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JOHN DONNE'S TWO ANNIVERSARIES

by

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This thesis treats three major problems in John Donne's Two Anniversaries: the subject of the two poems, the themes and structure, and Donne's references to Scholastic natural philosophy and to new science. The latter half of the thesis examines the poet's references to Scholastic thought and to the revolutionary scientific work of his contemporaries in order to determine his reaction to the two conflicting explanations of phenomena.

The complexity of the twin poems is immediately evident. This is the primary point of agreement among those who have studied the Two Anniversaries. The first problem which is examined--the question of the subject--has been variously resolved. Previous works have interpreted the subject as Astraea, goddess of Justice, Queen Elizabeth I, Christ, and the Virgin Mary. The poems were written as a tribute to Elizabeth Drury after the girl's father hired Donne to memorialize her in verse when she died. This thesis contends that Elizabeth Drury is indeed one subject of the poems. But since Donne never knew the girl personally, he was forced at points in the work to describe more famous women, actual or legendary, with whom he was more familiar in order to produce the two long poems. The evidence that in sections of the poems the subject being described is Astraea and Elizabeth I is considerable, and Chapter One of this thesis concludes that the subject is pluralistic.

Like the subject, the themes and structure of the twin poems are perplexing. The most commonly accepted analysis suggests that the two poems have two themes, the decay of nature and the contemplation of the glories of paradise. In the first poem Donne conducts an anatomy of the

world, an examination of its rotten carcass after its soul, or virtue embodied in Elizabeth, departed for paradise. The second describes the journey of the soul to paradise. In contrast to the first poem, the second does not debate the validity of Scholasticism or the validity of new science, but simply describes the journey of the soul through a Ptolemaic universe. The first poem laments the decay of nature since there is indication of change, and therefore corruption Donne argues, in both microcosm and macrocosm. Since the second poem deserts the intellectual issues raised in the first, the second indicates that Donne feels that a reliance upon grace is more important than determining the validity of world views. The structure of the Two Anniversaries is not flawless, and unity is found primarily by considering each complete poem as a unit. The chaos described in the first explains why the reliance upon grace in the second is necessary.

The third chapter of this thesis, which examines in detail Donne's references to medieval philosophy and to new science, suggests that he did not choose between the conflicting explanations of phenomena. At the time he wrote the Two Anniversaries (1611-12), Scholasticism had been only partially invalidated. The formulation of a new world view was gradual rather than immediate--it was based on the work of sixteenth and seventeenth century scientists--and the scientists among Donne's contemporaries often disagreed among themselves on points. Donne clearly relies upon classical and medieval aesthetics, but this is the only area of Scholasticism to which the poet consistently subscribes. For, while a completely formulated world view to replace the medieval was not yet available, Scholasticism had been discredited considerably and Donne was no longer secure within the old system. This study of the Two Anniversaries indicates that Donne should not be labeled as a medievalist or as a "modern" man, for he was exclusively neither.

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INTRODUCTION

Previous studies of the Two Anniversaries have indicated the complexity of the two poems. The subject of the poems has been variously interpreted, and Chapter One of this paper concludes that the subject is pluralistic. More than one theory of the subject is valid, but no theory disproves that Elizabeth Drury is one subject. The themes and structure of the twin poems, with which Chapter Two deals, are also perplexing. The themes are difficult to discern partly because the structure is not flawless. Unity in the poems is primarily found by considering each complete poem as a unit.

The references to medieval philosophy and to new science in the two poems have been considered detrimental to the technical success of the work, and called digressions. Broadly, however, Donne uses these references to promote his central themes. His use of these two sources of ideas is interesting per se. In the Two Anniversaries he refers to medieval astronomy, alchemy and classical and medieval aesthetics, and to new science. This raises the question of whether Donne was medieval or "modern" in his intellectual commitment. This problem has been generally treated: it is the special concern of Chapter Three to contribute to its resolution by examining Donne's references to medieval philosophy and new science in the Two Anniversaries.

CHAPTER I

THE SUBJECT OF THE TWO ANNIVERSARIES

John Donne was largely ignored in the eighteenth and nineteenth centuries, but his works, including the Two Anniversaries, have been enthusiastically examined in the twentieth century. The twin poems, however, have not been so widely read or carefully studied as Donne's Songs and Sonnets or his Divine Poems. After the Two Anniversaries were written in 1611 and 1612, the work was imitated by Webster in 1613 as he created an aura of mystery about his heroine in The Duchess of Malfi. The prose meditation on death in Drummond's Cypresse Grove (1623) parallels passages in the Two Anniversaries, especially Donne's passage commenting on the New Philosophy. Dryden's elegy Eleonora (1692) was also patterned after these poems. But in the eighteenth century the poems were either forgotten or misinterpreted. For example, the Spectator, No. 41 quoted a few lines from the Two Anniversaries and commented that the lines referred to a mistress of Donne, which is not the case. Fielding used these lines quoted in the Spectator to refer to Sophia, a mistress of Tom, in Tom Jones (IV, ii).¹

Dryden praised Donne's wit, but objected to his style, especially the style of his satires.² Specifically, Dryden condemned the conceits of Donne, disliking the metaphysical poet's application of "metaphysical wit"

¹Frank Manley, John Donne: The Anniversaries (Baltimore, 1963), pp. 7-8.

²Leah Jonas, The Divine Science (New York, 1940), p. 203.

to poetic imagery. In the eighteenth century "wit" and "conceit" no longer meant "intellect" and "imagination" as the terms were used by the seventeenth century metaphysical poets. Eighteenth century theories of form, wit and style reduced "wit" and "conceit" to "ingenuity" and "fancy." In the Age of Reason the wit of Donne was censured for its "unnatural" and "far-fetched" use. Dr. Johnson objected to Donne's conceits based on medieval philosophy and new science. The analytical quality and argumentative of his "wit" were considered inappropriate, and the harsh quality of his lyrics could not be reconciled with Neo-Classical "correctness." Johnson's evaluation was largely accepted in the nineteenth century, although Coleridge and De Quincey made some attempt to revive Donne. Their praise was not excessive. For example, Coleridge refers to Donne's misapplication of learning--to "the utmost boundless stores of capacious memory...exercised on subjects where we had no right to expect it."³

During the last ten years of the nineteenth century studies of Donne began to be made. These studies contributed to an understanding and appreciation of him in the twentieth century. The editing of Donne by Sir Herbert Grierson was one of the primary contributions to the poet's revival. By 1930 Donne was considered a poet of the first order. Eliot, while rating Herbert, Vaughn and Crashaw as superior to Donne as religious poets, called Donne one of the great masters of the English language, and one of the great preservers of the English tongue.⁴

³Itrat Husain, The Mystical Element In The Metaphysical Poets Of The Seventeenth Century (Edinburgh, 1948), pp. 41-5.

⁴T. S. Eliot, "Donne In Our Time," A Garland For John Donne, ed. Theodore Spencer (Cambridge, Mass., 1931), p. 19.

The subject of the Two Anniversaries, which are not considered to be among Donne's finest work, has perplexed scholars. Ostensibly at least, the subject of the two poems is Elizabeth Drury. In 1611 Donne was in need of a patron, and Sir Robert Drury, Elizabeth's father, hired him to write a poem in memory of his daughter who died in December of 1610 and was buried in the chancel of All Saints in Hawtea. Elizabeth was two months short of being fifteen when she died.⁵

When Donne wrote of her, he subscribed to the seventeenth century poetic principle that verse could preserve a mortal's fame. However, Donne was not a radical adherent to this principle. He wrote that his poetry eulogizing Elizabeth would affect posterity, but did not guarantee that her fame would be insured for eternity. Donne, in his pessimism, claimed that her fame would last until the world ends, and observed that the world was already in a state of decay.⁶ But in the first of the two poems, he pays her the compliment of attributing the decay of the world to her death.

Since Donne never knew the girl personally, the Two Anniversaries are not an expression of personal grief. His exalted praise of Elizabeth, whom he did not know, and his claim that she was the generating force of the world indicate that the poems do not describe only Elizabeth Drury.

One tradition, probably originating in 1896 with the work of E. I. Chambers, explains that A Funerall Elegie was written before the Two Anniversaries and that the Two Anniversaries are enlargements, developed

⁵ Herbert J. C. Grierson, The Poems of John Donne, II (Oxford, 1958), 187.

⁶ Jonas, pp. 202-5.

around the nucleus of A Funerall Elegie.⁷ Grierson agrees with Chambers that A Funerall Elegie, probably composed in 1610, was part one of the Two Anniversaries. Grierson explains that "later, when the idea of the anniversary poems emerged, and Of the Progresse of the Soul was written as a complement to An Anatomy of the World, these became the prominent part of the whole work in honour of Elizabeth Drury, and the Funerall Elegie fell into the subordinate position."⁸ However, the only evidence cited by Grierson to support Chambers' theory is external, and its validity has been challenged. When the two poems were published in 1611, A Funerall Elegie was placed following the First Anniversarie. Since the volume was not entered on the Stationer's register, it is not known exactly when in 1611 the volume was published.

In November, 1611, Donne left England with the Drurys to travel on the continent. The Second Anniversarie was probably begun in December, 1611, at Amiens, upon the first anniversary of Elizabeth Drury's death, for lines 511-8 allude to France. The Second Anniversarie was sent to London and the First Anniversarie and the Second Anniversarie were printed along with Joseph Hall's Harbinger early in April, 1612.⁹

Donne's praise of his subject in the Two Anniversaries can be better understood when it is realized that he relied upon the tradition of the elegy when he wrote. The death of the fifteen-year-old girl provided an "occasion" for Donne to write his poems. Like Milton's Lycidas, the Two

⁷Manley, p. 4.

⁸Grierson, p. 178.

⁹Manley, pp. 1-5.

Anniversaries blend classical and Christian themes--a typical Renaissance approach. The classical substratum is always present, though Donne primarily develops his two poems within a Christian context. For example, when he writes in the Second Anniversarie that "In all shee did, some Figure of the Golden Times were hid," and when he wrote: "She of whom th'Ancients prophesie,/ When they call'd vertues by the name of Shee," the contemporaries of Donne recognized that he was referring to Astraea, goddess of Justice, who fled a wicked world in order to remain in heaven as the constellation Virgo.

In the First Anniversarie Donne asserts that since Elizabeth has died and gone to heaven, the world is decaying. The decay of nature had long been a subject of pagan and Christian authors when he wrote. Hesiod developed a theory of degeneration. In pagan thought decay was explained in a theory of the four ages of the world, the Age of Gold, the Age of Silver, the Age of Bronze and the Age of Iron. The poet Aratus also contributed a legend of the world's decay. Astraea, the Maiden who became the constellation Virgo, appears in Aratus' Phaenomena.

Ovid and Virgil transmitted the legend that in the Age of Iron the evil of man knew no bounds, and that Justice, or the Maiden, was visible only when men gazed at Virgo. Virgil added an optimistic note to the legend, for he prophesized that Justice, embodied in the Maiden, would return to the world, and the world would again experience an Age of Gold. Ovid was not optimistic, however; according to him, all virtues had fled the earth and would remain in heaven forever. Donne, like Ovid, writes that only in heaven will virtue be found again.

When Donne attributes the decay of the world to Elizabeth Drury, he is retelling the story of Astraea. He explains that justice and beauty quit the world with the dead girl in such passages as the following:

Shee by whose lines proportion should bee
 Examin'd, measure of all Symmetree,
 Whome had that Ancient seen, who thought soules made
 Of Harmony, he would at next have said
 That Harmony was shee, and thence infer,
 That soules were but Resultances from her....
 (FA, ll. 309-14.)

Miss Nicolson argues that at points in the First Anniversarie Donne combines Astraea with his concept of the Virgin Mary.¹⁰ Elizabeth is never described in terms as clearly equating her with the Virgin Mary as with Astraea, however. Indeed, early in the Second Anniversarie Elizabeth seems to be disassociated with motherhood:

Immortal Maid, who though thou would'st refuse
 The name of Mother, be unto my Muse
 A Father, since her chaste Ambition is,
 Yearely to bring forth such a child as this.
 (SA, ll. 33-6.)

Ben Jonson did not feel that the twin poems were concerned with the Virgin Mary, and said that this was unfortunate. For, Jonson commented, "If it had been written of ye Virgin Marie it had been something."¹¹

Independently, Marius Bewley and Marjorie Nicolson developed the idea that the two poems on one level refer to Elizabeth I. Miss Nicolson maintains that Donne thought of Queen Elizabeth as the cohesive force which held the commonwealth together. These lines are interpreted as referring to Queen Elizabeth:

¹⁰ Marjorie Hope Nicolson, The Breaking of the Circle (New York, 1960), pp. 91-6.

¹¹ Manley, p. 7.

As these prerogatives being met in one,
 Made her a sovereign State; religion
 Made her a Church; and these two made her all.
 She who was all this All, and could not fall
 To worse, by company (for she was still
 More antidote, than all the world was ill,)
 Shee, shee doth leave it, and by Death, survive
 All this, in Heaven.

(SA, ll. 373-80.)

Miss Nicolson believes that by the time Donne composed the Two Anniversaries he was an Anglican convert and an admirer of Elizabeth I,¹² although in Progresse of the Soule he called her a heretic who was to have "in Paradise a low and fatall room." Bewley, however, believes that Donne is not an admirer of the Queen when he writes of her in the First Anniversarie. According to his theory, Donne's compliments in the first poem are double-edged--the Anglican Church and its head are compared to death and decay. Bewley agrees that the "Elizabeth" in the above passage is Queen Elizabeth, but emphasizes that not until the Second Anniversarie does Donne commit himself in favor of the Anglican Church and the Queen.¹³

Louis Martz considers the analysis that the central figure of the two poems is Queen Elizabeth incorrect. He argues that exponents of this interpretation fail to realize that the reference to a "monarch" is not a literal one, and suggests that the subject of the poems is only a ruler of herself--that the Elizabeth of whom Donne writes possesses the "control of true humility." The central point of the Two Anniversaries for Martz "lies in the assertion that religious virtue is the greatest of all human values."¹⁴

¹²Nicolson, The Breaking of the Circle, pp. 81-106.

¹³Marius Bewley, "Religious Cynicism In Donne's Poetry," Kenyon Review, XIV (1952), 621-33.

¹⁴Louis L. Martz, The Poetry of Meditation (New Haven, 1955), pp. 355-6.

However, the Elizabeth who "made warres, and triumph'd" (SA, l. 361) and who "gave pardons, and was liberall" (SA, l. 367) better describes Queen Elizabeth than a girl who possessed the self-control of "true humility" and never made any war on anything.

Elizabeth of the Two Anniversaries has not only been interpreted as Astraea, the Virgin Mary and Queen Elizabeth. William Empson believes that "the only way to make the poem sensible is to accept Elizabeth Drury as the Logos." Coffin has also stated that Elizabeth must be interpreted as a Biblical figure, Christ in fact. He writes:

This is the heavy burden of religion and philosophy shouldered upon the fragile story of the life and death of Elizabeth Drury. Unless we recognize in her brief encounter with human experience the lofty parallel to the incarnation of Christ himself, Donne's attempt is hopeless.... Though Christ is not named in either of the Anniversaries, He is definitely figured forth as Elizabeth Drury.¹⁵

Coffin points out that Elizabeth Drury unifies body and soul and argues that the "resolution of this apparent duality of man into the unified personality is something divine, to be achieved only by death." Only Christ, he argues, achieved this union of body and soul.¹⁶ But that the subject of the poems is described as something divine, or as a supernatural creature, does not establish that the subject is really Christ. Many of the women described by poets, in the Petrarchan tradition for example, are presented as divine. Donne could have assigned Elizabeth supernatural or divine attributes without intending her to represent the Messiah. Moreover, the subject of the Two Anniversaries departed from the world without experiencing anything like the Passion. Also, Donne at the opening of the first poem assigns his

¹⁵ Charles Monroe Coffin, John Donne and the New Philosophy (New York, 1937), pp. 258-76.

¹⁶ Ibid., p. 277.

subject a place in heaven as part "of the Quire, and Song" (FA, l. 10), an unfitting place for Christ.

While the argument that Elizabeth of the Two Anniversaries is Christ is an unconvincing one, it should not be replaced by a monistic interpretation, such as Grierson's, that the subject is simply the fifteen-year-old girl. He writes: "The subject of the Anniversaries was the fifteen-year old Elizabeth Drury, who died in 1610."¹⁷ Although no passages in the poems refer unmistakably to the Virgin Mary, the powers and attributes of the subject of the First Anniversarie correlate with those of Astraea, goddess of Justice. There are also passages, especially in the Second Anniversarie, which better describe Elizabeth I than Elizabeth Drury. But the two poems describe neither Astraea nor the Queen throughout, and there is no reason to assume that the daughter of Sir Robert Drury is not one subject of the work. The subject is pluralistic. It has perplexed readers since Jonson, who considered the work blasphemous, largely because the assumption that the poems refer to Elizabeth Drury consistently or not at all has prevailed. Donne wrote to eulogize her, but since he did not know her personally he had to rely upon literary tradition for material to compose his poems. Passages describe women whom Donne knew more about than Elizabeth Drury, and in these passages she is not the subject. Sir Robert Drury was evidently satisfied that the complex poems were fitting tribute to his daughter however, for he invited Donne and his family to live on his estate free of charge.¹⁸

¹⁷Grierson, p. 187.

¹⁸William R. Mueller, John Donne: Preacher (Princeton, 1962), p. 22.

CHAPTER II

THE THEMES AND STRUCTURE OF THE TWO ANNIVERSARIES

Like the subject, the themes of the Two Anniversaries have been variously interpreted. Grierson advances the most commonly accepted analysis of the work: the two poems have two themes, the decay of nature and the contemplation of the glories of paradise.

Metaphysical poetry has been very broadly defined as poetry in the tradition of Lucretius, Goethe and Dante; poetry concerned with the role of man in the drama of existence.¹⁹ In this sense of the term, the Two Anniversaries are metaphysical because they are concerned with the decay of man and all of nature after the death of Elizabeth, and with the journey of her soul to paradise. Man, like the earth and heavenly bodies, is no longer the perfect creature God originally made him. Early in the first of the two poems the fall of man and the decay of natural creation is described in the physical terms of injury and corruption:

Corruption entred, and deprav'd the best:
It seis'd the Angels, and then first of all
The world did in her cradle take a fall,
And turn'd her braines, and tooke a generall maime,
Wronging each joynt of th'universall frame,
The noblest part, man, felt it first; and then
Both beasts and plants, curst in the curse of man.
So did the world from the first houre decay,
That evening was beginning of the day,
And now the Springs and Sommers which we see,
Like sonnes of women after fiftie bee.

(FA, ll. 194-204.)

¹⁹Leonard Unger, Donne's Poetry and Modern Criticism (Chicago, 1950), p. 4.

In describing the decay of man and the world Donne speaks as if he were a physician:

But as in cutting up a man that's dead,
 The body will not last out, to have read
 On every part, and therefore men direct
 Their speech to parts, that are of most effect;
 So the worlds carcasse would not last, if I
 Were punctuall in this Anatomy;
 Nor smells it well to hearers, if one tell
 Them their disease, who faine would think they're well.
 (FA, ll. 435-42.)

As indicated in the subtitle of the first poem, the work is an anatomy of the world. The decay of the world is like the decay of the human body-- the wound was incurred when Elizabeth left the world and infection has spread from the initial wound to all parts. The sickness of the world cannot be isolated or restricted to a specific humor or organ, for the main organ of the trunk, the heart, is rotten:

And learn'st thus much by our Anatomy,
 That this worlds generall sicknesse doth not lie
 In any humour, or one certain part;
 But as thou sawest it rotten at the heart,
 Thou seest a Hectique feaver hath got hold
 Of the whole substance, not to be contrould,
 And that thou hast but one way, not t'admit
 The worlds infection, to be none of it.
 (FA, ll. 239-46.)

The images with which Donne develops his dissection of the world support the insight that the Metaphysical poets are distinguished by their ability to perceive relations more often logical than emotional or sensual.²⁰ The medical images of Donne are borrowed from physicians and alchemists whom he studied, unlike those of Shakespeare, for example, whose medical images are associated with the body of facts and cures known to the average

²⁰ Joan Bennett, Four Metaphysical Poets (New York, 1937), p. 4.

Elizabethan.²¹ As Donne expresses disgust with the decaying world and contemplates the glories of paradise, it is argued that he is actually conducting a self-anatomy--an anatomy of his own religious position:

Under the name of "an anatomy of the world" he gives us an anatomy of himself--the little world or microcosm. At the outset he must be provided with a skeleton on which to hang the nerve and muscle of man conceived by the imagination to be himself. From the beginning of The First Anniversary to the end of the Second, the chief business of the poet is the analysis of his own consciousness.²²

Line 157 of the Second Anniversary indicates that the work is at least in part a self-analysis, for Donne writes: "Thinke further on thy selfe, my soule," as he describes Elizabeth's trip to paradise and contrasts her virtues with the decay of the rest of creation.

Coffin explains that while Donne is conducting his self-anatomy, he deals with the problem presented by a dichotomy of body and soul: he unites the two technically and intellectually by using Elizabeth Drury as a Christ symbol. While the argument that Elizabeth is Christ breaks down at many points, Coffin's realization that Donne reconciles any opposed claims of body and spirit within a Christian context is essentially correct. In the Two Anniversaries he speaks not only of the virtue of Elizabeth's spirit, but praises the perfection of her body as well. Donne seems to consider the body also a "soul," or the written record of the Creator. Even at the close of the second poem when Elizabeth is safe in heaven, her body is praised:

Shee, who left such a bodie, as even shee
Only in Heaven could learne, how it can bee

²¹Milton Allan Rugoff, Donne's Imagery (New York, 1962), p. 220.

²²Coffin, p. 275.

Made better; for shee rather was two soules,
 Or like two full on both sides written Rols,...
 (SA, ll. 501-4.)

It has been suggested that as the First Anniversarie was developed, Elizabeth's death represented the fall of man. However, Donne states that the subject described cannot experience the fall, for she is free from the stain of the fall "by a true religious Alchymie" (FA, l. 182). Manley, however, works out an elaborate explanation in order to identify the fall of man with Elizabeth Drury's death. He argues that Elizabeth is a vague garden of Eden image--that she is the world, yet she is the soul of the world, the generating source on which the world depends. This would mean that Elizabeth is both microcosm and macrocosm. Manley's whole theory²³ does not fit the poems, however. If Elizabeth is the macrocosm, the world should have disappeared upon her death, for she went to paradise. Rather, it decays. Donne explains that there is "a kinde of World remaining" after her death:

For there's a kinde of World remaining still,
 Though shee which did inanimate and fill
 The world, be gone, yet in this last long night,
 Her Ghost doth walke; that is, a glimmering light,
 A faint weake love of vertue, and of good,
 Reflects from her, on them which understood
 Her worth; and though she have shut in all day,
 The twilight of her memory doth stay;...
 (FA, ll. 67-74.)

Only the memory of Elizabeth remains. The explanation that Elizabeth was the generating force of the world, the soul enticing men to virtue, enlightens the reader's understanding of the poem. But Elizabeth was not

²³

Manley, p. 15.

intended by Donne to represent the whole macrocosm, for he praises the body of Elizabeth in the Second Anniversarie while he devotes the entire First Anniversarie to portraying the rotten carcass of the world after her death. Elizabeth is not the world, for Donne explains that a new world is produced from the old world's carcass after Elizabeth has departed (FA, ll. 75-7). This new world may profit from the poet's dissection of the old:

This new world may be safer, being told
The dangers and diseases of the old:
For with due temper men doe then forgoe,
Or covet things, when they their true worth know.
(FA, ll. 87-90.)

Manley also argues that Elizabeth, who represents the soul of the world, is equated with wisdom and that it is the concern with wisdom which constitutes the essential theme of each poem. He defines wisdom as a form of celestial love by which the soul proceeds from love of the body to appreciation of the incorporeal. The Two Anniversaries are not Platonic exercises, however. It is the unity of body and soul which is praised by Donne in the two poems. In the context of Manley's own insight that Elizabeth was the soul of the world, it is obvious that the world decayed because body and soul were separated. The body, or carcass of the world, rots because she is in heaven.

The Second Anniversarie Manley interprets as a surge "upward toward eternal life" after man realizes the loss of his soul and, guided by this wisdom, seeks God. It is necessary for him to re-define "wisdom" at this point as the intuitive knowledge of woman in contrast to the rational and conscious knowledge of the male intellect. It is argued that Elizabeth, or intuitive knowledge, is the embodiment of the wisdom man acquires by realizing his fall. According to Manley's interpretation of the theme, it

is necessary to consider fallen man, or the reader, as the subject of the poem. To consider him the subject of the First Anniversarie is unrealistic, for Elizabeth in this poem is contrasted with fallen man, rather than identified with him. It would be difficult to consider fallen man, even aware of his transgressions, the subject of the Second Anniversarie. This poem describes the journey of a soul that was never tainted with original sin. Manley argues that the reader identifies with the progress of the soul.²⁴ The reader may identify with the journeying soul in some instances, but this does not establish the reader as technically the subject of the poem.

That it is necessary to advance various and involved interpretations of the themes suggests that the structure of the two poems is not flawless. Critics who have found unity in the poems have done so by ignoring the subject, by concentrating on the themes and by evaluating the entire poems. Mario Praz explains that the sense in Donne's poetry is realized not by examining each line or even each stanza separately, but rather the meaning is concluded with the last line of the poem.²⁵ The meaning, in other words, is to be found in the poem as a unit. Miss Nicolson points out that an essential unity is recognizable in the Two Anniversaries if the twin poems are considered antithetical poles of one logical unit. Interpreting the work as possessing two themes similar to those suggested by Grierson, she explains:

²⁴ Manley, pp. 18-27.

²⁵ Mario Praz, "Donne's Relation To The Poetry Of His Time," A Garland For John Donne, ed. Theodore Spencer (Cambridge, Mass., 1931), p. 56.

The Anniversaries are...as artfully though not so obviously articulated as "L'Allegro" and "Il Penseroso." The first is a lament over the body--the body of man and the body of the world--a meditation upon death and mortality. The second is a vision of the release of the soul from its prison. The whole, with antithesis of doubt and faith, despair and hope, death and the triumph of immortality, is a great symphony in which the harmony is more profound because of cacophony.²⁶

The Second Anniversarie is generally considered superior to the First. Martz points out the problems involved with the inclusion of Elizabeth in the first poem. Disagreeing with Empson, who thinks that Donne makes it clear throughout the poem that the decay of the world is caused by the girl's death, Martz maintains that the poem contains "a central inconsistency which defeats all Donne's efforts to bring its diverse materials under control." He feels that the First Anniversarie, with its "digressions," such as references to the New Philosophy, lacks the organic unity of the second poem. The description of the flight of the soul to paradise, according to Martz, is concerned primarily with faith, which leads man to turn from the world and seek God. This surrender to faith in the last poem is contrasted with the treatment of reason in the first poem. The passage on the New Philosophy in the First Anniversarie, Martz interprets, indicates the climax of decay--that the universe is mutable attests to its decay as a result of sin. His further remarks on Donne's references to new astronomy are more difficult to reconcile to the text; for example, that Donne was mocking the vanity of man's attempt to understand and control the universe. Nowhere in the twin poems is there any indication that Donne felt men were trying to

²⁶Nicolson, The Breaking of the Circle, pp. 65-6.

control the universe or that they might be capable of doing so, although it is possible that he may have been skeptical of their ever understanding it. It is argued that the discussion of the New Philosophy has no relation to "the untimely death of Mistris Elizabeth Drury."

Martz illustrates that both poems are meditations rather than a single eulogy. The First Anniversarie is divided into five main sections. Lines 1-90 are introductory: the five main sections each consist of a meditation, a eulogy, and a refrain and moral. Lines 91-190 constitute the first section, lines 191-246 the second, lines 247-338 the third, lines 339-76 the fourth, and lines 377-434 the fifth. Lines 435-74 form the conclusion. The first poem opens with a meditative unit which echoes the confession in the Booke of Common Prayer, that "there is no health in us." It is argued that this unit has no relation to the first ninety lines of introduction which explains the destruction and decay of the world as the result of Elizabeth's death. Martz also considers the return to the subject of Elizabeth and "the Petrarchan hyperbole of the world's death" after line 170 to be mechanical. Indeed, the whole poem is pronounced mechanical.

The Second Anniversarie, however, is praised by Martz in the most laudatory manner, for it is regarded as technically organic and free of any "sharp division of meaning" between meditations and eulogies such as the First Anniversarie is troubled by. It is one of the most successful religious poems ever written, he concludes:

In the previous poem every Meditation was strictly a scourging of the world and of man, every Eulogy the picture of a lost hope. But in the Progress every Meditation, together with this scourging, includes hope of salvation which is imaged in the Eulogy, and in every Meditation except the first, this hope, this upward look, is stressed in the latter part of

the Meditation, with the result that the reader is carried easily into the realm where the symbol of perfect virtue now lives.

The Second Anniversarie is divided into seven main sections, a meditation, a eulogy, and a refrain and a moral constituting the first section and a meditation, a eulogy, and a moral minus a refrain constituting the last six divisions. The introduction ends with line 44. Lines 45-84 comprise the first section, lines 85-156 the second, lines 157-250 the third, lines 251-320 the fourth, lines 321-82 the fifth, lines 383-470 the sixth, lines 471-510 the seventh, and lines 511-28 the conclusion.

The theme of the last poem, according to Martz, is the "true end of man." He argues that this poem successfully serves the aims of the meditation which are traditionally twofold: to remind men that the image of man the sinner is a "defaced image," and to contrast this with the original image which has the beauty lost through sin. It is the first poem rather than the second, as Martz believes, which best serves these functions; for only in the First Anniversarie is the decay of nature described in detail. The Second Anniversarie is primarily a description of the soul's journey to paradise: paradise and the virtuous soul in this region are pictured--fallen man and decaying nature are left behind in the First Anniversarie. Martz praises the second poem for its "firm religious center" because it takes the function of grace into account. One of the essential flaws of the first poem, he concludes, is the omission of grace.²⁷

²⁷Louis L. Martz, "John Donne in Meditation," John Donne, ed. Helen Gardner (Englewood Cliffs, N. J., 1962), pp. 152-70.

Although Martz successfully illustrates his contention that the twin poems are two meditations rather than one eulogy and is sensitive in his analysis of the shifts from meditation to eulogy within the various sections, his praise of the Second Anniversarie for its firm religious center, at the decided expense of the First, is exaggerated. If the second poem has unity because of its religious focus and dependence upon grace and faith, the first poem has a unity of a similar nature. Its "center" is the expression of bewilderment in the face of the decay of nature. The conflicting rational interpretations of the universe add to this bewilderment. If the Second Anniversarie expresses an acceptance of grace, the First Anniversarie is a description of the chaos which made a reliance upon grace necessary.

