

A Study of Smallest Semantic Units and Patterns that Influence User Preferences in *Kundan* Jewellery

By Parag Vyas



IDC, IIT Bombay
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Supervised By
Prof. V. P. Bapat

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Doctor of Philosophy

By

By Parag Vyas
(Roll No. 06413802)

Supervisor : **Prof. V. P. Bapat**



Industrial Design Centre,
Indian Institute of Technology, Bombay
2011

Approval Sheet

Thesis entitled '**A Study of Smallest Semantic Units and Patterns that Influence User Preferences in *Kundan* Jewellery**' is approved for the degree of Doctor of Philosophy.

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Supervisor

Chairman

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Abstract

India has a rich tradition of jewellery and there are a number of styles of jewellery making in practice. *Kundan* is a type of traditional Indian jewellery that uses a framework of gold crafted in intricate details to set chips of gemstones driven by form. So far, studies were limited to documentation of existing pieces, family heirlooms and collection of royalty published in form of photographic documentation. Jewellery was seldom studied with a scientific point of view where precise measurements and mathematical interpretation of articles under observation were possible.

A smallest semantic unit, often identifiable by a name, is fundamental building block of *Kundan* jewellery. An assemblage of these put together in a certain manner constitutes a form cluster, which in turn by repetition, constitute an article. This study in three major parts is focussed on smallest semantic units creating form clusters and their interplay that makes a neckpiece, typically.

An early part of study elucidates preferential semantic units, arranged in a particular manner as form clusters. Form clusters created by these preferential semantic units consequently influence likeness in a positive way and were used to create a line drawing of an article. Several such clusters were thus created, driven by the need of a tool to objectively study preferences of *Kundan* jewellery. A grid was proposed and developed, for purpose of understanding, was a three dimensional visual array in form of presentation plates.

This grid was designed to test effect of three variables namely cluster pitch, variety in proximity and number of semantic units in a form cluster. This three dimensional model was used as a virtual “test space” to see in which area of this space preferential likeness of subjects fell.

Test plates in actual size were made for presentation to subjects. People were approached and a survey was conducted by reaching out to people investigating their responses to presented designs. Data was analysed and presented in an easy to comprehend manner using diagrams and charts. Findings embody preferential likeness in age cluster, marital and social status of user groups. This research takes a form based approach to study jewellery preferences.

This thesis has seven chapters, First chapter is Introduction that starts with jewellery as ornamentation and covers brief history of jewellery. It compares working styles of Indian and western jewellers thereafter reflect on contemporary scenario, various influences and subject importance.

Second chapter is review of literature and available material on Kundan. It elaborates this particular style of setting alongside other styles and takes domain overview. With review of books, periodicals and published articles it finds areas for potential research.

Third chapter talks about research methodology and sets a frame of reference for overall research. It starts with identification of smallest semantic units which make the overall form of an article. These units are then catalogued and classified in five broad categories for ease of understanding.

The study continues in domain as fourth chapter that elucidates form clusters made of smallest semantic units and its various aspects like size, variety and cluster pitch. It illuminates pattern creation with these form clusters with a generating circle. In that way proposes a tool to measure various aspects facilitating a mathematical interpretation of abstract terms.

Chapter five propounds concept of a tool in form of a three dimensional grid, where cluster fineness/coarseness and number of constituting semantic units are arranged in a methodical manner. Preferential likeness can be studied with orientation to this, virtual three dimensional, space that provides a frame of reference. The study continues in investigation of areas in which preferential likeness amass according to diverse user profiles.

Chapter six deals with investigation of preferential likeness based on user profiles based on marital status, social status and age. In form of radar diagrams it gives directions in which these choices gyrate. These are studied with reference to number of smallest semantic units and cluster pitch.

Chapter seven is summary and conclusions that highlights research findings and lists key contributions. It puts forward potential use of the tool in giving design directions and trend forecasting as well as potential applications for research in other types of jewellery.

The appendices contain complementary information that may be useful in further research as well as illuminating a particular point.

CONTENTS

1.Chapter 1: Introduction	1
1.1. Jewellery as Ornamentation	1
1.2. History of Indian Jewellery	4
1.3. Diachronic History of Jewellery	6
1.4. Comparison of Style of Working of Indian and Western Jewellers	8
1.5. Contemporary Scenario and Influences	9
1.6. Psychological and Sociological Aspect of Jewellery	12
1.7. Subject Importance	14
1.8. Various Types of Jewellery	17
1.9. Structure of Kundan	19
1.10.Need of Research	23
1.11.Research Objectives	23
2.Chapter 2: Literature Review	25
2.1. Kundan	25
2.2. Jadau (Jadai Kaam)	26
2.3. Stone Setting Techniques	29
2.3.1. Setting v/s Beading	30
2.3.2. Types of Setting	31
2.3.3. Kundan Setting	33
2.3.4. Kundan Setting Details	34
2.4. Domain Overview	38
2.5. Review to Find Research Gaps	40
2.6. Methodical Surveys of Sources	41
2.7. Merits of Methodical Review	48
2.8. Insights From Research Review	48
2.9. Summary of Research Review	49
3.Chapter 3: Research Methodology	51
3.1. Research Structure and Evolution	51
3.2. Kundan Revival	58
3.3. Methodology for Identification of Smallest Semantic Unit	58

3.4. Smallest Semantic Units to an Article	59
3.5. Tabulation of Smallest Semantic Units	61
3.6. Classification of Smallest Semantic Units	67
3.7. Potential Application- Cataloguing	80
3.8. Summary	80
4. Chapter 4: Smallest Semantic Units and Form Clusters	81
4.1. Fundamental Building Blocks	81
4.2. Methodology to Find Most Frequently Used Semantic Units	89
4.3. Form Cluster and Pattern Creation	91
4.4. Proposition of a Tool	94
4.5. Limitation of the study	100
4.6. Preferred Semantic Units	101
4.7. Summary	101
5. Chapter 5: Testing Grid	103
5.1. Concept of a Testing Grid	103
5.2. Design of a Tool for Mathematical Interpretation	105
5.3. Development of a Tool (Methodology)	105
5.3.1. Cluster Pitch, as Levels of Fineness/Heaviness Measured on X-Axis	108
5.3.2. Numbers of Constituting Smallest Semantic Units in a Form Clusters Measured on Y-Axis	108
5.3.3. Varieties in Proximity, Diverse Constituting Smallest Semantic Units in a Form Clusters Compared, Z-Axis	109
5.4. Merits of Testing Grid	110
5.5. Limitations of Testing Grid	113
5.6. Application of Tool and its Implications	113
5.7. Summary	116
6. Chapter 6; Investigation of Preferential Likeness	117
6.1. Survey to Investigate Preferential Likeness	117
6.2. Motivational Factors	121
Part I - Based on Marital Status of Women : Married v/s Unmarried	125
6.3. Preferential likeness based on form cluster sectional plates	125
6.3.1. Percentages of preferential likeness of married / unmarried group at level 1	126
6.3.2. Percentages of preferential likeness of unmarried/married group	128

