

on a rather large scale design will tend to make the floor a dominant center of attention and displace toward the observer. Again, the factor that light colors advance making a physical space appear smaller and dark colors recede creating a physical surface that appears further away can be applied when selecting the flooring material color and texture. Since most of the critical visual activity involved in food preparation occurs at the counter height and above, the counter color and texture as well as the wall and cabinet color, texture, scale and contrast ratio are very important design considerations. A small textural pattern, or a color that falls in the mid range of the color spectrum should be selected for both the counter surface and the wall surface. Too great a visual pattern or too pure a color will only create psychophysiology problems as have been stated in that they will become dominant patterns in the visual field, thus making it difficult to see the task at hand. Retinal fatiguing colors such as yellow and blue should be avoided. The cabinet surfaces and the surrounding background should have a limited contrast ratio of around 3:1, which is frequently violated in typical harsh-white counter tops. Any greater contrast ratio than this causes a refocusing of the eye which becomes a fatigue factor. At the same time, if there is insufficient contrast in the visual field this also is visually fatiguing, so one should try to achieve the recommended contrast ratio for ease and efficiency of performance. Knowledge of the after-image effect of color can be helpful in selecting suitable kitchen colors.

The tactile characteristic of the surface material should also be considered. A smooth texture is perhaps more desirable for most of the activities performed in the kitchen. The thermal conductivity characteristics of some materials would prohibit their utilization in areas where hot and cold temperatures occur around the range and oven areas especially and where hot objects might be placed on the counter surface.

The treatment of pattern and scale of the ceiling surfaces is important not only from the visual aspect but also from sound, light and thermal requirements as well. The ceiling pattern or

texture should be light in color and should be plain or of a pattern that is small in scale with little contrast ratio in its pattern.

Sound

The matter of sound transmission in the kitchen area may not be a critical attitudinal requirement for this particular income group and their inherent living patterns but does have an adverse physiological effect nonetheless. Sound transmission throughout the entire structure from noises originating in the kitchen area should be minimized through design and construction wherever possible. Since much activity will evolve around this particular activity area with much conversation in and about the area, exhaust fans and ventilation requirements will be important in maintaining odor control as well as reducing heat in this particular area. Because of the nature of the surface materials used in this area from the counters to the various types of equipment, the noise level will be quite high and there will be no way to eliminate much of this noise except through selection of acoustical absorption materials for the ceiling finish.

If multiple units are "stacked" in order to maintain higher density ratios, then consideration should be given to sound transmission through the various air ducts and ventilation control units. The most common complaint in many large housing apartments today is the sound transmission from the surrounding units via openings around pipes, air ducts, etc.

Thermal Requirements

The thermal requirements for any income bracket are important in that they are determiners of general physiological "readiness" and willingness to perform. Temperature control and adequate air circulation in the kitchen are basic requirements to eliminate or reduce temperature and odor buildups.

Care and Maintenance

This area of the living unit will be subjected to intensive use; therefore, the selection of durable materials that satisfy physiological and psychological requirements and are fairly easy to maintain should be considered. With the advent of many new materials for use in the kitchen area, an educational program that will supply information as to the care of these materials must be considered. (This is not a unique requirement for this particular income group.)

The expenditure for major appliances in this area of the house is considerable, and the more knowledge as to their use and care of these appliances will be a determining factor in their cost and upkeep over a period of time, as well as to their future resale.