CHAPTER III

DONNE'S USE OF SCHOLASTIC NATURAL PHILOSOPHY AND FINDINGS OF NEW SCIENCE IN THE TWO ANNIVERSARIES

In addition to analyzing the subject, themes and structure of the Two Anniversaries, scholars have devoted much attention to examining Donne's use of medieval aesthetics, medieval astronomy and alchemy in the same work in which he uses ideas drawn from the findings of new science. His use of these two sources raises the question of whether he was essentially Scholastic in his thinking, or whether he should be classed as a "modern," who accepted the findings of new science and the method of new science, or the New Philosophy. The theology of Donne can be traced to theologians prior to the seventeenth century--notably Augustine and Aquinas. Michael Francis Moloney in his discussion of the relation of Donne to medieval and Renaissance thought has argued that the fundamental problem of classifying Donne lies in realizing that he deserted the Thomistic aesthetic for the naturalism of the Renaissance. The Scholastic aesthetic referred to did not reject nature, but rather attempted to supernaturalize it since natural inquiry was regarded by Aquinas and others as an area which was subordinate to theology.²⁸ Aquinas pointed out that no science could prove its first principles and that the area of natural inquiry was

²⁸Michael Francis Moloney, John Donne, His Flight From Mediaevalism (Urbana, 1944), pp. 210-13.

limited.²⁹ Donne adhered to Aquinas' aesthetics in the limited sense, in other words, as a discipline defining beauty, in the Two Anniversaries. This is especially evident in the First Anniversarie. In the sense that Moloney employs "mediaeval aesthetic," a synthesis of the claims of spirit and flesh is referred to. He explains that in Scholastic thought "the created beauty of the universe with all its manifold appeal to the sense of man is a faint and shadowy reflection of the Divine Beauty which is its source." It was this synthesis of spirit and flesh, regarding natural beauty and empirical objects as but reflections of their spiritual source or Creator, that the new science sought to destroy in order to examine objects of nature per se.

Moloney is aware of one strand of naturalism in the Renaissance which he traces from Byzantium and considers this to be the "New Ideology" which separated Donne from Scholastic thought. The findings of new science that contradict the Scholastic natural philosophy in the Two Anniversaries cannot be dismissed as a revival of naturalism which flourished in Byzantium as classical culture declined. Rather, the disintegration of medieval astronomy and alchemy lamented by Donne in the First Anniversarie was the result of the rise of new science which occurred in Western Europe in the sixteenth and seventeenth centuries with the revolutionary work of such men as Copernicus, Paracelsus, Tycho Brahe, Kepler

²⁹W. T. Jones, A History Of Western Philosophy (New York, 1952), pp. 438-61.

and Galileo. Moloney argues that Donne was torn between the Scholastic synthesis of spirit and flesh and Byzantine humanism which was characterized by paganism. Many of the scientists who initiated the scientific revolution were devout, and regarded spirit and matter as separate rather than antagonistic, as Moloney interprets Renaissance naturalism.³⁰ It is possible, however, that the advent of new science did cause men to question their religious beliefs inherited from the Scholastics. Donne in the Two Anniversaries is keenly aware of the work of contemporary scientists and exclaims that the New Philosophy "calls all in doubt." Both Scholastic astronomy, alchemy and aesthetics and new scientific discoveries serve Donne as sources of ideas to promote the central themes in his twin poems. The obvious conflict between these two sources of ideas accentuates the chaos described in the first poem, and helps to dramatize the decay and uncertainty in the world after virtue left it.

Studies examining Donne's relation to medieval thought have attempted to analyze his "temperament" as well as to discover the works with which he was familiar. Although it has been suggested that Miss Ramsay and Mrs. Simpson have exaggerated Donne's learning, their conclusion that he was remarkably well read in Scholastic theology and philosophy and in its opponents, such as Duns Scotus, as well as new science is generally accepted by students of Donne.³¹ Miss Ramsay and Mrs. Simpson have emphasized the Thomistic element in Donne, while attributing to him a modern

³⁰Moloney, pp. 210-13.

³¹Husain, pp. 37-8.

tendency to be tolerant in matters of religion. Sir Herbert Grierson has emphasized the skepticism in Donne's thought and poetry. T. S. Eliot regards the temper of Donne to be the antithesis of the Scholastic and of the philosophical system-maker like Aquinas. Eliot explains:

The encyclopaedic ambitions of the schoolmen were directed always towards unification: a summa was the end to be attained, and every branch of knowledge and practice was to have its relation to the whole. In Donne there is a manifest fissure between thought and sensibility, a chasm which in his poetry he bridged in his own way, which was not the way of medieval poetry....But perhaps one reason why Donne has appealed so powerfully to the recent times is that there is in his poetry hardly any attempt at organization; rather a puzzled and humorous shuffling of the pieces; and we are inclined to read our own more conscious awareness of the apparent irrelevance and unrelatedness of things into the mind of Donne.³²

In contrast to Eliot's explanation of Donne, Itrat Husain believes that Donne was basically a mystic. He argues that the key to understanding the metaphysical poet is realizing that references to new science in his poems are but incorporations into a mystic thought pattern. Donne, however, leaves too many conflicts unresolved after mentioning or outlining them to be secure within a mystical and organic vision of phenomena.³³

Moloney, dealing with the problem of Donne's Scholasticism, comments: "There is to be found in Donne...the reflection neither of the complete invalidation of the mediaeval thought, which Courthope asserts, nor, on the other hand, the untroubled reliance on the mediaeval premises, which

³²Eliot, p. 8.

³³Husain, p. 11.

Miss Ramsay analyses." He feels that Miss Ramsay achieves a better understanding of Donne than does Courthope, but that she fails to appreciate the points at which Donne breaks defiantly with medieval tradition.³⁴

In the Two Anniversaries it is difficult to tell whether Donne subscribes to medieval cosmology or to the cosmology of Copernicus, Kepler, Galileo and other contemporaries, since he uses both systems as structures on which poetic metaphors are developed. Mario Praz notes Donne's indiscriminate use of arguments and suggests that he used them pragmatically. For these arguments are "but a barrister's special pleadings; medieval philosophy he regards not as a complete explanation of the universe but as 'an arsenal' of arguments; his reason for choosing some and neglecting others is 'practical' rather than speculative."³⁵ Joan Bennett believes that Donne and his followers in the metaphysical school "were not speculating about the nature of things." Nevertheless, she emphasizes the extensive references of Donne, explaining that he "was widely read in most of the subjects that excited cultivated minds in his day: astronomy, chemistry, geography, physiology, law and theology, and he drew upon all these indifferently for illustration."³⁶

Donne does use Scholastic ideas and those of new science indiscriminately as he needs them to develop the structures of his poems, but in addition to using these two sources of ideas practically, he also expresses

³⁴ Moloney, p. 109.

³⁵ Pierre Legouis, Donne The Craftsman (New York, 1962), p. 71.

³⁶ Bennett, p. 32.

an intellectual plight. In the First Anniversarie he exclaims that new science causes him to doubt all his old beliefs about cosmology. The cosmology of the Scholastics based upon the work of the ancients had been challenged and partially invalidated by new discoveries. In time it was destroyed, but the destruction was gradual rather than immediate. Discussing the observations of Galileo through the telescope he invented, Charles Singer comments:

It is fair to remember that a complete system of philosophy, weaving into one vast scheme the moral and physical, the terrestrial and celestial worlds had been built up during the Middle Ages. This satisfied the need of the day. The fact that Galileo had made a breach in that scheme was no clear reason to abandon the whole.³⁷

After Donne refers to the heliocentric system of the universe in the First Anniversarie, he uses the Ptolemaic geocentric organization in the Second Anniversarie as he describes the flight of Elizabeth's soul to heaven. He seems insecure within the Scholastic scheme of natural science, yet unable to accept the findings of new science. Throughout the twin poems he combines references to the two systems. Grierson describes the problem facing Donne and his contemporaries who lived when new science was beginning to invalidate medieval premises:

One of the most interesting strands of thought common to the twin poems is the reflection on the disintegrating effect of the New Learning. Copernicus' displacement of the earth, and the consequent disturbances of the accepted mediaeval cosmology with its concentric arrangements of elements and heavenly bodies, arrests and disturbs

³⁷Charles Singer, A Short History Of Scientific Ideas (Oxford, 1962), p. 252.

Donne's imagination much as the later geology with its revelation of vanished species and first suggestion of a doctrine of evolution absorbed and perturbed Tennyson when he wrote In Memoriam and throughout his life. No other poet of the seventeenth century known to me shows the same sensitiveness to the consequences of the new discoveries of traveller, astronomer, physiologist and physician as Donne.³⁸

In these most frequently quoted lines from the First Anniversarie, Donne tells of this disintegrating influence of the new astronomy of Copernicus, Brahe, Galileo, Kepler and others upon his outlook:

And New Philosophy calls all in doubt
The Element of fire is quite put out;
The sun is lost, and Th'Earth, and no man's wit
Can well direct him where to looke for it.

(FA, ll. 205-8.)

Further Donne comments:

'Tis all in pieces, all coherence gone:
All just supply, and all Relation.

(FA, ll. 213-4.)

"The Element of fire is quite put out," refers to the invalidation of the ancient and medieval premise that a region of fire exists next to the sphere of the moon, and that this sphere of fire is turned about under the moon like a celestial sphere. Aristotle postulated the idea of the circle of fire and medieval men accepted his idea without questioning it. Fire was thought to surround the air as the air surrounds the water and the earth. Burton in The Anatomy of Melancholy (Part 2, Section 2, Member 3) explained that Rotman, Tycho Brahe, and Kepler were "exploding that element of fire, those fictitious, first watry movers, those heavens I mean above the firmament, which Debrio, Todovicus Imola, Partricius and

³⁸Grierson, pp. 188-9.

many of the fathers affirm." The astronomers of whom Burton spoke were abolishing the doctrine of the crystalline sphere and the Primum Mobile which was thought to surround the firmament, as well as declaring the region of fire non-existent.³⁹

Kepler, an assistant to Brahe who earlier stated that no circle of fire existed between the earth and moon, proved that this circle could not exist by a simple demonstration in optics. "If there was a sphere of fire under the moon, considerable refraction of the rays emitted from the stars would be evident," he argued, and no such refraction of rays from the stars is evident.⁴⁰ If Donne did not read Kepler's Dioptrice which appeared in January of 1611 before the First Anniversarie was composed, he could have read Kepler's earlier treatises on optics, Ad Vitellionem and De Stella Nova. Ad Vitellionem recalls Rothman and Pena's conclusion that air extends from earth to the confines of the moon, without a region of fire interrupting. The work notes that Tycho Brahe agreed with Rothman and Pena that the region of fire is a fiction. De Stella Nova demonstrates that in the highest ether stars are generated. Kepler in this work uses the proof of Tycho Brahe that ether directly succeeds the air of earth--that no solid orbs exist as medieval men believed.⁴¹

"The sun is lost, and Th'Earth, and no man's wit/ Can well direct him where to looke for it," is the first reference Donne makes in the

³⁹Grierson, p. 189.

⁴⁰Nicolson, The Breaking of the Circle, pp. 147-8.

⁴¹Coffin, p. 171.

First Anniversarie to displacement of the geocentric theory of the universe by the heliocentric theory postulated by Copernicus in his sixteenth century De Revolutionibus.⁴² Copernicus, however, did not destroy the assumption that movement of heavenly bodies formed a perfect circle: he believed that the planets move about the sun in circles. But in 1609 Kepler announced that the planets move about the sun in ellipses. That planets move in ellipses rather than in circles disturbed Donne greatly; like medieval men he felt that circular movement was necessary if the heavens were perfect rather than decaying. Donne felt the beauty and symmetry of the heavens had indeed been destroyed, and in the First Anniversarie exclaims:

We thinke the heavens enjoy their Sphericall,
 Their round proportion embracing all.
 But yet their various and perplexed course,
 Observ'd in divers ages, doth enforce
 Men to finde out so many Eccentrique parts,
 Such divers downe-right lines, such overthwarts,
 As disproportion that pure forme;...

nor can the Sunne

Perfit a Circle, or maintaine his way
 One inch direct; but where he rose to-day
 He comes no more, but with a couzening line,
 Steales by that point, so is Serpentine....
 So of the Starres which boast that they doe runne
 In circles still, none ends where he begun.

(FA, ll. 251-7, 268-72, and 274-5.)

Many seventeenth century men besides Donne were disturbed first that the earth was no longer the center about which the sun moved, and secondly, that planetary motion should be elliptical. Galileo, for example, did not

⁴²A. R. Hall, The Scientific Revolution 1500-1800 (London, 1954), p. 102.

mention Kepler's laws of planetary motion because he believed in the perfection of the circle and was suspicious of the elliptical pattern of movement.⁴³

Donne accepted the idea of his medieval predecessors that the circle indicated perfection: this is revealed in his statement that the heavens are in a state of disorder if bodies move in epicycles. It is also indicated in the First Anniversarie when he defines the decay of the earth. Donne asks, "Keepes the earth her round proportion still?" and finds that it does not. He argues that at creation the earth was a perfect sphere, but has developed "pockholes," or sea, and "warts," or mountains.⁴⁴ Describing the decay of the earth he writes:

Then Solidnesse, and roundnesse, have no place.
Are these but warts, and pock-holes in the face
Of th'earth? Thinke so: but yet confesse, in this
The worlds proportion disfigured is....
(FA, ll. 299-302.)

Donne conceived God as a classical aesthete whose work was characterized above all by symmetry and proportion. Medieval men transmitted the idea that the original earth was perfectly round, but the idea may be traced to classical sources or to Genesis. Ovid, for example, wrote in Metamorphoses that the sea was made from earth and that valleys and mountains were created after the earth was first made round. In the seventeenth century Thomas Burnet in The Sacred Theory of the Oviform

⁴³ Arthur E. Barker, "Recent Studies in the English Renaissance," Studies in English Literature, I (1961), 141-2.

⁴⁴ Marjorie Hope Nicolson, Mountain Gloom and Mountain Glory (New York, 1959), p. 76.

wrote that the "Notion of the Mundane Egg, or that the World was Oviform hath the Sense and Language of all Antiquity, Latins, Greeks, Persians, Aegyptians, and others."⁴⁵

In the Two Anniversaries Donne develops his theme of decay by emphasizing that it occurs in both the microcosm and macrocosm. Man decayed and experienced death: astronomers asserted that bodies unknown to the ancients and Scholastics moved in the heavens, and Donne concluded that, therefore, the macrocosm was no more immutable than man. That new bodies appeared in the heavens proved, more certainly than planets moving in epicycles, that the universe was decaying. In 1572 a "new star" appeared in the constellation of Cassiopeia, and was visible for sixteen months. Brahe assigned the "new star" to the region of the fixed stars. When a comet appeared, Brahe observed that it moved beyond the moon--in the "immutable heavens."⁴⁶ Galileo, who discovered the Milky Way and four unknown bodies circling Jupiter, published The Sidereal Messenger in 1611, and in 1612 reported that the surface of the moon was not perfect, or smooth, but that chasms and mountains covered it.⁴⁷

Donne refers to Galileo searching the heavens with his telescope for new bodies in the First Anniversarie:

And freely men confesse that this world's spent,
When in the Planets, and the Firmament
They seeke so many new;...

(FA, ll. 208-10.)

⁴⁵Nicolson, Mountain Gloom and Mountain Glory, p. 76.

⁴⁶George Williamson, Seventeenth Century Contexts (Chicago, 1961), pp. 10-11.

⁴⁷Marjorie Nicolson, "The 'New Astronomy' and English Literary Imagination," Studies in Philology, XXXII (1935), 429.

The reports of astronomers that new bodies had been discovered in the heavens was disquieting, but in 1604 a new star appeared in the constellation of Ophiuchus and was visible to all, including Donne. He refers to the "New Starres" at the end of this passage from the First Anniversarie:

Men finde out so many Eccentrique parts,
Such divers downe-right lines, such overthwarts,
As disproportion that pure forme: It teares
The Firmament in eight and forty sheires,
And in these Constellations then arise
New Starres, and old doe vanish from our eyes.
(FA, ll. 255-60.)

Although Donne could view the new star that appeared in Ophiuchus, and although he was familiar with the work of Copernicus and Galileo and with Kepler's proof that the region of fire could not exist, he nevertheless describes the journey of Elizabeth's soul to heaven as a trip through a Ptolemaic universe in the Second Anniversarie. When she begins her flight, the earth appears as the center of the universe--necessarily so, Coffin argues. These lines assure him that Donne is troubled about the real position of the sun, and may have regarded the earth or the sun as the center of the universe:

Who, if she meet the body of the Sunne,
Goes through, not staying till his course be runne.
(SA, ll. 201-2.)

The soul of Elizabeth is uncertain whether the heavens are organized according to medieval cosmology based on Ptolemy: she is uncertain whether the region of fire separates the moon from the earth according to Aristotle.

For:

she staves not in the ayre,
To looke what Meteors there themselves prepare;
She carries no desire to know, nor sense,
Whether th'ayres middle region be intense;

For th'Element of fire, she doth no know
 Whether she past by such a place or no;...
 (SA, ll. 189-94.)

Upon reaching the moon, she does not look to see if men live on it. After Galileo reported that like the earth, the moon had valleys and mountains, men thought of travelling to it and discovering human beings living there. The soul of Elizabeth, however, simply passes the moon:

She baits not at the Moone, nor cares to trie
 Whether in that new world, men live, and die....
 (SA, ll. 195-6.)

After passing the moon, the soul passes Mercury, the sun, Mars, Jupiter and Saturn. She speedily passes through the firmament of fixed stars and reaches paradise. Donne explains that the soul is travelling too fast to ponder the arrangement of the universe:

But ere she can consider how she went,
 At once is at, and through the Firmament,
 And as these starres were but so many beads
 Strung on one string, speed undistinguish'd leads
 Her through those Spheares, as through the beads, a string
 Whose quick succession makes it still one thing:...
 (SA, ll. 205-10.)

The speed with which the soul travels, and its disregard for surroundings, conveys "an instaneous approach to God."⁴⁸ It is suggested that the Second Anniversarie is concerned with final salvation, rather than with philosophical controversy,⁴⁹ and therefore in this poem Donne structures the soul's flight to paradise as a journey through a concentric universe. The soul simply is not concerned with the proofs of contemporary scientists

⁴⁸Coffin, pp. 188-92.

⁴⁹Ibid., p. 172.

against this arrangement, although the soul is not sure but that some of the old sign-posts are missing in the heavens--the fiery region may not have been encountered, for example. Also, the use of the Ptolemaic arrangement of bodies in the second poem may be practical. Scholastic cosmology may have been clearer to Donne than the mutable, heliocentric universe of the new scientists. Since the re-organization of the heavens was the work of several scientists over a period of centuries, Donne may have been unable to visualize a universe if every individual amendment to Scholastic cosmology were applied. The new scientists agreed with one another on some points, and dissented on others: Galileo did not accept Kepler's first law of planetary motion, for example, although both men accepted Copernicus' theory.

As Donne was aware of both old and new astronomy, so was he familiar with alchemy and with chemistry. In the First Anniversarie, and in his verse letter To the Countesse of Huntington, he refers to alchemy and the supernatural. When he discusses the Countess' dead sister, he mentions the doctrine of transubstantiation, the alchemical theory of the transmutation of metals, and the notion that the spirit of the Countess' sister "has entered into the living." In the First Anniversarie Donne describes Elizabeth Drury as "immune from the stain of the Fall," for she is pure "by a true religious Alchymie:"⁵⁰

Shee in whom verture was so refin'd
That for Allay unto so pure a minde

⁵⁰Bennett, pp. 33-4.

Shee tooke the weaker Sex; shee that could drive
 The poysonous tincture, and the staine of Eve,
 Out of her thoughts, and deeds; and purifie
 All, by a true religious Alchymie;...
 (FA, ll. 177-82.)

Yet Donne knew of the attack upon alchemy, and himself declares it to be all imposture in Loves Alchymie.

Two Anniversaries refers to the medieval idea that the body is composed of earth, water, air and fire in ascending order, fire being the purest element. Food was thought to be composed of the four elements and the liver was believed to convert food into blood, and fire into choler. An excess of a humor produced disturbances in the temperament of a person. In the normal body a mixture of the four humors was carried in the veins from the liver to the ruler of the middle region, the heart.⁵¹ In the First Anniversarie Elizabeth is described as possessing a perfect combination of elements, and consequently, a perfect combination of humors and a peaceful disposition:

Both Elements, and Passions liv'd at peace
 In her, who caus'd all Civill war to cease.
 (FA, ll. 321-2.)

Again in the Second Anniversarie Donne explains that the humors, or "ingredients," of Elizabeth are so perfectly combined that no one humor governs the other three:

Thinke these things cheerefully: and if thou bee
 Drowsie or slack, remember then that shee,
 She whose Complexion was so even made,
 That which of her Ingredients should invade

⁵¹E. M. W. Tillyard, The Elizabethan World Picture (New York, 1963), pp. 68-9.

The other three, no Feare, no Art could guesse:
 So far were all remov'd from more or lesse.
 But as in Mithridate, or just perfumes,
 Were all good things being met, no one presumes
 To govern, or to triumph on the rest,
 Only because all were, no part was best.

(SA, ll. 121-30.)

And further in this passage he emphasizes that the elements and humors were perfectly blended:

So though the Elements and Humors were
 In her, one could not say, this governes there.

(SA, ll. 135-6.)

Although Donne describes the perfection of Elizabeth in terms of the four elements, he nevertheless mentions in the Second Anniversarie the attack on these traditional four constituents of the body:

Have not all soules thought
 For many ages, that our body's wrought
 Of Ayre, and Fire, and other Elements?
 And now they thinke of new ingredients,
 And one Soule thinkes one, and another way
 Another thinkes, and 'tis an even lay.

(SA, ll. 263-8.)

The contemporaries of Donne disagreed with the Scholastics about the composition of the body and among themselves. One explanation seems as convincing to him as another, Donne concludes.

Cardan rejected fire as an element, and regarded only earth, water and air as elements. These last three provide nourishment, resist decay, remain fixed at definite places and aid generation, according to him. He rejected fire as an element since it only had the quality of heat, and therefore was not worthy to be counted among the elements. The line, "And now they thinke of new ingredients," refers to the theory of Paracelsus that the main constituents of the body are salt, sulphur and the element

mercury.⁵² The "new ingredients" of the sixteenth century physician Paracelsus were not refuted until Boyle defined the irreducible nature of an element.⁵³ That Donne was familiar with the work of Paracelsus is evident in the First Anniversarie which contains a reference to his theory of the "natural balsamum."⁵⁴

But though it be too late to succour thee,
Sicke World, yea dead, yea putrified, sine shee
Thy intrinsique balmes, and thy preservative,
Can never be renew'd,...

(FA, ll. 55-8.)

That Donne described Elizabeth's perfection in terms of the four elements and humors although he was familiar with the work of Cardan and Paracelsus indicates that Donne, like most men at the beginning of the seventeenth century, felt that the theory of the four elements had not been convincingly discredited. Even Kepler, who proved that the region of fire did not exist between the earth and moon, continued to believe that fire was a part of the original material which made creation possible.⁵⁵

Donne combines references to medieval astronomy and alchemy, and theories and proofs of contemporary scientists, but his aesthetics in the Two Anniversaries are distinctly classical and medieval. The First Anniversarie, describing the decay of nature, is structured according to the three definitions of beauty outlined by Aquinas in Summa Theologiae,

⁵²Coffin, pp. 172-3.

⁵³Herbert Butterfield, The Origins Of Modern Science (London, 1958), pp. 135-6.

⁵⁴Moloney, p. 65.

⁵⁵Coffin, pp. 172-3.

the three qualities of beauty being integrity or perfection, proportion, and color. Before Aquinas, Cicero and Augustine had listed proportion and color as criteria for judging beauty: Aquinas added integrity or perfection to these attributes. Cicero stated: "Beauty is a proportion of the parts, together with a certain agreeableness of color."⁵⁶ In the First Anniversarie Donne summarizes in two lines the decay of the world, or the loss of beauty, in terms of the definition of Cicero and Augustine:

For the worlds beauty is decal'd, or gone,
Beauty, that's colour, and proportion.
(FA, ll. 249-50.)

The Second Anniversarie repeats that the departure of the soul from the world removed proportion:

 she to Heaven is gone,
Who made this world in some proportion
A heaven, and here, became to us all,
Joy, (as our joyes admit) essentiall.
(SA, ll. 467-70.)

The reliance of Donne upon Aquinas has been examined by Sam Hynes, who argues that the very structure of the First Anniversarie depends upon the aesthetics of the thirteenth century Dominican. If the poem is divided into seven approximately equal sections rather than five, it is evident that the third (ll. 191-250), the fourth (ll. 251-338), and the fifth (ll. 339-76) describe the decay of the world in terms of Aquinas' definition of beauty. Donne even maintains the order in which Aquinas listed the three attributes. In section three he writes:

Then, as mankinde, so is the worlds whole frame
Quite out of joynt, almost created lame.
(FA, ll. 191-2.)

⁵⁶Nicolson, Mountain Gloom and Mountain Glory, p. 69.

The almost lame world lacks the first element of beauty according to the definition of Aquinas: perfection or integrity.

That the world lacks proportion is mentioned in section three of the First Anniversarie (according to Hynes's division of the poem) and in the Second Anniversarie, but it is in section four of the First Anniversarie that Donne elaborately develops the idea that the world lacks the fundamental element of beauty according to Aquinas, proportion. Commenting on the presence of water and mountains which disfigure the original perfect sphere of the earth, he asserts that these destroy proportion:

but yet confesse, in this
The worlds proportion disfigured is;...
(FA, ll. 301-2.)

And further he emphasizes that proportion is "beauties best:"

And, Oh, it can no more be questioned,
That beauties best, proportion, is dead,
Since even grieffe it selfe, which now alone
Is left us, is without proportion.
(FA, ll. 304-7.)

Section five opens with the observation that the element of beauty which Aquinas lists third is lacking in the world:

But beauties other second Element,
Colour, and lustree now, is as neere spent.
(FA, ll. 353-5.)

In section five appears another idea of the Dominican, that sight is the noblest of the senses:⁵⁷

⁵⁷Sam L. Hynes, "A Note On Donne And Aquinas," Modern Language Review, XLVIII (1953), 179-81.

Sight is the noblest sense of any one,
 Yet sight hath only colour to feed on,
 And colour is decai'd: summers robe growes
 Duskie, and like an oft dyed garment showes.

(FA, ll. 353-6.)

Donne's aesthetics are neither original nor "modern," for he repeats Cicero and Augustine's definition of beauty, and by their standards develops his argument of the decay of nature. But while Donne relies upon Cicero and Augustine, it is Aquinas whom he paraphrases. He systematically inserts Aquinas' three elements of beauty in the first of his twin poems, and the First Anniversarie is more coherent because of this. Also, Donne primarily objects to new science on aesthetic grounds. He laments that the heavenly bodies were proved by Kepler to move in epicycles rather than in circular patterns as the ancient and medieval astronomers believed. To Donne the circle was still associated with perfection. He objects to a heliocentric universe chiefly because it destroyed the harmony of the heavens and disarranged them. But to say that Donne was disturbed by new science simply because it was contrary to his aesthetic principles is to misunderstand Scholastic thought from which he borrowed his three "elements" of beauty. For Aquinas, and other Scholastics, knowledge was unified. Theology was queen of the sciences, and subordinated to theology which served as the unifying principle, aesthetics and natural inquiry could not be separated. To destroy the proportion of the heavens was to disrupt the whole order of existence. If the aesthetic beliefs of medieval men about the universe were proved to be wrong, then their whole body of knowledge about the natural world was invalid. For, medievalists had defined beauty, speculated about

God, and explained the natural world simultaneously. The attack of new science was essentially upon the method of Scholasticism. When Galileo, after viewing the heavens with his telescope, published works which indicated that empirical investigation invalidated the old science simply based upon premises, he attacked the entire rational hierarchy of knowledge.

After Donne examined the arguments of new science against medieval astronomy and alchemy, he was no longer secure within the Scholastic system. But neither could he accept the arguments and proofs of new science without reservation. A body of proofs that would invalidate old science completely was not available immediately, because the foundations of new science were laid over a period of two centuries. Since scientists often disagreed not only with the ancients and Scholastics, but with their contemporaries as well, general confusion existed. At the beginning of the seventeenth century it would have been extremely difficult, if not arbitrary, to accept the New Philosophy without reservation, while to cling to the whole body of Scholastic thought after the work of men like Kepler would have been an act of blind faith for men like Donne who were aware of the attacks against it. Donne felt that it was "an even lay" between the various explanations of the constituents of the human body, for example. In the Two Anniversaries he indicates that he is aware of Scholastic natural philosophy and of new science, and is confused by the conflict between the two systems. While his aesthetics are decidedly those of Cicero, Augustine, Aquinas

and medieval men in general, Donne exclaims that the new science has caused him to question Scholasticism. He cannot be conveniently described as a "modern man" or as a medievalist, for the Two Anniversaries indicate that Donne was exclusively neither.

CONCLUSION

In the Two Anniversaries Donne inserts descriptions of women-- legendary and actual--other than Elizabeth Drury whom he did not know personally. In order to produce two long poems memorializing the fifteen-year-old girl, in passages he assigns his subject attributes which other famous women possessed. Notably, in passages he describes Astraea and Queen Elizabeth I. When reading the two poems, it should be remembered that at the time Donne wrote it was expected that he should give something more than a strictly factual account of Sir Robert Drury's daughter. In the Renaissance poets assigned even living women supernatural qualities, as Donne assigns the dead girl in these two poems, although in others he breaks with the Petrarchan tradition and writes realistically of the women he has known.

Donne is less concerned with a meticulous structure than with mentioning in the two poems the major issues and conflicts of the early seventeenth century. He presents the conflicting interpretations of the natural world, for example, while describing the general decay of nature in the First Anniversarie. Opposed references to Scholastic philosophy and new science are used to accentuate the state of chaos after virtue and beauty, embodied in Elizabeth, left the world. In the Second Anniversarie Donne leaves the problem of whether the Scholastics or his contemporaries correctly understand the universe, and simply describes the flight of the soul through a

Ptolemaic arrangement of the heavens. This indicates that in the second poem a reliance upon grace and contemplation of the glories of paradise seem more important than resolving intellectual issues. The chaos described in the first poem explains why the reliance upon grace is necessary.

Donne could not in any case have resolved the conflicting interpretations of the universe which he discusses, for the medieval world view had been only partially invalidated when he wrote. He relies upon ancient and medieval aesthetics, but mentions rather than chooses between new science and medieval explanations of phenomena. Donne studied both medieval and contemporary works, and chose to observe rather than to judge or synthesize.

