, which are digitally manipulated to create even more unrealistic bodies and features, many feminist critics agree, emphasize make-up and a cult of thinness at the expense of both mental and physical health.

According to Wolf, professional beauty qualification (PBQ) has also become widely institutionalized as a criterion for hiring and promoting women. Citing television journalism as typical, Wolf describes a "double image—the older man, lined and distinguished, seated beside a nubile, heavily made-up female junior—which has become the paradigm for the relationship between men and women in the workplace."[47] By the 1980s, the news man was a fully defined individual whose aging gained him prestige; the newswoman, however, was only an appearance chosen first for youth and beauty and then trained in delivery skills. By 1991 women news anchors were twenty years younger and paid 23 percent less than their male counterparts.[48] What this ultimately translates into, according to Wolf, is that for men individuality and maturity is power, but for the female "anchorclone," generic replacement is the inevitable result of aging and experience.[49] As young women increasingly equate beauty with the anorectic image projected by models (who average 23 percent leaner than the average woman), and

therefore become increasingly dissatisfied with their own image, they fall victim to anorexia nervosa and bulimia.

Although eating disorders were thought to be relatively rare before the 1970s, with the onset of a new fashion image in the late 1960s and early 1970s, a variety of eating disorders began to surface, particularly bulimia and anorexia. By the 1980s, numbers had reached alarming proportions. One 1992 study, a repeat of one done a decade earlier, involved a group of 800 women and 400 men at a selective northeastern university. Testing for factors including drive for thinness, bulimia, maturity fears, perfectionism, and interpersonal mistrust, the study found that body dissatisfaction and the desire to lose weight were still the norm for more than 70 percent of young women, with 1 in 10 of them reporting "symptoms that would represent clinical or nearly clinical eating disorders."[50] Anorexia and bulimia can be as physically addicting and deadly as nicotine for some women, yet it is clearly glamorized in the world of marketing and advertising.[51]

Plato believed that the normative image, which revealed the ideal to our minds, was our remaining sense of a perfect world left behind at birth. Today this normative image tends to be developed through media. In such an artificial world, appearance is everything: going out without make-up is equated to literally with going out without one's "face" on, and perpetual hunger is common. Even legally, the beauty norm is well-established: some federal judges have upheld the right of employers to set appearance standards as a criteria for employment. "No woman is so beautiful" according to Wolf, "that she can be confident of surviving a new judicial process that submits the victim to an ordeal familiar to women from other trials: looking her up and down to see how what happened to her is her own fault."[52]

One particularly chilling story which illustrates the inherent power of this "beauty myth" is told by Mary Kay Ash, founder of Mary Kay Cosmetics, in her autobiography *Mary Kay*. The story is chilling for two reasons: first because of the bizarre reasoning involved, and second because Mary Kay herself uses the subject as an example of "success" to be emulated. In the story, a Mary Kay Cosmetics sales representative and former model is told that she may go blind. If she has an operation right away, she will have a 50 percent chance of sight, but if she waits, she will gradually lose her sight until it vanishes completely. Incredibly, the woman opts for certain blindness because "the thought of being unable to do her hair and make up her face was unbearable,"[53] and the interim could give her the time she needs to learn to put on her make-up correctly without being able to see. (She does this by placing cosmetics in the refrigerator and putting them on cold so she can feel them more

keenly.) At the time of Mary Kay's writing, the woman was blind, but impeccably rouged and lipsticked, selling Mary Kay cosmetics from jars marked in Braille. The importance of the external normative image was so strong that faced with the choice of life without "her face" or living in perpetual darkness, she chose to be seen rather than to see.

The Sex Sell: Men and Their Machines

It has also often been pointed out that a parallel cultural preoccupation with image exists between American men and their cars. S. I. Hayakawa comments, for example, that "the automobile is certainly one of the most important nonlinguistic symbols in American culture," that "it is one of our ways of telling others who we are," that automakers are the "grammarians of this nonverbal 'language.'"[54] Although it is probably more accurate to say that advertising agencies are the grammarians in this "language," Hayakawa's point is well taken in terms of the inordinate influence of advertising in general on cultural values, attitudes, and lifestyles, and of car advertising in particular in relation to personal preoccupations with speed and power. In his classic essay "Sexual Fantasy and the 1957 Car," Hayakawa states wryly that by 1957 the automobile industry had apparently decided that transportation was only a secondary reason for buying a car, and that its primary function was to allay "men's sexual anxieties."[55] Hayakawa found evidence for this in excessive horsepower allowing for speeds up to 125 miles per hour, rocket ship styling that suggested a Freudian impotence, and the sacrifice of "*all* else—common sense, efficiency, economy, safety, dignity, and especially beauty—to psychosexual wish fulfillment."[56]

Although today's cars no longer sport the giant fins of the 1957 Plymouth Fury, and motivational researchers have become more reality-oriented in terms of mileage, the car today still remains a significant part of our own advertising of who we are, and perhaps it is not too far a stretch to suggest a mythical connection between it and the wings of Icarus as a symbol of freedom and power. It is also a symbol that overlaps sign categories and exists among all economic levels: as an icon in a car ad, the car looks like what it is; as an indexical sign, it is associated with travel, new places, and new experiences; and as a symbol, particularly in terms of sexual potency, it transforms the power associated with the machine in the last century into the power of the individual.

In 1900, Henry Adams saw in the dynamos at the World's Fair a symbol of infinity and "began to feel the forty-foot dynamos as a moral force, much as early Christians felt the cross."[57] It seemed to him that "man had translated himself into a universe which had no common scale of measurement with the old"[58] and that this new power had taken the place of the productive spiritual power symbolized by the Virgin and expressed in the great European cathedrals, built by successive generations of men. In the 1920s, F. Scott Fitzgerald saw similarly in the proliferation of the automobile a dynamic force that had irrevocably altered the social order and the way people interacted with their environment and with each other. Spirituality had dissolved into a "pathetic wistfulness," and the world had no more outposts "to grasp his imagination." Yet in fifteen minutes, anyone could be out of sight.[59] From its beginning as a mere mechanism, the automobile grew into an image that ultimately transformed the whole of the society with its power, but left it nowhere to go. At least part of the success of Fitzgerald's Gatsby as a literary symbol derives from the power of the automobile as a cultural symbol of success and its ironic personal emptiness. In Sassure's terms, the automobile now presents itself as a signifier without the signified, a symbol of freedom without its possibility. As Barthes has observed, "The sign is ambiguous: it remains on the surface, yet does not for all that give up the attempt to pass itself off as depth."[60] Tellingly, automobiles in advertisements aimed at youth and middle income fantasizers are rarely still and usually focus on the journey and on speed, sports handling, or the power to handle rugged terrain.

In upscale cars, the appeal comes through the status of "having arrived," and these are often treated as if they were works of art, stationary and lit for viewing. David Ogilvy for example is credited with introducing Rolls-Royce as a viable American choice and later with increasing Mercedes-Benz sales fourfold through his advertising through print ads designed to capture upscale interest and prestige. Neither of Ogilvy's famous ads suggests speed, toughness, or handling, but rather artistic workmanship. The Rolls ad, for example, shows a one-third page illustration of a gleaming car with the headline "At 60 miles an hour the loudest noise in this new Rolls-Royce comes from the electric clock," and the Mercedes headline reads: "You give up things when you buy the Mercedes-Benz 230S. Things like rattles, rust, and shabby workmanship." Both ads are very heavy on copy, featuring carefully chosen engineering and synecdochic details which, like the electric clock, suggest far more than themselves alone. A master at his craft, Ogilvy always found the precise line of detail that would suggest the whole and create an emotionally loaded and vivid personality image in his reader's mind.

Joe Camel and the Marlboro Man: Images that Kill

According the Center for Disease Control, over 430,000 people die every year of tobacco-related causes—well over 1,000 people a day. After

years of debate over the possibility of banning tobacco ads altogether, with Tobacco companies continually winning the legislative battle as well as the battle for new smokers, President Clinton in August 1995 gave the federal Food and Drug Administration the go-ahead to assert regulatory power over tobacco, primarily as a drug delivery system for nicotine. As the reasons for his decision, he stated that "When Joe Camel tells young people that smoking is cool, when billboards tell adolescents that cigarettes may make them thin and glamorous, then our children need our wisdom and our experience." The initiative recognized that nicotine addiction is a pediatric disease, and that nicotine is an essential design feature of cigarettes.[61]

In the United States, approximately one billion packs of cigarettes are sold annually to children under eighteen years of age.[62] The World Health Organization estimates that worldwide, of adolescents who continue to smoke, "half will be killed by tobacco . . . 200 million to 300 million children and adolescents under twenty currently alive [will be] eventually killed by tobacco."[63]

First believed to have curative powers, tobacco was introduced into Jamestown, Virginia, in 1612. By the end of the eighteenth century tobacco was firmly entrenched as a plantation crop, and by the end of the nineteenth century, both the mass production of cigarettes and campaigns against smoking had begun. By the 1920s, however, cigarette sales had also reached $1 billion a year, primarily because of the impetus given the tobacco industry when cigarettes were included in soldiers' rations in World War I.

By the end of the 1930s, scientists knew of the major health risks, but it was not until 1964 that U.S. Surgeon General Luther Terry publicly confirmed the link between tobacco, cancer, heart disease, and other serious illness. In what many believe was the beginning of several misguided efforts to curb the industry, warning labels were required in 1966 (giving tobacco companies the legal defense implied by assumption of the risk and seemingly absolving them from further disclosure on harmful effects). In 1971 a legislative ban on radio and television advertising of cigarettes was enacted (this relieved tobacco companies of producing antismoking ads under the Fairness Doctrine). In 1986, the U.S. Surgeon General declared second hand smoke to be dangerous, and in 1993 the Environmental Protection Agency followed suit, declaring it to be a general health hazard.

In 1988, when the U.S. Surgeon General declared nicotine to be addictive, tobacco companies denied it. Appealing to the Constitution's First Amendment "freedom of speech" guarantee (exclusively sponsoring the 200th anniversary of the Bill of Rights in 1989, for example) and

with arguments that their advertisements contain important information for the potential consumer, tobacco companies continued to outwardly deny the validity of studies linking cigarettes to nicotine addiction and to cancer and other health risks. Yet beginning in 1994, internal documents from the tobacco industry began to emerge that belied this, showing that addictive levels of nicotine had been deliberately manipulated. By the 1960s, documents revealed, top Brown and Williamson and other tobacco executives knew that nicotine was addictive and that their own laboratory experiments showed that cigarettes cause cancer. Brown and Williamson subsequently conspired to misrepresent its own supposedly independent research findings by funneling damaging research results through its lawyers, who were bound by attorney-client privilege, and by disposing of damaging documents from their own research.[64]

Such documents lend insight into the question of why people have started to smoke and continued to smoke even while knowing the dangers of it. Because tobacco's capacity for addiction is apparently stronger than cocaine or heroin,[65] tobacco companies knew that they had to lure people into smoking before they fully realized they would become addicted, and that they had to counteract growing rational awareness with emotional appeals, primarily through alluring visual imagery. Because minors tend to smoke heavily advertised brands, and relatively few people switch brands, they also knew that if they could capture young smokers, they could retain brand-loyal smokers for the rest of their lives. Most smokers become addicted to cigarettes when they are minors,[66] and if people do not start smoking by the time they are eighteen or nineteen years old, the probability is they will not start at all. Recent studies by the University of California, San Diego cancer and control program, clearly establish the association between tobacco marketing and youth smoking. Young people are especially susceptible to marketing, particularly to advertising images.