at level 4	
6.4. Preferential likeness based on Fineness	129
6.4.1. Percentages of preferential likeness based on fineness (Married v/s Unmarried group) at level 1	130
6.4.2. Percentages of preferential likeness based on fineness at level 4	132
Part II - Based on Working v/s Non Working Women	133
6.5. Preferential likeness based on form cluster sectional plates	133
6.5.1. Percentages of preferential likeness of Working / Nonworking women group at level 1	134
6.5.2. Percentages of preferential likeness of working v/s Nonworking women group at level 4	136
6.6. 6.6. Preferential likeness based on Fineness	138
6.6.1. Percentages of preferential likeness, based on Fineness of Working / Nonworking women group at level 1	138
6.6.2. Percentages of preferential likeness, based on Fineness of Working / Nonworking women group at level 4	140
Part III - Based on Social Status - High, High-Middle and Middle	141
6.7. Preferential likeness based on form cluster sectional plates	141
6.7.1. Percentages of preferential likeness, on sectional plates of social status 1(high), social status 2(high middle) and social status 3 (middle) women group women group at level 1	142
6.7.2. Percentages of preferential likeness, on sectional plates of social status 1(high), social status 2(high middle) and social status 3 (middle) women group at level 4	144
6.8. Preferential likeness based on Fineness	146
6.8.1. Percentages of preferential likeness, based on fineness, status 1 (high), social status 2 (high middle) and social status 3 (middle) women group at level 1	146
6.8.2. Percentages of preferential likeness, based on fineness, status 1 (high), social status 2(high middle) and social status 3 (middle) women group at level 4	148
Part IV - Based on age Group 1. 20-29, Group 2. 30-39, Group 3. 40-49 and Group 4. 40-49 year	149
6.9. Preferential likeness based on form cluster sectional plates	149
6.9.1. Comparison of Preferences based on sectional plates Level 1	150

6.9.2. Comparison of Preferences based on sectional plates Level 4	152
6.10. Preferential likeness based on Fineness	154
6.10.1. Comparison of Preferences based on fineness of selection based on age group	154
6.10.2. Comparison of Preferences based on fineness Level 4 of selection based on age group	156
6.11. Preferred Cluster Pitch	157
6.12. Validation of Findings by Experts	158
6.13. Summary	160
7. Chapter 7: Summary and Conclusion	161
7.1. Major Findings of Research	161
7.2. Case Study/Testing of the Tool	166
7.3. Snapshots and Documentation of Case Study	169
7.4. Key Contribution	170
7.4.1. Primary Contribution of Research are Summarized as Below:	170
7.4.2. Secondary Contribution of Research are Summarized as Below:	171
7.5. Implication of Work	172
7.5.1. Managerial Implications for Clientele	172
7.5.2. Managerial Implications for Designers	173
7.5.3. Academic Implications	176
7.6. Limitations	177
7.7. Scope for Future Work	177
7.8. Future Directions	181
References	ix
Select Bibliography	xi
Glossary of Terms	xix
Appendix I	xxiii
Appendix II	xliv
Appendix III	lxvii
Appendix IV	xciii
Appendix V	cxi
Appendix VI	cxxi
List of Publications	

LIST OF FIGURES

Fig.1.1. Image of the self in the Jewel Mandala, adopted from Oppi Untracht	11
Fig.1.2. <i>Kundan</i> article, Times N Style 2005:90	15
Fig.1.3. <i>Kundan</i> article, Timeless jewels volume-7 issue-3 p127	15
Fig.1.4. <i>Kundan</i> article, Timeless jewels volume-7 issue-3 p5	15
Fig.1.5. <i>Kundan</i> article, Timeless Jewels volume7 issue3 p81	16
Fig.1.6. <i>Kundan</i> article, Timeless Jewels volume-7 issue-3 p41	16
Fig.1.7. <i>Kundan</i> article, Timeless Jewels volume-7 issue-3 p123	16
Fig.1.8. A Polarized convocation of Jewellers.(Adopted from Oppi Untracht)	18
Fig.1.9. A visual comparison of diamond crystals for formal cuts and chips used for <i>Kundan</i>	19
Fig.1.10. <i>Kundan</i> as a style of setting, using <i>vilandi</i> or <i>polki</i>	20
Fig.1.11. Flexible and Semi Flexible structure in a <i>Kundan</i> article	20
Fig.1.12. Visual comparison of <i>Kundan</i> and western style of settings. Two pictures in the upper half show the example of formal cuts in channel setting, the lower half two picture show example of <i>kundan</i> setting	21
Fig.1.13. Red, green <i>mina</i> on the backside of a <i>kundan</i> article	22
Fig.2.1. Examples of “ <i>kundan</i> ” jewellery	27
Fig.2.2. Examples for “victorian” jewellery	28
Fig.2.3. Examples for “ <i>pachchikam</i> ” jewellery	29
Fig.2.4. Setting and Beading	30
Fig.2.5. Bezel Setting and its variations	31
Fig. 2.6. Claw Setting and its variations	32
Fig.2.7. Pave Setting and its variations	32
Fig.2.8 & Fig.2.9 An ornament ghat fixed on to a shellac stick to facilitate setting of gems	33
Fig.2.10. & Fig.2.11. The gem setter at work burnishing foils with an agate hammer	34
Fig.2.12. & Fig.2.13. Lengths of purified gold ribbon, ready to be used for <i>kundan</i> setting	34
Fig.2.14. & Fig.2.15. Reflective foil, <i>joban</i> , is used behind gem stones to enhance their brilliance	34