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THE EFFECT OF CLEANING AGENTS

ON

CARPETS OF SELECTED FIBERS

by

Nancy Hefner Holmes

6873

A Thesis Submitted to
the Faculty of the Graduate School at
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Approved by

Pauline E. Keeney
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APPROVAL SHEET

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HOLMES, NANCY HEFNER. The Effect of Cleaning Agents on Carpets of Selected Fibers. (1964) Directed by: Dr. Pauline E. Keeney. pp. 63.

Unsoiled samples of wool, nylon, and acrylic carpets were cleaned with shampoo and powder type carpet cleaners to determine the effect of the cleaners on the color reflectance, pile height, and compressional resilience of the carpet samples.

Three samples of wool, nylon, and acrylic carpets were tested. They were of plush-twist, cut-pile, tufted construction and varied in color and pile height. Three shampoo and three powder type carpet cleaners were used. Samples to be treated and the cleaners were randomly assigned to groups. A uniform method of cleaning was employed.

Before treatment samples were analyzed for tufts per square inch and original readings were taken for pile height, compressional resilience, and color reflectance. Measurements on the treated samples were taken following the first cleaning and third cleaning (three cleanings were performed).

A rating scale was devised and employed to evaluate the general appearance (primarily pile distortion) following the first and third cleanings.

Pile height and compressional resilience measurements were taken with the C & R Tester. Data for light reflectance were obtained with the Gardner Multipurpose Reflectometer.

Twenty-seven analyses of variance were employed to determine any differences (1) among shampoo cleaners, (2) among powder cleaners, (3) between shampoo and powder cleaners, and (4) among carpet samples.

The results indicated that (1) the surface appearance of unsoiled nylon

carpets is more affected by carpet cleaners than the surface appearance of wool and acrylic carpets, (2) shampoo cleaners are more detrimental to the surface appearance of carpets than are powder cleaners, (3) shampoo and powder cleaners do not greatly affect the pile height and compressional resilience of unsoiled wool, nylon, and acrylic carpets, and (4) the color reflectance of unsoiled wool and nylon carpets is significantly affected by carpet cleaners. Powder cleaners caused greater changes in the color reflectance of wool and nylon carpets than did shampoo cleaners.

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CHAPTER I

INTRODUCTION

I. STATEMENT OF THE PROBLEM

The American carpet industry bases much of its advertising and sales promotion on the properties and performance of the various carpet fibers used in carpet construction. Similarly, one of the basic purposes of the textile industry is to develop new fibers and to improve present fibers so that the properties and performance of these fibers will be superior to those of fibers already in use.

American consumers, especially homemakers, are also concerned with the performance and serviceability of carpets and carpet fibers. Carpet manufacturers have realized this concern and several consumer education programs have been initiated recently by some of the well known carpet companies.

When the performance and serviceability of carpets and carpet fibers are considered, cleanability and the results related to cleanability are, by no means, small matters of concern. This is one of the major considerations of the consumer selecting a carpet.

The purpose of this study was to determine the effects of two types of cleaning agents - the shampoo type and the dry or powder type - upon the

performance factors of carpets made of wool, nylon, and acrylic fibers. The specific performance factors to be investigated were changes in color reflectance, pile height, and compressional resilience.

The specific objectives of this study were:

1. To determine the effects of shampoo type cleaners on color reflectance, pile height, and compressional resilience of cut-pile carpets of selected fibers.
2. To determine the effects of powder type cleaners on color reflectance, pile height and compressional resilience of cut-pile carpets of selected fibers
3. To compare the difference between the effects of powder type cleaners and shampoo type cleaners on the carpets of selected fibers.

II. IMPORTANCE OF THE PROBLEM

The American carpet industry, during the past ten years, has undergone major changes. A steady growth has occurred in the amount of carpet and rug fabrics used by consumers, as well as an increase in the number of carpets and rugs used in each household.

According to a 1963 research publication of the American Carpet Institute, ". . . the U. S. carpet market experienced dynamic growth during 1962 with square yard volume attaining a rate of 3.60 square yards per household, a level unequalled since the turn of the century."¹ In addition, Lowell P. Weicker, head of the American Carpet Institute, stated that, "Broadloom

¹American Carpet Institute, Basic Facts About the Carpet and Rug Industry (A Research Publication, New York: American Carpet Institute, 1963), p. 14.

shipments amounted to approximately four square yards per household [in 1963]."² Both of the above figures include the yardage going into commercial installation. The Carpet Institute reported also that in 1962, "an estimated 73 per cent of American homes have wall-to-wall carpets or large rugs in the living room."³

In addition to the growth in the carpet market, there has also been an increase in the kinds and number of rug and carpet cleaners for consumer use. Two types are now available - the standard shampoo-type and the more recently developed dry or powder-type. One source listed 30 of the shampoo-type cleaners.⁴

When considering the cleanability of carpets it would seem that the initial consideration in testing would be given to determining the effects of cleaning on the carpet fibers with no soil involved. The soil variable itself creates a specific condition. Results of studies in which cleaning effects on carpets are based on soil removal do not indicate whether the findings are a result of the soil, the fiber content of the carpet, the cleaner used, or a combination of any or all of the above factors.

²Lowell P. Weicker, "Record Carpet Sales Expected," Modern Textiles Magazine, 45:2, February, 1964, p. 21.

³American Carpet Institute, op. cit., p. 1.

⁴Institutional Research Council, Inc., Certified Products List 1964 (New York: Institutional Research Council, Inc., 1964), pp. 11-12.

CHAPTER II

REVIEW OF LITERATURE

Numerous studies have been conducted on the removal of soil from rugs and carpets by various cleaners and cleaning methods. However, only one published study that was reported included any measurement of samples that were cleaned but were not soiled.

Extensive information was available on the various fibers used in rug and carpet construction. Chemical and physical characteristics of these fibers were listed in several sources.

An attempt was made in this chapter to include any information or results from the cleaning studies that were pertinent to this study. Characteristics of the fibers tested have been included and compared.

I. FIBERS CURRENTLY USED IN RUGS AND CARPETS

A report by the American Carpet Institute has shown that wool continues to lead the carpet industry in surface fiber consumption. The Institute stated that "Wool is the traditional fiber for carpet manufacture and is still the most widely used because it has superior properties for this purpose."⁵

⁵American Carpet Institute, A Close-Up of American Carpet and Rugs (New York: American Carpet Institute, [n.d.]), p. 4.

Recently, however, synthetic fibers have entered the carpet field and are rapidly growing in use and importance. Nylon fiber ranks second in surface fiber consumption, while acrylic fibers are third, according to the American Carpet Institute. The fiber most recently developed which holds great potential for the carpet industry is polypropylene (olefin) fiber. Although it is still in the developmental stage, it has been reported to have excellent qualities highly desirable in a carpet fiber. In their 1963 report, the American Carpet Institute said of man-made fibers:

During 1962 man-made fibers accounted for a larger share of the fibers used in broadloom carpet production with the major gains scored by filament nylon, acrylics, and modacrylics. Filament nylon use increased 56% between 1961 and 1962 and accounted for one-quarter of all surface fibers used last year [1962]. As recently as 1958, this fiber was a negligible factor in the overall consumption picture. Acrylic consumption in 1962 . . . rose 66% over 1961. Polypropylene was in use by a few companies but exact estimates of the poundage consumed are not available.⁶

More recently, the use of acrylics in floor coverings has been estimated near 60 million pounds for 1964, in contrast with the 40 million pounds used in 1963.⁷

⁶American Carpet Institute, Basic Facts About the Carpet and Rug Industry, [n. d.] , p. 25.

⁷_____, "Outlook Bright for Home Furnishing Fabrics," Modern Textiles Magazine, 45:2, February, 1964, p. 15.

II. COMPARISON OF FIBER PROPERTIES

Certain properties have been considered highly desirable, if not necessary, for fibers used in carpet manufacture. Two such properties are color retention and resilience. Since the resilience of a carpet fiber would have a direct bearing on the recovered pile height and the compressional resilience of the carpet, this property was of great importance in this study.

In every source reviewed related to the properties of carpets and carpet fibers, resilience was of primary importance. According to Robinson, "A most desirable property of carpet surface is resilience, i. e., the power to store the energy of deformation and give it up again when the deforming force is removed."⁸

Another source referred to "Crush resistance" - a direct result of resilience - as "one of the most critical properties of a carpet fiber." Richardson and Stanley continued ". . . recovery of a fiber mass from high compressional loads is a fundamental property of the fibrous material."⁹

One question inevitably asked by consumers about carpets has been concerned with the color retention property. "In the textile business colour is

⁸George Robinson, "Wool and Other Fibers as Components of Carpet Pile Yarns," Textile Institute Journal, 43:8, August, 1952, p. 524.

⁹Graham M. Richardson and Harry Stanley, "How DuPont Developed 501 Filament Nylon for Carpets," Modern Textiles Magazine, 43:2, February, 1962, p. 50.

the best salesman," Harry Palfreeman has said, emphasizing at the same time that the color in a carpet should be permanent.¹⁰

Because of the importance of the resilience and the color retention of carpet fibers on the factors with which this study was concerned, the following section was included to compare the resilience and color properties of wool, nylon and acrylic fibers.

Wool Fibers

Domestic wools grown in the United States are not suitable for carpet manufacture and all wools used for carpets in this country have always been imported from various foreign countries, primarily from the Middle East, South America, New Zealand and Scotland. These imported wools are tough, lustrous, and springy. The elongation property of wool fibers is remarkable, as well as the ability to return to the original length. For these reasons, springy yarns made from wool fibers are highly desirable for cushiony carpets with excellent crush recovery.¹¹

From the standpoint of color, wool exhibits a greater affinity for dyestuffs than any other fiber.¹² However, certain dyestuffs, such as the acid

¹⁰Harry Palfreeman, "Fibers and Carpets," Canadian Textile Journal, 75:24, November 28, 1958, p. 71.

¹¹American Carpet Institute, A Close-Up of American Carpet and Rugs, p. 4.

¹²Edmund Knecht, Christopher Rawson and Richard Loewenthal, A Manual of Dyeing, Volume I (London: Charles Griffin & Company, Ltd., 1925), p. 59.

dyes, give better fastness properties than some other dyestuffs. According to the Wool Bureau, "its [wool] chemical composition allows many types of dyes to attach themselves securely. 'Dyed in the wool' means the truest, richest, and most enduring colors are found in wool fabrics."¹³

Nylon Fibers

In the field of synthetic fibers, the elasticity and resilience of nylon have contributed much to its use as a carpet fiber. Because of these properties of nylon, carpets made of this fiber have ". . . a cushiony pile that has excellent recovery from crushing."¹⁴ However, another source did not agree that nylon's resilience and compressional recovery were equal to those of wool and stated that nylon was actually inferior to wool in these respects.¹⁵

Although rigorous control must be practiced when dyeing nylon fibers, good washfastness can be achieved by using the neutral dyeing acid colors.¹⁶ One manufacturer of carpet nylon maintained that nylon fibers could be dyed with good fastness properties and in a wide range of colors.¹⁷

¹³The Wool Bureau, Inc., A Capsule Course on Wool (New York: The Wool Bureau, Inc., 1954), p. 19.

¹⁴American Carpet Institute, loc. cit.

¹⁵J. J. Press, (ed.), Man-Made Textile Encyclopedia (New York: Textile Book Publishers, Inc., 1959), p. 392.

¹⁶Ibid., p. 114.

¹⁷E. I. DuPont de Nemours & Co., Inc., Carpet Talk (New York: E. I. DuPont de Nemours & Company, Inc., [n.d.]), p. 6.

Acrylic Fibers

The resilience and hand of Acrilan have recently made it an important competitor with wool in the carpet industry. One mill executive has expressed the opinion that Acrilan is more like wool in hand and resilience than any of the manmade fibers.¹⁸ Acrilan has an inherent resiliency that makes it resistant to matting, crushing, and felting. In addition, its resistance to moisture absorption allows it to maintain resilience and to resist matting, especially in those areas with high heat and humidity.¹⁹

Color properties of the acrylic fibers depend on the individual fibers in this group because each of the fibers react differently to the various classes of dyestuffs. The acidic dyestuffs produce best results on Acrilan and Creslan because of their basic and nonionic character.²⁰ However, a combination of desirable properties provides acrylic fibers with the ability ". . . to resist undesirable appearance changes both during cleaning and in actual use. . . ." Among these properties, generally good dye fastness has been found for acrylic fibers.²¹

¹⁸G. L. Solomon, "Qualities and Taste Levels Rise for Carpet, Draperies, Upholstery," Modern Textiles, 44:1, January, 1963, p. 24.

¹⁹_____, "Acrilan in Carpets," American Fabrics, 40:Spring, 1957, p. 58.

²⁰Press, op. cit., p. 126.

²¹Ibid., p. 123.

III. CLEANERS AND THEIR EFFECT

With the dynamic growth of the American carpet market, the increase in rug and carpet cleaners available, and the wide variety of fibers now being used to produce soft floor coverings, the consumer is in constant need of sound information on home carpet cleaning. Obviously wool, nylon, acrylic and polypropylene fibers will not react identically when cleaned. When cleaning is done by the shampoo method, no rinsing is used, and a difference in color, pile height, and/or compressional resilience might naturally be expected as a result of this cleaning method. E. A. Leonard has stated that:

. . . in the case of the liquid detergent, the excess foam and a small fraction of the moisture put into the carpet are removed. Since no rinsing is used in this process the major portion of the detergent . . . remains in the carpet pile after cleaning. Depending upon the amount of detergent and brushing technique, there may or may not be severe distortion of pile.²²

When the powder method of carpet cleaning is used, the clays containing the dirt and grease are removed from the carpet by vacuuming. According to Leonard, "The advantages of this process . . . are, no color bleeding, . . . , shrinkage, or pile distortion."²³

An undesirable change in color, compressional resilience, or pile height would in most instances, be objectionable to the consumer. According to one source,

²²E. A. Leonard, "The Problems of Rug Cleaning," The Indian Textile Journal, 60:713, February, 1950, pp. 428-29.

²³Leonard, loc. cit.

The thickness of pile into which one sinks when one walks is part of the appeal of a good carpet. If the compressibility decreases, it means that there has been loss in the luxury 'feel' found in treading on the carpet.²⁴

Matting of the fibers because of no rinsing in the shampoo method or as a result of the clay clinging to the fibers in the dry method would affect both the pile height and the compressional resilience of a carpet. Strong chemicals, in either type cleaner, as well as a cleaner residue, may also cause a color change.

In 1953 Consumer's Union studied and evaluated 16 home-use rug cleaners of both the shampoo type and the powder type.

Seven wet cleaners were found Not Acceptable--they might damage rugs, either because of the curd they produced with the minerals in the water, or because they were excessively alkaline. Rug cleaners which contain soap should be avoided, as a rule; they are likely to leave a sticky residue which may accelerate resoiling and cause matting.²⁵

Since matting of carpets would have an important negative effect on their compression and compressional resilience Consumer's Union findings were pertinent to the objectives of this study. They presented a possible explanation for any reduction in compression or compressional resilience. Six of the shampoo cleaners and all three powder types which were tested by Consumer's Union were rated acceptable.

In relation to color and rug cleaners, Consumer's Union found color

²⁴ _____, "The Crush Resistance in Carpets," Skinner's Silk and Rayon Recorder, 30:9, September, 1956, p. 961.

²⁵ _____, "Rug and Upholstery Cleaners," Consumer Reports, March, 1953, p. 100.

modification of some rugs to be a problem with some of the powder cleaners. One cleaner left a light-colored powdery residue which could not be removed by vacuuming. This was especially evident on dark-colored rugs. Another cleaner, because of its inherent color, gave a yellowish cast to some rugs.²⁶

Consumer's Union made the following statement in regard to the choice of a wet or dry cleaner:

Quite aside from the general effectiveness of a cleaner, several factors . . . influence the choice between the wet and the powder types. Some rugs are not colorfast to water, and some twist rugs have a pile which will untwist if it gets very wet.²⁷

In a study by Herrick and Cooper, comparison was made of rug cleaning methods. Four home type cleaners, a granular detergent, a sawdust base, a liquid foam, and a soap, were compared with two types of commercial cleaning--the on-location type and the wet method. A composite soil was devised and applied for uniform soiling of the carpet samples (wool, cotton, and a wool-rayon blend). Each set of samples, containing one sample from each type, was soiled and cleaned five times. The same set was used each time for the same cleaner.

It was found that "two home cleaners, the granular detergent and the foam type, were fairly effective on the wool and on the blend but rated slightly below both types of professional cleaning."²⁸

²⁶Ibid., p. 100. ²⁷Ibid.

²⁸Orpha E. Herrick and Margaret M. Cooper, "Comparison of Rug Cleaning Methods," Journal of Home Economics, 47:6, June, 1955, p. 408.

Two of the conclusions drawn from the findings were:

1. No one cleaner was equally effective on all fibers on all rugs.
2. The various cleaners changed the carpets in different ways, some caused them to become lighter in color while others removed little soil so that eventually the soil stained the carpets to a much darker color.²⁹

Another study comparing cleaning methods on carpets was carried out at Kansas State University. Two home cleaning methods and a commercial method were compared for apparent effectiveness in soil removal.³⁰ Pile yarn fibers "included nylon, cotton, rayon, and wool from the low-price range, and nylon '501', an acrylic, a modacrylic, and wool from the medium price range."³¹ Tufted, low-loop pile carpets in beige or rose beige were used. Before treatment, the carpets were analyzed for stitches per inch, needles per inch, loop length, net pile thickness, back thickness, and total thickness. A pilot study indicated that three cleanings would show any important changes and each set of samples was cleaned three times.

Carpets cleaned by each method were subjected to treatments that included (1) not soiled-not cleaned, to serve as a standard of comparison, (2) not soiled-but cleaned, to detect color differences caused by the cleaning process itself, and (3) soiled and cleaned.³²

A composite soil was used to soil the carpets uniformly. Reflectance

²⁹Ibid.

³⁰Esther M. Cormany and Allene Wenger, "A Comparison of Cleaning Methods on Selected Tufted Carpets," Journal of Home Economics, 54:3, March, 1962, p. 212.

³¹Ibid. ³²Ibid.

readings were taken to determine any change after treatment. An impartial panel made subjective evaluations.

Some of the results of the data analysis were:

Analysis of variance of the not-soiled-but-cleaned carpets gave significant differences at the 5.0 per cent, 1.0 per cent, or 0.1 per cent level for the wave length, the method, and the interaction of the wave length times the method, with two exceptions. The highest reflectance readings were obtained from unsoiled commercially cleaned carpets, indicating that this cleaning process alone caused noticeable decreased color saturation.³³

Commercial cleaning caused more color change of carpets not-soiled-but-cleaned than did either home method. Less color change was found in home cleaned wool carpets than in commercially cleaned wool carpets,

. . . but wool carpets appeared to have had the greatest color changes for any of the cleaning methods. Higher ranking of nylon when the soiling process was omitted indicates a relationship between soiling and color change of particular importance for this specific carpet.³⁴

Comparison of the data indicated that in addition to the soiling and embedding processes, the cleaning process also had an important influence on progressive texture changes.

Hurley interviewed 90 homemakers concerning factors influencing carpet choice and the satisfactions that resulted. She found that 50 per cent of the subjects had cleaned their living room carpet with a carpet shampoo or a dry cleaning compound. Sixty-three per cent of those homemakers who reported

³³Ibid., pp. 213-214. ³⁴Ibid., p. 214.

having home cleaned their carpet did so once a year or more often. Twenty-six per cent had cleaned them twice a year.³⁵

Another finding by Hurley indicated that 21 per cent of those homemakers interviewed desired a comparison of carpet fibers. Of special interest was durability. In addition, 19 per cent desired information about cleaning carpets.³⁶

IV. SUMMARY

Wool remains the leading carpet fiber in use today, although synthetic fibers are rapidly becoming important in this field. Nylon and acrylic fibers rank second and third, respectively, in carpet fiber consumption. Polypropylene, a newly developed synthetic fiber holds great potential for the carpet industry, also.

Two important properties of carpet fibers are color retention and resilience. Good resilience is a necessity for carpet fibers, for it adds to the luxuriousness of a carpet. Fiber resilience determines to what extent the carpet pile will return to its original condition following deformation of any kind.

Color retention in carpets is quite obviously a factor of concern. Color is a major sales point especially in the carpet industry. However, it is also a necessity that a carpet maintain its original color since color schemes could

³⁵Patricia G. Hurley, "Factors Influencing the Selection of Rugs and Carpets and the Resulting Satisfactions," (Unpublished Master's thesis, The University of North Carolina, Greensboro, 1961), pp. 40-41.

³⁶Ibid., p. 50.

easily be altered adversely by a color change in the carpet.

It is a well established fact that wool fibers have remarkable resilience and a very strong dye affinity. Recently, however, Acrilan has been said to be very much like wool in hand and resilience. The status of nylon with respect to resilience is debatable. Some sources believe it to be quite inferior to wool in resilience, while others have said that the elasticity of nylon makes it a highly desirable carpet fiber.

Nylon and acrylic fibers are difficult to dye and the washfastness of colors is questionable.

Both shampoo and powder type cleaners are used to clean carpets; however, each type is apt to produce different effects on the fibers. A cleaner residue remaining in the carpet after cleaning may cause a color change or matting of pile. Strong solvents in the powder cleaners can also produce color change or pile distortion. However, the powder cleaners are considered to be less harmful to the carpet than are the shampoo cleaners.

No cleaner produces the same results on every fiber, although wool seems to be more affected than other fibers with respect to color change. Dry cleaning solvents appear to cause a loss of color in all fibers.

A large percentage of homemakers apparently use carpet cleaners of both the shampoo and powder types to clean their carpets in the home.

CHAPTER III

PROCEDURE

I. SELECTION OF CARPET SAMPLES

Carpets selected for experimentation included three fiber types -- wool, nylon, and acrylic. Each sample was of one fiber content; no fiber blends were used. Three samples (from different manufacturers) of each fiber type were selected to serve as replicates of the fiber. All carpet specimens were of plush twist, cut-pile, tufted construction. It was hoped that polypropylene fiber carpets could be included in the study, also, but carpets of this fiber type were not available in the above construction. Therefore, polypropylene fiber carpets were omitted.

An attempt was made to obtain as many of the experimental carpet samples as possible in beige. This was not possible, however, and even among those beige samples secured, there was a variation in shade.

Three samples of 100 per cent wool were selected for testing. Each sample was made by a different manufacturer. One was beige, another pastel blue, and the third sample was gold in color.

The three nylon carpet samples tested were made of 100 per cent "501" nylon. These samples were also constructed by different manufacturers. Two of the specimens were beige and the other a reddish brown.

The acrylic carpets selected included three 100 per cent Acrilan carpet samples. Two of the samples were beige and the other pastel blue. The blue sample was made by the same company manufacturing the blue wool sample.

II. SELECTION OF CLEANERS

An observation of the local market brought attention to several factors of interest to this study. It was found that at least 12 of the shampoo-type cleaners and six of the powder-type cleaners were available in this area. Sales personnel indicated cleaners which were sold most often. They also related some customer objections to the various cleaners. In many instances, a manufacturer recommends a cleaner for more than one or for all fiber-type carpets. Many consumers reported, however, that no one cleaner is equally effective on all fibers. It was indicated that any one cleaner usually gave satisfactory results on one fiber type only.

From those cleaners reported as sold most frequently three shampoo-type cleaners and three powder-type cleaners were selected for testing. Information was requested from the manufacturers concerning the basic ingredients used in those cleaning compounds selected. A description of those cleaners selected for testing follows:

Shampoo Cleaners

Cleaner A - A liquid concentrate consisting primarily of an ionic surfactant, optical brightener, isopropyl alcohol, perfume, and trace amounts of coloring.

Cleaner B - An all synthetic, neutral, aqueous formulation. It contains no alkali, phosphates, silicates, or other

strong inorganic detergents. There are no solvents such as alcohol, ether, or chlorinated hydro-carbons in this cleaner.

Cleaner C - Five different synthetic detergents of the lauryl sulphonate type are contained in this cleaner. The cleaner dries completely with no residue left in the carpet and does not dry sticky such as alka-aero-sulphonates do. The cleaner contains 15 per cent active cleaning ingredients and 85 per cent water; two optical bleaches and drying agents.

Powder Cleaners

Cleaner D - Contains wood flour, bentonite, and a high flash naphtha.

Cleaner E - Contains wood flour as an absorbent base, trichlor-ethylene and petroleum distillate solvents.

Cleaner F - Contains ground up bleached corn cob as carrier, solvents for cleaning oil and grease film, detergents for cleaning normal soil and dirt, and Fuller's Earth as the absorbent for the soil.

III. PREPARATION OF SAMPLES

Coding and Formation of "Test Carpets"

Samples of each fiber type were first coded with numbers one through three, indicating the three carpets of each fiber type. Each of the nine carpet samples (three wools, three nylons, and three acrylics), was then cut into seven nine-inch squares. Six were to be used for testing and one was to be retained as a control sample. The six squares for each sample to be tested were then coded (letters a through f).

Six groups, to be referred to as the "Test Carpets" were established and coded as Test Carpets I through VI. A sample of each of the nine carpets

was randomly assigned to each of the six test carpets. The nine squares in each group were then divided into two $4\frac{1}{2} \times 9$ inch rectangles to give a replicate within the test carpet of each carpet sample. The 18 pieces in each test carpet were randomly assigned a cleaning position in the test carpet. The pieces in each test carpet were then fastened together to form the 18×27 inch rectangular test carpets by means of a nylon tape covered with an adhesive.

The six cleaners were coded A through F and randomly assigned to a test carpet.

A master table showing this distribution of carpet samples and cleaners for testing is included as Appendix A.

Procedure for Cleaning the Test Carpets

The cleaning procedures specified on the containers of the shampoo cleaners were similar. This was true also of the powder-type cleaners. Therefore, a uniform cleaning method was established for the six groups of carpet samples.

The shampoo-type cleaners were diluted with water according to directions on the labels. The cleaner was then applied to the carpet samples with a nylon bristled brush and worked into the pile with short overlapping strokes. Precaution was taken not to soak the pile, nor to wet the backing. After application of the cleaner, the test carpet was brushed and the samples were dried overnight. The dry samples were vacuumed to remove any loose residue and to fluff the pile.

The procedure for cleaning with the powder-type cleaners was almost

identical to that used for the shampoos. A measured amount (one tablespoon) of the granular cleaning compound was sprinkled on each piece in the test carpet and then worked into the pile with a nylon bristled brush identical to the one used for cleaning with shampoos. These groups were allowed to dry for at least six hours and afterwards vacuumed to remove the cleaner from the carpet and to raise the pile.

Three cleanings were performed with each of the six cleaners on the same test carpet assigned. This arbitrary number of cleanings was arrived at on the basis of the Cormany and Wenger pilot study and the findings of the Hurley study. The pilot study indicated that three cleanings would show any important changes.³⁷

Hurley found that 40 out of 46 homemakers studied had cleaned their carpet with a home cleaner twice a year or less frequently.³⁸

IV. DATA COLLECTION

Preparation of Carpets for Measurement

Prior to data collection the samples were conditioned at $70^{\circ} \pm 2$ degrees Fahrenheit and $65\% \pm 2$ per cent humidity. The pile of the carpet samples was

³⁷Esther M. Cormany and Allene Wenger, "A Comparison of Cleaning Methods on Selected Tufted Carpets," Journal of Home Economics, 54:3, Mar. 1962, p. 212.

³⁸Patricia G. Hurley, "Factors Influencing the Selection of Rugs and Carpets and the Resulting Satisfaction" (unpublished Master's thesis, The University of North Carolina, Greensboro, 1961), p. 41.

brushed with a nylon brush before each conditioning and measurement interval.

Before any treatment was applied the nine carpet samples were analyzed for tufts per square inch. Original readings were then obtained for three variables -- light reflectance (color), pile height, and compressional resilience.

Measurements on the treated samples were taken following the first and third cleanings. Readings for the three variables were taken at three different positions on each sample.

Evaluation of General Appearance

A rating scale was used to evaluate the general appearance of the nine samples in each test carpet following the first and third cleanings. The researcher performed the rating. In each instance, the treated sample was compared with the control sample. Distortion of pile was the major consideration in this evaluation.

The following rating scale was used:

- Class 5 ----- negligible or no change
- Class 4 ----- slight change
- Class 3 ----- noticeable change
- Class 2 ----- excessive change
- Class 1 ----- severe change

Measurement of Pile Height and Compressional Resilience

The C & R Tester was employed for measuring pile height and compressional resilience. With this instrument,

The thickness measurement is made with a preload of one-half ounce on the sample. The indenting load is transferred from a ballbearing support to the indenting plunger by means of a screw, and handwheel. With this

arrangement the indenting load (dead weight) may be applied to the sample without impact to measure the compression and removed to measure the recovery.³⁹

The measurement of pile height included the thickness of the pile and the carpet backing. It was imperative that the specimen be flat on the instrument base when pile height and compressional resilience readings were taken. Since the samples were slightly larger than the base of the instrument, the base was enlarged with pieces of wallboard of the same thickness as the base. Therefore, the extended area was flush with the base of the instrument.

The compressional resilience was determined after each pile height measurement was obtained. A total indenting load of 18 ounces (weight--16 ounces, weight rack and handwheel assembly--two ounces) was lowered to rest on the spindle without impact. The weight applied to the sample equalled .374 pounds per square inch.

$$\text{PSI} = \frac{W}{A}$$

$$A = \frac{\pi D^2}{4}$$

$W = \text{weight in pounds}$
 $A = \text{area in inches}$
 $D = 1.129 \text{ inches}$

The recovered thickness was measured by rotating the handwheel to remove the weight, weight rack, and handwheel assembly from contact with the spindle. The pressure foot was then lifted and allowed to rest gently on the pile. The recovery reading was then taken. The percentage of compressional resilience was determined by dividing the original pile height thickness by the

³⁹Custom Scientific Instruments, Inc., C & R Tester Model CS-55 (Kearney, N. J.: Custom Scientific Instruments, Inc., [n.d.]), p. 1.

recovered thickness. The following formula was used for calculating the percentage of compressional resilience:

$$\text{Per cent Recovery} = \frac{R}{P} \times 100$$

R = Thickness of sample after maximum load has been removed.

P = Thickness of sample under preload.

Measurement of Light Reflectance

Data for light reflectance were obtained with the Gardner Multipurpose Reflectometer for analysis of any color change.