Youngsters, for example, who could name a favorite cigarette ad such as the Joe Camel cartoon, or owned a Marlboro T-shirt, were found to be nearly four times as likely to smoke as other youngsters.[67] Introduced by R. J. Reynolds in 1913, Camel cigarettes did not change its image until 1987, when it first introduced Joe Camel and the "smooth character" campaign. When it did, the campaign was embraced by children: In 1991, three articles appearing in *Journal of the American Medical Association* (JAMA) revealed that approximately 30 percent of 3-year-old children and 91.3 percent of 6-year-old children correctly matched a picture of Old Joe—Camel's "smooth character"—to a picture of a cigarette, making Old Joe Camel as well recognized as Mickey Mouse.[68]

Camels was also the brand of choice among 12–17-year-old males and the most named brand among 12–13-year-olds.[69]

The campaign turned the brand around, making it the number 6 brand in the $40 billion annual market. It also showed a disproportionate influence on smokers under 18 years of age, whose choice of Camel cigarettes jumped from .5 percent to 32.8 percent within three years of the start of the campaign.[70]

Both Camel and Marlboro brands have appeared regularly in films, on billboards, in promotional displays at youth-oriented events, in sporting events on television, and in personal paraphernalia such as T-shirts, posters, and caps. Their logos appear on video arcade games, children's toys, and candy products.[71] The repetition of these images—namely of the trade characters "Old Joe" Camel and the Marlboro Man—goes a long way in explaining why children and teenagers make up 90 percent of all new smokers.[72] When they do become smokers, 90 percent become persistent daily users, and 55 percent become dependent.[73]

Cigarette advertising, like advertising for jeans, relies almost totally on visual images, repetition, and adolescent psychological appeals. Joe Camel, for example, as a cartoon trade character perennially surrounded by cartoon females and at the center of everyone's attention and admiration, has been inordinately successful. As a discussed in Chapter 2, we give cartoons life by filling them up with ourselves, giving them power through our own identification with them and through the shared sense of experience which the ubiquitous images of advertising provides.

Astride a motorcycle or lounging in "cool" settings such as bars, jazz combos, and tropical beaches, the Bogart–Blues Brothers–Brando-on-a-motorcycle–James Dean–like camel always has a cigarette hanging from his lip or held prominently but casually between his fingers. Drawn from the original camel logo on the pack, the trade character has an added adolescent smugness and a self-conscious virility in his cartoon transformation that the original realistic camel on the pack lacks since it is merely an animal in the desert. Unlike the original, the cartoon "Old Joe" wears and uses "gear" that the smoker with "camel cash" coupons can also order from a hard goods catalog. The catalog features items like sunglasses, lighters, cards, T-shirts, and a Sony Discern CD player.

Some critics have even suggested an uncannily close physical resemblance between Joe's face and male genitalia—an accusation that R. J. Reynolds denies. *Village Voice* critic Leslie Savan insightfully comments that "The double message—it's a dick; nope, it's a camel—can be far more potent than explicit sex or explicit wholesomeness."[74] Perceptual ambiguity, like the "Face-or-Vase" and "My Wife or My Mother-in-Law"

images discussed in Chapter 1, can be extremely effective devices for grabbing and holding attention.

Just as Freud suggested that the processes of condensation and displacement are used by the psyche to evade its censor, so, too, cigarette advertisers have used apparently inoffensive yet symbolically loaded images to evade legislative censure. The positive illustration "condenses" the logically disparate images of cigarette smoking and social-sexual behavior into a single, emotionally persuasive image, while the cigarette "displaces" explicit sexual referents. The resulting message? Smoking is a socially positive, sexy act.

Because much of visual communication takes place almost instantaneously at the subconscious and emotional level, and because approximately 98 percent of typical cigarette ad space is occupied by a positive image, the primary impact of the message is felt visually and emotionally rather than verbally and rationally. The mandatory cigarette warning label is placed outside of the scene, a "tack-on" of verbiage in an otherwise visual narrative. Visual design elements invariably draw the eye away from it, and its own verbal format renders it once removed from the immediate world of the image. (Would the effect be the same, e.g., if the verbal warning were replaced by an inset *picture* of diseased lungs?)

The social image of tobacco in advertising is thus the reverse of its true physical picture. Recognizing that consumers read visual language more quickly and easily than verbal language, and that youthful consumers—like adult consumers—block out negative messages in favor of positive messages, advertisers and their agency representatives have traditionally played a psychological and semantic game with legislators and the public in order to keep profits high. Through images of Old Joe surrounded by admiring females in "cool" settings, and through the archetypal mythic appeal of the independent cowboy, tobacco companies have succeeded in seducing potential smokers while they are children and adolescents.

Although cigarette manufacturers still deny that they are attempting to appeal to children, and advertising agencies with cigarette accounts have traditionally attempted to defend their product messages by saying they were directed only at persuading existing adult smokers to switch brands, the facts seem to belie both statements. Only about 10 percent of smokers change their brand in any given year, yet the year of Old Joe's introduction, the tobacco industry spent $3.27 billion on cigarette advertising and promotions—a figure much larger than would be warranted by brand switching.[75] The campaign was also a failure in appealing to adults, but not to children. Studies

show that the Old Joe Camel cartoon is much more successful at marketing Camel cigarettes to children who think the Joe Camel ads look "cool," than to adults for whom the "Joe Camel" character has far less appeal.[76]

Although Joe Camel character has become of primary interest because of its appeal to children, no archetypal advertising symbol has had the total impact nor lasted longer than the Marlboro Man. The first filtered cigarette launched in the U.S., in the 1930s Marlboro was first positioned as a woman's cigarette when men were smoking nonfilter brands. The positioning was changed, however, because more men smoked than women, and Philip Morris realized that it had neglected a prime market—"post-adolescent kids who were just beginning to smoke as a way of declaring their independence from their parents."[77]

Fashioned by Leo Burnett in concert with Jack Landry of Philip Morris in 1955, according to Meyers, the Marlboro Man was the result of "months trying to come up with the right image to capture the youth market's fancy. At last it latched onto the concept of the weathered-looking cowboy riding off into the sunset—a perfect symbol of independence and individualistic rebellion."[78] According to Burnett, the Marlboro man was designed to "sell flavor in the cigarette, masculinity in the smoker," and although the concept originally was devised with various roles including a stevedore, a miner, and a truck driver, the cowboy was chosen because it was an archetypal image which thousands of westerns, fact and folklore had reinforced: "the ultimate man's and woman's man."[79]

The image of the Marlboro Man fit Leo Burnett's advertising convictions perfectly, for like Jung, he believed that the most effective images have an appeal deep in the psyche: "The most powerful advertising ideas are non-verbal, and take the form of statements with visual qualities made by archetypes. Their true meanings lie too deep for words."[80] The immediate success and the enduring quality of the image has borne him out: the Marlboro Cowboy took the brand from seventh position in the United States to first position in the world—a position which it has retained for forty years. In Nigeria, the cowboy is black; in Australia, he is in the outback; in Hong Kong, he is a ranch owner, but everywhere in the world the Marlboro Man has retained the same look, personality, and same profound archetypal appeal. In the JAMA studies, Marlboro was the brand most frequently named in all male adolescent groups and the brand of choice among youth, increasing in youths and young adults up to the age of 24 and then gradually decreasing.[81]

As both Boulding and McLuhan observed, the entrenchment of such archetypal images as the Marlboro Man and Old Joe is evidence of

their inherent power. Because such images are stable and resistant to contrary messages, according to Boulding, "change will be slow no matter how swiftly the messages themselves course through the channels of communication."[82] Because advertisers like Leo Burnett have been so adept at creating such commercial archetypes—as evidenced by the appeal of Burnett's Tony the Tiger, Charlie Tuna, the Jolly Green Giant, the Pillsbury Doughboy, and Morris the Cat—the staying power of these images is not easily undone.

One of the most visually intelligent men in the advertising industry, Leo Burnett understood the power of the visual image and advised his creative teams to mine the archetypal power within the image to appeal to the deepest part of the consumer psyche:

> a strong man on horseback, a benevolent giant, a playful tiger. The richest source of these archetypes is to be found at the roots of our culture—in history, mythology and folklore. Somewhere in every product are the seeds of a drama which best expresses that product's value to the consumer. Finding and staging this *inherent drama of the product* is the creative person's most important task: Do not lean on tricks, devices or "techniques." Keep the advertising relevant—shun irrelevant approaches in headlines and illustrations, no matter how clever they are.[83]

Conclusion

Visual language is more concise and more easily and quickly processed than verbal language, and the best "creatives" in advertising have been quick to seize on the value of images in reaching their potential consumers. Effective advertising visuals not only stop the viewer but also begin the communication process by simplifying the product message to its most quickly and easily understood form. Advertising images thus act as condensed cultural symbols, visually reduced statements that suggest a storyline that targeted consumers complete in their own imaginations, with themselves as the leading character, although significantly the product remains the hero. As such, they represent the epitome of the dynamic concepts of gestalt simplification, Gibsonian affordance, and perceptual closure.

Within the buying dynamic, consumers are both product users and self-identification seekers, buying products and services which are not only useful to them but which, in being used, also confirm self-image. In turn, their product use sends out meaningful messages to others about themselves. If a certain brand of blue jeans can effectively position itself

as "young, sexy, and on-the-move," for example, those same jeans, in being worn, will send out the signal that the wearer is also "young, sexy, and on-the-move." The same, of course, is true of status automobiles, celebrity-endorsed cosmetics, even orange juice. In this way advertisements become a vocabulary for a public discourse steeped in consumerism.

Although this makes consumers active players through their use of advertising, they are nevertheless always placed in a response mode reacting to the images that advertisers have created. These images tend to become more normalized by repetition as consumers become more accustomed to them and incorporate their images and their implied norms of appearance, gender roles, and social interaction into their own lives. When products fall short of their promise, consumers are then more likely to feel less adequate about themselves as persons.

In the attempt to break through the clutter without using a Unique Selling Proposition (USP) or meaningful product benefit, advertisers sometimes resort to more and more outrageous images to grab attention. This approach, however, often based on borrowed interest, as with images of sex or violence, is susceptible to an upward spiral of ever-increasing shock in order to get attention. For the consumer repetition accustoms and desensitizes, and that which once shocked inevitably comes to be seen as ordinary. This in turn necessitates another push of the envelope by the advertiser.

One alternative to this overstimulation spiral is the use of archetypal images that reach deeply into the psyche. In this respect, some advertising has been devastatingly successful not only in selling destructive products but also in clouding its method of communication. So successful has cigarette advertising been in this that over 430,000 people die of its images each year, initially victimized by a lack of awareness that images are the most potent form of perceptual language.

7

Political Images: Public Relations, Advertising, and Propaganda

> The nation that expects to be ignorant and free expects what never can and never will be.
>
> —Thomas Jefferson

Perhaps no single group has been more involved with image at all of its levels of signification than politicians—from the public conception of who the person is and what he or she "stands for," to the carefully constructed images disseminated to the media as "news," to the archetypal and nationalistic imagery used in political ads. Political imagery, in fact, cuts horizontally across the vertical currents of public relations, advertising, and propaganda. Nowhere is this more apparent than in the political images surrounding presidential campaigns, propaganda, and war.

Hill and Knowlton's PR War Effort

The Gulf War in which America interceded against Iraq on behalf of Kuwait in 1991 provides a variety of examples of how images can be particularly effective in emotionally moving mass audiences through visual stories, and in functioning as political rhetoric to manipulate public sentiment and influence foreign policy. In war, images are particularly crucial in defining the reasons for becoming involved, for rallying the support of the nation and maintaining morale, and for motivating soldiers to kill or die. All wars depend heavily on imagery for their maintenance and support.

For most Americans raised in a predominantly Judeo-Christian culture, the Middle East is a political and social enigma. When Iraq invaded Kuwait in August 1990, few Americans understood the basic issues of the conflict, yet they supported America's intervention in it. Watching key televised events, they believed they were seeing history

unfolding and they trusted their eyes and hearts in interpreting and understanding it. Yet much of what they saw and understood was manipulated for effect:

In 1990, for example, an anonymous Kuwaiti refugee named "Nayirah" delivered an emotional appeal before a congressional caucus hearing, a news event that moved the nation to moral outrage. She had personally witnessed a number of atrocities in Kuwait when Iraqi troops invaded, she said, but one image that she used was particularly compelling: in one hospital, newborn babies were torn away from their incubators and left to die. It was a powerful image, described with tearful sincerity. Those who did not see and hear her testimony as it was given caught it on the evening news, and most newspapers immediately featured her story in the most prominent way. It thus reverberated through the American society. President Bush used it as a touchstone symbol of inhuman depravity in several of his speeches on the war and on Saddam Hussein.