Fig.2.16. & Fig.2.17. Shellac flakes are heated and applied on a base	35
Fig.2.18. & Fig.2.19. An article is gently pressed in pliable shellac bed, heat applied for minor adjustments	35
Fig.2.20. & Fig.2.21. Stones are placed in cavities to see fit and appearances, process is iterative	35
Fig.2.22. & Fig.2.23. Colored stones are custom polished for fitting	35
Fig.2.24. & Fig.2.25. Fine grinding of stones begets a good snug fit	36
Fig.2.26. & Fig.2.27. Stones are finally fitted in their respective cavities and <i>surma</i> is applied to hold them	36
Fig.2.28. & Fig.2.29. Mild heat is applied to stones so it takes a proper seat in its bearing	36
Fig.2.30. & Fig.2.31. Excess material is trimmed off & piece is ready for <i>kundan</i> setting	36
Fig.2.32. & Fig.2.33. A very thin foil is cut in small pieces and these pieces are pushed in cavities remaining between the stone and bearing	37
Fig.2.34. & Fig.2.35. A sharp tool is used for pressing that fuses gold by compression	37
Fig.2.36. & Fig.2.37. Gemstones are set in place and excessive gold is trimmed off leaving a lustrous surface	37
Fig.2.38. & Fig.2.39. The piece is removed from plate and cleaned	37
Fig.2.40. <i>kundan</i> setting details	38
Fig.2.41. The view shows a cross sectional view of setting of a smallest semantic unit	38
Fig.2.42. Various sources explored for research relevance and its justification	41
Fig.2.43. Visit to exhibition and trade fairs, India International Jewellery Show	44
Fig.2.44. Visit to exhibition and trade fairs, India International Jewellery Show various Stalls	44
Fig.2.45.(A) Students instinctively exploring forms	45
Fig.2.45.(B) Students instinctively exploring forms	45
Fig.2.45.(C) Students instinctively exploring forms	46
Fig.2.45.(A, B, C & D) – Intuitively created patterns to find natural visual grammar of <i>Kundan</i>	46
Fig.3.1. Social and formal aspects influencing user preferences Group A(left) and Group B(right)	53
Fig.3.2. Research methodology schematic diagram	57
Fig.3.3. <i>Kundan</i> Necklace, smallest semantic units & form	60

Fig.3.4. Progression from basic curves that make smallest semantic units to a set of jewellery	61
Fig.3.5. Smallest semantic units and their names	62-66
Fig.3.6. (A) Naming based on appearance and resemblance	67
Fig.3.6. (B) Naming based on appearance and resemblance	67
Fig.3.7. Smallest semantic units with two axes of symmetry	68
Fig.3.8. Smallest semantic units with one axis of symmetry	68
Fig.3.9. Smallest semantic units with rotational symmetry	69
Fig.3.10. S, C, N, and Fan shape Smallest semantic units	69
Fig.3.11. Conjoined Smallest semantic units with two axes of symmetry	70
Fig.3.12. Characters and ligatures	70
Fig.3.13. <i>Sanyuktakshar & Beej</i> Mantra (Adopted from “Sacred Calligraphy of the East”)	71
Fig.4.1. <i>Kundan</i> Necklace, smallest semantic units & form Source: <i>Balakrishnan R. U.</i> , 2004, <i>Dance of The Peacock</i>	82
Fig.4.2. A tear drop forming a neck piece Source: <i>Balakrishnan R. U.</i> , 2006, <i>Jewels of the Nizam</i>	82
Fig.4.3. Progression from basic curves that make smallest semantic units to a set of jewellery	83
Fig.4.4.(A, B, C & D). Ways to achieve a meaningful form cluster, <i>Gothavani</i>	84
Fig. 4.5. Compositions of Semantic units that gel well, <i>Gothavani</i>	85
Fig. 4.6. Examples of aesthetically Pleasing and not so pleasing compositions	85
Fig.4.7. <i>Bharavdaar</i> form clusters with little counter space in between	86
Fig.4.8. <i>Jaalikaam</i> form clusters with more counter space in between	87
Fig.4.9. <i>Khila</i> form clusters with pronounced counter space in between	88
Fig. 4.10. Labelled Artworks for methodical study	90
Fig. 4.11. Preferred semantic units, primarily having symmetry	91
Fig. 4.12. Geometry of curves, best fitting circles	92
Fig.4.13. Articles with a heavy and dense appearances	93
Fig.4.14. Stonemasons grid as without underlay Source: <i>Mollerup P.</i> ,2004, <i>Marks of Excellence-The history and taxonomy of trademarks</i>	93
Fig.4.15. Stonemasons grid as underlay Source: <i>Mollerup P.</i> ,2004, <i>Marks of Excellence-The history and taxonomy of trademarks</i>	95
Fig.4.16. Principle circle, form cluster and cluster pitch	96
Fig.4.17. Diverse SSU	97-99
Fig.4.18. Different levels of fineness of cluster pitch	99

Fig.5.1. <i>Kundan</i> Necklace, smallest semantic units & form , front and back	104
Fig.5.2. Progression from basic curves that make smallest semantic units to a set of jewellery	104
Fig.5.3. Variables Encompassed in a cube, with reference to a point	106
Fig.5.4. (A & B). Fineness/ coarseness on x axis, Numbers of constituting semantic units on y axis & Varieties in proximity on z axis	107
Fig.5.5. Form clusters becoming progressively finer, left to right	108
Fig.5.6. (A, B & C). Cluster pitch and its mathematical interpretation, form clusters packed per unit length	108
Fig.5.7. A scale to gauge preferences amongst form clusters comprising of three to eleven Smallest Semantic Units	109
Fig.5.8. Diverse semantic units, a section showing gradually increasing visual variety	110
Fig.5.9. (A & B). <i>Kundan</i> artworks as presentation plates	111
Fig.5.10. Section of complete grid as an array	112
Fig.5.11. Mother Grid in use by designer Source: Author	114
Fig.5.12. Projection to see details enlarged. Source: M.K. Panchal & Vinay S., Ahmedabad	115
Fig.6.1. Respondent statistics based on Married v/s Unmarried	119
Fig.6.2. Respondent statistics based on Working v/s Non Working Women	119
Fig.6.3. Respondent statistics based on Social Status - High, High-Middle and Middle	120
Fig.6.4. Respondent statistics based on Age Group	120
Fig.6.5. A schematic three quarter profile of testing grid	122
Fig.6.6. A radar diagram depicting preferential likeness based on variety of smallest semantic units available for visual appreciation	124
Fig.6.7. A radar diagram depicting preferential likeness based on finesse of form clusters	124
Fig.6.8. Comparison of Preferences Level 1 of selection: Married v/s Unmarried	126
Fig.6.9. Comparison of Preferences Level 4 of selection: Unmarried Group (Married v/s Unmarried)	128
Fig.6.10. Comparison of Preferences Level 1 of selection based on fineness: Married v/s Unmarried	130
Fig.6.11. Comparison of Preferences Level 1 of selection: Married v/s Unmarried	132
Fig.6.12. Comparison of Preferences Level 1 of selection: Working v/s Nonworking	134
Fig.6.13. Comparison of Preferences Level 4 of selection: Working v/s Non-Working	136
Fig.6.14. Comparison of Preferences based on Fineness Level 1 of selection: Working v/s Non-Working	138