The instrument employs a null method, i. e., light from a single source is directed along two paths to two photoelectric cells and the amounts of light along these two paths are varied by mechanical means until the cells produce the same currents. A galvanometer is used to indicate the condition of equal current output. During instrument operation, a fixed comparison specimen is always placed in one beam, then unknown specimens are compared with a standard in the other.⁴⁰

A gray standard, supplied with the instrument, was used as the necessary working standard by which the reflectometer was adjusted. Readings for light reflectance were taken using the green filter.

The instrument was allowed a two-hour warm-up period previous to any measurements. After standardizing the reflectometer the sample was substituted for the standard and the scale moved the amount necessary to restore the galvanometer to zero.

⁴⁰Gardner Laboratory, Inc., The Gardner Multipurpose Reflectometer, Description and Instructions, Bulletin 158 (Bethesda, Maryland: Gardner Laboratory, Inc., 1960), p. 1.

V. ANALYSIS OF DATA

The statistical analysis included an evaluation of four factors for each of the fiber-type carpets tested: (1) the differences among shampoo cleaners, (2) the differences among powder cleaners, (3) the differences between shampoo and powder cleaners, and (4) the differences among fabrics. These were analyzed for pile height, compressional resilience, and color reflectance before cleaning and following the first and third cleanings. Standard analysis of variance techniques were utilized to determine any significant differences.

Twenty-seven analyses were computed by Univac according to the following model:

<u>Sources</u>	<u>Degrees of freedom</u>
Fabrics	2
Treatments	5
Shampoos vs. powder	1
Among shampoos	2
Among powders	2
Fabrics x Treatments	10
Samples treated alike	18
Total	35

Graphs were included to show the percentage changes for each fiber sample cleaned with each of the six cleaners.

A visual rating scale was devised and used to evaluate surface appearances of each of the fiber samples cleaned with each of the cleaners. In rating the appearance, distortion of the pile was the primary consideration.

CHAPTER IV

ANALYSIS AND INTERPRETATION OF DATA

I. CHARACTERISTICS OF THE CARPETS BEFORE CLEANING

The carpets used in the study were all of cut-pile, tufted construction. They differed in fiber content, appearance, and physical properties such as tufts per square inch, pile height, compressional resilience and color. Data pertaining to these physical characteristics are presented in Table I.

Appearance

All samples of each fiber type were unused carpets with the surface appearance as manufactured for consumer use. Wools 1 and 2 and Acrylic 1 appeared to be of identical surface appearance and pile density. Wool 3 because of the extremely low pile density differed most from all other carpet samples.

Acrylic 2 and Nylons 2 and 3 were almost identical in surface appearance and pile density. All three samples had the same number of tufts per square inch. Although Nylon 1 had only one less tuft per square inch than Acrylic 2 and Nylons 2 and 3, that sample appeared much less dense in pile and the surface appearance was not as pleasing as that of the other two carpets.

Acrylic 3 had a very good appearance and density. However, Acrylic 3 had a shorter pile than any of the other samples tested and comparison on an equal basis with the other carpets was not possible.

TABLE I
CHARACTERISTICS OF CARPET PILE BEFORE CLEANING

Fibers	Tufts per sq. in.	Pile height (Inches)	Compressional resilience (Per cent)	Color reflectance (Per cent)
Wool				
1	63	.658	98.3	18.6
2	63	.740	97.5	22.3
3	36	.739	92.7	24.2
Nylon				
1	48	.623	94.1	33.5
2	49	.724	94.6	23.5
3	49	.766	93.3	14.4
Acrylic				
1	63	.638	97.8	15.6
2	49	.741	96.4	32.4
3	56	.500	95.9	21.5

In summation, Wool carpets 1 and 2 and Acrylic 1 gave the best appearance with Acrylic 2 and Nylons 2 and 3 appearing second best. Wool 3 and Nylon 1 differed most from the other samples. Acrylic 3 differed most in pile height but the general appearance was very good.

Tufts Per Square Inch

The number of tufts per square inch in the carpet samples tested indicated a wider variation among the wool samples and acrylic samples than among the nylon samples.

Nylon samples 2 and 3 appeared to have the denser pile of the nylon samples although Nylon 1 had only one less tuft per square inch than did both of these samples. Wool 1 and Acrylic 1 were both manufactured by the same company and were identical except for fiber content. Although Wool 2 was obtained from a different source it appeared to be similar to Wool 1 and Acrylic 1. Wool 3 had the lowest number of tufts per square inch, but was comparable to the other two samples in quality and price.

With the exception of the marked difference in the number of tufts for Wool 3, the acrylics showed a wider variation in tufts per square inch. These ranged from 49 (Acrylic 2) to 63 (Acrylic 1).

Pile Height

The mean pile height of carpets ranged from approximately .500 inches (Acrylic 3) to .766 inches (Nylon 3). Wools 2 and 3 and Acrylic 2 were very similar in pile height and were only slightly lower than Nylon 3. Wool 1,

Nylon 1 and Acrylic 1 were between the high and low pile carpets ranging from .623 inches to .658 inches.

Compressional Resilience

The mean per cent compressional resilience of the carpets in the six cleaner groups ranged from 92.7 per cent to 98.3 per cent. Wool 3 and Nylon 3 had the lowest percentage resilience. Wools 1 and 2 and Acrylic 1 had approximately 98 per cent compressional resilience.

Color Reflectance

The mean per cent color reflectance of the carpets before treatment ranged from 14.4 (Nylon 3) to 33.5 (Nylon 1). Acrylic 1 and Wool 1 had reflectance readings slightly higher than Nylon 3 and Acrylic 2 was slightly less than Nylon 1. The other four carpets were very close in percentage color reflectance. Wool 1 and Acrylic 1 were manufactured by the same company and were dyed to be the same color. However, the differences in fibers caused the variation in color reflectance.

II. CHARACTERISTICS OF CARPETS AFTER CLEANING

Appearance of Samples After Cleaning

Table II shows (1) the rating scale used to evaluate the appearance of the pile of the carpets after the first cleaning and the third cleanings and (2) the appearance ratings of the treated carpets.

First Cleaning. Following the first cleaning the nylon carpets showed the greatest change in appearance when cleaned with Shampoo A. Nylons, however, showed no change when cleaned with Shampoo B nor did acrylics cleaned with Powder F.

There was a greater difference between shampoo and powder cleaned nylons after the first cleaning than between shampoo and powder cleaned wools or acrylics. Nylons ranked higher when cleaned with powder cleaners than did any other fiber type or cleaner group. Shampoo and powder cleaned wools showed identical mean ratings.

Third Cleaning. Mean values dropped sharply after the third cleaning. Nylons cleaned with Shampoo C had the lowest rating of all fiber-cleaner groups after three cleanings. Nylon carpets cleaned with shampoos had the lowest mean value for any group.

Wools showed less change between the first and third powder cleanings than did any of the other fibers cleaned with shampoo or powder cleaners. Both shampoo and powder cleaned nylons had the greatest change between the first and third cleanings.

Similarly, nylons showed the greatest change from the original rating

TABLE II
 RATING OF APPEARANCE OF CARPET SAMPLES
 AFTER CLEANING WITH SHAMPOO AND POWDER CLEANERS

		Rating Scale						
		Class 5 - Negligible or no change						
		Class 4 - Slight change						
		Class 3 - Noticeable change						
		Class 2 - Excessive change						
		Class 1 - Severe change						
Number of cleaning	Carpet fiber	Cleaner						
		Shampoo			Powder			
		A	B	C	D	E	F	
First	Wool	1	4	3	4	4	4	4
		2	4	4	4	4	4	4
		3	5	5	5	5	4	5
		Mean	4.3	4.0	4.3	4.3	4.0	4.3
	Nylon	1	4	5	5	5	5	5
		2	3	5	4	5	5	5
		3	3	5	5	4	4	5
		Mean	3.3	5.0	4.7	4.7	4.7	5.0
	Acrylic	1	4	4	4	4	4	4
		2	5	5	5	4	5	5
		3	5	4	4	4	5	5
		Mean	4.7	4.3	4.3	4.0	4.7	4.7
Third	Wool	1	2	2	2	3	3	2
		2	3	3	3	3	4	4
		3	3	2	3	3	2	3
		Mean	2.7	2.3	2.7	3.0	3.0	3.0
	Nylon	1	3	2	2	3	3	3
		2	3	3	2	3	3	2
		3	2	2	2	3	3	2
		Mean	2.7	2.3	2.0	3.0	3.0	2.3
	Acrylic	1	2	2	2	2	2	2
		2	3	3	3	3	3	3
		3	3	3	3	3	3	4
		Mean	2.7	2.7	2.7	2.7	2.7	3.0

(5) to the third cleaning rating. Wools and acrylics had almost the same amount of change in rating from the original to the third cleaning.

According to the results in Table II, nylon carpets show more varied effects in appearance when cleaned with either shampoo or powder cleaners than either wool or acrylic carpets. In addition, powder cleaners tended to have a less degrading effect on the carpets than did shampoo cleaners.

Changes in Pile Height After Cleaning

Table III shows the pile height of carpets before cleaning and following the first and third cleanings. Percentage changes from the original of each carpet sample treated with the six cleaners are shown in Figures 1, 2, and 3.

First Cleaning. Most of the samples of each fiber type treated showed an increase in pile height.

Nylons showed the greatest increase among the shampoo cleaned carpets and also among the powder cleaned carpets. The acrylic carpets showed the least change in pile height of the three fiber types. With the exception of carpet 3 treated with the shampoo cleaners, changes in pile height did not exceed 3.0 per cent. The wool carpets treated with the shampoo cleaners varied more than those treated with the powder cleaners.

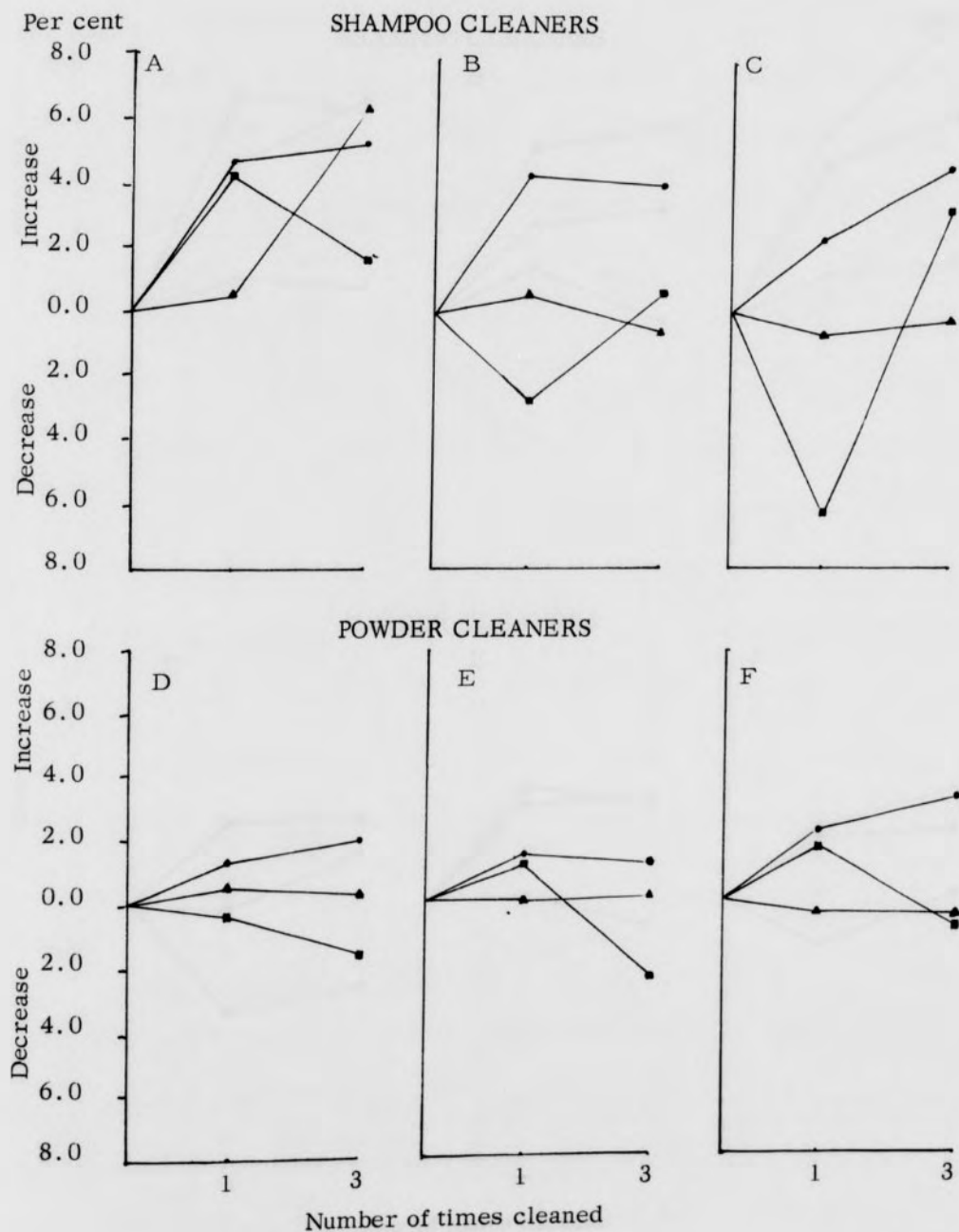
Third Cleaning. Nylon and wool carpets cleaned with shampoo cleaners showed the greatest changes following the third cleaning. Changes for wool carpets ranged from -0.6 per cent to +6.4 per cent and for nylon carpets -0.3 per cent to +9.3 per cent. Wool 3 had small decreases in pile height when cleaned with powder cleaners a third time. There was little change in the pile height of

TABLE III
PILE HEIGHT OF CARPETS BEFORE AND AFTER CLEANING

Fiber		Cleaner							
		Shampoo				Powder			
		A	B	C	Mean	D	E	F	Mean
(Inches)									
BEFORE CLEANING									
Wool	1	.651	.651	.662	.655	.661	.666	.659	.662
	2	.741	.738	.748	.742	.738	.737	.740	.738
	3	.732	.741	.748	.740	.741	.738	.739	.739
Nylon	1	.623	.612	.616	.617	.638	.622	.626	.629
	2	.722	.733	.726	.727	.733	.717	.716	.722
	3	.755	.775	.761	.764	.769	.767	.766	.767
Acrylic	1	.639	.638	.637	.638	.642	.631	.638	.637
	2	.742	.743	.735	.740	.741	.746	.740	.742
	3	.496	.498	.501	.498	.497	.498	.507	.501
FIRST CLEANING									
Wool	1	.682	.678	.676	.679	.670	.677	.673	.673
	2	.745	.743	.735	.741	.743	.737	.737	.739
	3	.762	.720	.702	.728	.738	.747	.752	.746
Nylon	1	.629	.620	.623	.624	.618	.623	.618	.620
	2	.756	.752	.760	.756	.733	.740	.733	.735
	3	.807	.814	.805	.809	.788	.796	.782	.789
Acrylic	1	.651	.648	.641	.647	.644	.648	.653	.648
	2	.748	.746	.736	.743	.729	.732	.736	.732
	3	.524	.515	.522	.520	.500	.507	.507	.505
THIRD CLEANING									
Wool	1	.686	.677	.692	.685	.674	.674	.680	.676
	2	.788	.733	.747	.756	.740	.738	.736	.738
	3	.745	.746	.771	.754	.728	.720	.732	.727
Nylon	1	.628	.611	.626	.622	.622	.617	.628	.622
	2	.770	.756	.771	.766	.747	.741	.743	.744
	3	.802	.821	.831	.818	.791	.792	.784	.789
Acrylic	1	.656	.643	.658	.652	.645	.647	.656	.649
	2	.757	.748	.747	.751	.744	.745	.739	.743
	3	.521	.512	.513	.515	.509	.513	.521	.514

CHANGE IN PILE HEIGHT OF WOOL CARPETS AFTER CLEANING

Key: ● Sample 1
▲ Sample 2
■ Sample 3



CHANGE IN PILE HEIGHT OF NYLON CARPETS AFTER CLEANING

Key: ● Sample 1
▲ Sample 2
■ Sample 3

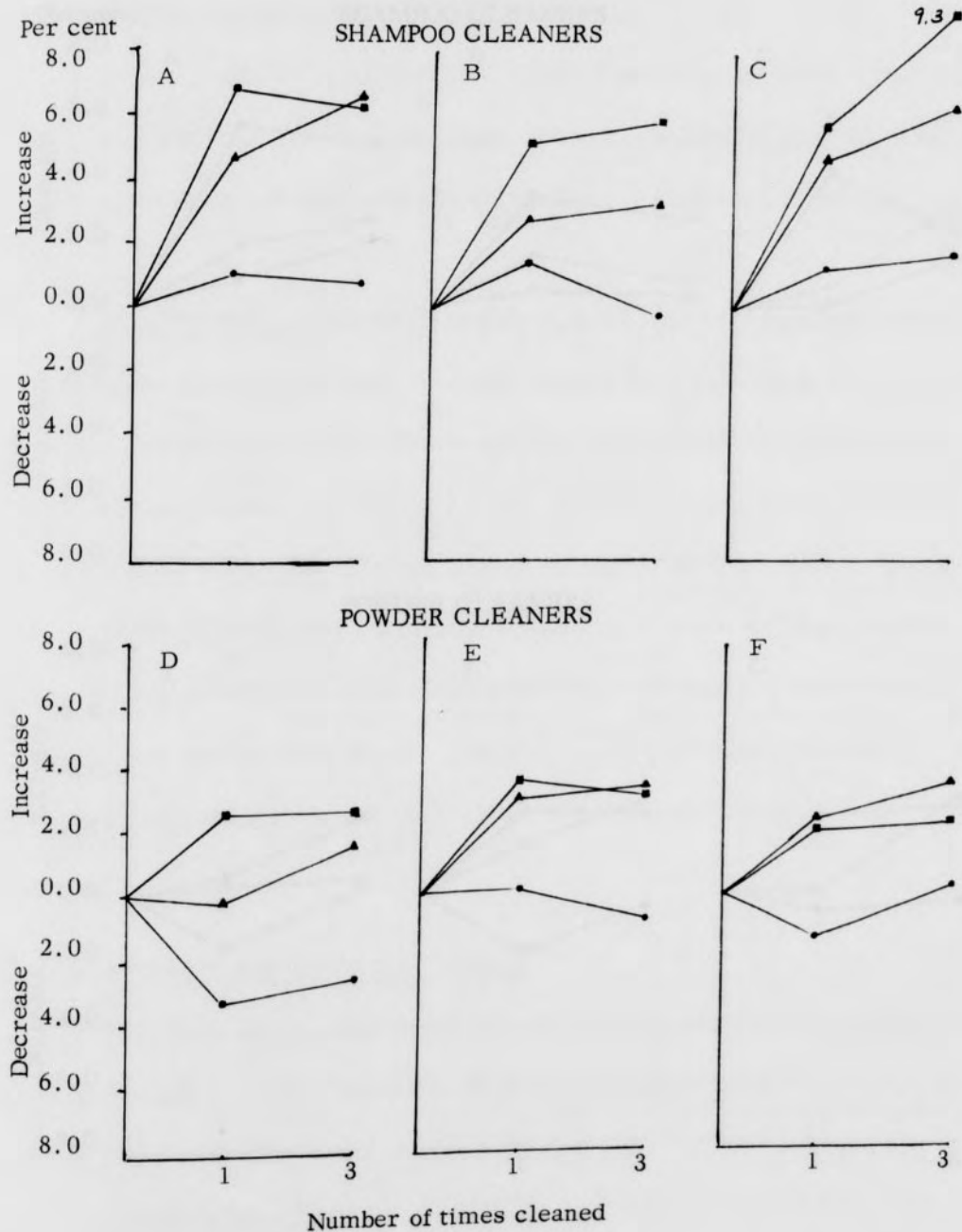
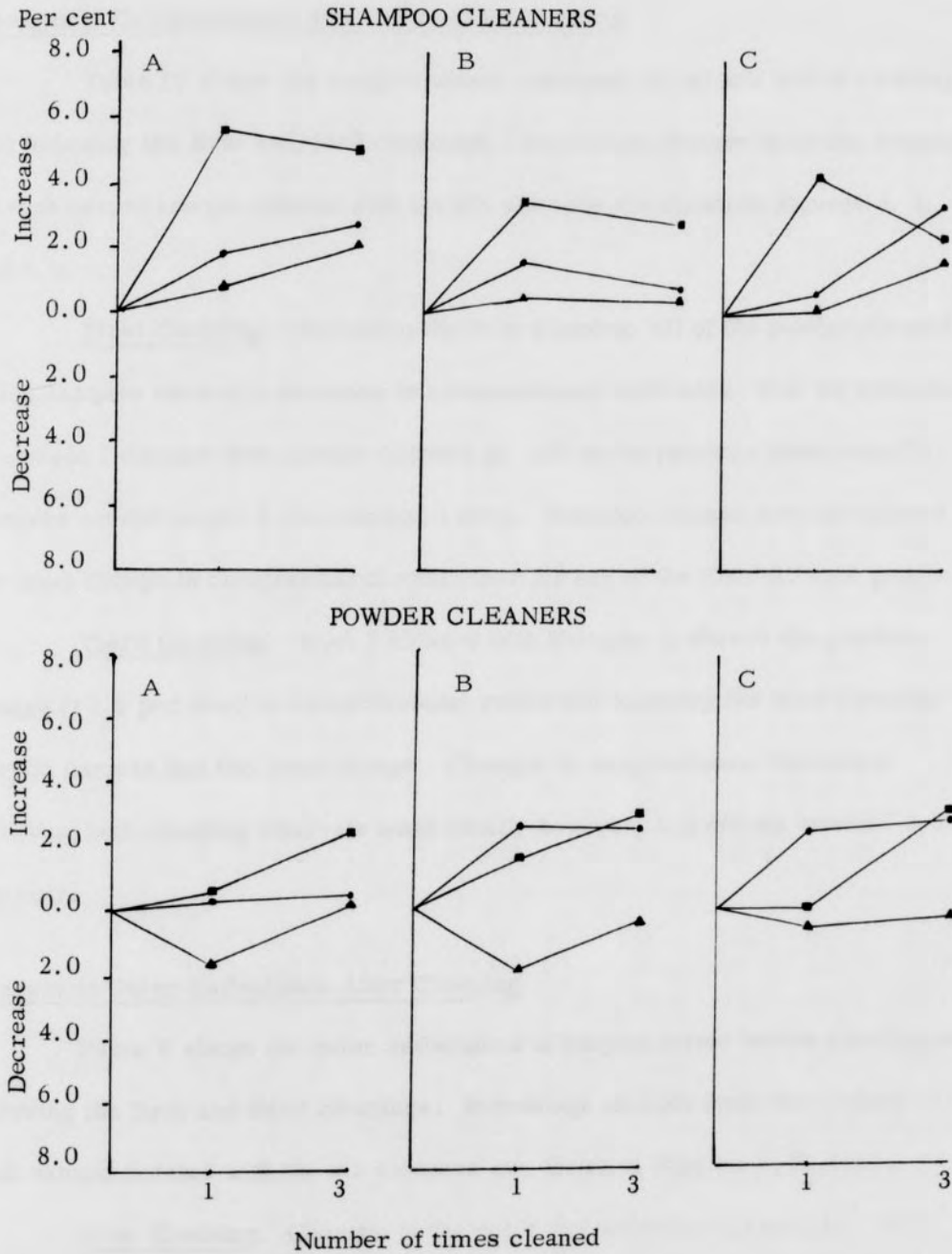


FIGURE 3

CHANGE IN PILE HEIGHT OF ACRYLIC CARPETS AFTER CLEANING

Key:
 ● Sample 1
 ▲ Sample 2
 ■ Sample 3



acrylic carpets cleaned with shampoo cleaners or in nylon and acrylic carpets cleaned with powder cleaners.

Changes in Compressional Resilience After Cleaning

Table IV shows the compressional resilience of carpets before cleaning and following the first and third cleanings. Percentage changes from the original of each carpet sample treated with the six cleaners are shown in Figures 4, 5, and 6.

First Cleaning. Following the first cleaning, all of the powder cleaned nylon samples showed a decrease in compressional resilience, with the exception of sample 1 cleaned with powder Cleaner D. All of the powder cleaned acrylic samples except carpet 3 also showed a drop. Shampoo cleaned acrylics showed the least change in compressional resilience for any of the fiber-cleaner groups.

Third Cleaning. Wool 3 cleaned with Shampoo A showed the greatest change (+2.6 per cent) in compressional resilience following the third cleaning; acrylic carpets had the least change. Changes in compressional resilience following both cleaning intervals were small, however, and did not exceed ± 3.0 per cent.

Changes in Color Reflectance After Cleaning

Table V shows the color reflectance of carpets tested before cleaning and following the first and third cleanings. Percentage changes from the original of each sample treated with the six cleaners are shown in Figures 7, 8, and 9.

First Cleaning. Changes in the color reflectance of all samples tested

TABLE IV

COMPRESSIONAL RESILIENCE OF CARPETS BEFORE AND AFTER CLEANING

Fiber	Cleaners								
	Shampoo				Powder				
	A	B	C	Mean	D	E	F	Mean	
(Per cent)									
BEFORE CLEANING									
Wool	1	98.5	98.0	98.5	98.3	98.0	98.0	98.5	98.2
	2	98.0	97.5	97.5	97.7	97.0	97.5	97.5	97.3
	3	93.0	92.5	93.0	92.8	93.5	91.5	92.5	92.5
Nylon	1	94.0	94.0	94.0	94.0	94.0	94.5	94.0	94.2
	2	94.5	94.0	94.5	94.3	94.5	95.0	95.0	94.8
	3	93.5	93.5	91.5	92.8	94.5	93.5	93.0	93.7
Acrylic	1	98.0	97.5	98.0	97.8	98.0	97.5	98.0	97.8
	2	96.5	96.5	96.0	96.3	97.0	96.5	96.0	96.5
	3	96.0	96.0	95.5	95.8	96.5	95.5	96.0	96.0
FIRST CLEANING									
Wool	1	97.5	97.5	98.0	97.7	98.0	97.5	97.0	97.5
	2	97.5	97.5	98.0	97.7	97.5	97.5	97.0	97.3
	3	93.0	94.0	94.5	93.8	93.5	92.5	93.5	93.2
Nylon	1	93.5	93.0	93.5	93.3	94.0	92.0	93.0	93.0
	2	94.0	95.5	95.0	94.8	94.5	93.0	94.0	93.8
	3	92.5	93.5	93.5	93.2	94.0	92.5	92.0	92.8
Acrylic	1	97.0	98.0	98.0	97.7	97.5	97.0	96.5	97.0
	2	96.0	97.0	96.0	96.3	96.5	94.5	95.0	95.3
	3	95.0	95.5	95.5	95.3	97.0	95.5	96.5	96.3
THIRD CLEANING									
Wool	1	96.0	98.0	97.5	97.2	97.5	97.5	98.0	97.7
	2	97.0	97.5	97.5	97.3	97.5	97.5	98.0	97.7
	3	95.5	94.0	94.0	94.5	93.0	93.5	94.5	93.7
Nylon	1	95.0	93.0	92.5	93.5	94.5	93.5	94.5	94.2
	2	94.0	95.0	94.5	94.5	95.0	94.0	94.5	94.5
	3	92.5	93.0	93.0	92.8	93.5	92.0	93.0	92.8
Acrylic	1	97.5	98.0	98.0	97.8	98.0	97.0	98.0	97.7
	2	96.0	96.5	96.5	96.3	96.0	96.5	96.5	96.3
	3	95.5	96.5	97.0	96.3	96.5	96.5	96.5	96.5

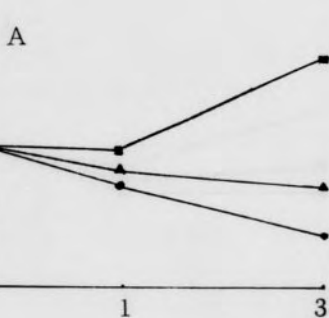
FIGURE 4

CHANGE IN COMPRESSIONAL RESILIENCE OF WOOL CARPETS AFTER CLEANING

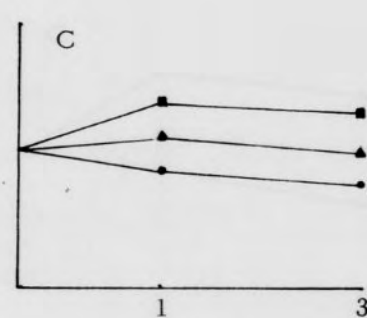
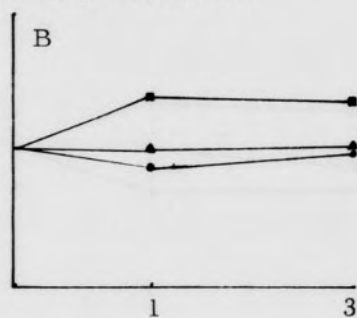
Key:
 • Sample 1
 ▲ Sample 2
 ■ Sample 3

Per cent

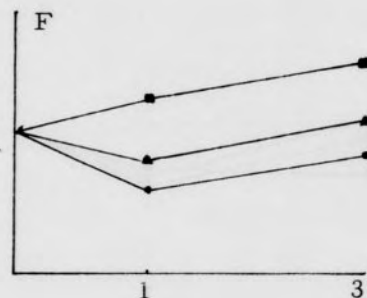
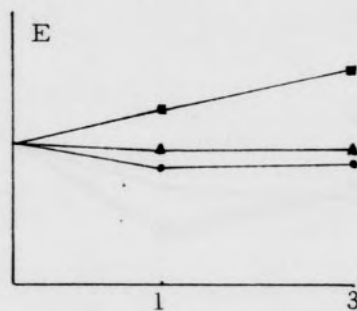
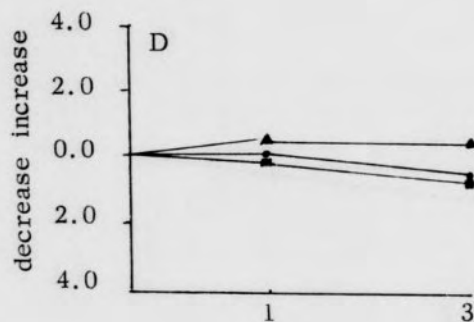
decrease increase
 4.0
 2.0
 0.0
 2.0
 4.0