That November, as the United Nations was debating the use of force against Iraq to drive its forces out of Kuwait, another young woman, Fatima Fahed, testified to other atrocities, giving detailed firsthand accounts of the horrors inflicted there by the Iraqis. Again, the nation was moved by the stories and the attractive young woman. Videotapes taken before the U.S.-led invasion showed other morally repugnant actions, as when apparently peaceful Kuwaiti demonstrators were openly fired on by Iraqi troops.

What was significant about all of these news events is that none of it was what it seemed. In truth, the New York Public Relations firm of Hill and Knowlton had been hired by an organization called "Citizens for a Free Kuwait," funded primarily by the Emir of Kuwait specifically to develop support for American and United Nations (U.N.) intervention. According to subsequent revelations by John R. MacArthur in the *New York Times*, Morgan Strong in *TV Guide*, ABC's *20/20*, and CBS's *60 Minutes*, Hill and Knowlton on behalf of their client had scripted, costumed, and rehearsed the fictional scenarios with the two women in order to incite the American public indignation: Nayirah in reality was the daughter of Kuwait's ambassador, and Fatima Fahed was the wife of Kuwait's minister of planning and a practiced Kuwaiti TV personality. Videotape footage shot inside Kuwait was recontextualized to make Iraqis appear to be the aggressors when the reverse apparently was true in the particular situations recorded. Although none of this suggests that Iraqis committed no atrocities, what it does suggest is that much of the support for the Gulf War was the result of a well-orchestrated, well-funded, and highly successful public relations effort paid for by a foreign government.[1]

Another one of the things that made this war unusual was that it was the first fully televised one. Although reporters extensively covered the Vietnam war on television, for example, the coverage rarely was live, and it was not continuous. In the Gulf War, however, CNN gave continuous 24-hour coverage, and as a result, viewers gained a false sense of seeing what was really happening and came to believe certain ideas that had no foundation in reality.

After the war began, the engineering of television imagery reverted to the military, which according to Reagan image-maker Michael Deaver, was a masterful "combination of Lawrence of Arabia and Star Wars."[2] The entire war lasted four weeks, cost the American public $61 billion and, according to secret reports and a Red Cross estimate, the lives of up to 200,000 Iraqi and 150 U.S. soldiers.[3] People were glued to their TV sets for hours on end, even when coverage consisted of only small blips on the screen, trusting that what they heard was true. One of the images that seemed to epitomize the war to many people was the image of a bomb being accurately placed down a target chimney. It was replayed again and again on CNN, which achieved its highest ratings ever, reaching up to almost 11 million homes during television primetime.

On TV, it seemed that the American combat technology was unbeatable: we could put our bombs exactly where they were meant to go, and this implied a clean technowar closer to the kind played in video games than in real life.[4] Video technology, was, in fact, an important part of what has been dubbed by media critics as "The Nintendo War" both because the war coverage, with simulations filling in for true action, made it look that way, and because soldiers fighting in the war saw their experiences within this context. While research by Morgan, Lewis, and Jhally showed that heavy viewers were more inclined to believe that "the war was being fought cleanly and efficiently with smart bombs that were damaging only buildings,"[5] in reality, of the 88,500 tons of bombs dropped, 70 percent missed their targets.[6]

In fact, the more people watched, the researchers found, the less they understood about what they were seeing or even about the basic issues that caused the war in the first place. Although heavy viewers were likely to know the names of the chief players and the weapons in the war, such as Joint Chiefs chairman General Colin Powell and General Norman Schwarzkopf, and the name of the "Patriot" missile, for example, they were also more likely to mistakenly believe that Kuwait was a democracy before the war. They were also less likely to know that the United States had sided with Iraq in the Iran–Iraq war, or that the United States had told Iraq before the invasion that there would be no ramifications if it invaded Kuwait.[7]

Much of this was the result of tight military control that not only censored reports but also restricted journalists' freedom to visit the front, to talk to troops, or to see war damage without military escort.[8] Journalists from nonparticipating countries found it difficult or impossible to get visas, pools were established so that the total number of journalists allowed access to information was severely curtailed, reports were censored and had to be distributed for common use, and journalists who attempted to step outside the rules faced loss of credentials and deportation.[9] According to communication researcher Nohrstedt, the result was media coverage that fulfilled only military and propagandistic aims but that lacked any tangible evidence of human suffering: "There was no body count as in Vietnam, and the image of a clinical, computerized war, which glorified the technological superiority of the alliance, penetrated all media."[10]

Although some military criticism was directed at reporter Peter Arnett's coverage of the bombings of what Arnett called a baby-formula factory (which the military called a production facility for biological weapons) and a civilian bomb shelter (which the military identified as an underground military command center),[11] what the public saw for the most part was a steady stream of computer simulations of the action, live-action "smart bombs" apparently hitting their targets, and interviews with military strategists.

What the public did not see, however, was combat itself, the resolution by House Banking Committee chairman Henry Gonzalez to impeach President Bush, massive public rallies in opposition to the war that erupted in Japan, Spain, North Africa, and other nations, or what soldiers referred to as their "turkey shoot" of fleeing Shiite and Kurdish conscripts.[12] Although part of the reason for this lack of coverage was military control of information, part of it was also due to pressure from advertisers who did not want their products viewed within negative contexts—that is, "surrounded by images of death, pain and destruction."[13] Because advertisers were "skittish about war coverage," lost advertising revenue totals rose as the war went on, for a combined sum of at least $125 million for the three commercial networks and $18 million for CNN, which had raised its rates to reflect its increased audience.[14]

In 1985, Neil Postman had argued that "viewers know that no matter how grave any fragment of news may appear . . . it will shortly be followed by a series of commercials that will, in an instant, defuse the import of the news, in fact render it largely banal."[15] In Gulf War news, this relationship is reversed: instead of networks showing concern that the presence of happy commercials would trivialize serious news, advertisers were asserting their economic right to withhold support from

images that might prime a grim attitude toward their products—fears that have been at least partially supported by some research[16]—leaving newscasters with the prospect of making violence positive, even entertaining, of treating only soft stories, or of losing their financial support. This primary concern over a positive context for messages in order to sell advertising time has obvious though significant dysfunctional consequences for news reporting in general; when lives are bartered for television rating points to keep sponsors happy, it has also profound ethical and moral implications for the media industry and the public.

In the Gulf War, people believed they were seeing reality unfolding before them instead of understanding that they were really seeing only a version of events, primarily because no intermediary was immediately visible. In part precipitated by a public relations firm on behalf of a client, in part controlled by political and military motives, and in part filtered by networks in their drive to create the "proper mindset" for reception of commercials, the images which emerged were both less accurate and less informative than people suspected. As a result, viewers came to feel that they were indeed in a position to make informed political judgments.

This sense of immediacy and truthfulness which is the result of watching a steady stream of images interpreted with authority is what George Gerbner warned about as "instant history"—that is, history constructed by technology which "concentrates power, shrinks time, and speeds action to the point where reporting, making and writing history merge."[17] This alteration of history is made possible by the ambiguity of the image—such as the dim blips of missiles seen in the night sky on relatively low resolution TV screens—and the verbal context that interprets it. Such images are responded to immediately and emotionally, without introspection or recognition of complexity. Like the images of *Top Gun*, images of the Gulf War made people feel a kind of conditioned reflex to the image without giving them either the time to reflect or the accurate and complex information necessary to do so. As Condry put it: "People saw the Patriots go into the sky like a Nintendo game, blowing up the Scuds, they thought. Words contrary came later and failed to change those impressions."[18] As discussed earlier, people not only believe what they see, but they must be highly motivated to critically examine it; when they do, they often persist in believing what they think they saw, even after it has been proven false.

When image and voice-over conflict, people will believe the image and ignore the voice-over. Control of the image, therefore, implies perceptual control as well because as Gerber states, "Images of actuality appear to be spontaneous and to reveal what really happens. They do not need logic to build their case."[19] They in fact bypass logic altogether

unless a conscious effort is made to review them. Received directly as "truth," however, there is little motivation to return to images and to analyze them, except in cases such as the O. J. Simpson images which were frozen in time onto the reviewable covers of national print magazines, and seen by people already sensitive to issues of stereotype. On television and in film, however, images are rapid and transient, disappearing faster than we can comprehend their meaning. They are therefore even more susceptible to manipulation through content and context. As one German publication commenting on Gulf War coverage put it: "The impatient television gobbles up all time for consideration, all time for checking and weighing information—the time that democracy urgently requires. . . . Democracy can protect itself only by rediscovering slowness."[20] Because it is clear that media technology is not going to slow down, it is vital that intelligent analysis and critical speculation be introduced into the process of viewing. In other words, TV coverage of the Gulf War provides us with some of the most persuasive arguments for the development and exercise of visual intelligence.

Political Advertising and Public Image

One of the more disturbing political uses of television apart from war coverage, but just as crucial to the workings of democracy, is the manipulation of political public image by advertising experts—people who know how to package and sell their product and how to use media effectively.

In 1952, the Republican Party made United States political history by becoming the first to use television spot ads to promote presidential ambitions—at a time when there were only about 19 million television sets in the country. In so-called "The Man from Abilene" spots, Dwight Eisenhower, from a podium in a studio, in low-angle shot, responded benevolently to questions posed by "ordinary citizens" below and to the left, who looked up at him admiringly. The spots were exceptional because prior to this, candidates had simply purchased half-hour segments of air time to explore issues and state positions; this time the political spots were done as commercials by a professional advertising agency—Batten, Barton, Durstine & Osborn (BBDO)—carefully shot in separate frames and edited together to achieve the desired effect. But what may be most notable is the fact that political audiences did not expect nor suspect the technical manipulation involved: Eisenhower was never in the company of the questioners, his television delivery technique was carefully choreographed, and the dramatic lighting and camera angles were professionally manipulated to give Eisenhower

stature and credibility. His glasses were removed; his clothes were changed.

In short, techniques that had formerly been reserved for commercial sales had moved unsuspected into the political arena, and the result was a landslide victory. Rosser Reeves, one of the most influential advertising men ever in the business and the one who wrote the spots, commented later of Eisenhower, "The man is very good. He handled himself like a veteran actor."[21] Reeves believed in the power of the television image. He had previously tried to convince Thomas E. Dewey to use television advertising against Truman when there were fewer than half a million sets in the country. Dewey refused, thinking it would be undignified. If undignified, it was, however, effective. The Republican National Committee was so pleased by the results that it kept BBDO on retainer to dispense media advice as needed. BBDO subsequently continued to supervise visuals—including cue cards, charts, graphs—and rehearsed four cabinet officers for a television panel in the spring following the election.[22]

Although the "Man from Abilene" spots were a "first" for television, professional advertising men had been in fact actively involved in politics from the turn of the century. In 1916, for example, a four-page insert was placed in the *Saturday Evening Post* and other magazines by Erikson, the GOP's advertising agency, urging Theodore Roosevelt to run for president; by 1917, Congress was for the first time considering the regulation of political ads. In 1918, Albert Lasker, then a partner in the powerful Lord & Thomas ad agency, supervised publicity and speechwriting for Warren G. Harding and even acted as a "bag-man" in paying off one of Harding's mistresses before the election.[23] By 1940, so many admen were involved in political campaigning that Dorothy Thompson lamented that the advertising "hard sell" had become a staple: "The idea is to create the fear, and then offer a branded antidote."[24]

Twelve years after the "Man from Abilene" spots, this "hard sell" technique of getting a vote in less than a minute was perfected to the point where a political commercial caused so much controversy that, while it ran only once on September 7, 1964 during "Monday Night at the Movies,"—like the Orwellian 1984 Apple commercial on the 1984 Super Bowl—it was repeated over and over again in the context of "news." The ad generated by the Doyle Dane Bernbach (DDB) advertising agency for Lyndon Johnson was the now infamous "Daisy" commercial, which shows a little girl counting and plucking the petals from a daisy, and then looking up as an ominous voice-over counts down to a nuclear explosion. Johnson's own voice tells us that "we must love one

another or die," and a voice-over announcer tells us that we should vote for Johnson because the "stakes are too high for you to stay home."