Fig.6.15. Comparison of Preferences based on Fineness Level 1 of selection: Working v/s Non-Working	140
Fig.6.16. Comparison of Preferences based on sectional plates Level 1 of selection: social status 1(high), social status 2(high middle) and social status 3 (middle) women group	142
Fig.6.17. Comparison of Preferences based on sectional plates Level 4 of selection: social status 1(high), social status 2(high middle) and social status 3 (middle) women group	144
Fig.6.18. Comparison of Preferences based on fineness Level 1 of selection: social status1 (high), social status 2(high middle) and social status 3 (middle) women group	146
Fig.6.19. Comparison of Preferences based on fineness Level 4 of selection: social status1 (high), social status 2(high middle) and social status 3 (middle) women group	148
Fig.6.20. Comparison of Preferences based on sectional plates Level 1 of selection based on age group	150
Fig.6.21. Comparison of Preferences based on sectional plates Level 4 of selection based on age group	152
Fig.6.22. Comparison of Preferences based on fineness of selection based on age group	154
Fig.6.23. Comparison of Preferences based on fineness Level 4 of selection based on age group	156
Fig.6.24. Articles selected by experts for reflection in form of written words and pencil/ink sketching view of the experts were found to be in concurrent	158-159
Fig.6.25. Articles selected by experts for reflection in form of written words and pencil/ink sketching	160
Fig.7.1. Articles made using grid approach, a photo realistic rendering for client's approval	167
Fig.7.2. <i>Kundan</i> article made using the tool and the grid approach, neck piece	167
Fig.7.3. <i>Kundan</i> article made using the tool and the grid approach, neck piece back side <i>minakari</i>	168
Fig.7.4. <i>Kundan</i> article made using the tool and the grid approach, extended to bracelet.	168
Fig.7.5. <i>Kundan</i> article made using the tool and the grid approach, extended to ear pieces	169
Fig.7.6. Articles being made using grid approach	169
Fig.7.7. Articles estimation and costing	170
Fig.7.8 A less sensitive, more decisive version of tool	171
Fig.7.9 A more sensitive, more detailed version of tool	172

Fig.7.10 One dimensional increment for more sensitivity in investigation of cluster pitch more finely	172
Fig.7.11. Mother Grid in use by designer, Source: Author	173
Fig.7.12. Trend forecasting by periodic application of the tool over years	174
Fig.7.13. A contoured printout can be used as a underlay and control over grinding a gemstone	175
Fig.7.14. Form clusters created by clients to express their ideas to designers	175
Fig.7.15. Structure of Proposed design source book	180

LIST OF TABLES

Table 2.1. A tabulation of respective of different sources explored their Advantage and Limitations.	47
Table 3.1. Smallest semantic units, description and classification.	72
Table 6.1. Comparison of Preferences Level 1 of selection: Married v/s Unmarried	126
Table 6.2. Comparison of Preferences Level 4 of selection: (Married v/s Unmarried)	128
Table 6.3. Comparison of Preferences Level 1 of selection based on fineness: Married v/s Unmarried	130
Table 6.4. Comparison of Preferences Level 4 of selection based on fineness: Married v/s Unmarried	132
Table 6.5. Comparison of Preferences Level 1 of selection: Working v/s Nonworking	134
Table 6.6. Comparison of Preferences Level 4 of selection: Working v/s Nonworking	136
Table 6.7. Comparison of Preferences based on Fineness Level 1 of selection: Working v/s Non-Working	138
Table 6.8. Comparison of Preferences based on Fineness Level 4 of selection: Working v/s Non-Working	140
Table 6.9. Comparison of Preferences based on sectional plates Level 1 of selection: social status 1 (high), social status 2 (high middle) and social status 3 (middle) women group	142
Table 6.10. Comparison of Preferences based on sectional plates Level 4 of selection: social status 1 (high), social status 2 (high middle) and social status 3 (middle) women group	144
Table 6.11. Comparison of Preferences based on fineness Level 1 of selection: social status 1 (high), social status 2 (high middle) and social status 3 (middle) women group	146
Table 6.12. Comparison of Preferences based on fineness Level 4 of selection: social status 1 (high), social status 2 (high middle) and social status 3 (middle) women group	148
Table 6.13. Comparison of Preferences based on sectional plates Level 1 of selection based on age group	150

Table 6.14. Comparison of Preferences based on sectional plates Level 4 of selection based on age group	152
Table 6.15. Comparison of Preferences based on fineness of selection based on age group	154
Table 6.16. Comparison of Preferences based on fineness Level 4 of selection based on age group	156
Table 7.1. Explanation and Elaboration	178

This thesis is written as Tribute to my Forefathers.

Chapter 1

Introduction

1.1. Jewellery as Ornamentation

Jewellery has a universal appeal, omnipresent device of ornamentation, makes its presence felt across time and space. It is an integral part of culture in Southeast Asia, specifically Indian subcontinent. Here too, distinctively, its positive associations are embedded in Indian mind set and enjoys an important position amongst material possessions, depicting social status of a person and family.

Through history of human civilization, jewellery is known to be a reflection of a culture in one of its most refined forms. India has a rich cultural heritage, and it can boast of a history that has tradition of jewellery like no other country. Jewellery enjoys a special status amongst women in India, besides being her pride possession it conveys the status of the person on many different levels. At a glance the jewellery worn can communicate, none verbally merely by

the look, whether the person is married, engaged or single. The absence of jewellery worn by women indicated either widowhood or abandonment, therefore till date women not wearing jewellery is considered inauspicious in several communities. The thought reflects, as observed by (Untracht 1997:19),

“Traditional Indian ornaments have become established symbols of ethnic unity and identity, which is why, in India, from generation to generation, all women within a rural community aspire to own the same traditional objects. In a country such as India, where the geographic origin and caste of an individual is often a question of great curiosity, traditional, symbolic jewelry often helps to enlighten.

Women in Indian art and in life pursue adornment as a form of devotion to men, and with a fervency that parallels religious conviction. Only when they can no longer perform this role, as in widowhood or old age, do women abandon jewelry by custom. While youth, fertility, and men exist, women in India follow a terrestrial theology in which jewelry plays a significant role in achieving male and female union.”