SHAMPOO CLEANERS



POWDER CLEANERS



Number of times cleaned

FIGURE 5

CHANGE IN COMPRESSIONAL RESILIENCE OF NYLON CARPETS AFTER CLEANING

Key:
 • Sample 1
 ▲ Sample 2
 ■ Sample 3

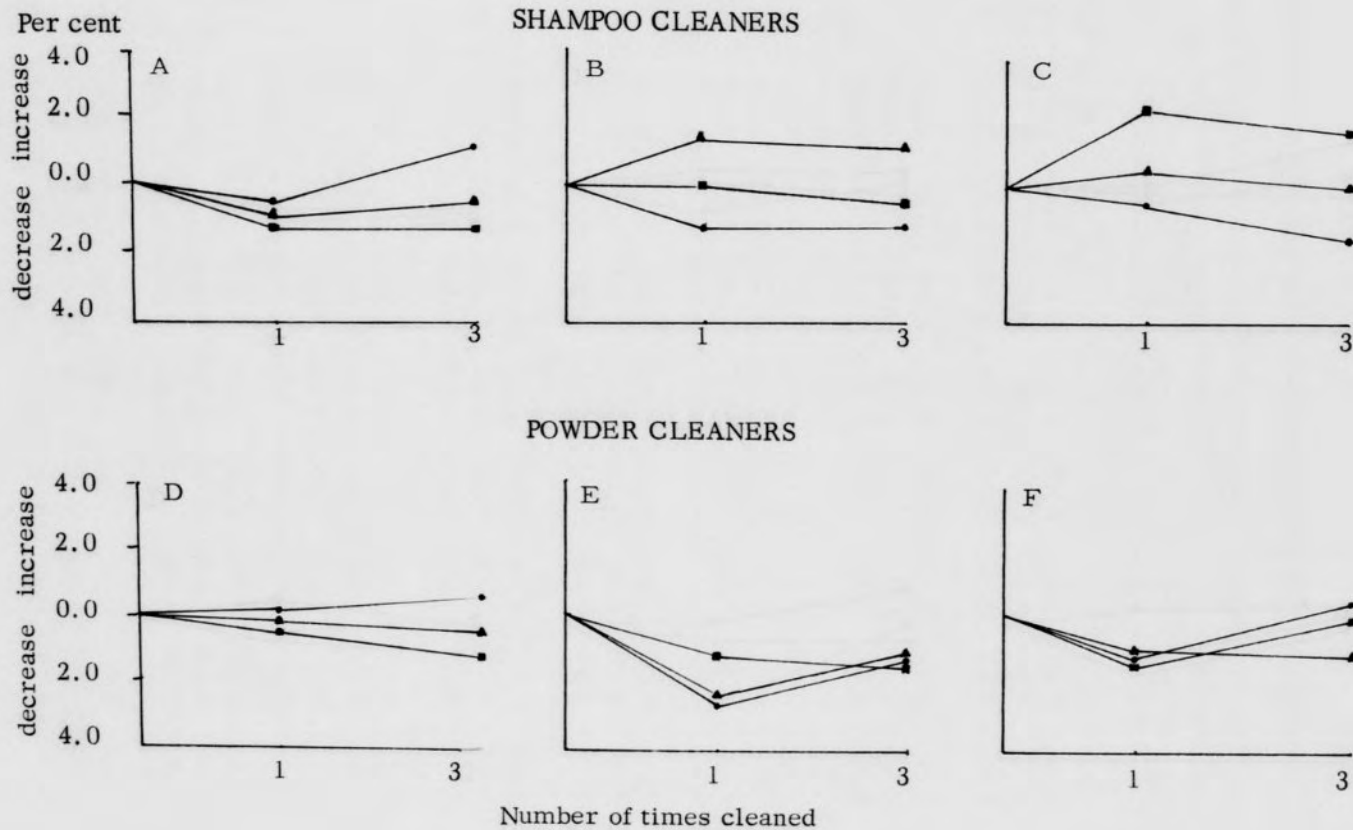


FIGURE 6

CHANGE IN COMPRESSIONAL RESILIENCE OF ACRYLIC CARPETS AFTER CLEANING

Key: ● Sample 1
▲ Sample 2
■ Sample 3

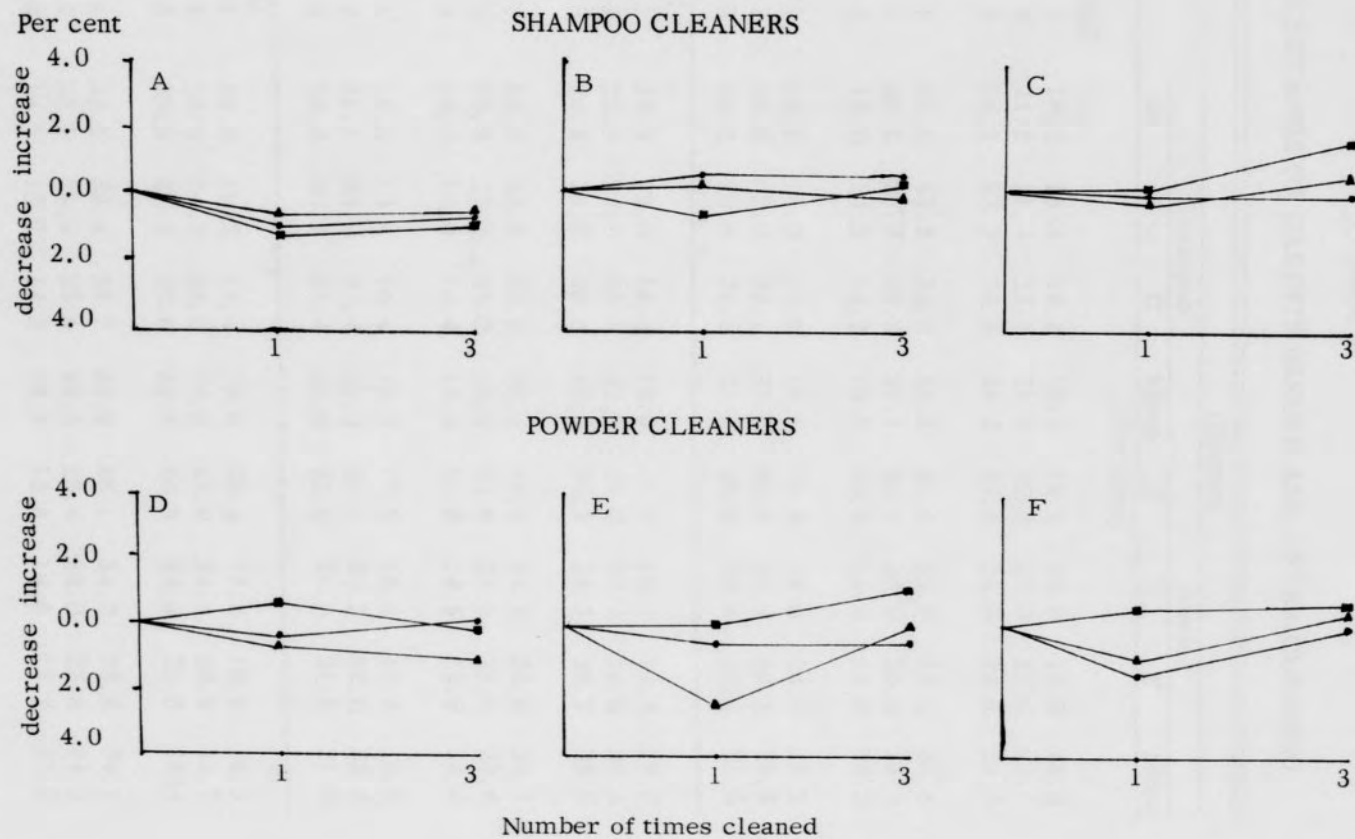


TABLE V

COLOR REFLECTANCE OF CARPETS BEFORE AND AFTER CLEANING

Fiber		Cleaner							
		Shampoo				Powder			
		A	B	C	Mean	D	E	F	Mean
(Per cent)									
BEFORE CLEANING									
Wool	1	18.2	18.4	18.8	18.5	18.8	19.0	18.8	18.8
	2	21.6	21.4	22.9	21.9	22.9	22.6	22.4	22.6
	3	24.1	23.9	24.5	24.2	24.2	24.0	24.6	24.3
Nylon	1	33.1	33.2	34.3	33.5	33.6	33.8	33.2	33.6
	2	23.0	23.0	23.3	23.1	23.1	25.0	23.4	14.3
	3	15.0	14.3	14.2	14.5	14.4	14.6	13.8	14.3
Acrylic	1	15.8	15.0	15.6	15.5	16.4	15.8	14.8	15.7
	2	32.0	32.0	32.1	32.0	32.9	32.4	33.2	32.8
	3	22.2	20.8	21.4	21.4	20.6	20.8	23.0	21.5
FIRST CLEANING									
Wool	1	18.3	19.0	18.6	18.6	21.0	18.2	18.4	19.2
	2	22.9	22.9	23.1	22.8	23.0	25.4	22.8	24.4
	3	24.8	24.8	26.4	25.3	26.3	24.8	26.2	25.8
Nylon	1	33.9	33.5	33.2	33.6	34.2	34.2	33.8	34.1
	2	23.2	23.2	23.3	23.2	23.9	23.6	23.4	23.6
	3	14.2	14.6	14.4	14.4	15.0	14.6	13.8	14.4
Acrylic	1	15.3	15.4	16.4	15.7	17.2	15.6	15.2	16.0
	2	31.6	33.0	31.4	32.0	32.1	33.2	32.0	32.5
	3	20.2	20.2	21.4	20.6	21.0	21.0	21.0	21.0
THIRD CLEANING									
Wool	1	18.4	19.2	19.4	19.0	20.4	17.4	18.9	18.9
	2	24.0	24.4	24.0	24.2	27.0	24.4	22.8	24.7
	3	25.9	27.2	27.0	26.7	26.5	24.4	25.5	25.4
Nylon	1	33.6	33.4	32.7	33.3	36.1	34.2	33.8	34.7
	2	23.2	23.3	23.6	23.3	25.4	24.0	22.6	24.0
	3	14.2	15.7	14.2	14.7	16.8	14.6	13.7	15.0
Acrylic	1	15.8	16.2	15.0	15.6	17.7	16.4	15.8	16.6
	2	31.6	32.9	30.6	31.7	34.2	33.8	32.8	33.6
	3	20.4	20.4	20.5	20.4	22.2	20.7	21.9	21.6

CHANGE IN COLO

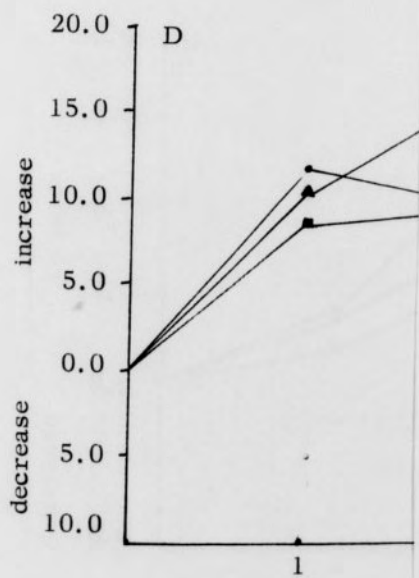
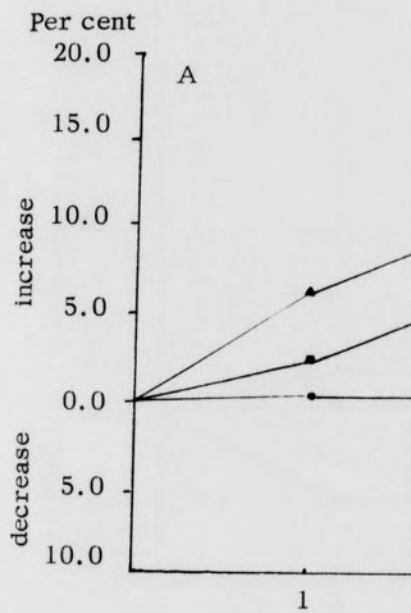


FIGURE 8

CHANGE IN COLOR REFLECTANCE OF NYLON CARPETS AFTER CLEANING

Key:
 ● Sample 1
 ▲ Sample 2
 ■ Sample 3

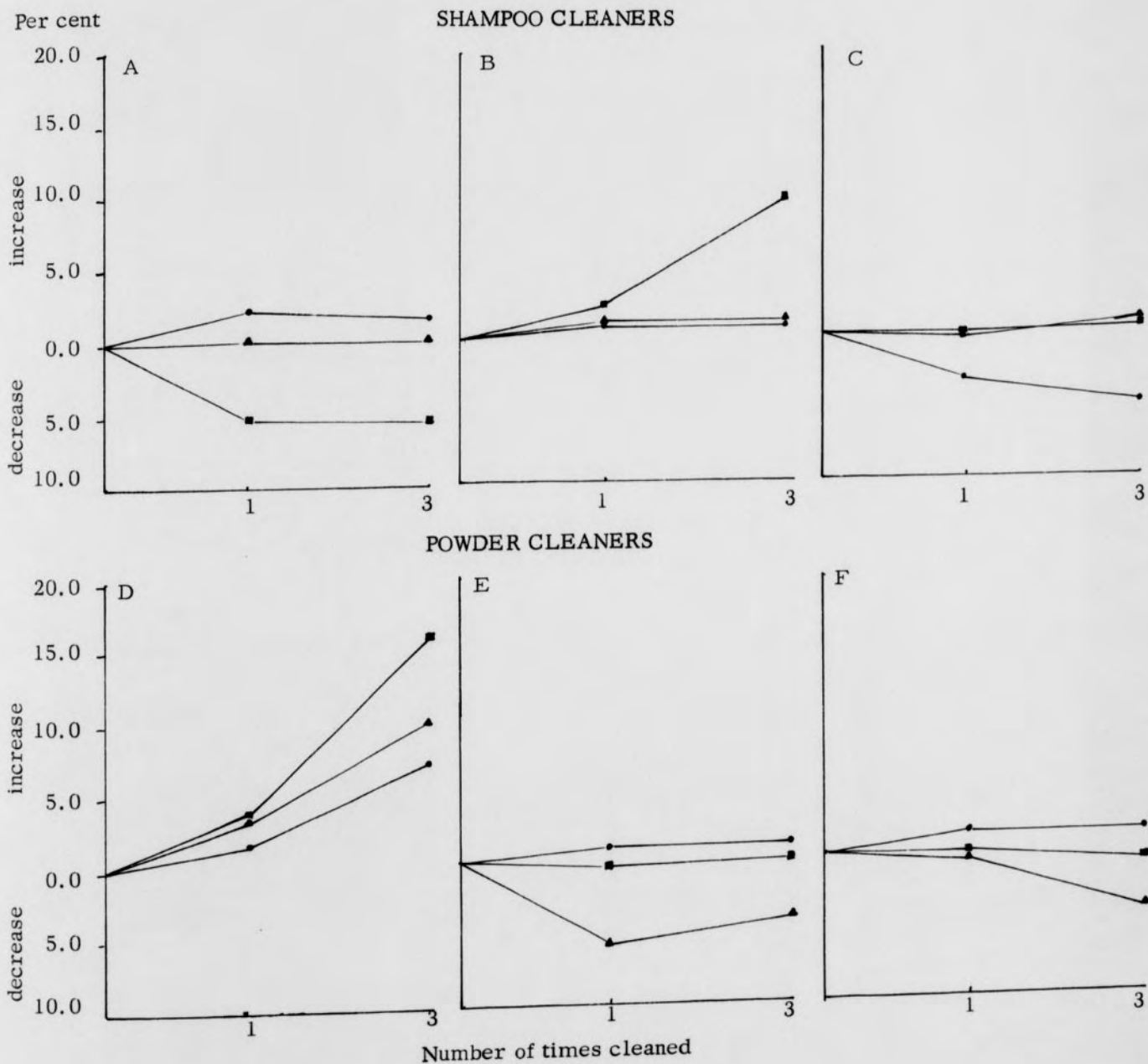
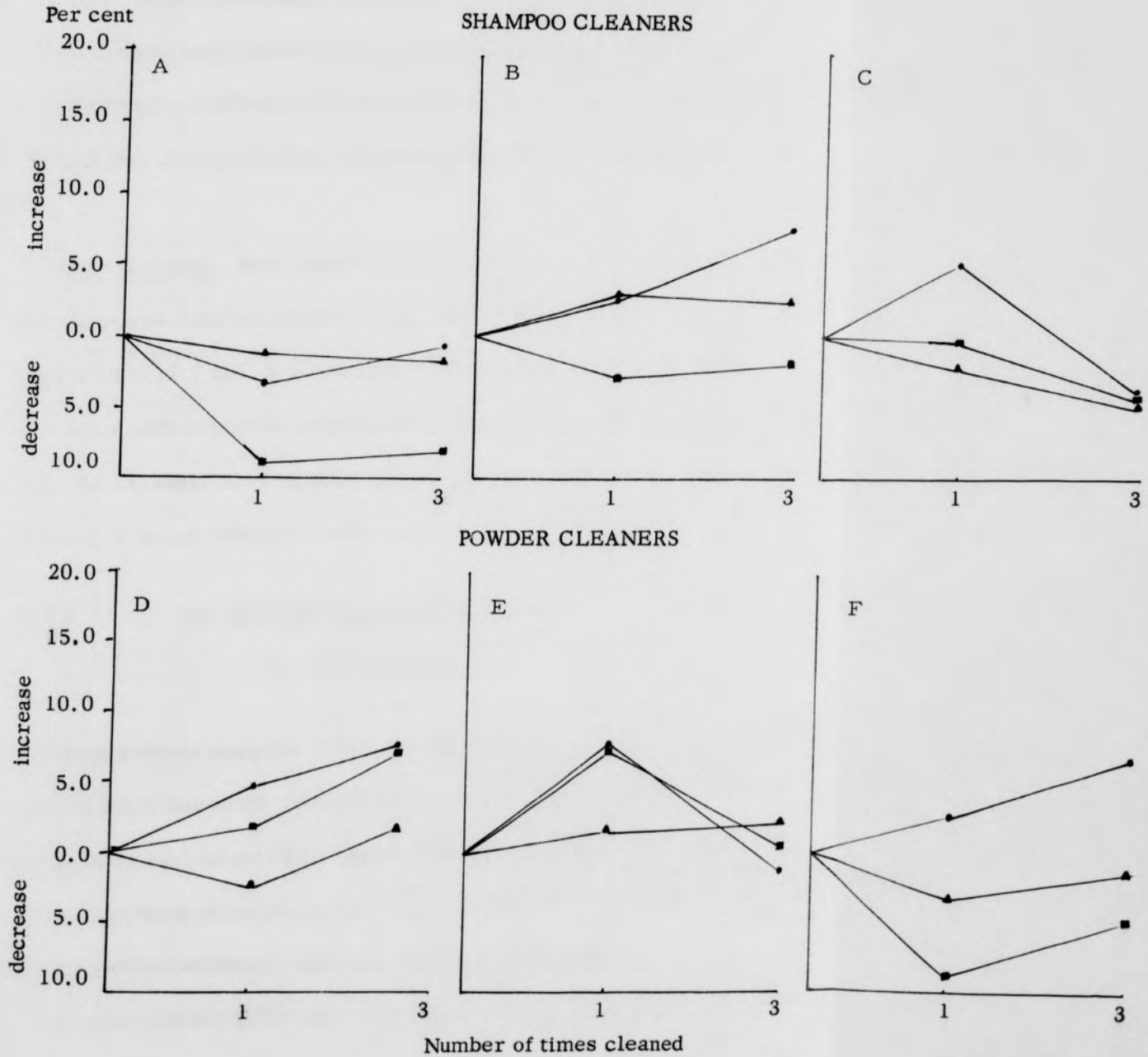


FIGURE 9

CHANGE IN COLOR REFLECTANCE OF ACRYLIC CARPETS AFTER CLEANING

Key:
 • Sample 1
 ▲ Sample 2
 ■ Sample 3



were highly varied. Both shampoo and powder cleaned acrylic carpets had more decreases in color reflectance after the first cleaning. Acrylic 3 cleaned with Shampoo A showed the greatest decrease (-9.0 per cent) in color reflectance, while shampoo cleaned wool carpets 1 and 2 had the smallest decreases (0.2 per cent and 0.8 per cent, respectively). Wool 2 cleaned with Powder D increased most in color reflectance (12.0 per cent). Nylon carpets cleaned with Powder F had less change in color reflectance than any other fiber-cleaner group.

Third Cleaning. Wool carpet 2 cleaned with Powder D increased most in color reflectance after the third cleaning, while Wool 1 cleaned with Powder E decreased most (+17.7 and -8.2 per cent, respectively). However, wool carpets cleaned with Powder F showed less change from the original reflectance value than did any other fiber-cleaner group. All three nylon carpets increased progressively in color reflectance after each cleaning with Powder D.

III. STATISTICAL SIGNIFICANCE OF RESULTS

Twenty-seven analyses of variance were used to determine any significant changes for either of the three variables - pile height, compressional resilience, and color reflectance. Each of the three variables was analyzed for differences (1) among shampoo cleaners, (2) among powder cleaners, (3) between shampoo and powder cleaners, and (4) among carpet samples.

An analysis was performed for each set of original measurements as

well as for those measurements obtained after treatment. Any significance obtained on the original readings indicated that there was some variation in those samples prior to treatment.

Differences in fabrics were highly significant for each variable (Table VI). These significances were expected, however, since the three samples of each fiber type were different.

Pile Height

The treatments applied to the carpet samples produced significant changes in pile height at the .05 level of probability for wool carpets following the third cleaning and for nylon carpets following the first cleaning. When the treatments were broken down, the difference in pile height of shampoo and powder cleaned nylon carpets after the first cleaning was highly significant (.01). Shampoo cleaned nylon carpets had a greater mean increase in pile height than did powder cleaned nylons (Figure 2). Differences between shampoo and powder cleaned wool and nylon carpets were significant at the .05 level after the third cleaning and for acrylic carpets following the first cleaning.

Compressional Resilience

Differences in compressional resilience between treatments and between shampoos and powders were significant at the .05 level of probability for nylon carpets following the first cleaning. Nylon carpets cleaned with powder cleaners showed highly significant differences (.01 level) after the first cleaning. The differences in compressional resilience produced by the shampoo

TABLE VI
SIGNIFICANCE OF DIFFERENCES IN PILE HEIGHT,
COMPRESSIONAL RESILIENCE AND COLOR REFLECTANCE OF
CARPET SAMPLES MEASURED BEFORE AND AFTER CLEANING

Source	Number of times cleaned								
	Wool			Nylon			Acrylic		
	0	1	3	0	1	3	0	1	3
PILE HEIGHT									
Fabrics	**	**	**	**	**	**	**	**	**
Treatments	--	--	*	--	*	--	--	--	--
Shampoo vs. powder	--	**	*	--	**	*	--	*	--
Among shampoos	*	--	--	--	--	--	--	--	--
Among powders	--	--	--	--	--	--	--	--	--
Fabrics x treatments	--	--	--	--	--	--	--	--	--
COMPRESSIONAL RESILIENCE									
Fabrics	**	**	**	**	**	**	**	**	**
Treatments	--	--	--	--	*	--	--	--	--
Shampoo vs. powder	--	--	--	--	*	--	--	--	--
Among shampoos	--	--	--	--	--	--	--	--	*
Among powders	--	--	--	--	**	--	*	--	--
Fabrics x treatments	--	--	--	--	--	--	--	--	--
COLOR REFLECTANCE									
Fabrics	**	**	**	**	**	**	**	**	**
Treatments	*	**	*	--	*	**	--	--	**
Shampoo vs. powder	*	*	--	--	*	**	--	--	**
Among shampoos	*	--	--	--	--	--	--	--	--
Among powders	--	**	**	--	*	**	--	--	--
Fabrics x treatments	--	--	--	--	--	--	--	--	--

*Significant at the .05 level of probability.

**Significant at the .01 level of probability.

--No significance.

cleaners on acrylic carpets were significant after the third cleaning. There were no significant changes for wool carpets.

Color Reflectance

Following the first cleaning, the color reflectance of wool carpets showed highly significant differences (.01 level of probability) between treatments and among powder cleaners. After the third cleaning, however, color reflectance differences were highly significant among powder cleaners for wool carpets; between treatments, between shampoo and powder cleaners, and among powder cleaners for nylon carpets; between treatments, and between shampoos and powders for acrylic carpets.

CHAPTER V

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

I. SUMMARY

The American carpet industry and American consumers are each concerned with the performance and serviceability of carpet fibers. When performance factors are considered, the cleanability of carpet fibers is of prime importance.

The study was designed to test three specific performance factors related to the cleanability of carpets and carpet fibers. The objectives of the study were:

1. To determine the effects of shampoo cleaners on color reflectance, pile height and compressional resilience of cut-pile carpets of selected fibers.
2. To determine the effects of powder cleaners on color reflectance, pile height, and compressional resilience on cut-pile carpets of selected fibers.
3. To compare the differences between the effects of powder cleaners and shampoo cleaners on the carpets of selected fibers.

Recently a dynamic growth in the carpet industry has produced major changes in this area. Square yard volume of carpet per household has increased steadily during the past ten years. In addition, carpet cleaners have increased in kind and number.

One important aspect of the study was that unsoiled carpet samples were tested. It was considered of primary interest to first determine the effects of cleaners on the fibers alone.

Carpets selected for experimentation included three fiber types - wool, nylon, and acrylic. Three samples of each fiber type were tested. Samples were of plush twist, cut-pile, tufted construction. They varied in color and pile height.

Cleaners used in the study were selected from those shampoo and powder cleaners reported by local sales personnel as sold most often. Three shampoo and three powder types were used. A description of the basic ingredients used in the manufacture of those cleaners selected for testing was obtained from the manufacturers.

Samples to be treated were coded and test carpets were formed. Cleaners were randomly assigned to these test carpets. Manufacturers recommendations for using the cleaners were quite similar. Therefore, a uniform method of cleaning was employed for all cleaners. Application of both types of cleaning compounds was made with a nylon bristled brush. Three cleanings were performed with each cleaner.

Prior to data collection, samples were conditioned at 70 degrees plus or minus two degrees Fahrenheit and 65 per cent plus or minus two per cent humidity. The samples were analyzed for tufts per square inch before treatment and readings were taken for light reflectance, pile height and compressional resilience. Measurements on the treated samples were taken following the first

and third cleanings.

A rating scale was devised and employed to evaluate the general appearance of the samples tested following the first and third cleanings. Distortion of the pile surface was the primary objective in this evaluation.

Pile height and compressional resilience measurements were taken with the C & R Tester. Data for light reflectance were obtained with the Gardner Multipurpose Reflectometer.

Data analysis included three phases. An analysis of variance was used to determine any significant differences in pile height, compressional resilience, and color reflectance for four factors: (1) the differences among shampoo cleaners, (2) the differences among powder cleaners, (3) the differences between shampoo and powder cleaners, and (4) the differences among carpet samples.

Graphs showing the percentage changes for each fiber sample cleaned with each cleaner were included.

Mean values of visual rating scores were obtained for each of the fiber samples cleaned with each cleaner.

All carpets used in the study were purchased new. They differed in appearance, fiber content, and physical properties such as pile height, color reflectance, compressional resilience, and tufts per square inch.

Characteristics of Carpets Before Cleaning

Before treatment the surface appearances of Wools 1 and 2 and Acrylic 1 were most alike. Wool 3 and Nylon 1 differed most from the other carpets in appearance.

There was a greater variation in tufts per square inch among the wool carpets and acrylic carpets than among the nylon carpets. Wools 1 and 2 and Acrylic 1 had the most tufts per square inch (63). Wool 3 had less tufts per square inch (36) than any of the other samples.

The mean pile height of carpets ranged from approximately .500 inch (Acrylic 3) to .766 inch (Nylon 3).

The mean per cent compressional resilience of the carpet samples ranged from 92.7 per cent (Wool 3 and Nylon 3) to 98.3 per cent (Wools 1 and 2 and Acrylic 1).

The range of the mean percentage color reflectance was from 14.4 (Nylon 3) to 33.5 (Nylon 1).

Characteristics of Carpets After Cleaning

Nylon carpets showed a wider variation in appearance rating after the first cleaning (3.3 to 5.0 - negligible or no change) and after the third cleaning (2.0 to 3.0). After the first cleaning, nylon carpets cleaned with shampoo cleaners ranked higher in appearance than any other fiber-cleaner group. Following the third cleaning, shampoo cleaned nylon carpets had the lowest mean value for any group. Powder cleaned wool carpets showed less change in

appearance between the first and third cleanings than did any other group.

Shampoo and powder cleaned nylon carpets had the greatest change between the first and third cleanings.

Powder cleaners tended to have a less degrading effect on the carpets than did shampoo cleaners.

An increase in pile height occurred in almost all of the samples after the first cleaning. Acrylic carpets appeared to be less affected in pile height after both cleaning intervals than did wool or nylon carpets. Nylon carpets again showed the greatest change. After the first cleaning, the difference in pile height between shampoo and powder cleaned nylon carpets was highly significant (.01).

Changes in compressional resilience were very small after both cleanings in almost every instance. The differences in compressional resilience among powder cleaned nylon carpets after the first cleaning were the only highly significant (.01) differences. There were fewer significant changes in compressional resilience, however, than in either pile height or color reflectance.

There were more significant changes in the color reflectance of the cleaned carpets than in both pile height and compressional resilience combined. These changes were highly varied.

Shampoo and powder cleaned Acrylic carpets had more decreases in reflectance after the first cleaning according to the graphs. However, the only highly significant differences after the first cleaning were found in wool carpets.

Differences in color reflectance for the six treatments and among powder cleaners were highly significant (.01).

After the third cleaning the number of highly significant changes increased. Differences in color reflectance among powder cleaners used on wool and nylon carpets were significant at the 1.0 per cent level. Differences among the six cleaners and between shampoo and powder cleaners were significant at the 1.0 per cent level for nylon and acrylic carpets.

II. CONCLUSIONS

The results of this study indicated the following conclusions:

1. The surface appearances of unsoiled nylon carpets are more affected by carpet cleaners than are those of wool and acrylic carpets.
2. Shampoo cleaners are more detrimental to the surface appearance of carpets than are powder cleaners.
3. Shampoo and powder cleaners do not greatly affect the pile height and compressional resilience of unsoiled wool, nylon, and acrylic carpets.
4. The color reflectance of unsoiled wool and nylon carpets is significantly affected by carpet cleaners. Powder cleaners caused greater changes in the color reflectance of wool and nylon carpets than did shampoo cleaners.

III. RECOMMENDATIONS FOR FURTHER STUDY

Further investigation related to carpet, carpet fibers, and carpet cleaners would be desirable for greater insight into the relationships of one factor to the other. The following recommendations are made for future study:

1. A study similar to this one be conducted using both unsoiled-treated samples and soiled-treated samples.
2. More intensive studies be conducted using only one fiber type for each study and including more treatments than cleaning alone; i.e., fume fading, spot and stain removal, and light fading.
3. A comparable study be conducted using a heavier compression load for testing compressional resilience.
4. A study be performed to determine how informed with respect to carpet and carpet fiber properties and performances are carpet sales personnel.
5. A study of a random sampling of homemakers or carpet owners to be conducted to determine their opinions and preferences concerning the different carpet fibers and cleaners.