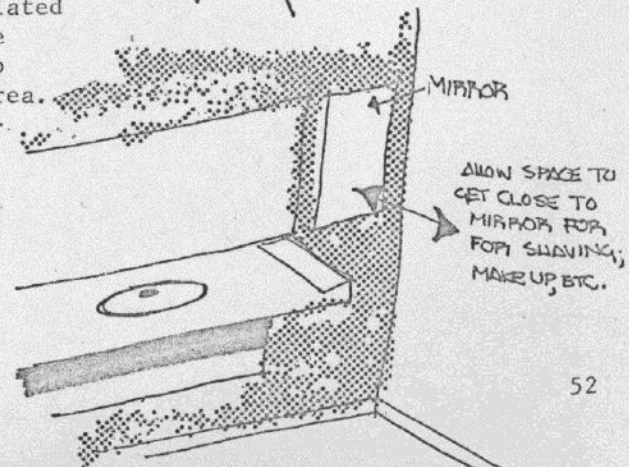
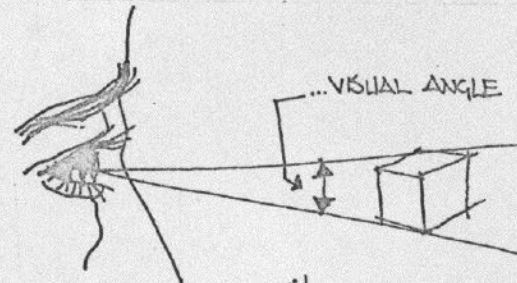
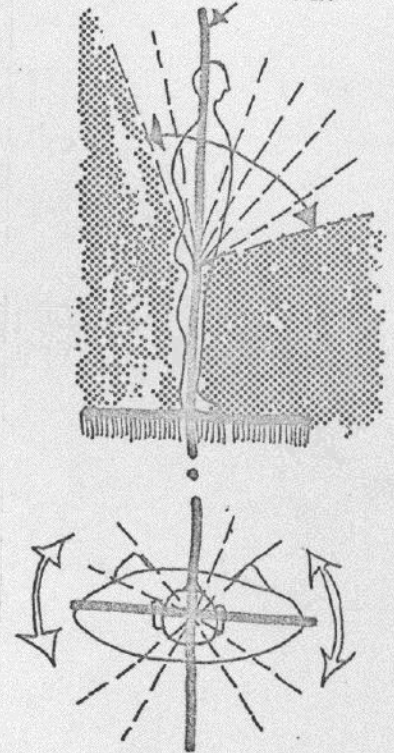
Space Requirements

Tasks performed in this area require a spatial surround that allows for ease of movement around the gravitational axis of the body. The space must allow for this movement to take place without forcing the body to perform in a position where body movements are restricted. Personal hygiene tasks require a spatial surround which allows for lateral, vertical and rotational movement patterns. These patterns will describe a volume of space around the body that must be provided for the human being to efficiently perform a task.

Bathing tasks involve a large range of body movements that require the placement of support elements within the critical reach patterns of the human body. These patterns can be determined by use of human body measurements derived by various human factor research studies. The use of safety devices should be employed in areas wherever an unbalanced body position may be encountered while performing the task. These devices should provide an additional means of support that allows the human body to move safely from one bathing task to another. The placement of safety devices shall be determined by considerations of both body movement and visual identification.

Visual identification plays an important role in the performance of personal care tasks such as application of cosmetics and shaving. The critical visual angles of identification determined by object size and distance can be enlarged by reducing the visual distance to mirror surface. This relationship will decrease focal distance and make visual identification of facial features easier. Unrelated visual elements should be minimized in the surround in order that support be given to the visual tasks being performed in the area. Visual balance and ability to perceive detail correctly will be reduced if strong surface patterns conflict with the main visual center.

← GRAVITATIONAL OR INVAARIANT AXIS



Light

Natural light in the bathroom area should enter the space in a manner which distributes equally throughout the task areas. High contrasts and glare from mirror surfaces should be eliminated. Areas that are distant from window openings should, if they are included, have increased light levels to balance out high contrasts caused by natural light source at the window areas. The light and brightness levels within the space should be within the adaptation level limits of the human eye. These limits in light contrast should be no greater than 7:1 for practical purposes and ideally a ratio of 4 1/2:1.