As Jeff Greenfield comments in *The Real Campaign*, "What the ad's creator, Tony Schwartz, had done was to demonstrate a power of television never applied to political commercials until then: the power to make implied arguments through the use of voice and image, without the need to argue those positions."[25] While Johnson's opponent, Goldwater, was never mentioned by name, nor any argument on the probability of Goldwater's policies resulting in nuclear war was presented, the message was devastatingly clear and effective, uniting three powerful images: child, daisy, and dreaded nuclear bomb mushroom cloud. Although the Democrats spent little more than half the Republican advertising budget of $16 million on their commercials, DDB's manufactured daisy/bomb image dominated the campaign—combining "Kuleshov effect" and the advertising hard-sell at its best—and completely overpowered the earlier "In your heart you know he's right" ads for Goldwater done by the Leo Burnett Advertising agency.

Although political and advertising slogans had always resembled one another verbally, the "Daisy" commercial announced full force that it would now be *visual* rhetoric that would carry the day politically, and subsequent campaigns relied heavily on the same kinds of hard-sell images based on fear. Two of the most effective were the "red telephone" ad for Mondale run in 1984 and the "Willie Horton" ads used by Bush against Dukakis in 1988. When focus groups held during the 1984 primary campaign revealed that in a recession they would prefer Gary Hart as President, but in an international crisis, they would prefer Mondale, the red phone as symbol of potential nuclear war with the U.S.S.R. was born, and the Hart campaign never recovered. The "Willie Horton" ads used by Bush against Dukakis tapped primal fears and drove home the image of a liberal whose prison furlough program was putting criminals back out on the street to prey on the public. Utilizing the image of a revolving door, the ad featured men walking into prison and directly out again. Both the ominous red telephone and the revolving door became symbols that touched the core of voters' political and social fears.

Reagan's 1984 campaign, which ultimately defeated Mondale, was also one of the most visual and successful political campaigns ever waged, utilizing almost $25 million, more than half the entire campaign budget, on high-production value political advertisements.[26] It was the most visual presidential campaign yet waged, one that succeeded in substituting national and archetypal symbols for a discussion of issues and images for information. The epitome of this approach is seen in the

Republican National Convention's substitution of a political campaign film for the usual nominating speech, which—as part advertisement and part documentary—"marked the coming of age of the televisual campaign film."[27] The move to substitute the visual for the usual verbal rhetoric was daring and unprecedented, yet it clearly showed the faith which the Reagan campaign, under the guidance of the BBDO ad agency's "Tuesday Team" had in the power of images as visual rhetoric.

Written by Phil Dusenberry, BBDO's executive creative director and originator of the "Pepsi Generation" commercials, the film sequenced levels of images ranging from slice of life moments and documentary footage of political events to emotionally loaded cultural symbolism. In the film, interviews with the elderly are joined to clips from the attempted assassination of Reagan, footage of the Normandy invasion, images of the Statue of Liberty under repair, and American flags being waved, raised, saluted, and admired. Archetypal images reminiscent of those used in "Marlboro" ads also appear, with Ronald Reagan as the Marlboro Man riding his horse on his California ranch. The images move in visual cycles, beginning with idealized images of earth, developing into slice-of-life images of people at work, and closing in political images of Reagan mixing with the people, in the hospital or at the White House. The film's closing is a montage of images of the land, its people, its patriotic symbols, and finally Reagan himself with arms over his head in a victory sign.

When the chairman of the Democratic National Committee strenuously objected to the airing of the film as part of convention coverage, complaining that the Democratic Mondale campaign film had not been aired because it had been considered a commercial, the controversy ironically ensured that it would be seen, since it was now a news event. As a news event, the networks had few reservations about showing it at least in part; in the end, both CNN and NBC aired the whole eighteen-minute film, and ABC and CBS aired excerpts. The blurred association among political coverage, structured news events and news coverage of actual events created only temporary discomfort, however, for as researcher Joanne Morreale points out, by the next presidential election, both Bush and Dukakis had developed the same kind of films to precede their acceptance speeches at their respective conventions. Both were aired without generating any controversy at all.[28]

By the 1992 election, in fact, candidates had become so visually oriented and so public-relations savvy that two tools of image manipulation dominated the scene: "VNRs" and focus-group research. VNRs (video news releases), like their public relations print counterpart "press releases," are pieces written and developed to support a particular point

of view. The idea is to produce a visually slick video with carefully managed content that resembles a news report closely enough to get favorable press coverage without paying for it and to influence decision making in some way, from product purchase to political voting. Traditionally, such well done press releases in print have appeared so similar to actual news articles that presses have often merely changed a few words and run them "as is." Sometimes reporters will add their own bylines, but with only a few alterations, submit them substantially unchanged.

In the case of VNRs, visual footage is often used in part or in full because stations have cut back on personnel in recent years—particularly after the losses incurred in their coverage of the Gulf War—and such professionally done "freebies" are welcome. They fill in for an overtaxed staff; and in contrast to relatively unexciting news, VNRs are visually rich stories that serve the station's purposes by keeping audience interest. The danger, of course, is that they are in fact biased sources masquerading within a trusted context as objective ones. VNRs may also bump significant but nonvisual stories simply because they are slicker and more visually interesting to watch, the product of more time, effort and money by vested interests. When reporters take the material and add their own names to them, the stories also take on the additional credibility associated with reputation.

In the 1992 presidential election, VNR successes inspired candidates to take a hard look at the traditional campaign trail techniques. For candidates, the decision to purchase satellite time (for about $600 an hour), and produce and distribute spots from a central location or to beam into interviews by local news anchors is both a cost-effective and a politically strategic one. Local anchors are often awed by the possibility of interviewing a presidential candidate live and conduct their interviews accordingly: questions become predictable and soft, and the overall tone remains uncritical and celebrity-driven. By staying in one place, candidates also have the potential of reaching television stations nationwide at a total cost of about $20,000—as opposed to the $50,000 cost for a thirty-second commercial during newscasts, if it is allowed at all.[29] Ultimately, such satellite interviews accomplish three image-oriented achievements: at low cost, they enhance the local anchor's image by joining him or her with a presidential candidate, thereby making the interview more desirable for the station and easier for the presidential candidate to get local access; they make the candidate appear more grass-roots oriented and attuned to local concerns; and they allow for the kind of target-marketing and nuanced image tailoring that is the lifeblood of all successful advertising campaigns.

Just after announcing his presidential candidacy, Bill Clinton conducted about forty interviews with stations in twenty-five states without ever leaving the local Arkansas television studio.[30] Thus able to bypass scheduling red-tape at the national broadcast level, he avoided the practiced scrutiny of top network journalists, and easily reached and impressed localized audiences by directly addressing their particular concerns—all without purchasing more expensive advertising time or suffering travel inconvenience and the financial and physical energy drain that it implies. As the underdog in the election, this was more advantageous to Clinton than to Bush who already had national exposure and was building a platform on international issues.

At the same time, focus groups (small representative groups of people brought together to speak about various areas of concern, and led by qualified professionals) conducted at various stages of their campaigns allowed both Clinton and Bush the opportunity to tailor make their public images and broadcast their messages in a form most palatable to voters. When a fifty-one-minute Bush campaign speech got no significant audience response from a focus group until its conclusion, for example, a commercial with a different slant was shot the next day in time for the New Hampshire primary.[31] When the Gennifer Flowers scandal broke during Clinton's campaign, and focus groups registered that they were impressed that he went out and met groups of reporters, the campaign launched a successful "meet the press" strategy. When focus groups didn't like his hair, he had it restyled.[32]

Such focus groups were first conceived to study the effect of the American propaganda series directed by Frank Capra of *It's a Wonderful Life* (U.S.A., 1946) fame. The series, which consisted of seven feature films[33] and was originally designed for showing to the armed forces, also became part of a research effort that tested how successful the films actually were in raising morale and in motivating soldiers to the war effort. The "focused interview," where individuals were asked specific in-depth questions, was an essential part of the evaluation, and one that yielded surprising results—showing that some scenes even provoked reactions opposite to what was intended. Initially disappointing to behavioral scientists because the series seemed to have little effect in changing attitudes, ultimately, however, the very fact of its limited effects led researchers to understand more about the complexity of the process of media influence and to abandon a simple formalized theory of direct manipulation and persuasion techniques in favor of more subtle, multivariate models.

The focus-group approach also had profound effects on research methodology for future advertising and politics. Marketers—the first to

adopt the qualitative research method—found focus groups helpful in gaining consumer motivational insights and even in formulating language for ads to which consumers could relate; later as politicians began to adopt successful marketing and advertising techniques for their own purposes, candidates used focus groups to track attitudes hidden in traditional voter opinion polls, to formulate promises and concerns for political platforms adapted to what people wanted to hear, to identify opponent vulnerabilities, and to head off problems down the road. By 1992, it was estimated that voters saw not a single ad that had not been tested before a focus group first.[34]

What all of this ultimately means is that the voting public cannot afford to be naive about the way visual political messages are formed, how a specific impact can be engineered, or about the possible bias of the television message. The electronic media has created a politics of image different from its counterpart in print journalism—one where political figures become media celebrities, VNRs masquerade as hard news, and both TV personalities and political personalities alike manipulate the media to gain the highest audience approval ratings. Politics thus has evolved into a business of manufactured images. Its visual language has become a means of influencing attitudes in subtle and often undetected ways, and whoever controls the visual message wields power in shaping public opinion.

In the twentieth century, nothing illustrates the danger inherent in this power better than Adolf Hitler or the images of the Third Reich.

Images of Hitler

Among the most powerful images and symbols used by any politician is the flag. Because of this, it is not surprising that the foundation of Hitler's careful political design and the importance of symbolism can be seen in the design of the Nazi flag, which he used effectively to incorporate mythic and cultural meanings into the everyday level of existence. As propaganda researcher Zeman notes,

> The flag was the centerpiece of the Nazi decorative scheme. . . . It was the subject matter of many of their songs: it provided the hypnotic, repetitive pattern for the backcloth of their public meetings. . . . The red stood for socialism: the white of the central circle for nationalism. But the significance of the swastika—a Sanskrit word for good fortune and well-being—the main part of the emblem . . . became the symbol of infinity, of the sun, of recreation; it was found on the textiles of the Incas, on relics in the excavations in Troy, in the catacombs in Rome. It was one of the sacred signs of Buddhism . . . For Hitler, the sign had . . . racial connotations, symbolizing the victory of the Aryan man and of creative work, which "in itself has been eternally antisemitic."[35]

Because the flag as a cultural symbol embodied powerful archetypal yet ambiguous meanings, it was central to Hitler's vision and ubiquitous throughout the Reich's propaganda efforts. Such layering of meaning suggests the archetypal through the specific; as the semiotician Peirce noted, in signs there may be a great deal of overlapping of categories, and little if any exclusivity. In director Leni Riefenstahl's *Triumph of the Will* (Germany, 1936), for example, Hitler dramatically uses the ceremony of the "blood flag"—the official flag stained with the blood of Nazi martyrs—to touch the new flags presented to his Storm Troops. Symbolically this allowed the blood of the dead to flow into the blood of the living and give military purpose to the present. At each flag presentation, as Hitler pauses grimly and rifles are fired, national pride is channeled into war.

All visual and verbal images repeated in Nazi propaganda similarly flow into and out of cultural past and present; the ubiquitous Nazi flags, flames, banner insignias, and especially the swastika itself, are rife with associations on every level and are designed to bring the memory of the past into current consciousness. In addition, Hitler invoked religious symbolism, incorporating in his speeches the Catholic imagery into which he was born, deliberately conjuring the myth of the savior and its association with blood. In *Triumph of the Will*, for example, Hitler tells his Hitler Youth, "You are flesh from my flesh; blood from my blood," and admonishes Party members: "Our total image will be that of a holy order; only the best will be Party members. Today we expunge what is bad. What is bad has no place among us. It is our will that this state will last 1,000 years. The Party is a symbol of eternity." Combining religious fervor with militant nationalism through the flag, he reminds his soldiers of the humiliation of World War I by listing the major battles, lowering flags to the ground, and then with a snap, raising them with the proclamation, "You are not dead; you live in Germany." As the parade of flags approaches Hitler's raised platform in the film, soldiers are so closely packed together that the mass has the appearance of rippling water, which literally parts, like a Red Sea. Of the spectacle, William Shirer says in his *Berlin Diary* that "Borrowing a chapter from the Roman church," Hitler was "restoring pageantry and colour and mysticism to the drab lives of twentieth century Germans." The Nuremberg meetings, he says, "had something of the mysticism and religious fervor of an Easter or Christmas Mass in a great Gothic cathedral."[36]

Black and white photos of Adolf Hitler that were created especially for an advertising campaign conceived by Goebbels in 1935 also show how attention to image can be effective in manipulating public opinion. Mass produced as coupons included in packages of cigarettes, the photos show Hitler in various situations and poses designed to enhance his public image and personal aura. The pictures could be mounted alone or pasted into a special album manufactured just for this purpose. Almost all of the ad campaign photos are taken outside, from a slightly low or low angle and lit by natural sunlight. Hitler is shown genial, relaxed, sociably mixing with other people, usually with a child whom he affectionately hugs, pats, or gazes on dotingly. In one exception to this format, Hitler is shown in uniform at a (democratically) round dinner table, at a slight distance from the camera, talking sociably with a smiling Goebbels and others. The shot is taken from a slightly high angle, and prominent in the foreground is a large symbolic pot with a large ladle.[37] The high angle accomplishes two things: it allows us to see into the half-full pot, and it emotionally registers Hitler as one of the people. The "one-pot" meal was a nationalistic drive to save money that could then be given to Nazi charities.