Within social groups it denotes the social status of the person, and it is on social occasions like marriage that the display of jewellery (possessed by a person) is in its full grandeur. The typical Indian wearer has in mind not only the aesthetic value but also an investment for a moment of need. The observation was appropriately reflected by (Untracht 1985:8)

“An amazingly broad range of motives govern an individual’s desire to possess and use jewelry. These ideas are often result of a person’s exposure to the opinions of family, friends, and peers, or to the social and cultural milieu with which one feels identified. Motivations are compounded in complexity by the psychological forces that shape attitudes at all levels of contemporary society, by the circumstances of economics and politics, and by group opinions in general. Today, in addition to this *mélange*, we are subjected to mass media communication, which pours out constant visual and verbal messages of what an individual should like and possess.

The three main groups to which these persons belong are the wearer who of course is central, the collector, and the investor. Connected with each of these are types of jewelry that interest them and the reasons for their interest.”

When we try to look beyond the obvious we find that image of the self (Untracht 1985:9) is at the root of all embellishment activities and people go at lengths taking pains, to an extent of getting themselves pierced and impaled, so that jewellery can be worn in the body void thus created. This is done in an attempt to look more pleasing aesthetically or project an image to

achieve a particular effect. The appeal of jewellery is universal in its nature and it touches people across continents and cultures.

Indian jewellery is known, all over the world, for its finesse and craftsmanship. Although India has a very large variety of styles of jewellery, little is available in form of documentation or empirical studies as compared to the spectrum. This scarcity of material was observed by (Balakrishnan & Kumar 2004:15), as under,

“We humbly sit by the craftsman painstakingly shaping precious metals and gems into timeless jewels. Above all, we are the chroniclers, documenting an art whose terminology, purity of form and distinctive reason for being are fast vanishing even as we write.

In the absence of any documentation of designs, symbolism and terminology, we have had to rely on evidence in sculptures, paintings, photographs, contextual literary references, and discussions with elderly people, jewellers and craftsmen, temple priests and philosophers. Ancient texts and travelogues have proved to be invaluable sources of information in this endeavour.”

This can be attributed, partly, due to the tradition in which the craftsmen work anonymously in their *Karkhana*, slowly perfecting their style of jewellery. They are master craftsmen, practising jewellery, often seeking no personal name, fame or glory, refining their skills, before passing them on to their apprentices who are often sons or blood relatives. This anonymity and lack of documentation, relying on verbal transfer of knowledge, as also in *Vedic* tradition, is reflected in observation by (Untracht 1997:18) ,

“Part of the explanation for goldsmith anonymity can be attributed to the Hindu caste system, in which the jeweler, surprisingly, held a relatively low position. Despite the fact that his works were in wide use by the entire upper-caste echelon, as well as the religious community, even master jewelers were considered unworthy of personal acclaim as far as records are concerned. Another factor was the long-dominant Hindu philosophy, eroding today, that a person’s occupation is preordained from birth. One’s work is one’s destiny and ethical *dharma*, or moral and religious temporal duty, a fact to which one willingly submitted. Formulated within the framework of a sacerdotally dominated social order, the jewelers’ creations were made for the glory of the Divine. Any desire to express personal ego through one’s work was an alien concept. The aim was simply to perform one’s occupation to the best of one’s ability and serve the needs of the community of earthly clients and celestial divinities.

This state of anonymity was furthered by the organization of related, interdependent occupations within a trade, a concept that originated as elsewhere with medieval Indian guilds. Creating a single ornament might involve the combined efforts of the designer, goldsmith or silversmith, engraver, enamellist, polisher, lapidary, and stone setter—all distinctly individual occupations involving long training in specialist skills. Which of these deserved the credit for the creation of that ornament is a moot question.

Unfortunately, because of the high intrinsic value of the precious metals and gemstones used, the greater part of this class of jewellery in India has been melted down to make new creations, a process that parallels the Hindu concept of the eternal cycle of creation, preservation and destruction through which everything passes.”

This recycling of gemstones and precious metals has a detrimental effect on availability of material for study, as the form is lost and along with it the history of part of tradition it came from.

1.2. History of Indian Jewellery

India was traditionally called “*sone ki chidiya*” literally translating to the golden bird. Having survived ravages of foreign invasions in the past, India still boasts of one of the largest collection of gold in private hands¹. Such is the covetousness for gold in Indian mind set that till date it is one of the largest consumers of gold in form of ornaments. This can be best described as observed by (Balakrishnan & Kumar 2004:22)

“India was a ‘gem-bearing’ country. Deep inside the earth lay a veritable treasure trove of precious stones. Precious metals and minerals lay ensconced in her high mountains. Her innumerable rivers carried gold dust over fertile plains. India was home to the stone that lasts ‘forever’; Pliny’s ‘*adamas*’ was the Indian diamond. The country’s legendary wealth enticed adventure-minded travellers, traders in quest of the finest gems and dealers searching for the one piece that would ensure them untold riches. Trade routes and sources of merchandise were guarded with great secrecy and all kinds of fanciful stories fabricated to deter competitors. However, many of these intrepid travellers maintained detailed journals of their voyages, recording their visits to the mines, their dealings with gem traders, their audience with local rulers and their interaction with the people. These chronicles provide invaluable information of their passage, their impressions on politics, life

1. People rarely talk about how much gold they hold and no figures are shared. However, it is common knowledge that a substantial part of annual savings of a household are converted to gold on auspicious occasions. These over the years and generations become substantial as it is rarely sold back or cashed in.

and people, on the economics of trade, and on mining operations. They are the principal sources in the reconstruction of the story of the Indian gem traffic.”

Same thought is reflected by (Untracht 1997:15), a little more pertaining to celebration of body, that suggests that our affinity to gold has remained stable over passage of time,

“India, like no other country on our planet, can rightfully boast of an unbroken heritage of jewelry design that spans at least five thousand years and extends back into antiquity. Its people have expended limitless energy and creativity in the invention of ornaments that celebrate the human body and in developing opportunities for their use. By adorning the visible, material body, they also seek to satisfy a universal longing for the embellishment of its intangible counterpart: the human spirit.

Indian jewelry comprises a vast and complex assortment of marvels. Traditional ornaments-having a distinct cultural identity play a significant and fascinating role in characterizing Indian civilization.”

There are references to jewellery in ancient writings, recorded in *Kautilya's Arthashastra* where meticulous descriptions are given about gold and its metallurgy, types of alloys, types of colours those carat gold alloys reflect, plating and enamelling techniques etc. This document also describes good ornament and the parameters against which it is judged, that include symmetry, strongly made, good polish, not artificially gilded, well proportioned, pleasant to wear, not gaudy, full of lustre, beautifully shaped, even and captivating to the eye. The parameters are equally valid today as they cover at length the formal and finishing aspects.