It is most important to increase central lighting for tasks slightly over general lighting to develop a light surround which stimulates body action for a task. The light across the task area should be of equal distribution with transitional areas of contrast to adjacent areas that are no greater than 3:1. This ratio will allow the human mechanism to perform a task without adverse lateral or vertical movement in order to come to balance or equalize within a light density pattern.

Balanced light conditions as previously described should be established for both day and night conditions. The location of the light source should be selected on the basis of light distribution over the various task areas. Light distribution from the source should not cause direct, reflected or veiling glare on surfaces involved in the task performance. Ideal light conditions in the bathroom area will provide a continuous spectrum of illumination. The efficiency of visual accommodation for correction and distance depend on the presence of all the color bands of white light. (Incandescent light contains more of the color bands of white light than the fluorescent.) A light source that operates over a continuous spectrum of illumination will light a surround that permits greater perception of three dimensional space and form. This type of form inspection is very important in tasks that involve identification of facial features.

The selection of various incandescent illuminants should be considered in regard to the surface colors within the task area. Areas where cosmetics are being applied require a surround that supports accurate color identification and selection without the problem of after-image effect of certain colors.

In the bathroom area, a color temperature of the task area should be approximately 2850°K. This color temperature is desirable for tasks requiring color matching. Colors supporting this color temperature range will generally run in the light gray to warm pastel color range, combined with an incandescent light source. The illumination levels within the bathroom area should be high enough to support the task being performed. This level can be established by determining the critical visual angle involved in task performance. Generally, the illumination levels must increase as the visual angle decreases and decrease as the visual angle increases. An example of this relationship would be distinguishing fine hair during the shaving task.

Surfaces

Materials selected in the bathroom area should support the human mechanisms involved in the performance of the task. Floor materials in areas where bathing tasks are being performed should support body movements safely over wet and slippery surfaces. The surface should be impervious to water and create sufficient friction to prevent slipping. Colors and surface texture should not cause the floor plane to visually displace (move toward or away from the observer) or appear cold as a result of surface color. Selecting warm gray or tan colors will visually appear on the warm end of the spectrum and override the cool physical reaction due to a physiological thermal response to the flooring material (surface) by the human mechanism. Warm colors displace toward the observer because they focus in back of the retina and as a result increase body tension.

Generally, all materials selected for use in the bathroom area should be impervious to the action of water. Critical surfaces that support bathing tasks should be constructed to counteract against all forms of water penetration. Materials that absorb water should not be used in areas where water comes into contact with a surface. All forms of metal should be protected from rusting and destroying other materials in contact with metal surfaces. Safety items such as grab-bars should not be of a highly reflective finish.

Water barriers should be used under shower stalls and floor areas where water might collect.

Developing the bathroom surround to support the variety of tasks requires special care in the selection of a light source, surface color and the texture that is utilized. Colors used on the wall surface should combine with the light source to give an overall room color temperature of around 2850° Kelvin. This color temperature implies a selection of colors that would range in the light grays to the warm pastels. The use of pure color should generally be avoided in the bathroom area because the human mechanism tends to build up an avoidance toward a surface which communicates too rapidly. Choosing colors for various surfaces in the pastel color range will create a harmonic relationship of surfaces within the bathroom area. (Chromatic selection should be based upon those colors that are a mixture of closely associated spectral bands and not from either a very narrow spectral range or at opposite ends of the color spectrum.) The use of the above mentioned colors causes the human eye to make fine oscillation movements. This action forces the focusing mechanisms of the eye to move through various planes of space before making final focus. This combination of visual actions causes the human eye to perceive greater depth in three dimensional space and form that is not achieved with a narrow spectral band of color.

A supporting surround which triggers these actions will generate a visually stimulating space within limits that allows the human mechanism to perform in an optimum manner over a long period of time.