This was when Hitler's popularity and power was on the rise. When he achieved absolute power, other people disappeared from pictures of him, and official portraits always showed him from a low angle and always with a serious expression. This was quite deliberate. Hitler felt that any sign of human weakness in a photographic image or portrait painting could be fatal to the public image of strength that he and his propaganda efforts had so carefully constructed. His concern over public image was so strong that he refused regular physical examinations, particularly when he felt ill, because he was sure the news would leak out.[38]

His official photographer Heinrich Hoffmann, for example, was not allowed to publish any photos of Hitler that showed him playing with his Scots terrier because it was not a German breed, or wearing the glasses he always used for reading, because this could reveal a physical weakness and an intellectualism that the Party had associated with the Jews.[39] He understood well the power of the image and dramatic presentation, and from his first political ambitions, he planned a visual campaign to create a new German culture by controlling artworks and films and by promoting a particular style of public and government architecture. For every detail, the psychological effect of the visual was weighed, and while Hitler ultimately proved inadequate in military strategy, the visuals that delineated his rule were consistently effective. For example, while other 1932 presidential candidates included slogans on their campaign posters, Hitler's election poster shows only his face lit as if from within. His eyes are darkly riveting and serious, and the name "Hitler" is reversed out against a totally dark background.

Both in his official portraits and in Leni Riefenstahl's propaganda films that he himself commissioned, Hitler appears as if bathed in light from above, and always above the crowd. The painted portrait by Fritz Erler, which constituted the main exhibit at the Great German Art Exhibition in 1939, is typical: viewed from a low angle, standing firm on granite blocks symbolizing the power of the Third Reich, Hitler is placed against a dark shadow, but is unnaturally bathed in light about his head, shoulders, and boots. At the beginning of *Triumph of the Will* when Hitler emerges from the clouds and, standing, rides through the city in his open car, sunlight dances on him. Low-angle close-ups of his hand outstretched in the Nazi salute are particularly effective as light seems to emanate *from* them. Both he and the Reich's eagle, shot low angle against the sky, figure predominantly throughout.

Because Adolf Hitler also understood that relative size, closely related to distance, has psychological implications of importance, he paid close attention to it, particularly in public spaces. Believing that he had a natural talent for architecture, for example, he instructed his Reich architect, Albert Speer, on the monumental scale for the architecture that was to be an integral part of the Third Reich. Speer called Hitler's concept "architectural megalomania,"[40] designing structures and choreographing architecturalized propaganda images on a grand scale for him, including the Nuremberg rallies, where 200,000 troops became solid columns supporting the platform from which Hitler addresses them en masse before 100,000 spectators. This image, captured so well in *Triumph of the Will*, was a crucial one both literally and figuratively within Nazi propaganda, for its whole purpose was to immerse the individual within the mass and to surface and exploit a latent mythic German unity.

As the official record of the Sixth Nazi Party Congress held at Nuremberg, September 4–10, 1934, the film's action as well as its sets were entirely manufactured for the proper visual and emotional effect, both as a spectacular mass meeting and as a propaganda film—Goebbels called it "the great film vision of the Führer."[41] The architecture of the halls and stadium, and all of the ceremonies, parades, marches, and processions were designed with the film camera in mind as the chief means of spreading propaganda. To the outside world, Hitler was determined, Germany would appear a undefeatable massive fortress. Within Germany itself, mass rallies, demonstrations, and parades would form the societal glue that would unify the cause and turn individual consciences into group-think. Speer himself invented the "cathedral of light"

which took place at night within a symbolic sacred ring enclosed by anti-aircraft searchlights. Of the effect, Speer said,

> The actual effect surpassed anything which I had imagined. The hundred and thirty sharply defined beams, placed round the field at intervals of forty feet, were visible to a height of twenty to twenty-five thousand feet, after which they merged into a general glow. The feeling was of a vast room, with the beams serving as pillars of infinitely high outer walls.[42]

In the architectural plans for a Nuremberg Party Rally Site which was never built, Speer designed a 400,000 seat stadium so large it could encompass a building three times the pyramid at Cheops, and a statue 60 feet taller than New York's Statue of Liberty. Hitler's plan for a new Berlin, inspired by the Champs Elysées of Paris, also included buildings proportionate to the psychological power of the Third Reich. As Speer describes it, Hitler wanted an arch of triumph 400 feet high (the Arc de Triomphe is 160 feet high), and a central avenue two and a half times longer.[43] Of Hitler's new capitol building, the Reich Chancellery in Berlin, which was the only building of Hitler's new planned capitol ever to be built, Hitler purportedly told Speer: "On the long walk from the entrance to the reception hall they'll get a taste of the power and grandeur of the German Reich."[44] The reception hall was Hitler's only disappointment because he felt it should have been three times larger.

Although parts of the Chancellery, such as the Cabinet Room, were never used, the building itself nevertheless fulfilled its symbolic function perfectly, for it was of a size and proportion to reflect the larger than life blood-myth of the German people. This myth had also been at least partially fostered by size and image in the national legacy of nineteenth-century political chauvinism, and was induced frequently to overcome the sting of the German defeat in World War I. Pictorially, Boulding suggests that a grand nationalistic though delusionary image had also been fostered through school atlases of the old German Empire. Because the United States and Germany each occupied a full page in the atlas, the visual impression was one of equal power. German youth may thus have been led to form a mental image that seriously overestimated German capabilities in relation to those of the United States in the first World War.[45]

This placement of parts in relation to one another and the "blocking" or position within a given scene was always a conscious part of every design of the Third Reich, particularly in relation to roles and power within social and cultural contexts. For example, when Speer inadvertently discovered the plans for the Soviet pavilion that was to be

built next to the German one at the 1937 Paris World's Fair, he threw out his original plans and designed the German pavilion as if it were checking the onslaught of the Soviet pavilion that had a pair of 33-foot Soviet figures striding triumphantly toward the German pavilion. Speer's design, for which he earned a gold medal, involved a cubic mass elevated on stout pillars, with a giant eagle grasping a swastika in its talons and looking down from a tower onto the Russian sculptures.[46] Such positioning left little doubt in the psychology of balance of power.

Both the Nazis and the Soviets were particularly attuned to such visual power, and both exploited architecture and mass rallies in the same way. Both also believed fully in the power of film, and both promoted and kept tight control over them. Hitler himself was profoundly affected by film, particularly by the architecture of such films as Fritz Lang's *Metropolis* (Germany 1926), and before the war he is reported to have seen every film, both domestic and foreign, to be distributed in Germany, usually ending each evening with a showing of two films after dinner. When censors were in disagreement on a film, it was Hitler who passed judgment.[47] Hitler even legislated the moral content of German films, mandating, for example, that any female character who broke up a marriage die before the film's end.

Under Goebbels as Minister of Propaganda, the industry was tightly controlled: Goebbels personally viewed every one of the 1,363 films produced during the twelve years of the Third Reich, as well as all newsreels, cartoons, documentaries, and shorts. Under his orders, film trucks were dispatched throughout the Reich, special showings were given at reduced rates, and each official newsreel of the action at the front was released everywhere on the same day. Many films were censored or banned; all were scrupulously checked for ideas that might conflict with Nazi ideology. *Tarzan of the Apes* (U.S.A., 1931), for example, was banned because it ran counter to Nazi doctrine on "hereditary biology."[48] So strong was the control that it lingered well after the Reich's demise. In 1965, for example, when *The Sound of Music* opened at the city Palast in Munich, one-third of it was missing. The film stopped at the point when Maria wedded Von Trapp in order to avoid showing their escape from Nazi Germany.[49]

Image and Group Psychology

Because Hitler and Goebbels were aware that people's actions are a reflection of their own self-images, and that self-image is achieved through interaction with others, they were also extraordinarily successful in channeling the Nazi vision through images of group psychology in

vast live demonstrations, in uniforms for practically every political function, and particularly in art where as part of "Kulturpolitik," "degrading" art (such as works by French Impressionists and German Expressionists) was expunged from German museums, and books were banned and burned to "purify the public libraries" of dissenting world visions. Hitler's ultimate goal was to establish a new national image, a pervasive mindset in which new forms of creative expression would find inspiration in a mystic and heroic German past, a past that Hitler associated with the music of Wagner and a Nazi interpretation of Nietzsche. In such authoritarian structures as Hitler envisioned, history shows us, image becomes all-important as a societal glue, defining prepackaged roles, and channeling dissatisfaction toward scapegoats such as intellectuals and Jews. Such an image must also be continually supported by ritual and ceremony, even by overt coercion, and group psychology must be utilized to pressure individuals into social conformity and to encourage their identification with a charismatic leader.

Through his use of symbols and ritual, Hitler was able to meld the Germany of the present with its mythic past and so transform a nation in chaos into what Freud called "a group mind." According to Freud, in the group mind, the key figure is the leader who becomes the individual members' superego and takes over their critical faculties as the group conscience. The nature of the attachment of the members to the leader is found in a desexualized libido, libido being the energy force (eros) of the life instinct to establish unity and to bind together to preserve this unity. The leader draws from a basic group-forming instinct as strong as the instinct for life itself, yet maintains no emotional attachments and must be independent, self-confident, and of "masterly nature." In short, the leader represents all those qualities unavailable to common group members, but toward which they continually yearn.

According to Freud, as discussed earlier, the ultimate result of the formation of a group is an emotional intensity raised to a pitch that would seldom if ever be reached outside the group. It is a pleasurable experience for the group members to surrender themselves completely to their passions, losing a sense of individual limitation, and the emotional release is infectious: as it effects the same release in another, the passion is mutually enhanced and intensified. Because the group is naturally inclined to extremes, it is excited only by excessive stimulus, which means that the leader's argument need have no logical force: "He must only paint in the most forcible colors, he must exaggerate, and he must repeat the same thing again and again."[50]

Albert Speer, an upper-middle-class intellectual who might be thought of as naturally resistant to such manipulation, commented:

"Both Goebbels and Hitler had understood how to unleash mass instincts at their meetings, how to play on the passions that underlay the veneer of ordinary respectable life." Goebbels well knew how to whip up "wilder and wilder frenzies of enthusiasm and hatred."[51] All of this repelled Speer, yet he too was transformed in listening to Hitler speak:

> He spoke urgently and with hypnotic persuasiveness. The mood he cast was much deeper than the speech itself, most of which I did not remember for long. Moreover I was carried on the wave of the enthusiasm which, one could almost feel this physically, bore the speaker along from sentence to sentence. It swept away any skepticism, any reservations. Opponents were given no chance to speak. This furthered the illusion, at least momentarily, of unanimity. Finally, Hitler no longer seemed to be speaking to convince; rather he seemed to feel that he was expressing what the audience, by now transformed into a single mass, expected of him.[52]

Such staging emphasizes the role that image plays in relation to words, for in such displays, the words matter very little except as they serve to build the general mythic image of the unified Reich—which was everywhere supported by flags, banners, and lighting effects—and provide verbal touchstones like an objective correlative for the primal passions, such as the vilification of Jews. "In such an atmosphere," Shirer commented, "every word dropped by Hitler seemed like an inspired word from on high. Man's—or at least German's—critical faculty is swept away at such moments, and every lie pronounced is accepted as high truth itself."[53]

Conclusion

Arguing that there is in fact an "old" print politics and a "new" politics that invests political messages with the personality and characteristics of electronic media, researchers Robinson and Sheehan in 1983 concluded that the electorate has come to see politics the way the networks present it, not the way it once appeared in traditional print. In their view "the media agenda becomes the public agenda; the tenor of the media influences the tenor of the times; exposure to television fosters a political response in keeping with its own style and substance."[54] Television thus changed political coverage not only by influencing the presentation of the message to accommodate the medium and then altering its content accordingly, but also by establishing its own issues, which in turn have been exploited by politicians, demagogues, and the military who understand both the medium and how to tap into its vulnerabilities.