It further elaborates the care that must be taken for setting a gemstone firmly in its place and how by controlling metal quantity in strategic locations a setting can be made well. It gives detailed processes of gilding and enamelling along with colours to be used in enamelling.

The document also explains ways by which a jeweller can cheat his clientele by mixing amounts of copper or silver in a fixed proportion. There are laid down norms for their wages along with other craftsmen (Rangarajan 1992:744)

The past of Indian jewellery are best described by (Balakrishnan & Kumar 2004:12), as below,

“The story of Indian jewellery goes back over 5000 years to the prehistoric past. It is scattered over vast tracts of land, and nestles amidst silent emblems of human endeavour...Decoration of his physical surroundings and of his self was a consuming preoccupation. From the clay beneath his feet, he fashioned

items for everyday use...from deep within the earth, he extracted imperishable minerals and metals and crafted beautiful pieces to adorn his body. Generation after generation these archetypes of human endeavour passed through time, and were admired, worshipped and worn by man, woman and child. The story of Indian jewellery is woven from these time-worn threads. Silent links in the history of our land.”

There are even older references to jewellery in *Matsy Purana*(Balakrishnan & Kumar 2004:196), as “captivated by the celestial gem *Kaustubha* as it emerged from the cosmic waters, Lord *Vishnu* appropriated it for himself and wore it on his breast.” Text had clearly pertained to major gemstones that constitute an exciting aspect of Indian jewellery.

Since antiquity, India has been famous for its diamond deposits. Until 1729, when diamonds were discovered in Brazil, India was the world’s sole source of that magnificent gemstone. Despite being discovered in Brazil, they were secretly shipped to India for being sold as for a long time no one believed that they could be found outside India. Jewellers in India also had access to the other four of the “five great gemstones” *maharatnani*: diamonds, rubies, sapphires, emeralds, and pearls that reflect beautifully in a *panchratna haar* or “five gemstone necklace”. It was for the availability of colour stones alongside, Indian jewellery embraces colourful jewellery, while European jewellery remained monochromatic or dichromatic in its essence².

1.3. Diachronic History of Jewellery

The earliest form of Jewellery, or more accurately ‘prototype jewellery’ was beads that were fashioned by forces of nature namely corrosion and erosion. These were used often ‘as found’ or minimally altered by either enhancing/modifying an orifice through which a thong/rope/thread could be passed.

Animal teeth such as walrus & elephant ivory, nails feathers, exoskeletons like conch and fragments of bones were other materials available for prototype jewellery. Some of these retain their primal appeal to date in form of say, mother of pearl jewellery. For making jewellery either this were tied with a thong or had a naturally occurring hole through which a thong could pass³.

² It is pertinent to mention the mining and therefore availability of five major gemstones to Indian jewellers of the era. These came from gem bearing mines inland as well as spread over Kashmir, Barma and Sri Lanka. Some of these mines are still operational marginally.

³. A principle that holds good till date, either the stones are held mechanically by arresting them in a variety of

With the advent of tools and techniques through ages (metal tools being available in bronze ages and iron ages) came a marked change in jewellery and its forms. With the invention of bow drill, it was possible to make a hole through beads of various materials and shapes (Appendix I). These primitive instruments sometimes used abrasive slurry to cut through a very hard material that resulted into the typical biconic hole. These conical divergent or barrel holes (Untracht 1997:79) are also a tell tale sign of 'antiquity' of jewellery.

With onset of Bronze Age, jewellery underwent a total transformation and now various forms could be fashioned from metals that were malleable and ductile as compared to hard and brittle minerals.

Jewellery of mediaeval times, especially European jewellery is documented and studied as some specimens survived difficult times. (Scarisbrick 2007:187) These were the times where precious metals and gemstones revealed their power at its best and to a large extent were used to buy power, life and even deliverance where redemption could be bought.

However, the best usage of technology came to jewellery making with the industrial revolution where new tool materials and precision machinery revolutionized every walk of life. With new tools, working both in metals and gemstones at much finer levels became possible.

In post First World War era, finer metalwork for setting smaller sized gemstones and concurrently polishing of smaller sizes of the same was a significant landmark of the times. Where once polishing of fractional carat weight a stone was neither possible nor economically viable, with available technology it became a feature of the jewellery of times. It became a practice to surround a major gemstone with several smaller stones to give appearance of a relatively larger stone⁴.

Today, as the jewellery industry enjoys high-end computer aided design and development, a major technological jump has taken place. In situation casting of diamonds using lost wax moulds is a common thing for mass production of jewellery. Rapid prototypes and specialized software have made developmental work fast and precise. These new developments bridged a large time gap between sketches to products (articles of jewellery) by directly providing a wax master ready for investment casting.

ways or having a through and through hole to allow a different material to pass through.

4. Today it is possible to have up to six hundred stones in a single carat; moreover it is possible to set them Micro Pave on an article. A discussion with Mr. Vikram Singh (designer), Mishti jewels, Mumbai August 2011.

1.4. Comparison of Style of Working of Indian and Western Jewellers

As discussed earlier in this chapter, Indian master craftsmen work anonymously and it's difficult to trace work to a single master. However, for sake of assessment, compared to Indian jewellery, European jewellers have very good documentation of designs, processes and specifications. Indian lack of documentation in various traditions, especially craft based is most severely felt in jewellery domain in the Indian scenario.

European master jewellers practising a style that is synonymous with their names, were confined to a jewellery house. Their hand is recognizable and distinctly different from other master jewellers but is not a tradition followed by others in fraternity of jewellers. For example, the House of Van Cleef & Arpels, known as one of the leading and most stylish jewellery dealers of the 20th century, had its origins in 1906. It was established that year, by three enterprising young men - Alfred Van Cleef, and the brothers Charles and Julien Arpels - opened a shop in the Place Vendome, at that time the prime centre of fashion and luxury in Paris. Van Cleef & Arpels' collections have traditionally concentrated on the major gem stones - diamonds, rubies, emeralds and sapphires - and the firm is renowned for creating unique pieces of jewellery. Their use of many coloured stones in one article of jewellery makes them a good candidate for comparison with Indian *Kundan* that also uses many coloured stones in one single article. Some items, however, such as bracelets with "invisibly set" rubies or sapphires, became such classics that they are still being produced. (Snowman 1990:208)

To further clarify this fine aspect we can compare any other famous master jeweller say *Bulgari*, Cartier or Tiffanies with Indian *Kundan* articles to come to an overall understanding on subject matter. While *Kundan* is a distinct jewellery style, it is not limited to one house or setting but practised by several craftsmen.