Ceiling surfaces in the bathroom area should be a smooth finish with a flat white color of fairly high reflectance. This type of surface and color selection will help reflect and distribute light equally throughout the task areas. Color contrasts throughout the bathroom area should be relatively low, especially in areas where body movement depends on stability established by the surround. High contrasts would set the human mechanism into greater movement activity. This condition would cause a loss of stability and in turn would make the entire space undesirable to perform the various tasks.

The use of coarse textured surfaces and strong design patterns should be avoided in the bathroom area. These patterns set up visual interest centers that conflict with the tasks being performed. Continuity in the use of materials and color patterns is desirable in small bathroom spaces. Special care should be used in selecting a mortar color for joints in tiled surfaces. To express continuity, mortar color should blend or match color selection of large tile surfaces.

Materials used for counter or work surfaces should be non-porous and easy to clean and maintain. It is desirable to eliminate all patterns which would conflict with the tasks and also cause visual displacement of surface. Counter color reflectance should not contrast with surround surface colors greater than the contrast limits of 3:1. The color should be generally neutral in respect to surrounding surfaces. Its light reflectance should remain within the overall contrast limits of 3:1. The work surface should visually appear at the height established by physical performance measurements for tasks involved.

Sound

High sound levels are created in the bathroom area by such things as running water, the flushing of the toilet, shaving, etc. These sounds are transmitted to other living spaces through the air and through the framework of the house. Sounds

created in the bathroom area tend to be amplified because surfaces are generally very hard and non-porous. These surfaces are good reflectors of sound and in general help to reinforce all sounds created in the bathroom area.

Sounds traveling through the framework of a home can be reduced by minimizing vibrations caused by mechanical equipment. Equipment that vibrates should be put in with flexible mounts and pipe connections should be cushioned where they come in contact with the framework. Airborne sound can be controlled by various types of wall construction. It is important to consider the different types of wall construction available for solving sound problems. Many sounds travel through and around doors and cracks in wall construction. The best door for isolating sound in critical areas is of a solid core material.

Bathroom sounds can be minimized in other areas of the house by mere location. This can be accomplished by locating bath areas between natural buffer zones. Closets, storage areas, stairways and kitchen walls can serve as useful barriers in sound control. Orientation of bath areas should be considered in regard to the mechanical service walls. These walls can sometimes be combined to serve both functional needs as well as sound control barriers. Functional combinations of sound barrier walls and mechanical service walls should be considered.

SPECIFIC PERFORMANCE REQUIREMENTS

Methods of Implementation

Following are a number of specific recommendations which may be used to effect the design principles and sociologic objectives cited in the Introduction and General Performance Requirements sections of this report. The outline listings by functional areas of the residence are anything but all-inclusive -- the principles can be interpreted for design application to each and every element of the buildings, equipment and their surrounds. The sequence of listing is entirely random and does not reflect priorities when "trade-offs" are required for optimum design solutions.

Also, extreme care has been taken to avoid using the "value structures" of the individuals preparing this report. The recommendations are based on research evidence or the best present knowledge known to this design team existing among the many disciplines studying and reporting on physiological, psychological and sociological human functions.

SPECIFIC PERFORMANCE REQUIREMENTS

General Requirements

1. Each family's unit should be readily identifiable visually from the commons areas and visually discernable from each other.
2. Noise transmission, while desirable to eliminate or reduce as much as economically possible, will not be as critical as in middle and upper income groups.
3. If construction is not of traditional materials, then it will become highly important that the architectural forms generated be of a residential character found among typical middle income families.
4. If wood or sheet materials are used for the exterior surfaces of the units, it would be desirable to introduce masonry materials such as bricks into the paving of walkways or yards and into low walls which could serve as exterior seating.
5. Access to individual units should be private. (Vertical circulation necessary to achieve this design objective should be handled by means of exterior entrances worked out in relation to grade slopes. This will also minimize the costs associated with construction of enclosed space and remove the inherent difficulties of maintaining common spaces such as stairwells.)
6. Provision should be made for the installation of thru-wall air conditioners as initial or subsequent purchases if air conditioning is not provided initially.
7. One, two, three and four bedroom units should be included in each cluster grouping with an abundance of the three and four bedroom units. (Bedroom space is the lowest cost of all finished space and most vital to large families. Bath, kitchen and living space should be adjusted to relative sizes of families.)
8. Orientation and plantings for solar control will be critical for site planning. (If not satisfied through this means, architectural devices such as overhangs and balconies must be provided.)
9. To preserve community appearance, the TV antenna problem (especially colored sets) requires that a technical solution be provided in the initial construction.
10. An owner should be able to express his status or individuality without discomforting other owners.