Within the media-created political environment, political figures alter delivery styles to become more like credible anchor persons; action news-type "media events" dominate political coverage; media personalities become more like politicians with their own career agenda, just as politicians become more like media personalities, issuing VNRs that can be easily translated into news stories. These skills arising from visual awareness are generally unmatched by the viewing public, who still tend to treat what they see as truth, rather than as deliberate constructions driven by political or economic motivations. Even research analysis of news and political coverage still tends to ignore the significance of visuals, with the effect that often the visual substance of the message and its effects go unexamined. As Bruce Gronbeck noted even in 1978, "Historically, verbal acts have occupied most of the attention of communication analysts . . . [because] 'rhetoric' and 'communication' traditionally have been defined in terms of 'words' and . . . 'political communication' has been dominated by researchers nurtured in speech communication departments in universities."[55]

Images from the Gulf War, however, reveal how manipulated images can exploit apparently objective news and documentary forms to produce a semblance of truth through "images of actuality" that "appear to be spontaneous and to reveal what really happens." Images from advertising and propaganda show how cultural and archetypal images and symbols can be used to tap the personal psyche, and while there gain strength and grow. The Third Reich showed how attitudes and behavior can be controlled at every level of personal, social, and political existence through the manufacture of visual images that bypass linear logic and convince by association.

Ultimately, all images are both political and personal, because their ramifications extend into both conscious and unconscious realms and affect every area of our existence: the nation that expects to be *visually* ignorant and free expects what never can and never will be.

8

Media Images and Violence

They're guilty of murder. We all are—me, too.

—Ted Turner, CNN

By the time a student graduates from high school, he or she has spent an average of about 13,000 hours in school and 25,000 hours in front of the television set. Today, because of the increasing amount of violence on television, this means 18,000 hours of visual conditioning dominated by violence. The American Medical Association has estimated that by the time a child completes elementary school, he or she has already witnessed well over 8,000 murders and 100,000 acts of violence. The National Coalition on Television Violence estimates that children in homes with premium cable channels or a VCR will witness 32,000 murders and 40,000 attempted murders on the screen by the time they are 18 years old. In the inner city, estimates for media exposure to violence go far beyond this.

Exactly what effects this exposure causes has been the source of continuous debate from the early days of television, with media gatekeepers insisting that the programming is a response to audience interest and demand, and media's critics insisting that television itself creates the demand and in turn promotes ever-increasing violence within the society. Because visual media are only part of the many influences in our lives that combine to formulate attitudes and behavior, however, research has always been vulnerable to the chicken-or-egg question of which came first: Do violent television programs and films encourage violence? Or do people who have a predisposition to violence simply prefer violent programs and movies? The problem of a variety of other potential causes for violent behavior has also promoted an inevitable circle of finger pointing in fixing responsibility.

To further complicate the problem, terms used in research studies and in describing research results are often confusing and even may connote unintended positive or negative valences in differing contexts.

Bryant, Thomson

Advertising Effects

Advertising is the greatest art form of the twentieth century.
—Marshall McLuhan, *Advertising Age*, September 3, 1976

We live in a country in which mass media receive most of their support from advertising revenue. As a result, we are bombarded with advertisements every day of our lives. Whether it is billboards, newspapers, magazines, radio, television, the Internet, the side of a bus, or some other conspicuous location, ads scream at us to try particular products or services.

When you consider the enormous sums of money spent on advertising each year in the United States, it probably comes as no surprise that a significant amount of research in various disciplines has been devoted to the effects of advertising messages. After all, advertisers want to make sure that they are getting their money's worth. In addition to advertising researchers, psychologists, marketing and consumer researchers, and others are interested in researching the effects of advertising on media users.

As with other research domains, some advertising research has been *theoretical* while other research has been *applied* in nature. Theoretical studies, conducted mostly by scholars in traditional disciplines, use a variety of research methods to test hypotheses and advance knowledge in the field. The primary purpose of theoretical research is to gain a richer understanding of a phenomenon, in this case, the role and effects of advertising for individuals and society. Applied research also employs a variety of research techniques to answer questions of practical value to advertising practitioners and media professionals.

Considering the connection between advertising and persuasion, researchers in mass communication have been very interested in studying the effects of advertising. The focus of these researchers has been either on the processes involved whenever advertising media effects occur or on the differences in effects produced by the media context in which the advertisement is embedded. Media context refers to program type, whether humorous, sad, serious, riveting, and so forth.

This chapter explores the various effects on individuals (rather than a group or culture) of reading, watching, or listening to advertising messages, and the individual's processing of those messages. We first examine advertising as part of the current media environment, then we review past research to discover what has been learned about the ways that individual audience members react to ads in various media. We look at particular characteristics of individuals, such as their moods, that cause them to use and react to media and advertising in different ways. We also explore the importance of media context to the success of the advertisement, and we examine other factors, such as repetition or the frequency of exposure, and comprehension and miscomprehension of advertising messages, as influences on effects. Finally, we take a look at recent research in the field and trends for future research.

ADVERTISING IN TODAY'S MEDIA ENVIRONMENT

A **medium** can be defined as "any transmission vehicle or device through which communication may occur" (Stewart & Ward, 1994, p. 317). Advertising media include the various types of mass media such as television, radio, and print sources. Advertising differs considerably from personal selling, which employs the medium of interpersonal communication.

Today's media environment offers an abundance of choices for advertisers. In recent years, the increased volume of advertisements in various types of mass media has caused some advertisers to select less conventional media. The segmentation of audiences and the personalized nature of today's media provide advertisers with new vehicles to reach specialized audiences. New media sources such as shopping networks on television and information services on the Internet have provided viable alternatives to the standard, 10-second commercial slot. Computer-assisted methodologies and specialized databases have caused a boom in telemarketing, which (although often annoying to recipients) allows advertisers to reach a more specific audience than would be available through traditional mass media sources. Direct mailings to targeted audiences also reach people with similar characteristics. The proliferation of television channels and increased knowledge about each channel's audiences also give advertisers access to large numbers of people with similar and desirable demographics. Additionally, some advertisers have opted to sponsor special events with wide reach, such as the immensely popular Super Bowl, the World Series, or the Olympic Games.

The matching of demographics with particular media has evolved considerably through the years. Early studies showed that the use of certain media was highly related to a person's level of educational attainment. Berelson and Steiner (1964) found that people with less education tended to read less, listen to radio more, and watch television more than their better-educated peers, whereas those with higher levels of education preferred print media to broadcast media. The increasing availability of computerized demographic information allows today's advertisers to know more than ever before about particular audience characteristics. The many activities and attributes of millions of consumers are recorded and matched to their likelihood for using particular media or engaging in certain purchasing behaviors.

Through the years, research has indicated that a person's attitudes with regard to a particular media product within a particular medium influence both media use and message effects. For example, an important study in 1962 measured differences in brand quality and preference ratings among readers of three different magazines, *McCall's*, *Look*, and *Life*. Readers perceived that products

Advertising messages bombard us daily.
Source: © CORBIS

appearing in *McCall's* were of much higher quality than the *same* products in *Look* and *Life* ads (Politz Research, 1962). Clearly, the individual's attitude about particular magazines made the difference.

New media choices continue to appear. In the future, as these choices increase, researchers will continue to examine individuals' attitudes regarding these media and the advertising messages they carry. Such information will be especially valuable to advertisers.

RESEARCH TRADITION

Throughout the history of media effects research, some people have believed that mass media messages have direct and powerful effects upon audiences, whereas others have held the view that direct mass media effects are rather limited. Research in the 1940s and after emphasized the importance of interpersonal communications among audience members in modifying media effects. The *transactional* model recognized that the presence of any number of factors—specific characteristics of the sender, the message, the transmitter or channel, the audience as a group, and the individual audience member—could mitigate the strength of media effects.

As you will recall from Chapter 10, "Persuasion," the elaboration likelihood model offers a modern take on the transactional model. The potential of a media message to persuade an audience member depends on myriad factors,

such as an individual's mood and predispositions, other individual characteristics, or the likelihood that a message will be thought through carefully. The same holds true for the persuasive power of an advertising message. Effects from exposure to different characteristics of media content vary from person to person. Different people use media differently and react to it differently; therefore, advertisements affect them differently.

Communication researchers have identified many different individual characteristics of consumers that influence media effects. Each person is motivated by different factors to use particular media. A person's emotional state at the time of media use also influences media effects, as does the person's prior experiences and knowledge (Thorson & Reeves, 1990).

One theoretical basis for such individualized effects is called **selective exposure** (Zillmann & Bryant, 1985). People tend to watch, listen to, and remember media messages that are consistent with their attitudes, interests, or predispositions. For example, someone with a beloved feline companion would be more likely to attend to commercials featuring products for cats than would someone who dislikes cats and dotes on a pet poodle.

A great amount of research has supported the idea of selective exposure (Broadbent, 1977; Greenwald & Leavitt, 1984; Krugman, 1988; Pechmann & Stewart, 1990). The related area of uses and gratifications research has also proven productive (Gunter, 1985; see Chapter 8). Research has shown that when people watch television, they tend to make their selections based upon what they *don't* want to see rather than what they *do* want to see. Stewart and Ward (1994) stated it in this way:

> Viewers appear to avoid programs they do not like rather than select programs that they do like. In contrast to the selection of a specific magazine or book, the critical decision for the television viewer appears to be whether or not to turn on the television. The choice of program is clearly secondary. What effect such processes have on advertising in the different media remains to be determined. (pp. 330–331)

One of the most important components of selective exposure, attitude formation, and attitude change is that of *involvement* on the part of the audience member. Involvement of the media user can be loosely defined as *personal connections with media content*. For example, a television viewer who watches a program and is reminded repeatedly of personal, real-life situations is said to be a highly involved viewer.

Much scholarly research has identified characteristics of audience members (or consumers) and links between *consumer and medium* that may cause an advertisement to be effective or ineffective. An audience member's attitude regarding the medium, uses of the medium, involvement while using the medium, and mood states that affect media usage have been found to be critical factors in the mix (Stewart & Ward, 1994).

The emphasis on the role of involvement in advertising effects as a challenge to the traditional transactional model can be traced to the 1960s. Krugman (1965, 1966) applied "involvement" not only to the individual audience member, but also to characteristics of the medium and characteristics of the product. Based

upon the amount of control exercised over a medium by a user and the level of cognitive processing required, Krugman described various media as either low involvement or high involvement. Print media were characterized as **high involvement,** considering the reader's level of control and necessity for information processing. For example, a reader has time to read a print advertisement carefully, ponder its ramifications, and possibly obtain new knowledge or change existing knowledge. Broadcast media such as television were labeled **low involvement** because of the viewer's lack of control over the rate at which the information is received and the low level of processing usually required.

Due to the low involvement nature of broadcast media, Krugman found the presence of only subtle advertising effects. Television advertising proved most advantageous for developing *product recognition* on the part of the consumer, and for *brand perception.* Attitude change as a result of exposure to TV advertising was not likely and, if present, difficult to measure.

Since Krugman's initial studies, others have investigated the issue of involvement and its connection to various advertising effects and responses. Two major studies in the 1980s offered evidence that high involvement print media provide advertisers with the best means for making product messages known to audiences (Lloyd & Clancy, 1989; Audits & Surveys, 1986). A few years later, Buchholz and Smith (1991) studied degrees of audience involvement among low involvement (broadcast) media. These researchers recognized that people do not always attend to commercial messages with the same level of involvement. Due to distractions, personal interest, or myriad other factors, some people at certain times or under some circumstances might pay more attention to a commercial than would someone else. The researchers set out to test these differences. They presented two groups with a commercial message embedded in other broadcast material (television and radio). The first group (high involvement) was told to pay close attention to the advertisement. They instructed the other group (low involvement) to focus on the broadcast material that surrounded the ad. The high involvement group processed the ads more thoroughly and thought about the personal relevance of the product much more than the low involvement group.