In this manner, although this is a style but there are multiple practitioners, collectively following one tradition. *Kundan* is one such style that has remained wholesome despite western influences in terms of form and technology. This can be attributed to the labour intensive nature of the style and difficulty in mechanization due to large variance and none standardization of stones used in setting. The traditions often misread by people is best described as (Balakrishnan & Kumar 2004:16),

“The artistic merit of this unbroken tradition has been misunderstood by the uninitiated, who have labelled it ‘aesthetic conventionalism’... What matters is the intensity of the expression and such work will be original in the same sense that ‘the recurrent seasons, sunrise and sunset are ever new’.”

Another significant difference between these two major lines, European and Indian, is use of machine work and mechanically precise components. As compared to European, Indian jewellery relies more on a symmetric appearance but is not ruthlessly precise mechanically. However, a lot of importance is given to overall composition making it look beautiful. The typical advantage is that Indian settings can accommodate diverse sizes and shapes of stones and the designs still look symmetrical and balanced, while European jewellery demands the stones to be of standard geometry with very little tolerance for variance within a lot.

1.5. Contemporary Scenario and Influences

The contemporary Indian scenario appears promising, the export of articles of jewellery to overseas markets has made its mark on the world map and India is one of the largest exporters of jewellery and allied articles. On the other side, it is importing latest manufacturing technology and tools to work more effectively and efficiently from technologically more advanced countries from Europe and Americas. According to Gem and Jewellery Export Promotion Council, India has emerged as front runner in polished diamonds, where weight by weight it processes in excess of seventy percent of world’s small diamonds. It is also a major centre for polishing and processing of both precious and semi precious colour stones. This export of articles of jewellery besides import of tools and equipment is merely a reflection of past where the fraternity of jewellers benefitted from this exchange of knowledge and resources. Indian jewellery craftsmen have for a long time absorbed techniques from other cultures and adapted them for their devices. The enrichment by these techniques creates “nuances within the tradition” a paradox existent within fraternity of jewellers, more things change more they remain the same, within a tradition. The thought is observed by (Balakrishnan & Kumar 2004:16),

“In spite of the strong Portuguese, Dutch, French and British presence in different parts of the country from 15th century onwards, very little western influence of prevailing contemporary European styles is evident until the 20th century. The art deco movement that was popular in Europe at the time contributed a small share

of influence, as did other western styles that were introduced by renowned foreign jewellery firms soliciting business in India; but this was confined to the wealthy aristocratic classes with little or no visible mark on the vast jewellery using peoples of India.”

The jewellery had several influencing factors, most prominent being the European influence, especially as a result of erstwhile maharajas being exposed to European technical skills, the cross cultural exchange is best described as (Untracht 1997:19),

“It has long been recognized that no culture exists in a vacuum. Thus, this organized journey through India’s jewelry world concludes with a look at the cross-cultural exchange between Indian jewelry concepts and those of the West, a process that continues today. The fabled maharajas who possessed impressive accumulations of ancestral traditional jewelry were well aware of the highly refined level of design and technical skill that Western jewelers could offer them. During the nineteenth and early twentieth century’s, they commissioned the grand joailliers of Europe to produce elaborate ornaments for them. At the same time, jewelers of the Western world fed upon the creative design concepts of Indian jewelry and invented a synthetic Indo-Western style by adopting several of its characteristic elements. Once these entered the lexicon of Western design resources, their Indian origin was often unacknowledged or overlooked.”

On one hand above text reflects cross cultural exchanges, the later part shows clearly the need for research and documentation to protect our intellectual property, which may be lost like other finer crafts.

Today the jewellery serves many purposes, besides being an investment it satisfies human needs on various levels. However, the enhancement of one’s self image (Fig.1.1) remains its prime function that is fulfilled by its form, aesthetically pleasing to the eyes of wearer and observer alike. As (Untracht 1985:9)

“The functions that jewelry serves for the wearer, starting with the more basic types, which are later subdivided, jewelry can be classified into the following groups: jewels whose main function is remembrance; jewels that serve an actual functional purpose such as holding clothing parts together; jewels with artistic purpose, made to express an aesthetic; jewels concerned exclusively with contemporary concepts; jewels that are dominated by traditional concepts; jewels for official use that express the hierarchical, structural nature of society; and jewels with magical powers, concerned with the irrational and with an individual’s inner fantasy life.

All of these relate to areas that concern basic aspects of the human being: the self-image, the root image, and the public image.”

There are also movements that started in sixties that made use of none precious materials such as plastics, and are covered under an entirely different category of “costume jewellery” to accompany a particular dress during a particular event. They were made of relatively inexpensive materials like base metals, glass, plastics such as Bakelite and almost anything and everything. Sometimes unusual metals like Niobium and Aluminium were used to achieve amazing effects.