SPECIFIC PERFORMANCE REQUIREMENTS

11. Activities within the living area should not be seen or heard by others unless the owner wishes it.
12. A living unit should have a view without the source of direct sun glare.
13. Housing units should reflect the visual appearance of an overall stable community.
14. Exterior plantings and surface materials should define areas of outdoor activities.
15. Exterior sound control problems should be handled by activity orientation, land contours and plantings.
16. Exterior building materials should be a color and texture which does not generate high contrasts on the building site.
17. Finishes on exterior materials should provide an overall low reflecting surface on building facade.
18. Double glazed window units should be considered for their insulating quality. A reduction in heat loss and gain could result in an overall savings to the owner. (5/8" sealed DSB or sealed crystal sheet units could be considered to keep costs down.)
19. Double glazed windows will yield a greater usable floor area during the winter months. A more desirable thermal gradient for human activities would also result.
20. Window locations should allow for freedom of natural ventilation into major living areas.
21. Window placement and proportion should allow natural light to enter living areas in an equally distributed manner with contrasts minimized.
22. Depth of rooms should not be so great that light contrasts greater than 7:1 cannot be solved by supplemental lighting.
23. Orientation of rooms should allow for physical as well as implied freedom of movement in the four major directions.
24. Consideration should be given to the sun, breeze and view orientation of major activity areas within the living unit.
25. The bedroom areas should be zoned within the home and oriented toward quiet exterior areas.

SPECIFIC PERFORMANCE REQUIREMENTS

26. Work areas and mechanical areas should be easily reached from the service entry.
27. General storage areas should be located near service or main entry.
28. Additional storage for outdoor equipment should be considered in relationship to the exterior of the living unit.
29. A decision is required initially on heating and cooling systems in relation to rental, purchase or rental-purchase of the housing units in each cluster. A metered or non-metered central system of heated and/or chilled water with a heat exchanger in each unit or metered electric resistance heating with window air conditioners, or a combination, could be considered.
30. While vertical visual cues are essential for spatial orientation, excessive vertical or horizontal repetition such as venetian blinds, striped wall paper or closely striped fabrics should definitely be avoided. (This affects the critical flicker frequency of individuals.)
31. Current middle class values represented by current decoration fads such as "op art" should not be reflected in low income housing.
32. Colored fixtures and equipment (bathroom and kitchen) will be desired by this income group. Great care should be taken in the selection of colors based on information included in the General Performance Requirements.

Outdoor Space

1. Each cluster, while being physically related to one another, should be perceived as a single unit by having open space around it and a varied approach.
2. The materials common throughout each cluster such as walls, paving and steps should be of a material which reflects quality and durability such as brick, stone or concrete.
3. Asphalt paving materials used within the clusters or private courts would not be desirable for this income group.
4. The private courts should preferably be oriented away from the late afternoon sun.
5. Each family should have some private outdoor space either at the front or rear of their units and preferably both.
6. The private courts should be provided with ample visual screening. This visual screening should be accomplished by planting and orientation of the units to each other rather than high walls.
7. The general landscaping should be of a type requiring minimum maintenance. (The maintenance of the exterior grounds belonging to some units can be expected to be neglected and, for that reason, the landscape materials, both natural and artificial, should be of a durable character.)
8. A visually private service yard should be provided for each unit to satisfy the transition problem of eventually using clothes drying equipment. (A high percentage of initial occupants would continue to use outdoor drying lines even if provided a clothes dryer.)
9. Each entryway should have enough differences to distinguish it from others.
10. Because older people and young families with children will be in this income group, excessive amounts of stairs should be avoided or alternative access provided.
11. There should be an area for visiting and meeting with neighbors, preferably near the main entrance.
12. The car storage should be close enough to each unit to provide visual contact.