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APPENDIX

Handwritten text, possibly a title or subtitle, located at the top of the page.

Table I: [Faint title]

Acrylic 1	Wood 1	Acrylic 2	Wood 2	Acrylic 3	Wood 3
Acrylic 4	Wood 4	Acrylic 5	Wood 5	Acrylic 6	Wood 6
Acrylic 7	Wood 7	Acrylic 8	Wood 8	Acrylic 9	Wood 9
Acrylic 10	Wood 10	Acrylic 11	Wood 11	Acrylic 12	Wood 12
Acrylic 13	Wood 13	Acrylic 14	Wood 14	Acrylic 15	Wood 15
Acrylic 16	Wood 16	Acrylic 17	Wood 17	Acrylic 18	Wood 18
Acrylic 19	Wood 19	Acrylic 20	Wood 20	Acrylic 21	Wood 21
Acrylic 22	Wood 22	Acrylic 23	Wood 23	Acrylic 24	Wood 24
Acrylic 25	Wood 25	Acrylic 26	Wood 26	Acrylic 27	Wood 27
Acrylic 28	Wood 28	Acrylic 29	Wood 29	Acrylic 30	Wood 30
Acrylic 31	Wood 31	Acrylic 32	Wood 32	Acrylic 33	Wood 33
Acrylic 34	Wood 34	Acrylic 35	Wood 35	Acrylic 36	Wood 36
Acrylic 37	Wood 37	Acrylic 38	Wood 38	Acrylic 39	Wood 39
Acrylic 40	Wood 40	Acrylic 41	Wood 41	Acrylic 42	Wood 42
Acrylic 43	Wood 43	Acrylic 44	Wood 44	Acrylic 45	Wood 45
Acrylic 46	Wood 46	Acrylic 47	Wood 47	Acrylic 48	Wood 48
Acrylic 49	Wood 49	Acrylic 50	Wood 50	Acrylic 51	Wood 51
Acrylic 52	Wood 52	Acrylic 53	Wood 53	Acrylic 54	Wood 54
Acrylic 55	Wood 55	Acrylic 56	Wood 56	Acrylic 57	Wood 57
Acrylic 58	Wood 58	Acrylic 59	Wood 59	Acrylic 60	Wood 60
Acrylic 61	Wood 61	Acrylic 62	Wood 62	Acrylic 63	Wood 63
Acrylic 64	Wood 64	Acrylic 65	Wood 65	Acrylic 66	Wood 66
Acrylic 67	Wood 67	Acrylic 68	Wood 68	Acrylic 69	Wood 69
Acrylic 70	Wood 70	Acrylic 71	Wood 71	Acrylic 72	Wood 72
Acrylic 73	Wood 73	Acrylic 74	Wood 74	Acrylic 75	Wood 75
Acrylic 76	Wood 76	Acrylic 77	Wood 77	Acrylic 78	Wood 78
Acrylic 79	Wood 79	Acrylic 80	Wood 80	Acrylic 81	Wood 81
Acrylic 82	Wood 82	Acrylic 83	Wood 83	Acrylic 84	Wood 84
Acrylic 85	Wood 85	Acrylic 86	Wood 86	Acrylic 87	Wood 87
Acrylic 88	Wood 88	Acrylic 89	Wood 89	Acrylic 90	Wood 90
Acrylic 91	Wood 91	Acrylic 92	Wood 92	Acrylic 93	Wood 93
Acrylic 94	Wood 94	Acrylic 95	Wood 95	Acrylic 96	Wood 96
Acrylic 97	Wood 97	Acrylic 98	Wood 98	Acrylic 99	Wood 99
Acrylic 100	Wood 100	Acrylic 101	Wood 101	Acrylic 102	Wood 102

APPENDIX

Table II: [Faint title]

Acrylic 1	Wood 1	Acrylic 2	Wood 2	Acrylic 3	Wood 3
Acrylic 4	Wood 4	Acrylic 5	Wood 5	Acrylic 6	Wood 6
Acrylic 7	Wood 7	Acrylic 8	Wood 8	Acrylic 9	Wood 9
Acrylic 10	Wood 10	Acrylic 11	Wood 11	Acrylic 12	Wood 12
Acrylic 13	Wood 13	Acrylic 14	Wood 14	Acrylic 15	Wood 15
Acrylic 16	Wood 16	Acrylic 17	Wood 17	Acrylic 18	Wood 18
Acrylic 19	Wood 19	Acrylic 20	Wood 20	Acrylic 21	Wood 21
Acrylic 22	Wood 22	Acrylic 23	Wood 23	Acrylic 24	Wood 24
Acrylic 25	Wood 25	Acrylic 26	Wood 26	Acrylic 27	Wood 27
Acrylic 28	Wood 28	Acrylic 29	Wood 29	Acrylic 30	Wood 30
Acrylic 31	Wood 31	Acrylic 32	Wood 32	Acrylic 33	Wood 33
Acrylic 34	Wood 34	Acrylic 35	Wood 35	Acrylic 36	Wood 36
Acrylic 37	Wood 37	Acrylic 38	Wood 38	Acrylic 39	Wood 39
Acrylic 40	Wood 40	Acrylic 41	Wood 41	Acrylic 42	Wood 42
Acrylic 43	Wood 43	Acrylic 44	Wood 44	Acrylic 45	Wood 45
Acrylic 46	Wood 46	Acrylic 47	Wood 47	Acrylic 48	Wood 48
Acrylic 49	Wood 49	Acrylic 50	Wood 50	Acrylic 51	Wood 51
Acrylic 52	Wood 52	Acrylic 53	Wood 53	Acrylic 54	Wood 54
Acrylic 55	Wood 55	Acrylic 56	Wood 56	Acrylic 57	Wood 57
Acrylic 58	Wood 58	Acrylic 59	Wood 59	Acrylic 60	Wood 60
Acrylic 61	Wood 61	Acrylic 62	Wood 62	Acrylic 63	Wood 63
Acrylic 64	Wood 64	Acrylic 65	Wood 65	Acrylic 66	Wood 66
Acrylic 67	Wood 67	Acrylic 68	Wood 68	Acrylic 69	Wood 69
Acrylic 70	Wood 70	Acrylic 71	Wood 71	Acrylic 72	Wood 72
Acrylic 73	Wood 73	Acrylic 74	Wood 74	Acrylic 75	Wood 75
Acrylic 76	Wood 76	Acrylic 77	Wood 77	Acrylic 78	Wood 78
Acrylic 79	Wood 79	Acrylic 80	Wood 80	Acrylic 81	Wood 81
Acrylic 82	Wood 82	Acrylic 83	Wood 83	Acrylic 84	Wood 84
Acrylic 85	Wood 85	Acrylic 86	Wood 86	Acrylic 87	Wood 87
Acrylic 88	Wood 88	Acrylic 89	Wood 89	Acrylic 90	Wood 90
Acrylic 91	Wood 91	Acrylic 92	Wood 92	Acrylic 93	Wood 93
Acrylic 94	Wood 94	Acrylic 95	Wood 95	Acrylic 96	Wood 96
Acrylic 97	Wood 97	Acrylic 98	Wood 98	Acrylic 99	Wood 99
Acrylic 100	Wood 100	Acrylic 101	Wood 101	Acrylic 102	Wood 102

Handwritten text at the bottom of the page, possibly a note or signature.

APPENDIX A

RANDOM DISTRIBUTION OF CARPET SAMPLES AND CLEANERS

Test Carpet I; Cleaner A			Test Carpet II; Cleaner E			Test Carpet III; Cleaner F		
Acrylic 1f ₂	Wool 2f ₁	Nylon 3a ₁	Wool 2c ₂	Wool 1e ₁	Acrylic 2e ₁	Nylon 1b ₂	Acrylic 3d ₁	Nylon 3f ₁
Wool 1f ₁	Wool 3f ₁	Nylon 2a ₁	Nylon 2b ₂	Nylon 2b ₁	Acrylic 3f ₁	Wool 3d ₁	Acrylic 1d ₁	Nylon 2d ₂
Wool 1f ₂	Acrylic 2a ₁	Wool 3f ₂	Nylon 3e ₁	Wool 3e ₁	Acrylic 3f ₂	Nylon 3f ₂	Acrylic 3d ₂	Nylon 2d ₁
Acrylic 3b ₁	Nylon 1a ₁	Nylon 2a ₂	Nylon 1d ₁	Acrylic 2e ₂	Acrylic 1c ₂	Wool 1b ₂	Acrylic 2c ₂	Wool 2d ₂
Acrylic 2a ₂	Wool 2f ₂	Acrylic 3b ₂	Nylon 1d ₂	Wool 1e ₂	Wool 3e ₂	Wool 1b ₁	Acrylic 1d ₂	Acrylic 2c ₁
Acrylic 1f ₁	Nylon 3a ₂	Nylon 1a ₂	Acrylic 1c ₁	Nylon 3e ₂	Wool 2c ₁	Nylon 1b ₁	Wool 3d ₂	Wool 2d ₁
Test Carpet IV; Cleaner D			Test Carpet V; Cleaner B			Test Carpet VI; Cleaner C		
Wool 2b ₁	Wool 1c ₁	Acrylic 1e ₁	Wool 1d ₂	Acrylic 1b ₁	Nylon 1f ₁	Acrylic 3e ₁	Wool 1a ₁	Acrylic 2f ₁
Wool 2b ₂	Acrylic 3a ₁	Nylon 1e ₂	Nylon 2e ₁	Wool 2a ₁	Acrylic 1b ₂	Wool 3a ₁	Nylon 1e ₂	Acrylic 1a ₁
Acrylic 2d ₁	Acrylic 1e ₂	Acrylic 3a ₂	Wool 1d ₁	Nylon 3b ₂	Acrylic 3c ₂	Nylon 2c ₁	Nylon 1c ₁	Wool 1a ₂
Acrylic 2d ₂	Wool 3b ₂	Nylon 1e ₁	Nylon 1f ₂	Nylon 3b ₁	Acrylic 3c ₁	Wool 3a ₂	Nylon 2c ₂	Acrylic 3e ₂
Nylon 2f ₁	Wool 1c ₂	Nylon 2f ₂	Acrylic 2b ₂	Wool 3c ₂	Wool 3c ₁	Nylon 3c ₂	Acrylic 2f ₂	Wool 2e ₂
Nylon 3d ₁	Nylon 3d ₂	Wool 3b ₁	Acrylic 2b ₁	Wool 2a ₂	Nylon 2e ₂	Acrylic 1a ₂	Nylon 3c ₁	Wool 2e ₁

Example:

Key to Code

3-----Numbers 1, 2, and 3 - the three samples of each fiber type

b-----Letters a through f - the six samples of each fiber sample

1-----Sub numbers 1 and 2 - the two replicates of each sample in each group

APPENDIX B

Analysis of Acrylic Carpets

Variable	Pile Height			Treatment	
		df	SS	MS	F
Fabrics		2	0.31036	0.15518	2180.46**
Treatments		5	0.00105	0.00021	2.95
Shampoos vs. powder		1	0.00068	0.00068	9.62*
Among shampoos		2	0.00018	0.00009	1.30
Among powders		2	0.00018	0.00009	1.27
Fabrics x Treatments		10	0.00071	0.00007	1.26
Samples treated alike		18	0.00102	0.00006	
Total		35			

Analysis of Nylon Carpets

Variable	Color Reflectance				Treatment
		df	SS	MS	F
Fabrics		2	2197.2817	1098.6409	2040.37**
Treatments		5	30.9653	6.1931	11.50**
Shampoos vs. powder		1	5.9209	5.9209	11.00**
Among shampoos		2	1.3899	0.6949	1.29
Among powders		2	23.6544	11.8272	21.96**
Fabrics x Treatments		10	5.3845	0.5384	2.44
Samples treated alike		18	3.9802	0.2211	
Total		35			

Significance

	df	2-10	5-10	1-10
F	05 =	4.10	3.33	4.96
	01 =	7.56	5.61	10.04

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THE DEVELOPMENT AND USE OF A WEAR-TEST PROGRAM
TO EVALUATE THE CONSUMER SATISFACTION OF TWO MODELS
OF DUNGAREES FOR BOYS

by

Margaret Grace Holloway

A Thesis Submitted to
the Faculty of the Graduate School at
The University of North Carolina at Greensboro
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of the Requirements for the Degree
Master of Science in Home Economics

Greensboro

July, 1964

Approved by

Eunice M. Deemer
Eunice M. Deemer, Adviser

APPROVAL SHEET

This thesis has been approved by the following committee of the
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HOLLOWAY, MARGARET GRACE. The Development and Use of a Wear-Test Program to Evaluate the Consumer Satisfaction of Two Models of Dungarees for Boys. (1964) Directed by: Miss Eunice M. Deemer. pp. 79.

This study was planned for the purpose of developing a wear-test program for a selected apparel item that would indicate to the manufacturer consumer satisfactions of the product in use. Two models of dungarees for boys were selected for the wear-test study. One model was the standard-cut dungarees produced by the cooperating manufacturer. The second model was a prototype specially manufactured for this study.

An interview technique was developed to measure responses pertaining to the expectations and satisfactions of the test garments. This was used in the actual wear-testing of the test garments so that they would be subjected to usual wear and care. Fifty-one boys in the size range of 4 to 16 regular were selected to wear the dungarees during a six-week period.

Schedule forms were developed and used for obtaining specific information in two interviews with the mothers of the boys in the sample. Schedule forms for use with an interview held prior to the wear period were designed to obtain from the respondents the expectations of the test dungarees, and the importance of factors considered in selecting and purchasing dungarees. Schedule forms for use with an interview held at the close of the wear period were designed to obtain from the respondents the degree of satisfaction of each model of dungarees in use, and the preferences for specific features and general characteristics of each model.

Most respondents were satisfied with both models, but in regard to

over-all satisfaction, the standard-cut model was preferred. After analyzing the results of this study, a new model incorporating the preferred features of the prototype and the preferred features of the standard-cut model was recommended.

The author wishes to express her sincere appreciation to Miss Evelyn Smith and Dr. Nadine Koenig, directors of this studio, for their helpful understanding, and most available guidance.

Appreciation is also extended to Mrs. Deborah Day and Miss Jennifer Moore, members of the studio committee, for their interest and helpful suggestions; to Mrs. Edna Kelly for her advice and assistance; to Mr. Fred Burdick, Director of Research and Development, and Mr. William Lottick, Director of Quality Control, of East Hill, Inc., for their interest in the study and for supplying the diamonds used in the study.

The author would like to thank Mr. J. S. Blackwell, principal of Highland School, for his cooperation; the respondents who supplied the data for the study; and their wives who participated in the study.

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The author would like to thank Mr. J. R. Blackwell, principal of Sedgefield School, for his cooperation; the respondents who supplied the data for the study; and their sons who participated in the wear-testing.

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CHAPTER I

INTRODUCTION

Students of clothing and textiles, as well as consumers and manufacturers, have been interested in studies dealing with satisfactions and dissatisfactions of ready-to-wear merchandise. The majority of such studies have been based on laboratory-wear procedures with minor emphasis on consumer reaction to garments given usual wear and care. Little consumer-use research has been reported giving major emphasis to:

1. Garment characteristics and factors considered most important by the consumer in the selection of a given garment.
2. Expectations of that item at the time of purchase.
3. Degree of satisfaction with the garment in usual use and care.

The complexities of the current market and the rapidity of technological developments in the clothing and textile industries bring to the consumer an increasing array of clothing and textile products. As more ready-to-wear merchandise is being purchased by the family unit than in any previous era, it becomes more important for manufacturers to meet the changing demands of consumers. It would be helpful to the producers to know consumers' preferences, their expectations of garments, and their major concerns in selecting wearing apparel. There appears to be a dearth of consumer-use research which deals with the primary concerns of consumers in the selection of clothing, in granting

consumers the opportunity to voice their reactions to garment features, and, if desired, to suggest improvements to the manufacturer of the garments.

I. PURPOSE OF THE STUDY

Because of the lack of direct communication between consumers and producers, the purpose of this study was to develop a wear-test program for a selected apparel item that would indicate to the manufacturer consumers' satisfactions of the product in use.

The specific objectives of this study were:

1. To develop a wear-test program that would include:
 - a. Consumers' expectations, satisfactions and dissatisfactions of two models of boys' dungarees.
 - b. Consumers' preferences for specific features and general characteristics of the dungarees.
 - c. Factors of importance in the selection of boys' dungarees.
2. To suggest recommendations for improvement of the products used in this wear-test.
3. To suggest recommendations for future wear-test programs.

The design of this study was planned with the full cooperation of the manufacturer who supplied the dungarees distributed to the subjects for the wear-test. Permission was received from the subjects in the sample to relay to the manufacturer answers given on the questionnaires and to probe questions asked during the interviews.

It is assumed that considerable confidence can be placed in the answers

of the respondents, since they would have no special reasons for favoring either model of dungarees. The subjects would not own the dungarees nor would they have a choice in their selection. These factors might permit a more realistic comparison of the two models.

II. DEFINITIONS OF TERMS USED

Components of satisfaction are the individual constituents or elements which contribute to the satisfaction of the wearer. Components include: fabric, appearance, ease-of-care, quality of construction, comfort, fit, style and cut, durability, ease of putting on and taking off, and color.

Consumer's deficit is the degree of satisfaction that is less than the satisfaction the consumer expected when she bought the item.

Consumer's surplus is the degree of satisfaction exceeding the satisfaction the consumer expected when she bought the item.

Expectation is the consumer's anticipation of satisfaction with the serviceability of the garment during wear.

Over-all satisfaction is the expressed feeling that the garment as a whole fulfills the requirements, expectations, and desirable conditions of serviceability for the wearer.

Preference is a stated high position of rank indicating favor or liking.

Usual wear is the customary and habitual wear that the subjects give dungarees.

Wear-test is a test based on the subjection of the selected garments to

usual wear for a limited period, by subjects who ordinarily use that type of garment as a basic part of their wardrobe.

REVIEW OF LITERATURE

A review of wear-test programs has been made to survey the methods, procedures, and findings of such studies. Only the findings that would be useful in developing this particular study are included. The majority of the studies reviewed were carried out under the supervision of research personnel at various land-grant colleges, Agricultural Experiment Stations, and the U. S. Army Quartermaster Corps. The studies selected to be reviewed in this chapter are representative of the wear-test research programs of these agencies. A review of a previous study using hand simulators is also included.

RESEARCH STUDIES AT COLLEGES AND UNIVERSITIES

A Wear-Test of Men's Work Trousers

The purpose of this study was to evaluate the durability and comfortability of six different fabrics and to obtain information about farmers' needs and desires for their work trousers. Thirty farmers were given three pairs of trousers made of different fabrics. A detailed schedule for use of the trousers

Willy Egan Jones, "Evaluating Performance of Work Trousers," *Comprehensive Textile Research*, West Coast College, April, 1953, pp. 1-25.

CHAPTER II

REVIEW OF LITERATURE

A review of wear-test programs has been made to survey the methodology, procedures, and findings of such studies. Only the findings that could be used in developing this particular study are included. The majority of the studies reviewed were carried out under the supervision of research personnel of colleges and universities, Agricultural Experiment Stations, and the U. S. Army Quartermaster Corps. The studies selected to be reviewed in this chapter are representative of the wear-test research programs of these agencies. A review of a preference study using boys' dungarees is also included.

I. RESEARCH STUDIES AT COLLEGES AND UNIVERSITIES

A Wear-Test of Men's Work Trousers¹

The purpose of this study was to evaluate the durability and desirability of six different fabrics and to obtain information about farmers' needs and desires for their work clothes. Sixty farmers were given three pairs of trousers made of different fabrics. A rotation schedule for use of the trousers

¹Mary Olga Olson, "Evaluating Performance of Work Trousers" (unpublished Master's thesis, Iowa State College, Ames, Iowa, 1959), pp. 1-54.

was planned so that each pair would be worn for three or four days and then laundered with commercial soaps or detergents in conventional washing machines.

Data for this study were collected from judging sessions, daily reports of length of wear and the laundering procedures, questionnaires, and laboratory tests of fabric strength. A panel of eight homemakers judged and rated the trousers on appearance, color change, and evidences of wear at the end of 27 weeks. Evaluation of consumer acceptance of the trousers after wear was based on the opinions of the wearers in regard to the test garments, fabrics, and desirable characteristics of work trousers. The persons responsible for the laundering of the trousers answered questions concerning care of such garments.

Recommendations for an improved procedure included the following: more limitation on variables by using trousers of the same color and construction details, a wear period that incorporates the four seasons, fewer participants, interview-questionnaires rather than mailed questionnaires, and trained judges.²

A Study of the Performance of Selected Wash and Wear Suits for Men³

The purpose of this study "was to determine what the consumer could expect in the performance of wash and wear suits, and what problems might be

²Ibid., pp. 53-54.

³T. Faye Mitchell, June C. Wilbur, and Eleanor Young, A Study of the Performance of Selected Wash and Wear Suits for Men, Research Publication No. 20 (College Park, Maryland: College of Home Economics, University of Maryland, June, 1961), pp. 1-45.

encountered in home laundering and commercial wetcleaning and drycleaning."⁴

Thirty-six suits and 12 pairs of slacks constructed from 12 variations of wash and wear fabrics were worn by businessmen from occupations in which it was believed that personal appearance was important. A two-week wear period consisted of five wearings of eight hours each. At the end of each wear period, the garments were laundered in the laboratory. One set of garments was drycleaned; one set was wetcleaned; one set was laundered in accordance with the manufacturers' recommended home laundering procedures. One garment of each of the 12 fabric types was kept as a control. After the fifth and fifteenth launderings, a panel of ten men and ten women, half of whom were trained in textile evaluation and half of whom were average consumers, evaluated and rated the over-all appearance and construction features of the garments. Two other methods of evaluation included wearers' opinions of the performance, comfort, wrinkling, and soiling of the garments, and laboratory testing. With four exceptions, the garments, regardless of method of laundering, were still acceptable for business wear at the close of the thirty-week wear period.

⁴Ibid., p. ix. ⁵Ibid., p. 45.

A Serviceability Study Comparing an All-Cotton Chambray with a Chambray of Cotton Warp and Viscose Rayon Filling⁶

The general objectives of this study were: to compare the serviceability of the two chambrays by employing laboratory and wear tests, to study effects of wear upon different seam finishes used on the two fabrics, and "to estimate the reliability of laboratory tests in predicting wear and serviceability."⁷

Six blouses of each chambray were worn and laundered by students at the University of Alabama. To obtain uniform laundering results, the students laundered the blouses after each wearing according to a given procedure similar to Test No. 1 of home laundering procedures established by the American Society for Testing Materials.⁸ After five months of wear and at the end of the seven-month wear period, the blouses were returned to the laboratory for physical testing. It was concluded that laboratory tests alone are an inadequate evaluation of the serviceability of apparel. Such tests are a valuable means for evaluating fabric, but a serviceability test

. . . not only includes all of the factors relating to the serviceability and satisfaction to be derived from a fabric, but also provides opportunity to study garment design and construction techniques. It is the combination of these factors which render consumer satisfaction.⁹

⁶Pauline E. Keeney, Ann Watson, and Henrietta M. Thompson, A Serviceability Study Comparing an All-Cotton Chambray with a Chambray of Cotton Warp and Viscose Rayon Filling, Bulletin No. 11 (University, Alabama: School of Home Economics, June, 1947), pp. 1-26.

⁷Ibid., p. 1. ⁸Ibid., p. 11. ⁹Ibid., p. 25.

A Study of Consumer Satisfaction with Children's Clothing¹⁰

The purpose of this study was to investigate the relative merits of fabrics made of various textile fibers. Principal interest centered upon the N and S or the contrast between garments made of natural and man-made fibers.¹¹

Thirty-three boys and 33 girls of the ages five, eight, and ten years were divided into six age-sex strata. Each child was given a variety of garments to be worn during a six-month period. Some garments were home-laundered and others were laundered under controlled laboratory conditions. After the second, fourth, and sixth months of wear, seven "consumer judges" who were homemakers with degrees in home economics, rated individual garments in response to the question, "Is this garment in suitable condition for my child to wear to school today?"¹² A five-point rating scale composed of the following degrees of satisfaction was used: (1) entirely satisfactory, (2) satisfactory, (3) fairly satisfactory, (4) hardly satisfactory, and (5) not satisfactory.¹³

¹⁰Emil Jebe, Elizabeth Beveridge, Glen R. Hawkes, Fannie Potgieter, and Opal Roberson, "How to Study Consumer Satisfaction with Children's Clothing Made of Different Textile Fibers," Journal of Home Economics, L (March, 1958), 213-218.

¹¹Ibid., p. 214. ¹²Ibid., p. 213. ¹³Ibid., p. 217.

II. RESEARCH STUDIES AT AGRICULTURAL EXPERIMENT STATIONS

A Wear-Test of Men's White Cotton Broadcloth Shirts¹⁴

The purpose of this research project was to study "the effect of varietal, regional, seasonal differences and method of harvesting [of cotton] on the wearing quality of shirts."¹⁵ Fifty-three men of varying ages, height, weight, and occupations were each given seven shirts made from seven different broadcloths. The seven shirts were to be worn in consecutive order and given the same treatment that the wearer would give other shirts of similar quality. Each wearer recorded his schedule for wearing the shirts, visible signs of wear, changes in shirts following laundering, and his opinion of how the shirts compared with each other and with similar shirts that he owned. Thirty-four sets of the shirts were commercially laundered and 19 sets were laundered by household methods, but all shirts in any one set were laundered by the same method. Shirts were returned upon request by the investigator or when the wearer felt they were "worn out". At the end of the wear period, appearance, change in breaking strength, and cellulose degradation were evaluated in the laboratory. Wearers' opinions were compared to laboratory tests.¹⁶

¹⁴Serviceability of Shirts Made from Cotton of Two Varieties, Regions and Seasons of Growth, Bulletin No. 804 ([College Station], Texas: Texas Agricultural Experiment Station, April, 1955), pp. 1-15.

¹⁵Ibid., p. 1. ¹⁶Ibid., pp. 1-8.

A Wear-Test of White Cotton Broadcloth Sports Shirts with Home-Applied Cotton Fabric Finishes¹⁷

During three summers, 20 sets of shirts (a set consisted of five shirts each) were worn in a rotation plan by 15 subjects. Four shirts of each set were treated with four different finishes and one shirt was untreated. Uniform laundering in an agitator type automatic washer and applications of the finishes were done in the laboratory. Prior to wear and at regular intervals, each wearer was asked to record his opinion of the appearance, comfort, and wrinkling of each of his five shirts, and the over-all preference for a finish. In addition, physical and chemical tests were performed in an effort to analyze the effect of each applied finish on color, strength, degradation of cellulose, and visible wear. After every fifth laundering, similar tests were performed on fabric swatches treated with the same finishes. After 30 periods of wear and laundering, two trained examiners ranked each set of five shirts in the order of wear.

¹⁷Effectiveness and Serviceability of Four Home-Applied Cotton Fabric Finishes, Bulletin No. 853 ([College Station], Texas: Texas Agricultural Experiment Station, March, 1957), pp. 1-8.

A Serviceability Study of Boys' Shirts and Jeans¹⁸

The purpose of this study was to investigate the performance of fabrics and garments in use. Various types of shirts and two weights of cotton denim, western-cut blue jeans of size 12 were worn to school by nine and ten-year old boys. One set of garments was laundered in the individual homes, following the usual procedure; one set was rotated among the wearers and laundered under controlled conditions in the laboratory after each day of wear; one set was not worn, but was laundered in the laboratory. Periodically, after wear and launderings, garments were analyzed in the laboratory for thread count, thickness, fluidity, strength, elongation, color change, abrasion resistance, and dimensional change. The properties of fabrics of unworn, unlaundered garments were also analyzed.

A Preference Study of Boys' Shirts, Jeans, and Slacks¹⁹

Four states in the north central region cooperated in a study to determine (1) mothers' preferences, as well as purchase, use, and care practices for pants and shirts for nine and ten year old boys; and (2) existing relationships between these preferences and buying practices and certain family background characteristics.²⁰

Three hundred ninety-six mothers from the four states were

¹⁸Serviceability of Boys' Shirts and Jeans, North Central Regional Publication No. 103 (Madison, Wisconsin: [n.n.], August, 1959), pp. 1-40.

¹⁹Mothers' Preferences and Buying Practices for Boys' Shirts, Jeans and Slacks, North Central Regional Publication 116 (Wooster, Ohio: Ohio Agricultural Experiment Station, January, 1961), pp. 1-36.

²⁰Ibid., p. 33.

interviewed. Each mother examined and chose the garment she preferred from a pre-selected group of boys' jeans, slacks, and shirts representative of the market offerings. The sample of jeans consisted of three western-cut and three standard-cut garments. Two different weights of denim and three different colors were included.

. . . . Findings for the five types of boys wear (jeans, slacks, white T-shirts, colored knit shirts and woven shirts) were analyzed by four background factors (occupation of father, family income, family size, and employment status of mother).²¹

It was found in this study that almost 100 per cent of the boys wore jeans for school and "work." The style, fabric, and color were the main influences on the mothers' selection of some jeans and rejection of others included in the study.²²

A Study of Consumer Satisfaction with Women's Blouses²³

The four objectives of this field and laboratory-wear study conducted by Agricultural Experiment Stations in New York, Pennsylvania, Rhode Island, West Virginia, and New Hampshire were:

²¹Ibid., p. 33. ²²Ibid., p. 35.

²³Consumer Satisfaction with Women's Blouses, Part I: Field Study in Four Communities in the Northeast, Northeast Regional Bulletin No. 34 (Kingston, Rhode Island: University of Rhode Island Agricultural Experiment Station, June, 1959), pp. 1-97; and Consumer Satisfaction with Women's Blouses, Part II: Laboratory-Wear Studies, Northeast Regional Bulletin No. 35 (Kingston, Rhode Island: University of Rhode Island Agricultural Experiment Station, June, 1958), pp. 1-61.

. . . to determine buying practices in the selection of blouses; to devise methods of determining satisfactions with the blouses at stated intervals during period of use; to analyze characteristics of fabric and construction of selected blouses that were similar to those purchased by customers; and to determine any relationship of buying practices, fabric, and blouse characteristics to satisfactions with the blouse.²⁴

The following methods for obtaining data were included in the field study: interviews with store executives, observance of consumer behavior at point of sale, and interviews with customers. Information pertaining to merchandising practices was obtained during the interviews with executives of various stores. Shopping practices of customers and descriptive data of blouses selected were ascertained by trained people who observed customers purchasing blouses in selected stores. Data on the consumers' buying practices, and on the use, care and satisfaction of the blouses were obtained during the two interviews with the observed purchasers. Approximately a ten-week period elapsed between the first and second interviews.