Five Important Consumer Characteristics

Stewart, Pavlou, and Ward (in press) provided a concise list of five different consumer characteristics that influence the effectiveness of ads. These five characteristics have been very important in empirical research and in the development of theory on advertising effects.

1. Attitudes toward the medium.
2. Uses of the medium.
3. Involvement while using the medium.
4. Mood states affecting media usage.
5. Interactivity of the medium.

Source: Stewart, D. W., Pavlou, P., & Ward, S., (in press). Media influences on marketing communications, in J. Bryant & D. Zillmann (Eds.), *Media effects: Advances in theory and research* (2nd ed.). Mahwah, NJ: Erlbaum.

Certain types of television programs may cause people to experience certain types of moods. Comedy programs may produce lighthearted or cheerful moods. A serious drama might cause the viewer to experience a more contemplative mood. A highly suspenseful program may produce an intensely anxious mood on the part of the viewer.

Research has revealed the importance of media context on a person's mood, as well as the importance of a person's mood on a number of psychological processes, including memory, attention, the forming of attitudes, and so forth (Gardner, 1994). A person's mood affects involvement. It also affects a person's response to an advertisement and subsequent consumer behavior (Gardner, 1985).

Research has shown that the moods produced by watching particular kinds of television programs cause viewers to react differently to the commercial messages shown during the programs. Kennedy (1971) found that people who watched a comedy program had a less positive attitude toward the advertised product than those who watched a suspense program, but in this and another study (Soldow & Principe, 1981), viewers of comedy *recalled* ads far more readily than did suspense viewers.

Individual television programs or specific episodes within genres also affect viewers' responses to ads. In one study, viewers of situation comedies (sitcoms) and action programs offered similar ratings for the effectiveness of commercials embedded in each program type; however, significant differences emerged from episode to episode (Yuspeh, 1977). Specific episodes were more likely than others to affect both viewers' recollections of the brands advertised and their intentions to buy the advertised products.

Another study compared the differences in mood and advertising effects while viewing happy television programs as opposed to sad ones (Goldberg & Gorn, 1987). Overall, commercials shown during happy programs tended to be evaluated higher and to produce more positive thoughts. They also found that program-induced moods had more of an effect on viewers' responses to commercials with high emotional appeals than commercials with straight, informational appeals.

Subsequent research identified an important *interaction* effect between the mood invoked by the media context (program) and that of the embedded commercial. Specifically, commercials with emotional tones or moods consistent with the media context received higher ratings than commercials with tones different from those evoked by the media context. (Examples of inconsistencies would be a funny commercial that appears during a sad program, or a sad commercial shown during a comedy performance.) Researchers found that viewers not only rated context-consistent commercials as more likable, but said they would be more likely to purchase the products that were pitched (Kamins, Marks, & Skinner, 1991).

The theoretical explanation for this interaction effect can be found in **consistency theory.** This theory takes the position that viewers wish to maintain a

particular mood for the duration of a program. Commercials with tones or moods that are consistent with those presented in the program are therefore more effective than commercials with tones that differ from the media context.

MEDIA CONTEXT STUDIES

Even though media context was an important part of many of the involvement studies discussed previously, those studies are usually not classified under the heading of "media context research." Involvement studies emphasize various consumer characteristics that result in media effects. Media context studies focus upon *media content or stimuli* rather than on *particular consumer characteristics*. These studies measure more immediate responses—cognitive, physiological, and even behavioral—to advertisements in different media.

Stewart and Ward (1994) identified several ways that researchers have explored the effectiveness of advertisements embedded in various kinds of media context. These different types of media context studies include cognitive response studies, observational studies, studies of psychological measures, and priming studies. In each branch, immediate responses to advertisements were measured in some way.

Cognitive Response Studies

People experience any number of different responses when exposed to advertisements. When the spokesperson for a brand of toothpaste claims that a survey showed that more dentists use Brand X than any other, one viewer may believe the spokesperson whereas another may have serious doubts about the claim. The viewer who does not know much about social scientific research methods might be inclined to take the spokesperson's word. This more knowledgeable viewer believes that the use of a survey provides enough evidence to support such a claim. Another viewer may question the claim due to the vagueness of the information regarding the survey. This viewer wonders: Was a random but representative sample of dentists surveyed? Were strict survey methods employed, or did the product advertisers search only for dentists who use Brand X? Would another survey produce similar results? If one of the viewers is a dentist who does not use Brand X nor know of any colleagues who use it, he or she might have serious doubts about the claim. If that same dentist had attended a recent medical conference in which survey findings revealed Brand X to be the preferred choice among dentists and their families, the claim would be much more trusted.

As shown from the previous example, the nature of a person's response to an advertising message depends on personal knowledge or personal experiences. In other words, advertising responses are affected by a person's level of knowledge about the product or service or claim. Someone with considerable knowledge about a particular product or subject would be more likely to listen carefully to related advertising claims and have a stronger opinion—pro or con—regarding those claims.

Wright (1973) studied several different cognitive responses to advertising messages, such as supporting arguments, counterarguments, and so forth. He examined users of different types of media under differing levels of involvement, then asked questions of the participants to measure certain factors. Media users were exposed to either print or audio versions of an advertisement for a new product. Prior to exposure, Wright created conditions of high involvement by telling a portion of the participants that they would be asked to make a decision about purchasing a new product that would be advertised during the session. Low involvement was created by not giving other participants such instructions. Wright found that people from both groups reacted differently to the print ads than to the audio ads. For the print version, members of the high and low involvement groups tended to think more about the ads, trust the source more, and think of more supporting arguments. More people who read the print version also expressed an intention to buy the product compared with respondents hearing the audio version of the ad.

Observational Studies

Rather than rely upon the self-reports of participants, some researchers prefer to gather information about advertising responses by *direct observation* of consumers as they view the ads. In one study of advertising on television, mothers were asked to observe as one of their children watched television and to record information about the child's behavior while viewing (Ward, Levinson, & Wackman, 1972). As might be expected, the research found that children were very active while watching television, and the levels of activity ranged from high (ignoring the television) to low (full attention to the programming). Whenever a commercial interrupted a program, it captured the attention of most of the children, but their attention waned steadily as more commercials were shown, then picked up toward the end of the commercial "pod" as they grew impatient for the return of the regular program.

Another TV advertising study attempted to determine what particular characteristics of television programs attracted the attention of children (Bryant & Anderson, 1983). Attention was measured as the portion of time a child's eyes were directed toward the television screen, or "eyes on screen" time. The study found that children tended to be attracted by changes in sound and in movement (depiction of much physical activity).

As for print ads, the eye movements of newspaper readers have been tracked using a unique device. A camera mounted on a helmet allows a video image of a person's field of vision to be transmitted to a computer. As the person focuses on different points, a light beam on the pupil is superimposed on the video image and allows researchers to track eye movements (Newspaper Advertising Bureau, 1987). Referring to this and other studies, Tolley and Bogart (1994) asserted that newspaper readers scan most pages. If they see something they are interested in, they read it, but they end up ignoring many other items. These findings confirmed earlier studies that showed many readers engage in an information-filtering process to decide if printed items are worth the effort of their full attention (Broadbent, 1977; Greenwald & Leavitt, 1984).

Studies Involving Psychological Measures

Another means of measuring responses to advertisements involves the use of equipment to determine if physiological changes occur. Electroencephalographic (EEG) responses measure changes in the brain waves of viewers. One study found considerable EEG activity during exposure to television commercials, and also a relationship between the EEG responses and the likelihood that a viewer would remember certain parts of the ads (Rothschild & Hyun, 1990).

Scientists have discovered that the left and right sides of the brain process information differently. Speaking very generally and in rather simple terms, the right side of the brain appears to specialize in processing pictures and music, while the left side of the brain performs the mental tasks involving words and numbers. This would lead one to hypothesize that print advertisements would tend to be processed more on the left side of the brain, while television ads would be oriented more toward the right hemisphere. Krugman (1977) made such a hypothesis, but research findings did not support the assertion (Weinstein, Appel, & Weinstein, 1980). Measurement of such a hypothesis proves difficult because most print ads contain pictures as well as words and television ads also typically contain spoken words (Rossiter, 1982).

Priming Studies

In these studies, researchers look for instances of priming in the media context. One approach to conducting such research is to examine the content of a program to determine if the viewer's attention might be drawn to certain aspects of an ad. For example, one of those fresh-face Cover Girl ads that feature gorgeous, pencil-thin supermodels might work better if embedded in a show that features hip, good-looking teens. Imagine the incongruity of seeing one of those ads in the middle of a heart-wrenching program about someone struggling to lead a normal life after surviving an accident or illness that left the person with a grossly disfigured face and body. The audience member has been primed to be especially sensitive about the importance of appearance and might react negatively to models who appear so fortunate and frivolous in contrast to the individual in the program.

Studies have revealed that media context "primes" viewers to pay more attention to particular ads or parts of ads (Herr, 1989; Higgins & King, 1981; Wyer & Srull, 1981; Yi, 1990a, 1990b). Readers or viewers can be primed *cognitively* or *affectively*. In other words, exposure to particular media content may cause audience members to *think* or *feel* more strongly about certain aspects of advertisements than they would have otherwise. If someone reads a positive-sounding editorial or news story, and then looks at an advertisement, that person usually feels more positively about the brand in the advertisement and usually reports a higher likelihood of purchasing the product (Yi, 1990a).

Advertising research on priming has focused on the power of media context to affect the reaction of audience members to ads. Studies to explore effects in the opposite direction (commercials priming responses to programs) have not been conducted but would prove interesting (Stewart & Ward, 1994). Using again the fresh-face Cover Girl ads as an example, such research would examine whether one of those "easy-breezy" ads shown at the beginning of a program would "prime" audiences or cause them to think or feel differently about the program than had they not viewed the commercial.

THE IMPORTANCE OF ADVERTISING FREQUENCY AND REPETITION

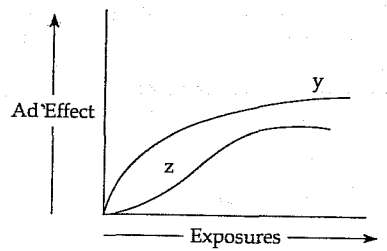
Media planners have attempted to measure many factors related to advertising exposure. One of these examines the effects of the cumulative number of exposures to an ad on a person's likelihood to buy the product.

Two different models of advertising response function have emerged. The first of these (depicted as an S-curve) posits that people must be exposed to an ad several times for that ad to have any effectiveness. After a number of exposures the ad achieves greatest impact, then begins slowly to decline in effectiveness (Burke & Srull, 1988). The other model does not have a threshold effect. Response to the advertisement begins with the first viewing and rapidly becomes more effective, then slows with subsequent exposures resulting in diminishing returns (see Figure 17.1).

Another factor related to exposure involves consumer attitudes toward long cycles of exposure to the same advertisements. A number of studies (see Pechmann & Stewart, 1988, for a review of the literature) have found that prolonged exposure to the same ad causes consumers to feel resentful and sometimes irritated, in a phenomenon called **advertising wearout** (Calder & Sternthal, 1980; Petty & Cacioppo, 1986). As a result, effectiveness of the ad declines. Most of us have experienced advertising wearout at some time in our lives—remember those Ronald McDonald TV commercials?

After reviewing studies concerning advertising wearout, Pechmann and Stewart (1988) determined that three "quality" exposures to a particular ad were needed for the ad to have an effect. A quality exposure is one in which the audience member pays attention to the ad and it evokes certain thoughts or feelings (i.e., it causes cognitive or affective processing). An audience member may have to be exposed to an ad any number of times for three "quality" exposures to occur.

FIGURE 17.1.
Source: From Bryant and Zillman, *Media Effects: Advances in Theory and Research*, p. 322. Copyright © 1994. Reprinted by permission of Lawrence Erlbaum Associates, Inc.