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13. The car storage should be located so it is easily apparent which car belongs to which unit.
14. Community space for repair and storage of disabled cars would be desirable.
15. A play area for small children with space for supervision should be provided which could also serve as a gathering spot for mothers.
16. Materials having low reflectance should be used in the play area.
17. Darker colored materials should be used in the play area and general courtyards. White or near white should be avoided.
18. Shading by either trees or canopies should be provided in the play area and sitting areas.
19. Space for older-age play should be provided to maintain the peer group relations these children would have.
20. If lighting is used where the source of light cannot be concealed, it should be placed outside the central visual field.
21. Lighting having a narrow chromatic band should be avoided in all situations.
22. To better control noise, the units should be sited so the quiet areas of each unit such as the bedrooms do not adjoin the potentially noisy areas such as the public courtyards.

SPECIFIC PERFORMANCE REQUIREMENTS

Living-Dining Space

1. A combination living-dining space is preferable to independent living and dining rooms. However, a living-dining combination space should be decorated in such a way as to reflect the unique activities of each area.
2. The living-dining area should provide open, flowing space free from obstacles for easy maneuverability of furniture to facilitate communication activities.
3. The dining area should provide comfortable eating space for six people with sufficient room for expandable table space to accommodate at least eight.
4. Adequate circulation space should be allotted around dining table and chairs for seating and service activities.
5. Minimum clearance from floor surface to underside of dining table should be 26".
6. Maximum height from floor to table top is 28".
7. Chair height for adults is 17" to 18".
8. Structural components, window divisions or space dividers in this area should provide well defined vertical reference points. Excessive angularity should be avoided.
9. Window placement in this area should be oriented to provide best exterior views of site consistent with sun control.
10. General light level in this area should be medium to low in intensity (10-15 foot candles). Equipment should be provided to facilitate variable light level control.
11. Facilities should be provided for a light center to accommodate critical visual activities such as reading writing, sewing, etc. (40-50 foot candles).
12. Modeling shadow should not exceed 7:1 nor be less than 3:1 (4 1/2:1 optimum).
13. Overhead lighting should be provided in the immediate dining area above the dining table.
14. Room illumination should be balanced to reflect all chromatic bands of the spectrum. This can be achieved by combining both fluorescent and incandescent sources or incandescent with reflected surface colors.

SPECIFIC PERFORMANCE REQUIREMENTS

15. Color scheme should be of a medium pastel range.
16. Pure yellows and blues should be avoided. Most wood paneling is in the accepted range, but high contrasts and strong patterns should be avoided.
17. Surface texture on major wall areas should be kept to a small scale.
18. Wall coverings with high relief texture should be avoided on major wall areas.
19. Surface pattern or design in wallpaper, curtains, furniture fabric and floor coverings should avoid large, bold pattern. Extremely high contrast and complex design should be avoided or used in small amounts for accent.
20. The living area space need accommodate living room furniture seating for no more than six persons and should be capable of being arranged as a conversational grouping for that number.
21. TV watching should be a planned function in the living area without visual interference from windows.
22. The living area should facilitate installation of a fireplace which may be purchased by the occupant initially or at a later date.
23. Planning should minimize circulation of traffic through the living area.
24. The scale of textures should be selected on a basis of the surface plane location. Background surfaces should be kept to a small texture; foreground elements or accent pieces can be larger in texture.