During the first interview, two methods were used to determine consumers' satisfactions. One was a five-point rating scale on a continuum from extreme satisfaction to dissatisfaction. A ranking method by which a consumer compared the satisfaction of "her new blouse with her other blouses of the same type" was also used. In the second interview, each woman ranked her new blouse "in relation to all others she owned."²⁵ However, because of small numbers of blouses, the ranking method seemed to be an inadequate measure of

²⁴Consumer Satisfaction with Women's Blouses, Part I, op. cit., p. 11.

²⁵Ibid., p. 75.

consumer satisfaction.

The following classifiers were used for cross analyzing the data:

Satisfaction Score
 Socio-Economic Score
 Age of Interviewee
 Information about the blouses--fiber, fabric, color, type, and price
 Information about the store--type of store and highest price of blouses
 sold in store
 Information about shopping practices--whether blouse was tried on,
 whether interviewee shopped with companion, whether interviewee
 mentioned anything about appearance or performance of blouse, or
 both.²⁶

After eliminating data obtained from price questions and the ranking
 method, the measures used for giving individual scores for satisfaction in-
 cluded:

. . . rating on general satisfaction, mean of ratings on specific
 components, and a weighted average of ratings on specific com-
 ponents²⁷

No one measure appeared to be superior, but the simplest score, rating on
 general satisfaction, was selected as the best measure of over-all satisfaction
 for use in the analysis of the results. This field study appeared to indicate
 that

. . . in making a rating of general satisfaction, the respondent, in
 some way, took count of all components which were important to her and
 weighted them in respect to that importance. Thus, the respondent for
 whom appearance was very important would see the beautiful blouse as
 generally more satisfactory, while the respondent whose time was limited
 would rate as generally satisfactory the blouses which required little
 time for care.²⁸

.....

²⁶Ibid., pp. 23-24.

²⁷Ibid., p. 85.

²⁸Ibid., p. 86.

When each respondent's rating of her blouse as to specific components of satisfaction was compared to her rating on its general satisfactory nature, the order of importance of the components was found to be: (1) comfort, (2) becomingness, (3) ease of care, (4) fit, (5) appearance, (6) compliments about the blouse, (7) looks well with other garments, and (8) suitability for variety of occasions. . . .²⁹

The main objective of the laboratory-wear phase was:

. . . to determine what, if any, leads could be obtained as to the cause of consumer satisfaction or dissatisfaction with garments, through the use of physical and chemical tests.³⁰

White blouses of varying styles, fiber content, and prices were subjected to use and laundering under controlled and non-controlled methods, after which chemical and physical tests were applied. At the end of the one-year wear period, the wearers' opinions were obtained on interview schedules similar to those applied in the field study. It was concluded that:

Although the measurement of physical and chemical change in fabrics by means of laboratory test methods is of value in assessing the degree to which certain desirable properties are retained or lost in use, these data alone are not sufficient for evaluating satisfaction or dissatisfaction with garments. Aesthetic qualities, comfort, suitability to a specific wardrobe, and the many other factors that may affect a consumer's feeling about a garment are probably equally, perhaps more, important. These must be obtained from the consumer himself. . . .³¹

²⁹Ibid., p. 8.

³⁰Consumer Satisfaction with Women's Blouses, Part II, op. cit., p. 5.

³¹Ibid., p. 45.

A Study of Consumer Satisfaction with Men's Shirts and with Women's Slips and Casual Street Dresses³²

This study was planned to determine levels and components of satisfaction with men's shirts and with women's slips and casual street dresses, and relationships between satisfaction with them and characteristics of the garments, practices in their selection, use, and care, and various socio-psychological characteristics of the consumer.³³

Subjects were selected from four geographic areas of the Northeast Region. Each group of subjects for each type of garment was interviewed for attitudes toward favorite, least-liked, and comparative reference garments. In addition to answering open-end questions pertaining to an interviewee's values related to clothing, buying habits, price, and use and care of garments, each subject adjusted a mechanical "thermometer-type instrument" to the degree of satisfaction that he or she rated the components and the general satisfaction of the garments. Components of satisfaction that were rated included: comfort, appearance, fit, becomingness, ease-of-care, and durability.

Three basic measures of satisfaction were used in the study: (1) comparison of the favorite garment with the least-liked garment and of both with the reference garment, (2) ratings on general satisfaction and the components of satisfaction, including a comparison of the ratings on each of the components with the rating on general satisfaction, and (3) individual difference scores obtained by subtracting the ratings of the least-liked and reference garments from the rating of the favorite and the rating of the favorite from the least-liked garment.³⁴

³²Consumer Satisfaction with Men's Shirts and with Women's Slips and Casual Street Dresses, Part I: Field Studies in Four Communities in the Northeast, Northeastern Regional Research Publication No. 984 (Ithaca, New York: New York State College of Home Economics at Cornell University, May 15, 1963), pp. 1-71.

³³Ibid., p. 4. ³⁴Ibid.

.....

Minimum levels for each of the components of satisfaction were established for general satisfaction with the garments studied. For general satisfaction a higher level was required for the components comfort, fit, and appearance than for durability or ease-of-care.³⁵

.....

From the data in this study, price appears to have relatively little relationship to levels of satisfaction with a garment. . . .

No significant relationships were found between the practices in selection and in care of garments that were investigated and any of the components of satisfaction.³⁶

The wear-laboratory phase included men's shirts and women's slips, but specific findings were not available when the present study was undertaken. However, it was indicated in the summary of the field study that responses from both phases were very similar with no tendency toward significant difference in 84 per cent of the comparisons made.³⁷

III. WEAR-TEST PROGRAM OF THE U. S. ARMY QUARTERMASTER CORPS

The Quartermaster Research and Engineering Field Evaluation Agency is responsible for the accelerated field testing of military clothing prior to its issuance as a standard item of apparel. Field evaluations include "surveys,

³⁵Ibid. ³⁶Ibid., p. 5. ³⁷Ibid., p. 58.

engineering and user tests."³⁸ "Accelerated testing seeks to compress an anticipated service life-time of an item or material into a shorter testing period."³⁹ In established wear-test obstacle courses, military garments are subjected to conditions which are as severe as or more severe than stresses in usual service. Following the wear period, a trained "observer-recorder" examines the apparel for any apparent damages.

. . . abrasion resistance, snag resistance, human wear pattern, and water repellency are evaluated simultaneously. . . . Further, accelerated wear testing takes into consideration effects of laundering on the item, and also, human wear pattern effects on the item--the latter yielding data on clothing utility and design not obtainable by machines in the laboratory.⁴⁰

³⁸Quartermaster Research and Engineering Field Evaluation Agency (Fort Lee, Virginia: U. S. Army Quartermaster Research and Engineering Command, January, 1959), p. 9.

³⁹Accelerated Testing (Fort Lee, Virginia: U. S. Army Quartermaster Research and Engineering Field Evaluation Agency, 1962), p. 5.

⁴⁰Ibid., p. 6.

CHAPTER III

DEVELOPMENT OF THE WEAR-TEST PROGRAM

A wear-test program, using two models of boys' dungarees, was developed as a means for conducting and testing a consumer-use research study. This study which was planned to determine the consumer acceptance of the two models of garments required the development of specific procedures. The first procedure was the development of an interview technique with accompanying schedules to obtain the responses pertaining to the expectations and satisfactions of the test garments. The second procedure was concerned with the use of the schedules developed and the actual wear-testing of the garments.

I. GARMENTS USED IN THE STUDY

The models of dungarees used in the wear-test study were supplied by a garment manufacturer located in Greensboro, North Carolina. Although other types of wearing apparel are produced by this firm, dungarees constitute the major item of output.

One model to be worn by the subjects was the standard-cut dungarees produced and offered on the current market by the cooperating manufacturer. The second model was a prototype especially manufactured for this study. Incorporated in the prototype were changes which the manufacturer believed to be

improvements that might result in increased consumer satisfaction and sales appeal.

Differences between the models of dungarees selected for the wear-test study are presented in Table I. Essentially, the parts of the prototype differing from the standard-cut model were: zipper length, zipper weight, tab fastener on zipper, fly closing finish, seam finish, thread, and pockets.

The standard-cut dungarees were labeled Model A and the prototype labeled Model B for ease of identification. Each pair was labeled on a front side pocket and on the fly facing. Different sizes of dungarees were used for the study, based on the percentage of dungarees the manufacturer sells in the respective sizes. One pair of each of the two models was issued to each of the subjects selected for the wear-test study.

The garments were distributed to boys who wore dungarees of even sizes in the range of 4 to 16 regular, inclusive. A six-week period and the following instructions were established:

1. The two models should be worn on alternate days.
2. Each pair should be worn a minimum of three days per week.
3. The dungarees should be given the usual wear.
4. The usual laundering procedures should be followed.
5. The record of wear and laundering should be completed daily, stating the number of hours either model was worn and the days on which each model was laundered.

TABLE I
COMPARISON OF THE TWO MODELS OF DUNGAREES

Garment feature	Model A (Standard-cut)	Model B (Prototype)
Fabric	14 ounce cotton denim	14 ounce cotton denim
Zipper Length	Standard length, varying with size of garment	One inch shorter than standard length
Weight	#5 gripper zipper with 100% cotton tape	Lighter weight--#42 brass zipper with nylon-filled cotton tape
Tab fastener	Double camlock slider	Memory-lock slider
Garment construction Seam finish	Felled inseam and outseam (Term used by manufacturer for a turned and double-stitched seam stitched on the outside)	Open inseam and outseam (Term used by manufacturer for a single-stitched plain seam pressed open)
Thread used in critical seams	Soft cotton	Dual duty nylon core
Cutting of garment Pockets Front side	Standard cut, varying with size of garment	One inch shorter than standard cut
Watch	Standard watch pocket	No watch pocket
Fly facing	Cut-on fly	Cut-off fly (applied fly facing)

II. SELECTION OF SUBJECTS

The boys selected for the wear-test were pupils from a rural elementary school in Guilford County, North Carolina. The administration was willing to cooperate according to the following criteria established for the study:

1. The administration approved of dungarees as an acceptable and usual garment for boys to wear to school.
2. The student body represented a cross section of socio-economic classes.
3. Boys represented the size range of 6 to 16, inclusive.

With permission of the principal, letters were distributed at the school and the boys were requested to give them to their mothers. A copy of the letter distributed is in Appendix A. The purpose of the study and a brief description of the procedure to be followed during the wear-test period were stated in the letters. Each mother interested in participating in the study was requested to complete and return the form attached to the letter. Information requested on this form included:

1. The name and age of the boy
2. The size of dungarees worn
3. The name and address of the mother
4. A convenient time for arranging an interview
5. Directions for finding the home

III. SCHEDULES AND INTERVIEW TECHNIQUE FOR COLLECTION OF DATA

A combination of interviews and schedule forms was prepared to obtain data before and after the wear period. Two interviews were scheduled with each of the respondents. The first interview took place prior to the wear period and the second interview took place at the close of the wear period.

Forms used during the interviews included:

Interview I

Schedule I

General Information Sheet

Schedules II and III

Expected Degree of Satisfaction of Dungarees Based on Previous Experience (a form for evaluating each model)

Schedule IV

Factors of Importance in the Selection and Purchase of Boys' Dungarees

Interview II

Schedule I

General Information Sheet

Schedules V and VI

Degree of Satisfaction of Dungarees Used in this Study (a form for evaluating each model)

Schedule VII

Preferences for Specific Features in the Dungarees

Schedule VIII

Preferences for Over-All and Specific Satisfactions of the Dungarees

In addition, Schedule IX, Record of Wear and Laundering, was prepared so that the respondents or wearers could record during the wear period: (1) the

dates and the number of hours each model of dungarees was worn, and (2) the dates on which each model was laundered.

General Information Sheet (Schedule I, Appendix B)

A form was developed for use in identifying the participating families. It was believed that the education and occupation of each of the parents would be helpful in determining if the sample consisted of a cross section of the population. Also included on this form were questions which dealt with the usual laundering procedures the mothers carried out in the care of dungarees.

Schedules for Determining the Expected Degree of Satisfaction of Dungarees

Based on Previous Experience (Schedules II and III, Appendix B)

A form listing over-all satisfaction and components of satisfaction was used to obtain from the respondents the expected satisfaction of each model of dungarees in regard to characteristics listed. The following items were included:

1. Fabric
2. Appearance
3. Ease-of-care
4. Quality of construction
5. Comfort
6. Fit
7. Style and cut
8. Durability
9. Ease of putting on and taking off
10. Color
11. Over-all satisfaction

A five-point rating scale was included on the schedule for evaluating each component of satisfaction and the over-all satisfaction. The continuum used and the

corresponding numerical values of the ratings were:

Degree of satisfaction	Numerical value (Degrees)
Extremely	5
More than average	4
Average	3
Less than average	2
Unsatisfactory	1

Schedule for Determining the Factors of Importance in the Selection and Purchase of Boys' Dungarees (Schedule IV, Appendix B)

This form was designed to obtain from each respondent the importance of factors considered in the selection and purchase of dungarees. The items listed were:

1. Color
2. Fabric weight
3. Feel of fabric
4. Expected durability
5. Style and cut
6. Sewing
7. Size
8. Fit
9. Brand
10. Price
11. Appearance
12. Information on label

A three-point rating scale used to describe the importance of each factor was included on the schedule. The degrees of importance were described as: great, average, and little.

Schedules for Determining Degree of Satisfaction of Dungarees Used in This Study (Schedules V and VI, Appendix B)

The same listing of items and the same rating scale were used on these schedule forms as were used on Schedules II and III. Schedules V and VI were devised to obtain from the respondents their rating of the degree of satisfaction of each model of dungarees subjected to wear in regard to the characteristics listed.

Schedule for Determining Preferences for Specific Features in the Dungarees (Schedule VII, Appendix B)

A schedule form listing the specific features that differed in the two models and to be checked by respondents indicating their preferences included:

1. Zipper length
2. Zipper weight
3. Tab fastener on zipper
4. Fly closing finish
5. Seam finish
6. Thread wear
7. Front pockets
8. Watch pocket

Answers given to the probe question in Interview I which asked, "What do you particularly like or dislike about these dungarees?" gave reason to include the following items on the check list:

1. Feel of fabric
2. Reinforced knee area
3. Rivets on the pockets

Schedule for Determining Preferences for Over-All and Specific Satisfactions of the Dungarees (Schedule VIII, Appendix B)

This form listed the same items that were included in Schedules II and III and was designed to obtain from the respondents preferences for one of the models in regard to each of the characteristics listed.

The Interview Technique

Approximately one week prior to the wear period, those selected to participate in the study were notified. A time was arranged for the delivery of the dungarees and the first interview. At the close of the six-week wear period, a time was arranged for the second interview.

Interview I. Two pairs of unlabeled dungarees, one a new pair that had not been used and a second pair that had not been used but had been laundered five times, were used as reference garments during this initial interview. These were aids employed in establishing a rapport and in helping the respondent to understand the type of information she would be asked to give when evaluating the test garments. "Probe" questions were asked to encourage the respondent to express freely her opinion of the reference garments. Examples of these questions were:

1. What do you particularly like or dislike about these dungarees?
2. Which fabric do you prefer?
3. What is most important to you when selecting dungarees?
4. What would you like to see improved in dungarees?
5. Is the brand important to you?

Two pairs of dungarees, the standard-cut model and the prototype, were given each respondent. She was asked to examine each model and then complete Schedules II, III, and IV. Information regarding the education and occupation of each parent was completed on Schedule I. Respondents were given Schedule IX, Record of Wear and Laundering (Appendix B), which would be collected at the time of Interview II.

Interview II. During the second interview, Schedule IX was collected and questions pertaining to laundering procedures on Schedule I were completed. The respondents were asked to complete Schedules V, VI, VII, and VIII pertaining to the satisfaction and preferences of the dungarees. The respondents were questioned as to their willingness to participate in continuing the wear-test of the same dungarees at another time.

IV. ANALYSIS OF DATA

Consumer Satisfaction

The degree of satisfaction based on a six-week period of wear and care was determined from the data on the five-point rating scale. The total frequency of each rating for the individual characteristics listed on the schedule form was tabulated and ranked in descending order of frequency. From this tabulation, two comparisons were made: (1) over-all satisfaction and components of satisfaction between the two models, and (2) individual components of satisfaction within each model.

The total frequency of the three highest ratings (extremely, more than

average, and average) was computed to determine those characteristics which appeared to give the greatest satisfaction. The total frequency of the two lowest ratings (less than average and unsatisfactory) was computed to determine the characteristics giving least satisfaction.

Computation of Consumer's Deficit and Consumer's Surplus

In this study, consumer's deficit is the degree of satisfaction that is less than the satisfaction the respondent expected when she received the test dungarees. Consumer's surplus is the degree of satisfaction exceeding the satisfaction the respondent expected when she received the test dungarees.

The measure of over-all satisfaction was used to determine the consumer's deficit and the consumer's surplus of each model of dungarees received by each respondent. In this study, expected over-all satisfaction refers to ratings given the dungarees prior to the wear-test period. Actual over-all satisfaction refers to ratings given the same dungarees at the close of the period.

The degrees of consumer's deficit and consumer's surplus were determined by finding the degree of difference between the expected over-all satisfaction and the actual over-all satisfaction. By this measure, when the expected satisfaction exceeded the actual satisfaction, a consumer's deficit was observed, indicating that the garment was less satisfactory than the respondent expected it to be. When the actual satisfaction was less than the expected satisfaction, a consumer's surplus was observed, indicating that the garment was more satisfactory than the respondent expected it to be.

The degree of consumer's deficit or consumer's surplus was greatest when the ratings of expected satisfaction and the actual satisfaction were checked at opposite ends of the continuum on the rating scale. When the ratings were less widely separated on the continuum, the deficit or surplus was of a lower degree. When there was no difference in the degree of expected and the degree of actual over-all satisfaction, it was indicated that the dungarees were as satisfactory as they were expected to be by the respondent, with no consumer's deficit and no consumer's surplus.

Consumer Preferences

The preference check lists were tabulated for the purpose of determining: (1) the preferred features of each model; and (2) the model preferred in respect to individual components of satisfaction and over-all satisfaction.

The data indicating each respondent's preferences of the individual factors included on the preference check lists were tabulated to determine the total frequencies. Such data were summarized to indicate the preferred features and characteristics of the two models.

Factors of Importance in the Selection of Dungarees for Boys

The total frequency of each rating given individual factors considered to be important in the selection and purchase of dungarees for boys was tabulated and summarized.

CHAPTER IV

SUBJECTS SELECTED AND WEAR-TEST RESULTS

I. SELECTION OF SUBJECTS

Three hundred and eighty-one letters were distributed, seeking mothers and sons willing to participate in the six-week wear-test program. Two hundred and six mothers returned the accompanying forms, indicating that they would participate in the study if selected.

Since only dungarees in even sizes 4 to 16 regular were to be wear-tested, forms returned by potential participants whose sizes were not in that size range were eliminated. Because none of the students wore garments of size 4, two boys of that size living in close proximity to the University were included in the study. The forms completed by those eligible for participation were separated into seven groups on the basis of the size of dungarees. Each group was shuffled and the number to be selected in each size was drawn randomly to make up the final sample of 51 persons. There were only four boys available to wear size 16 regular, so an adjustment had to be made in the number of dungarees worn in the other sizes. The final selection of participants in relation to garment sizes is given in Table II. Three subjects were not included in the final analysis of data because of illness of two participants and the unsatisfactory fit of one pair of dungarees of another participant.

TABLE II
SELECTION OF PARTICIPANTS IN RELATION TO GARMENT SIZES

Garment size	Number of eligible respondents	Predetermined number of participants	Actual number of participants
4	2	2	2
6	7	5	6*
8	18	8	8*
10	14	9	12
12	20	9	9
14	12	9	10
16	4	8	4*
Total	77	50	51

*One participant in this size was later eliminated from the study, leaving a total of 48 subjects.

Seventeen of the mothers of the boys combined homemaking with an outside occupation. Two of these mothers held professional positions at a University while the remainder were engaged in clerical or industrial work. The educational level of the respondents varied, but the majority had completed high school. Fifteen of the respondents reported that they continued formal education beyond high school. Four of these had earned academic degrees from colleges and universities.

Occupations in which the fathers were engaged varied. Those named most often were: truck driver, machine operator, small business manager, and clerical worker. Others included: salesman, engineer, teacher, detective, supervisor, farmer, construction worker, and semi-skilled industrial worker. The majority of the fathers had completed high school; nine men had some formal education beyond high school; and nine others were college graduates.

II. DATA FROM THE WEAR-TEST

All data presented were based upon the information given by 48 respondents.

Included in the descriptive analysis of the data of this wear-test were:

1. Hours of wear and number of launderings
2. Consumer satisfaction
3. Consumer's deficit and consumer's surplus
4. Consumer preferences
5. Factors considered important when selecting dungarees

Hours of Wear and Number of Launderings

The results obtained from tabulating the data on Schedule IX indicated that the amount of wear and laundering given each model of dungarees was comparatively close. The number of hours the standard-cut dungarees were worn ranged from 62 to 366 with a mean of 160. The number of hours the prototypes were worn ranged from 68 to 330 with a mean of 146. The range of launderings of the standard-cut dungarees was from one to 18 with a mean of 8.6. The range of launderings of the prototype was from one to 20 with a mean of 8.2.

Consumer Satisfaction

The results obtained from tabulating the data on Schedules V and VI indicated the satisfactions and dissatisfactions of each model of dungarees. As may be observed from Figure 1, the categories labeled more than average and average on the rating scales were used most frequently. The category labeled unsatisfactory was used least often. Figure 1 and Table III indicate the comparative frequency of the satisfaction ratings of the two models.

Satisfaction of standard-cut dungarees. The category of extreme satisfaction was checked most frequently for the evaluation of: (1) durability, (2) quality of construction, and (3) style and cut. The category of more than average satisfaction was checked most frequently for the evaluation of:

1. Over-all satisfaction
2. Appearance
3. Fabric
4. Durability
5. Color

The category of average satisfaction was used most frequently for the evaluation of: (1) ease of putting on and taking off, (2) ease-of-care, and (3) comfort.

The standard-cut model was rated high on all of the components of satisfaction and on the over-all satisfaction. There was little variation in the total frequencies of the higher ratings (extremely, more than average, and average) for each of the components and over-all satisfaction. The range of these frequencies indicating the satisfactory components was from 93.7 per cent to 97.9 per cent, with two exceptions: the color of the garment noted by 91.6 per cent and the fit of the garment noted by 89.6 per cent.

FIGURE 1

DEGREE OF SATISFACTION OF DUNGAREES USED IN THIS STUDY

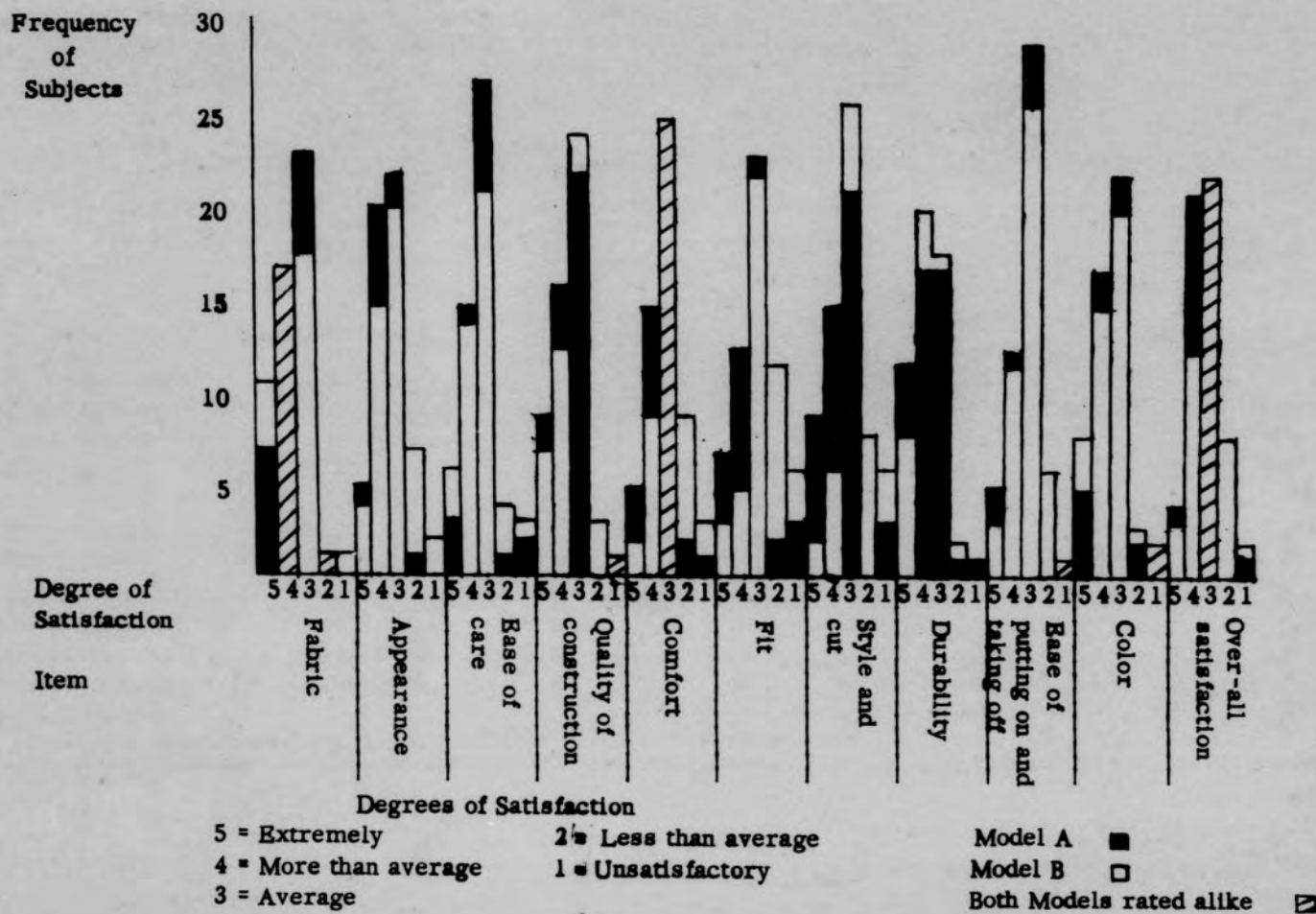


TABLE III
DEGREE OF SATISFACTION OF DUNGAREES USED IN THIS STUDY

Item	Degree of satisfaction									
	Extremely		More than average		Average		Less than average		Unsatisfactory	
	Model	Model	Model	Model	Model	Model	Model	Model	Model	Model
	A	B	A	B	A	B	A	B	A	B
(Per cent)		(Per cent)		(Per cent)		(Per cent)		(Per cent)		
Fabric	14.6	22.9	35.4	35.4	47.9	37.5	2.1	2.1	--	2.1
Appearance	10.4	8.3	41.7	31.2	45.8	41.7	2.1	14.6	--	4.2
Ease-of-care	6.2	12.5	31.2	29.2	56.3	43.8	2.1	8.3	4.2	6.2
Quality of construction	18.8	14.6	33.3	27.1	45.8	50.0	--	6.2	2.1	2.1
Comfort	10.4	4.2	31.2	18.8	52.1	52.1	4.2	18.7	2.1	6.2
Fit	14.6	6.3	27.1	10.4	47.9	45.8	4.2	25.0	6.2	12.5
Style and cut	18.8	4.2	31.2	12.5	43.8	54.1	--	16.7	6.2	12.5
Durability	25.0	16.7	35.4	41.7	35.4	37.4	2.1	4.2	2.1	--
Ease of putting on and taking off	10.4	6.2	27.1	25.0	60.4	54.2	--	12.5	2.1	2.1
Color	10.4	16.7	35.4	31.2	45.8	41.7	4.2	6.2	4.2	4.2
Over-all satisfaction	8.3	6.2	43.8	27.1	45.8	45.8	--	16.7	2.1	4.2

The two lower ratings (less than average and unsatisfactory) were used very little in describing the standard-cut dungarees. The following items were not rated in the category of less than average:

1. Quality of construction
2. Style and cut
3. Ease of putting on and taking off
4. Over-all satisfaction

Two components, fabric and appearance, were not rated in the category of unsatisfactory.

On the basis of this method of evaluation of consumer satisfaction, most respondents in this study were very well satisfied with the standard-cut dungarees.

Satisfaction of the prototype. In evaluating the prototype, the category of extreme satisfaction was checked most frequently for the evaluation of:

(1) fabric, (2) durability, and (3) color. The category of more than average satisfaction was checked most frequently for the evaluation of:

1. Durability
2. Fabric
3. Appearance
4. Color

The category of average satisfaction was checked most often for the evaluation of: (1) style and cut, (2) ease of putting on and taking off, and (3) comfort.

The range of the total frequency of the higher ratings (extremely, more than average, and average) for each of the components and the over-all satisfaction was much wider than the range describing the standard-cut model. The lowest total frequency describing the prototype was 62.5 per cent and the highest total frequency was 95.8 per cent. The total frequency of those three ratings

indicated that fabric, durability, and quality of construction were the most satisfactory.

There was some indication of dissatisfaction and of less than average satisfaction with all components and with the over-all satisfaction of the prototype, with one exception; no one rated durability unsatisfactory. Based on the total frequency of the ratings (less than average and unsatisfactory) the following components were the least acceptable characteristics: (1) fit, (2) style and cut, and (3) comfort.

This lower degree of satisfaction of the prototype as compared to the standard-cut dungarees may have been due in part to the difference in waistline measurements of the two models. Unfortunately, the waistline measurement of the prototype was from one inch to two and one-half inches larger than the standard-cut model of the corresponding sizes.

The total frequency of the two lower ratings (less than average and unsatisfactory) in the evaluation of fit of the prototype was 37.5 per cent while the total frequency of the same ratings of the standard-cut model was 10.4 per cent.

Relationship of components to over-all satisfaction. The results of this study indicate that components of satisfaction are not mutually exclusive of each other. Respondents indicated verbally as well as on the rating scale, that fit, style and cut, and comfort were interrelated in the dungarees. Over-all satisfaction ranked fourth among the less satisfactory aspects of the prototype. Possibly this indicates a high degree of satisfaction of fit, style and cut, and comfort are necessary for a high degree of over-all satisfaction of dungarees.