Sometimes too many exposures result in diminished returns. When a television advertisement has good persuasive power, repeated showings of that ad result in increased sales of the product. An ad that does not persuade does not result in increased sales, even if that ad is shown repeatedly. Moreover, once consumers have reached the point where they are either persuaded or not persuaded by a commercial, repeated exposure to that ad makes no difference (Blair, 1987, 1988). Finally, the consumer who already has a negative attitude about a product may become even more negative when exposed repeatedly to ads for that product (Stewart & Ward, 1994).

In terms of print advertising, frequency of ads has been found to produce a greater effect for low-awareness brands than high-awareness brands. The "effects" include consumer awareness of the brand, attitude toward the brand, and intention to buy the brand. Ads for brands that readers do not readily recognize need to be run more often for an effect to occur. The persuasive power of ads for more recognizable brands is not so dependent upon frequency (Time, Inc., 1981).

Frequent exposure to an advertisement results in a process of learning on the part of the consumer, but many factors may influence the learning process. Prior experiences and prior knowledge of the consumer or message variables within the advertisement may cause the learning process to be accelerated or slowed. Also, learning and memory research (Ebbinghaus, 1902) has shown that people tend to forget what they learn over time, that the first or last items in a series are more easily remembered than those in the middle, and that overlearning or overrepetition makes long-term memory possible—for overrepetition, consider how hard pressed one would be to find someone unfamiliar with the brand name associated with Snap, Crackle, Pop.

Several studies have tried to identify schedules of advertising frequency that result in greater learning and ad recognition among consumers. In the 1950s Zielske (1959) found that both short-term repetitions and long-term repetitions produced effective consumer recall of the messages in direct-mail ads; however, those who received ads weekly tended to recall more about the ads than those who received the ads on a monthly basis. A later study of print advertising found that magazine ads with the greatest recognition effect also ran at weekly rather than monthly intervals (Strong, 1974, 1977). It is interesting to note that this same study also found that weekly ads had greater recognition effect than daily ads.

Media Multiplier Effect

A recent study showed that advertising campaigns that use both print and television media are more effective than ad campaigns that use only one medium or the other. The proper mix of media in the ad campaign results in maximum brand awareness among consumers. Magazine Publishers of America (MPA) calls the phenomenon the "Media Multiplier Effect."

MPA commissioned two research companies, Millward Brown and A. C. Nielsen Corp., to study the effectiveness of ads in magazines and on television, separately and together. The studies found that 65 percent of consumers who see ads on television and in magazines are brand-aware, compared with only 19 percent who see magazine ads only and 16 percent who see television ads only.

Sources: Morris L. (1999, 2 August). Studies give "thumbs up" to mags for ad awareness—print ad scrutiny: Media multiplier effect urges combo buy over just one medium over another, Special Report, *Advertising Age*, p. S16; Chhaya (1999, 22 April), Print+TV=wow! *Business Today*, p. 89; Magazine world: Take a fresh look at print: New insights into the effectiveness of print in the media mix, (1999, 29 April), *Business Wire*, NEXIS, Online Library: NEWS, File: CURNWS; Proof that print advertising really works, (1998, 16 November), *Business Wire*, NEXIS, Online Library: NEWS, File: CURNWS.

COMPREHENSION AND MISCOMPREHENSION

If an advertisement is to be persuasive, a consumer must fully comprehend the importance of its message. Miscomprehension may result in misunderstanding and severely limit the persuasive power of the ad. As with the reception of news (Robinson, Levy, & Davis, 1986; Gunter, 1987) persuasion research has long revealed that comprehension is an important mediator variable (Hovland, Janis, & Kelley, 1953; McGuire, 1972; Ratneshwar & Chaiken, 1991).

A number of studies have shown that miscomprehension is a problem with both print and broadcast advertisements (Jacoby & Hoyer, 1982; Jacoby, Hoyer, & Sheluga, 1980; Jacoby & Hoyer, 1989) but more of a concern with *broadcast* ads (Jacoby, Hoyer, & Zimmer, 1983; Morris, Brinberg, Klimberg, Rivera, & Millstein, 1986). In these studies, the advertisements were for the same products and otherwise equal, except for the medium in which they appeared. This suggests that comprehension or miscomprehension may be correlated with high and low involvement.

As for print ads, one study found that only 20 percent of the participants comprehended the magazine advertisements they were shown (Russo, Metcalf, & Stephens, 1981). Another study of print ads found that comprehension was related to a reader's age, educational level, and income (Jacoby & Hoyer, 1989). Other factors that have been identified as possible determinants of miscomprehension include the individual characteristics of a medium or a message or the individual expectations of a consumer.

RECENT RESEARCH

In recent years, the proliferation of interactive media—the Internet, mobile telephones, interactive television, and so forth—has created a completely new vista for researchers interested in the effects of marketing communications. New media present a new set of characteristics and concerns for today's advertisers and advertising researchers. According to Stewart, Pavlou, and Ward:

> This new form of communication is predominantly electronic, but it has many of the characteristics of other forms of communication: (1) it can be interactive, but without the human touch of personal selling, (2) it provides the opportunity for direct response from and to the consumer, (3) it allows mass communication among consumers without the marketer's intervention, and, (4) it shares some of the characteristics of print and broadcast advertising, at least with respect to the more traditional advertising that appears on it (banner ads, e-announcements). (in press)

Interactive media make the consumer an active part of the marketing process, forcing advertising researchers to reconceptualize the entire sales experience that involves marketing communications (Pavlou & Stewart, 2000), as well as consumer processing and perceptions (Rodgers & Thorson, 2000). The Internet is creating a new type of marketing communication that merges traditional advertising by way of mass media with the interpersonal advantages of personal selling (Stewart, Frazier, & Martin, 1996). Interactive media also have the advantage of facilitating word of mouth communications, long considered the most effective type of advertising (Rosen, 2000; Hoyer & Macinnis, 2001), through chat rooms, message boards, and the like. Researchers are increasingly addressing consumers' active participation in the marketing communication process.

Virtual showrooms and interactive consultations available by means of interactive advertising offer benefits to consumers and advertisers (Wikstrom, 1996). The use of interactive media often facilitates the creation of consumer profiling, either from information gathered directly from consumers or through tracking of online behavior. E-mail communications from sites such as *www.coolsavings.com* give targeted customers the advantage of information about specific products personalized to their interests.

Advertising and New Communication Technologies

Private research firms report that people who live in homes connected to the Internet are spending about 16 percent less time watching television. With such reports, advertisers are taking notice and investing more and more money in online activities. Advertising on the Internet exceeded $1 billion for the first time in 1998, and is projected to grow to at least $8 billion annually by 2005. According to the Internet Advertising Bureau, online ad revenues reached $491 million during the third quarter of 1998, more than double the amount posted for the same period during 1997.

Online advertising is considered superior to television advertising in that it offers the added advantage of accountability. Web advertising can be targeted to reach specific types of consumers. Results are readily measurable, unlike television advertising, which reaches vast numbers of people but cannot be easily measured for effectiveness.

Nielsen recently began researching Web audiences and found that Microsoft, Cataloglink, Amazon, and Yahoo were the top advertisers. Another digital media measurement firm, Media Metrix, listed AOL, Yahoo, and Microsoft sites as the three most popular websites. According to both firms, about 35 to 37 million homes in the United States were connected to the Internet early in 1999.

Advertising researchers have already begun to turn their attention to the Internet and other new communication technologies. Many of the same issues they have explored with advertisements and audiences on traditional media such as television, radio, magazines, and newspapers, are now being examined with regard to the Internet, interactive TV, online publications, and so forth.

Sources: Hall, L. (1998, 23 March). Web ads change online business: Net advertising could reach $8 billion a year, *Electronic Media*, p. 16; also, Harper, J. (1999, 24 March). Nielsen logs on to rate what's happening on line; Data for advertisers similar to TV tallies, *Washington Times*, p. A1; Elliott, S. (1999, 10 February). The media business: Advertising—addenda; on-line advertising doubles in quarter, *The New York Times*, p. C8; Internet advertising revenues exceed $1 billion for the first time, (1999, 9 February), Business Wire, NEXIS Library: News, File: Curnws. Internet advertising bureau—IAB—announces second quarter 1998 advertising revenue reporting program results (1998, 29 October), Business Wire, NEXIS Library: News, File: Curnws.

When a person sees a knockout sweater for sale on the Internet at a reasonable cost, one of the most important factors that determines whether the sweater is purchased is *trust*. Not only does the consumer trust the product, but does the consumer trust the website enough to enter a credit card number and buy the sweater? "Trust" on the part of a consumer toward an advertiser may be defined as:

> the subjective probability with which consumers believe that the marketer will perform a particular interaction in a manner consistent with their expectations. (Stewart, Pavlou, & Ward, in press)

The notion of trust on the part of the consumer toward the advertising source has received a good deal of attention in recent years, especially with the proliferation of electronic commerce. Trust on the part of the consumer has been found to make consumers more likely to do business with the same company (Doney & Cannon, 1997), and lack of trust has been found to be a stumbling block for many consumers when responding to Internet marketers who desire personal information (Hoffman, Novak, & Peralta, 1999).

Despite the drawbacks to e-commerce, some scholars are optimistic that interactive media will serve to enhance consumer trust (Forrest & Mizerski, 1996). Interactions between consumers and advertisers require the exchange of information, as in instances of technical assistance related to the product. Such interactions may serve to strengthen a bridge of trust over time.

SUMMARY

Advertising media include broadcast and electronic media and print sources. Advertising is distinguished from personal selling, which employs the medium of interpersonal communication.

Several models of media effects have been advanced through the years, including the bullet or hypodermic needle model, the limited effects model, and the transactional model. The last of these recognized that many factors—specific characteristics of the sender, the message, the transmitter or channel, the audience as a group, and the individual audience member—could mitigate media effects.

The power of an advertising message to persuade an audience member depends on many factors, such as an individual's mood and predispositions, other individual characteristics, or the likelihood that a message will be thought through carefully. Communication researchers have identified many different individual characteristics of consumers that influence media effects. One theoretical basis for individualized effects is called selective exposure. Each person is motivated by different factors to use particular media and seek different messages. People watch, listen to, and remember media messages that are consistent with their attitudes, interests, or predispositions. A person's motivation to use a particular medium, the person's emotional state at the time of consuming media, and the person's prior experiences and knowledge all influence effects.

Involvement on the part of the audience member is an important component of selective exposure, attitude formation, and attitude change. Involvement of the media user can be loosely defined as personal connections with media content.

Involvement refers to the amount of control exercised over a medium by a user and the level of cognitive processing required. Print media typically are *high involvement*, considering the reader's level of control and necessity for information processing. Broadcast media such as television typically are *low involvement*, owing to the viewer's lack of control over the rate at which the information is received and the low level of processing usually required.

Low-involvement television advertising proves most effective for developing product recognition on the part of the consumer, and for brand perception rather than attitude change. High involvement print media work best to make product messages known to audiences.

Different television programs evoke different moods. A person's mood affects involvement, a person's response to an advertisement, and subsequent consumer behavior. An *interaction* effect occurs between the mood invoked by the media context (program) and that of the embedded commercial. Commercials with emotional tones or moods consistent with the media context are more effective than commercials with tones different from those evoked by the media context. Consistency theory posits that viewers wish to maintain a particular mood for the duration of a program.

Involvement studies emphasize various consumer characteristics that result in media effects. Media context studies focus upon media content or stimuli rather than on particular consumer characteristics. Different types of media context studies include cognitive response studies, observational studies, studies of psychological measures, and priming studies.

Prolonged exposure to the same ad sometimes causes advertising wearout, when consumers feel resentful and sometimes irritated. As a result, effectiveness of the ad declines. Three "quality" exposures to a particular ad are needed for the ad to be effective. Print ads produce greater effects for low-awareness brands than high-awareness brands. Low-awareness brands need to be run more often, but high-awareness brands are not so dependent upon frequency for effectiveness.

If an advertisement is to be persuasive, a consumer must comprehend the message. Miscomprehension may result in misunderstanding and severely limit the persuasive power of the ad.

Recent research has focused on marketing communications in the interactive media environment. The dynamics of interactive media are causing researchers to enter uncharted territory with regard to marketing communications.

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