These findings were comparable to a hypothesis developed from the Northeast Regional study of satisfaction of blouses stating, "There are patterns of relationship between a measure of general satisfaction with a garment and the measure of specific components of satisfaction."⁴²

It is interesting to note the similarity of results of this study to those in the Northeast Regional study of satisfaction of men's shirts, and women's dresses and slips indicating:

. . . that comfort is an extremely important component of general satisfaction with garments, and that the attributes most frequently contributing to comfort are the fit of the garment and the texture of the fabric.⁴³

Data from the same study also confirmed:

. . . the hypothesis that high general satisfaction with a garment requires minimum levels of satisfaction for specific components such as comfort and appearance. The results also indicate that the minimum levels of satisfaction for specific components, necessary for the high general satisfaction, vary with the type of garment.⁴⁴

Consumer's Deficit and Consumer's Surplus

For purposes of the analysis of consumer's deficit and consumer's surplus, the measure of over-all satisfaction was used. The degree of difference between the expected satisfaction and the actual satisfaction was derived from the ratings made by each subject. Table IV summarizes the degree of

⁴²Ibid., p. 60

⁴³Consumer Satisfaction . . . Part I: Op. cit., p. 27.

⁴⁴Ibid., p. 37.

deficit and the degree of surplus of each model of dungarees. Also summarized in Table IV is the frequency in which the degree of expected over-all satisfaction and the degree of over-all satisfaction were rated the same.

TABLE IV
 CONSUMER'S DEFICIT AND CONSUMER'S SURPLUS OF
 SATISFACTION OF TWO MODELS OF DUNGAREES*

Degree of consumer's deficit	Frequency of each degree of deficit		Degree of consumer's surplus	Frequency of each degree of surplus	
	Model A	Model B		Model A	Model B
	(Per cent)			(Per cent)	
1	18.8	33.3	1	14.6	14.6
2	--	6.2	2	6.2	2.1
3	--	4.2	3	--	--
4	--	2.1	4	--	--
Totals	18.8	45.8		20.8	16.7

*Expected over-all satisfaction and actual over-all satisfaction rated the same; Model A 60.4 and Model B 37.5.

The frequency of one degree of consumer's surplus was the same for each model, 14.6 per cent. The frequency of a two-degree consumer's surplus of each model was relatively low. The standard-cut model rated slightly higher than the prototype.

Data on the two models indicated that the frequency of the consumer's deficit of each degree was greater than or the same as the frequency of the

consumer's surplus of the corresponding degree, with one exception; there was a two-degree surplus in the standard-cut dungarees. There was no indication of a two-degree deficit in that model.

Data on the standard-cut dungarees showed that the majority of the respondents rated the expected degree of over-all satisfaction and the actual over-all satisfaction in the same category. It might be recognized that there was a high frequency of neither consumer's deficit nor consumer's surplus, indicating that the majority of the standard-cut dungarees used in this study were as satisfactory in use as they were expected to be. Expected over-all satisfaction and the actual over-all satisfaction were rated in the same category by 60.4 per cent of the respondents.

In contrast, this measurement of the prototype was comparatively lower than that of the standard-cut model. Data indicated that only 37.5 per cent of the prototypes were as satisfactory in use as they were expected to be.

Consumer Preferences

Preferences for specific features and characteristics were determined from the data of Schedules VII and VIII.

Preferences for specific features. The results obtained from tabulating the data of Schedule VII were used to indicate the model of dungarees preferred in regard to each feature listed on the form. The results of Schedule VII are summarized in Table V.

Although the specifications given for the amount of warp sizing used in

TABLE V
PREFERENCES FOR SPECIFIC FEATURES IN THE DUNGAREES

Feature	Preference of dungarees			
	Model A	Model B	Models equally desirable	Neither model desirable
	(Per cent)			
Feel of fabric	14.6	41.7	43.7	--
Zipper length	54.2	6.2	39.6	--
Zipper weight	14.6	16.7	68.7	--
Tab fastener on zipper	10.4	14.6	75.0	--
Fly closing finish	25.0	14.6	60.4	--
Seam finish	43.8	35.4	20.8	--
Thread wear	22.9	12.5	64.6	--
Front pockets	37.5	14.6	47.9	--
Watch pocket	43.8	45.8	10.4	--

the fabric of the two models were the same, the fabric of the prototype had a distinctively softer hand, particularly prior to laundering. A much higher percentage of respondents indicated that they preferred the softer fabric of the prototype to the fabric of the standard-cut model. Other features of the prototype preferred to those of the standard-cut model were the: (1) lighter weight zipper, (2) memory-lock slider on zipper; and (3) elimination of watch pocket. The percentage preferring these was only slightly greater than the percentage of respondents preferring the heavier weight zipper, the double camlock tab

fastener, and the watch pocket of the standard-cut model.

Features preferred of the standard-cut model to those of the prototype were the:

1. Standard length zipper
2. Cut-on fly
3. Felled inseam and outseam
4. Soft cotton thread
5. Standard cut front side pockets

Slightly over 66 per cent of the respondents preferred a reinforced knee area in dungarees while 31.2 per cent said this was not an important feature, particularly in the larger sizes. Slightly over 54 per cent of the respondents indicated a preference for rivets on the pockets of dungarees and 35.4 per cent stated that rivets were undesirable. The remainder of the respondents expressed no opinion.

Additional features preferred in dungarees were listed by the respondents. Those items included:

1. Deeper hip pocket with snap closing
2. Plain inseam and flat-felled or French outseam
3. Less length in legs of dungarees
4. Trimmer cut legs
5. Garment cut on grain
6. Zipper on the watch pocket
7. Vat dyed dungarees
8. Fly front closing for size 4
9. Knee patch of same color as fabric in dungarees
10. Correct size
11. Elasticized waistband for little boys
12. Variety of colors

The listing of reasons for preferences proved valuable primarily as an indication of the range of possible reasons given for particular preferences.

Since the degree of satisfaction of the two models was relatively close, both the number of such reasons and the frequency of each reason were limited. Some of the reasons given for preferences are summarized in Table VI.

It was believed by the majority of the respondents that a reinforced knee area in dungarees was necessary for: (1) longer wear of dungarees, and (2) protection. In contrast, reasons given for a plain knee area as used in the test dungarees were: (1) less bulk, making dungarees comfortable and easy to launder, (2) no curled edges of knee patches, and elimination of wear and strain on denim at edges of patches, and (3) reinforcement unnecessary in large sizes.

Rivets were used on the pockets of both models of the test dungarees. Those respondents who favored the use of rivets stated that the pockets did not pull loose as easily as pockets without such reinforcement.

Reasons given by those respondents who disliked the use of rivets were: (1) rivets scratch iron, furniture, walls, cars, and (2) rivets make ironing difficult. Some respondents believed that thread bar tacks substituted for rivets would be durable and easy to press.

Preferences for over-all and specific satisfactions. The results obtained from tabulating the data of Schedule VIII were used to indicate the model preferred in regard to the components of satisfaction and the over-all satisfaction. The findings are tabulated in Table VII. The following characteristics of the prototype were preferred to those of the standard-cut model: (1) softer hand, (2) ease-of-care, and (3) color.

The standard-cut model was preferred for the following characteristics:

TABLE VI
REASONS FOR PREFERENCES FOR SPECIFIC FEATURES
IN THE DUNGAREES

Feature	Reasons for preferences	
	Model A	Model B
Feel of fabric	-----	Softer and more comfortable
Zipper length	Dungarees easier to slip on and off Less strain on zipper	-----
Zipper weight	-----	Neater appearance
Tab fastener on zipper	Larger tab fastener	Secure lock, and zipper stayed fastened
Fly closing finish	Neater Less bulk, irons smoother	Neater, more finished appearance
Seam finish	Better appearance Enclosed seams Cuffs turned back stayed in place	Smoother appearance Easier ironing, mending Less bulk Dries quicker
Thread wear	-----	-----
Front pockets	Deeper pockets Easier ironing when pockets are large	-----
Watch pockets	Useful for carrying coins, particularly for little boys	Unnecessary Added thickness, harder to iron Not necessary for watch, but if fitted with zipper could use it for change

TABLE VII
 PREFERENCES FOR OVER-ALL AND SPECIFIC SATISFACTIONS
 OF THE DUNGAREES

Item	Preferences for dungarees		Models	
	Model A	Model B	Equally desirable	Neither model desirable
	(Per cent)			
Fabric	14.6	33.3	50.0	2.1
Appearance	45.8	22.9	31.3	--
Ease-of-care	12.5	20.8	62.5	4.2
Quality of construction	35.4	12.5	50.0	2.1
Comfort	27.1	16.7	54.1	2.1
Fit	39.6	8.3	52.1	--
Style and cut	39.6	8.3	50.0	2.1
Durability	16.7	14.6	68.7	--
Ease of putting on and taking off	25.0	8.3	66.7	--
Color	6.2	16.7	77.1	--
Over-all satisfaction	47.9	14.6	35.4	2.1

1. Appearance
2. Quality of construction
3. Comfort
4. Fit
5. Style and cut
6. Durability
7. Ease of putting on and taking off
8. Over-all satisfaction

The preference for the over-all satisfaction of the standard-cut model was three times greater than the indicated preference for the over-all satisfaction of the prototype. A distinctly greater preference for the style and cut, and fit of the standard-cut was observed in comparison to the prototype. This frequency of preference was the same for both components in the standard-cut model which was almost five times greater than the preferences for the prototype. It was indicated in the study of consumer satisfaction that there appeared to be a close relationship between the style and cut, and fit for obtaining over-all satisfaction. A similar relationship is shown here.

Components ranking high in being equally desirable in the two models were:

1. Color
2. Durability
3. Ease of putting on and taking off
4. Ease-of-care

Only three respondents indicated that some characteristics were undesirable in both models. These included:

1. Fabric
2. Ease-of-care
3. Quality of construction
4. Comfort
5. Style and cut
6. Over-all satisfaction

Some of the reasons given for preferences of the components and overall satisfaction are included in Table VIII.

Recommendations for New Model of Dungarees

Because of the small number of respondents in the wear-test program, caution must be taken in suggesting a new model of dungarees. However, based on the evaluations of the satisfactions, consumer's deficit and consumer's surplus of satisfaction, and preferences determined in this study, suggestions for a new model are made. It is indicated in the comparison of the two models that the prototype would not be as well liked as the standard-cut model. However, distinct features in both test garments were preferred and might be incorporated in the production of a new model.

It would be suggested that the standard-cut model be used as the basic pattern with the following changes:

1. Fabric with less warp sizing
2. #42 brass zipper with nylon-filled cotton tape
3. Memory-lock slider on the zipper
4. A dye that is more colorfast to crocking, light, and washing
5. Reinforced knee area (for sizes 4 to 12)
6. No watch pocket on size 4.

Factors Considered Important When Selecting Dungarees

The findings obtained from Schedule IV were used to indicate the importance of various factors considered in the selection and buying of dungarees. The results of Schedule IV are summarized in Table IX.

The rating, great importance, was checked most frequently for the

TABLE VIII
 REASONS FOR PREFERENCES FOR
 OVER-ALL AND SPECIFIC SATISFACTIONS

Item	Reasons for preference	
	Model A	Model B
Fabric	After washing, was more comfortable and softer Seemed to be more durable	Neater appearance Softer Better color retention Seemed to be more durable
Appearance	Neater Appearance of felled seams Trim appearance Better fit in waistline Side seams, perpendicular to floor	Neater Appearance of plain seams Color retention
Ease-of-care	Less care needed Showed soil less Less bulk in seams-- easier to iron	Seams and fabric ironed more easily
Quality of construction	Stronger seams	Stronger seams
Comfort	Better fit After washing, softer Felled seams did not chafe legs Longer zipper Trim-cut	Softer fabric, particularly when new
Fit	Better fit True size	-----
Style and cut	Slimmer, more tapered line Nicer appearance Side seams, perpendicular to floor	Wider-cut legs

TABLE VIII (continued)

Item	Reasons for preference	
	Model A	Model B
Durability	Less wear, particularly in knee area	Superb Less wear in knee area
Ease of putting on and taking off	Longer zipper closing	-----
Color	Deeper	Less fading
Over-all satisfaction	More comfortable Better fit Looked neater	Preferred, with reservations concerning: (1) Length of fly closing (2) Size of waistline

TABLE IX
 FACTORS OF IMPORTANCE IN THE
 SELECTION AND PURCHASE OF BOYS' DUNGAREES

Factor	Importance		
	Great	Average	Little
Color	45.8	39.6	14.6
Fabric weight	60.4	37.5	2.1
Feel of fabric	60.4	37.5	2.1
Expected durability	62.5	37.5	--
Style and cut	52.1	47.9	--
Sewing	64.6	33.3	2.1
Size	83.3	16.7	--
Fit	83.3	16.7	--
Brand	35.4	39.6	25.0
Price	31.3	60.4	8.3
Appearance	60.4	39.6	--
Information on label	56.2	31.3	12.5

evaluation of: (1) fit, (2) size, and (3) sewing. The category of average importance was checked most frequently for the evaluation of:

- 1. Price
- 2. Style and cut
- 3. Color
- 4. Brand
- 5. Appearance

Of these, the latter three factors were checked an equal number of times. The category of little importance was used most often for the evaluation of:

(1) brand, (2) color, and (3) information on label.

The following factors were checked in two categories only, great and average importance:

- 1. Expected durability
- 2. Style and cut
- 3. Size
- 4. Fit
- 5. Appearance

Additional factors considered important and listed by respondents

were:

- 1. Easy-sliding zipper
- 2. Easy-to-snap fasteners
- 3. Reinforced knee area
- 4. Ease of laundering
- 5. Depth of pockets
- 6. Vat dyed fabric
- 7. Narrow-cut legs
- 8. Garment cut on grain of fabric
- 9. Watch pocket without zipper
- 10. Washable size label stitched into dungarees

Factors of importance to the consumer are also of importance to manufacturers who hope to produce dungarees which will have sales appeal and meet

the expectations of the consumer.

CHAPTER 2

RESEARCH DESIGN AND METHODOLOGY

1. INTRODUCTION

The study was planned for the purpose of developing a wardrobe program for a clothing apparel store that would facilitate the manufacturer's re-organization of the product lines. Two models of designers for boys were selected for the wardrobe study. One model was the advertisement designer produced by the clothing manufacturer. The second model was a style that is specifically manufactured for this market. Interpretation of this model were changes which the manufacturer believed to be improvements that would result in increased consumer satisfaction and sales appeal.

The specific objectives of this study were:

1. To develop a wardrobe program that would be able to:
 - a. Measure the reactions of two models of boys' designers and the satisfaction and dissatisfaction with them.
 - b. Measure consumer preferences for specific features and general characteristics of the designers.
 - c. Measure the importance of the selection of boys' designers.
2. To suggest recommendations for improvement of the program used in this wardrobe.
3. To suggest recommendations for future research.

CHAPTER V

SUMMARY AND RECOMMENDATIONS

I. SUMMARY

This study was planned for the purpose of developing a wear-test program for a selected apparel item that would indicate to the manufacturer consumer satisfactions of the product in use. Two models of dungarees for boys were selected for the wear-test study. One model was the standard-cut dungarees produced by the cooperating manufacturer. The second model was a prototype specially manufactured for this study. Incorporated in this model were changes which the manufacturer believed to be improvements that would result in increased consumer satisfaction and sales appeal.

The specific objectives of this study were:

1. To develop a wear-test program that would include:
 - a. Consumer expectations of two models of boys' dungarees and the satisfactions and dissatisfactions with them.
 - b. Consumer preferences for specific features and general characteristics of the dungarees.
 - c. Factors of importance in the selection of boys' dungarees.
2. To suggest recommendations for improvement of the products used in this wear-test.
3. To suggest recommendations for future wear-test programs.

This study required the development of two specific procedures. The first procedure was the development of an interview technique with accompanying schedules to obtain responses pertaining to the expectations and satisfactions of the test garments. The second procedure was concerned with the use of the schedules developed and the actual wear-testing of the dungarees.

A plan for the wear-test period of the test dungarees was established during which the two garments would be subjected to usual wear and care for six weeks. Boys to be wearers were selected from an elementary school in a rural area near Greensboro. From 381 letters distributed, seeking mothers and sons willing to participate, 206 responses were received from mothers indicating their interest in being respondents for the study. Fifty-one boys in the size range of 4 to 16 regular were selected, including two children of pre-school age to wear the size 4 dungarees.

Schedule forms were developed and used for obtaining specific information in two interviews with the mothers of the boys in the sample. One interview was held prior to the wear period and the second interview was held at the close of the wear period.

Schedule forms for use with Interview I were designed to obtain from the respondents:

1. The expected degree of satisfaction with the serviceability of each model during wear.
2. The importance of factors considered in selecting and purchasing dungarees.

Schedule forms for use with Interview II were designed to obtain from

the respondents:

1. The degree to which each model fulfilled the expectations and desirable conditions of serviceability during the six-week wear period.
2. The preferences for specific features in each model in regard to the changes made in the prototype.
3. The preferences for over-all satisfaction and specific components of satisfaction of the test dungarees.

The analysis of data was based on the information given by the respondents on the schedule forms. Consumer satisfactions, consumer's deficit and surplus of satisfaction, and preferences were studied. In addition, the importance of factors considered in the selection of dungarees was included in the findings.

The tabulations of the five-point rating scale for each model of dungarees were used in describing the satisfaction of the garments in use. Based on this method of evaluation, most respondents were satisfied with both models of dungarees. The total frequency of the three highest ratings (extremely, more than average, and average) in the evaluation of over-all satisfaction indicated that the standard-cut model was more satisfactory than the prototype.

The evaluation of expected over-all satisfaction and the actual satisfaction was used to determine the consumer's deficit and the consumer's surplus of satisfaction with each model of dungarees. The frequency of consumer's deficit was less in the standard-cut model than in the prototype; the frequency of consumer's surplus was greater in the standard-cut model than in the prototype.

Based on the findings of the preference check lists, the standard-cut model was the preferred pair of dungarees in regard to over-all satisfaction. Also, the following specific features and characteristics of this model were preferred:

1. Standard length zipper
2. Cut-on fly
3. Felled inseam and outseam
4. Soft cotton thread
5. Size of front side pockets
6. Appearance
7. Quality of construction
8. Comfort
9. Fit
10. Style and cut
11. Durability
12. Ease of putting on and taking off

Specific features and characteristics preferred in the prototype included;

1. Softer fabric
2. Lighter weight zipper
3. Memory-lock slider on zipper
4. Plain front with no watch pocket
5. Ease-of-care
6. Color

In a comparative evaluation of the two models, the contrast in satisfaction was most apparent in the following features and characteristics:

1. Hand of fabric
2. Zipper length
3. Size of front side pockets
4. Appearance
5. Fit
6. Style and cut
7. Ease of putting on and taking off

After analyzing the results of this study, a new model incorporating the

preferred features of the prototype and the preferred features of the standard-cut model would be recommended. It would be suggested that the standard-cut model be used as the basic pattern with the following changes:

1. Fabric with less warp sizing
2. #42 brass zipper with nylon-filled cotton tape
3. Memory-lock slider on the zipper
4. A dye that is more colorfast to crocking, light, and washing
5. Reinforced knee area (for sizes 4 to 12)
6. No watch pocket on size 4.

The respondents indicated that the following considerations were of particular importance to them when selecting and purchasing dungarees:

1. Size
2. Fit
3. Sewing
4. Expected durability
5. Style and cut
6. Fabric weight
7. Feel of fabric
8. Appearance

These would also be considered as factors of importance to manufacturers who hope to produce dungarees which will have sales appeal and meet the expectations of the consumer.

II. RECOMMENDATIONS FOR FUTURE WEAR-TEST PROGRAMS

After evaluating the procedure developed and carried out in this study, the following suggestions would be made to a garment manufacturer who might use this plan as a guide for conducting wear-test programs:

1. Use a larger sample of subjects.

2. Extend the wear period
 - a. To a total of 12 weeks, or
 - b. Until the respondent considers the dungarees to be worn out, so that seam finish, thread wear, durability, and quality of construction could be more readily evaluated.
3. Conduct laboratory studies and compare findings.
4. Develop a more simplified method for obtaining data from respondents who have had less than a high school education.
5. Use an appropriate statistical test with a larger sample to determine the relationship of the importance of each component to the over-all satisfaction.
6. Conduct the wear-test program only during seasons in which dungarees are usually worn in the geographical area.
7. Study consumer's deficit and consumer's surplus of each component of satisfaction as well as over-all satisfaction.

III. RECOMMENDATIONS FOR FURTHER STUDY

Recommendations for further study pertaining to this particular wear-test procedure are:

1. Extend the wear period
 - a. To a total of 12 weeks, or
 - b. Until the respondent considers the dungarees to be worn out so that seam finish, thread wear, durability, and quality of construction could be more readily evaluated.
2. Develop a more simplified method for obtaining data from respondents who have had less than a high school education.
3. Study buying practices of consumers as a separate consumer research project.

4. Study consumer's deficit and consumer's surplus of each component of satisfaction as well as over-all satisfaction.

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Department of Psychology
The University of New Mexico
Albuquerque, New Mexico

Dr. Margaret Holloway, Graduate Assistant
The University of New Mexico

Albuquerque, N.M.
November 22, 1964

Dear Margaret:

I am a graduate assistant in the Department of Psychology and I am doing a year-long study on the effects of...

As a part of my research project, I am doing a year-long study on the effects of...

When a consumer is dissatisfied with the performance of products she buys, whereas at other times she is pleased with their performance. I need to be convinced that products on the market meet the needs and wants of the consumer. My primary interest is in the consumers' and buyers' opinions of the responsibility of designers.

APPENDIXES

Therefore, I am conducting a study on how designers are held to their designs. Each day will be given two pairs of new designs for making, with pairs to be worn three times a week, or every other day. It is not necessary that they be worn for the entire day. There will be no cost for the designers to the participants in the study. I need help of various sizes and ages to wear the garments, and am willing for volunteers.

If you and your own children to be considered as participants in the study, please check (✓) the attached sheet and return the completed sheet to the department mailbox by Tuesday, December 1. If you give your consent and your name is accepted as participants, I will contact you by telephone to arrange for a time to discuss the designs to you. At that time, I would like to ask a few questions regarding your opinion of the designers and what you look for in designers when you buy shoes. This interview will last approximately one-half hour. At the end of six weeks, I will contact you again so that we may discuss your opinion of their garments after use.

I wish to thank you for your consideration of this request and hope you will give us permission to include your name among those persons who would be willing to participate in our study and thereby be selected.

Sincerely,
[Signature]

APPENDIX A

CORRESPONDENCE

School of Home Economics
The University of North Carolina

Greensboro, N. C.
March 12, 1964

To: Homemaker

From: Margaret Holloway, Graduate Assistant

I am a graduate assistant in the Department of Clothing and Textiles. As a part of my research project, I am doing a wear-test study on boys' dungarees.

Often a consumer is dissatisfied with the performance of garments she buys, whereas at other times she is pleased with their serviceability. I feel it is important that products on the market meet the needs and wants of the consumer. My present interest is in the consumers' and boys' opinions of the serviceability of dungarees.

Therefore, I am conducting a study in which boys are asked to wear dungarees. Each boy will be given two pairs of new dungarees for wearing, each pair to be worn three times a week, or every other day. It is not necessary that they be worn for the entire day. There will be no cost for the dungarees to the participants in the study. I need boys of various sizes and ages to wear the garments, and am asking for volunteers.

If you and your son consent to be considered as participants in the study, please check (✓) the attached sheet and return the completed form to his homeroom teacher by Tuesday, March 17. If you give your consent and your son is selected to participate, I will contact you by telephone to arrange for a time to deliver the dungarees to you. At that time, I would like to ask a few questions regarding your opinion of the dungarees and what you look for in dungarees when you buy them. This interview will last approximately one-half hour. At the end of six weeks, I will contact you again so that we may discuss your opinion of these garments after use.

I wish to thank you for your consideration of this request and hope you will give us permission to include your name among those persons who would be willing to participate in the study and who may be selected.

MH-k

Please complete the following form and return it to your son's homeroom teacher by March 17, 1964.

- _____ 1. We would be interested in being considered for this study.
- _____ 2. We would not be interested in being considered for this study.

If you checked #1 above, complete the following:

Size of dungarees your son wears _____

Please check - Husky _____ Regular _____ Slim _____

Your son's name _____

Your son's age _____

Your name _____

Address _____

Phone _____

Best time to be called:

_____ a.m.

_____ p.m.

_____ After 6:00 p.m.

_____ Other: state time _____

If you checked #1 above, please give directions that I should follow to reach your home.

APPENDIX B

SCHEDULE FORMS

SCHEDULE I

GENERAL INFORMATION SHEET

Wearer's Name _____ Address _____

Age _____

Size _____ Phone _____

Mother's Name _____

Mother's Education _____

Father's Education _____

Mother's Occupation _____

Father's Occupation _____

CARE PROCEDURES:

Laundering

Commercially _____

Home _____

1. Hand laundered _____
2. Machine laundered _____
 - a. Automatic washing machine _____ Approximate washing time _____
 - b. Wringer-type washing machine _____
3. Brand name of soap or detergent _____
4. Type of bleach, starch, or other products used, if any _____
5. Drying

Air dried: Indoors _____ Outdoors _____

Machine dried: _____
6. Ironing, if any _____

SCHEDULE II

Dungarees A ✓
Dungarees B

EXPECTED DEGREE OF SATISFACTION OF DUNGAREES BASED ON PREVIOUS EXPERIENCE

(How satisfactory do you think this pair of dungarees will be? Check the appropriate column for each of the items listed.)

Item	Degree of satisfaction				
	Extremely	More than average	Average	Less than average	Unsatisfactory
Fabric					
Appearance					
Ease-of-care					
Quality of construction					
Comfort					
Fit					
Style and cut					
Durability					
Ease of putting on and taking off					
Color					
Over-all satisfaction					

SCHEDULE III

Dungarees A _____
Dungarees B ✓

EXPECTED DEGREE OF SATISFACTION OF DUNGAREES BASED
ON PREVIOUS EXPERIENCE

(How satisfactory do you think this pair of dungarees will be? Check the appropriate column for each of the items listed.)

Item	Degree of satisfaction				
	Extremely	More than average	Average	Less than average	Unsatisfactory
Fabric					
Appearance					
Ease-of-care					
Quality of construction					
Comfort					
Fit					
Style and cut					
Durability					
Ease of putting on and taking off					
Color					
Over-all satisfaction					

SCHEDULE IV

FACTORS OF IMPORTANCE IN THE SELECTION AND PURCHASE OF BOYS' DUNGAREES

(Listed below are some factors which may be important considerations to you when selecting and purchasing boys' dungarees. Please check the appropriate column, indicating the importance of each factor listed.)

Factors	Importance		
	Great	Average	Little
Color			
Fabric weight			
Feel of fabric			
Expected durability			
Style and cut			
Sewing			
Size			
Fit			
Brand			
Price			
Appearance			
Information on label			
Other: List			

SCHEDULE V

Dungarees A ✓
Dungarees B

DEGREE OF SATISFACTION OF DUNGAREES USED IN THIS STUDY

(How satisfactory do you think this pair of dungarees was? Check the appropriate column for each of the items listed.)

Item	Degree of satisfaction				
	Extremely	More than average	Average	Less than average	Unsatisfactory
Fabric					
Appearance					
Ease-of-care					
Quality of construction					
Comfort					
Fit					
Style and cut					
Durability					
Ease of putting on and taking off					
Color					
Over-all satisfaction					

SCHEDULE VI

Dungarees A _____
Dungarees B ✓

DEGREE OF SATISFACTION OF DUNGAREES USED IN THIS STUDY

(How satisfactory do you think this pair of dungarees was? Check the appropriate column for each of the items listed.)

Item	Degree of satisfaction				
	Extremely	More than average	Average	Less than average	Unsatisfactory
Fabric					
Appearance					
Ease-of-care					
Quality of construction					
Comfort					
Fit					
Style and cut					
Durability					
Ease of putting on and taking off					
Color					
Over-all satisfaction					

SCHEDULE VII

PREFERENCES FOR SPECIFIC FEATURES IN THE DUNGAREES

Answer each question by placing a check mark in the appropriate column, indicating which pair of dungarees you like better. If you have no preference and like the particular feature of the two pairs of dungarees equally, check both columns. For those features for which you have checked a preference in only one column, give your reason.

Which pair of dungarees do you prefer for:	Dungarees		Reason for preferring dungarees A or B
	A	B	
Feel of fabric			
Zipper length			
Zipper weight			
Tab fastener on zipper			
Fly closing finish			
Seam finish			
Thread wear			
Front pockets			
Would you prefer the dungarees to have the following features?	Yes	No	Reason
Reinforced knee area			
Rivets on the pockets			
Watch pockets			
Others (list)			

SCHEDULE VIII

PREFERENCES FOR OVER-ALL AND SPECIFIC SATISFACTIONS OF THE DUNGAREES

Answer each question listed below separately. If you have a preference for either pair of dungarees, place a check in the appropriate column, and give your reason. Check both columns if you have no preference.

Which dungarees do you prefer for:	Dungarees		Reasons for preferring dungarees A or B
	A	B	
Fabric	<input type="checkbox"/>	<input type="checkbox"/>	
Appearance	<input type="checkbox"/>	<input type="checkbox"/>	
Ease of care	<input type="checkbox"/>	<input type="checkbox"/>	
Quality of construction	<input type="checkbox"/>	<input type="checkbox"/>	
Comfort	<input type="checkbox"/>	<input type="checkbox"/>	
Fit	<input type="checkbox"/>	<input type="checkbox"/>	
Style and cut	<input type="checkbox"/>	<input type="checkbox"/>	
Durability	<input type="checkbox"/>	<input type="checkbox"/>	
Ease of putting on and taking off	<input type="checkbox"/>	<input type="checkbox"/>	
Color	<input type="checkbox"/>	<input type="checkbox"/>	
Over-all satisfaction	<input type="checkbox"/>	<input type="checkbox"/>	

SCHEDULE IX

RECORD OF WEAR AND LAUNDERING

Date	Dungarees A		Dungarees B	
	Number of hours worn	Check the days on which laundered	Number of hours worn	Check the days on which laundered
April 1				
April 2				
April 3				
April 4				
April 5				
April 6				
April 7				
April 8				
April 9				
April 10				
April 11				
April 12				
April 13				
April 14				
April 15				
April 16				
April 17				
April 18				
April 19				
April 20				
April 21				
April 22				
April 23				
April 24				
April 25				
April 26				
April 27				
April 28				
April 29				
April 30				

Date	Dungarees A		Dungarees B	
	Number of hours worn	Check the days on which laundered	Number of hours worn	Check the days on which laundered
May 1				
May 2				
May 3				
May 4				
May 5				
May 6				
May 7				
May 8				
May 9				
May 10				
May 11				
May 12				
May 13				
May 14				
May 15				
May 16				
May 17				
May 18				
May 19				
May 20				
May 21				
May 22				
May 23				
May 24				
May 25				
May 26				
May 27				
May 28				
May 29				
May 30				
May 31				