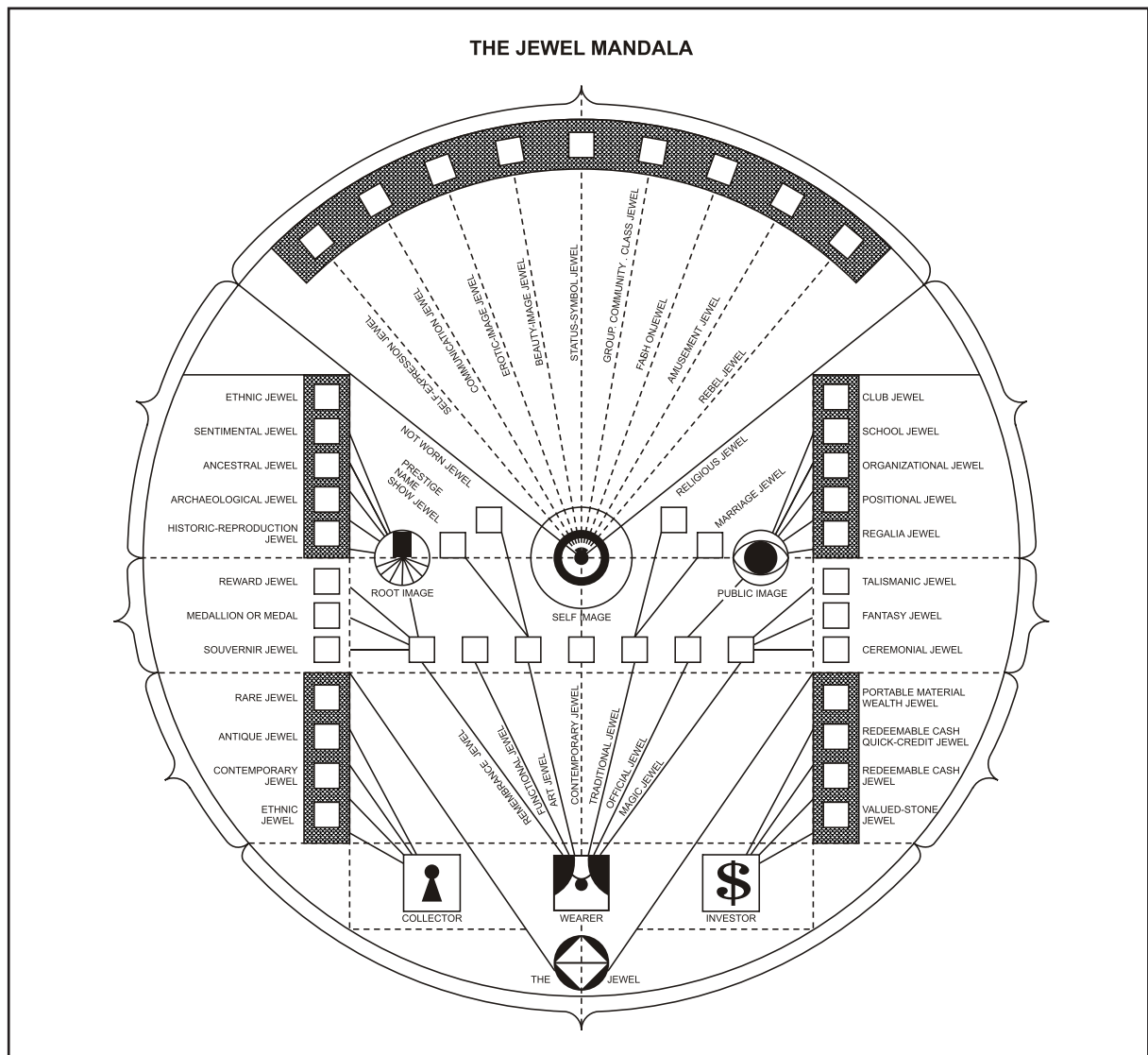


Fig.1.1. Image of the self in the Jewel Mandala, adopted from Oppi Untracht.

The jewel mandala can be read inside out starting with the image of self leading to any of the variety of beauty-image jewel or status-symbol jewel. On the other hand it can be read outside in, where it starts with portable material wealth jewel or redeemable cash quick credit jewel. This idea is propounded in following point.

Trend of costume jewellery was started by Hollywood, a movie star where one piece was designed specifically for one scene to accompany a particular outfit. These articles had little intrinsic value and high extrinsic value due to use of a particular technique or material.

Due to its relatively inexpensive nature, lot of experiments took place in this category and some of the pieces became more expensive than jewellery made in gold or silver due to its history or uniqueness. This category was a diversion from the main body of work, hence not perused in more details.

1.6. Psychological and Sociological Aspect of Jewellery

Jewellery in India is synonymous with bullion metals, preferably gold or silver. The reasons for these metals being preferred for jewellery is both sociological and psychological as often the bulk users are women. The affinity of Indian women (and men) to gold can be attributed to deep roots dating back to times when India was a collection of *Ganarajya*, several kingdoms coexisting side by side.

It was a custom that women married and left their father's house to join the family of the husband. This tradition continues to present date. In those days, often the family in which a girl was given was from a different *Ganrajya*, a different state in today's context. The custom was to give share of girl in paternal property in form of jewellery, at the time of wedding, an important part of her trousseau. Sons of family in turn married women from other republics and their women brought with them their share in their paternal property, in a similar form.

The sons stayed in land and therefore inherited immovable property, which in turn was inherited by male lineal descendents. Female lineal descendents continued to be married to distant lands and the system worked wonderfully, where they carried their wealth with them in a very compact form of 'jewellery' that was portable and held its cash value across diverse states and ethnicity. Even to date the cash value of gold holds fairly consistent across countries and continents. Gold and in turn jewellery made from gold, also has a universal appeal in tribal, rural or urban settings.

This convention of women being endowed with portable wealth in form of gold

jewellery served another purpose in emergencies like war or warlike situations. If the family had to abandon land they lived in for any reason, all was lost. A portion of total assets converted into gold, could be carried to the place wherever they moved and this corpus was available to the family to tide over a difficult situation and start a new life.

Largely the quantity of gold held by a family was in individual possession of women, where they enjoyed absolute control over this material possession. This gold was also protected by a strict code of conduct in society where it was considered beneath a man to touch it even in most trying situations. A house selling gold was a bad sign, a distressful situation beyond control. So much so that for changing a worn out or damaged article the order was to buy a quarter amount more at time of replacement of old jewellery. This was called *Sawaya*, one and a quarter, a custom that is even seen today while a family orders old gold to be melted down for reconstitution or new jewellery to be made.

In not so distant past, if for a reason men had to borrow from *Streedhan*, wealth controlled by women it had to be borrowed in ceremony that bore witness to the event and they had to double it and deposit back before the next financial year came to an end. This wealth also enjoys a special protection under the law where a women's personal jewellery cannot be confiscated to pay debts of men and the possession of jewellery is proof enough to make it her property.

It can easily be understood from the passages why the psychological affinity to gold runs so deep in Indian mind set. These factors are in a cumulative history of a family often dormant and in subconscious, built as a final line of defence for survival of a family in dire situations. Above examples put light on hoarding tendency that can be seen among women (and men) in India towards gold jewellery.

To date, India has one of largest collection of gold in personal possession and Indians are one of the largest consumers of gold worldwide. This typical consumption of gold by Indians in the form of bullion metal as well as ready ornaments is known all over the world. One typical behaviour of Indian consumers is one sided purchase, repeatedly buying only over the years. Bought articles are rarely, almost never sold⁵.

5. A contradiction to this pattern can be seen in extreme or war like situations, where at call of the then prime minister Mr. Lal Bahadur Shastri large quantities of gold were donated for a national cause in a single day. It is also not uncommon for people to donate huge quantities of gold, almost anonymously to temples and charities. These paradoxes of extreme affinity and selfless donations exists side by side in India.

1.7. Subject Importance

Kundan as a traditional style has made a comeback in recent times. It is a style that has remained unaffected by European influences in form and can be called as an authentic Indian style where the motifs are distinctively Indian and identifiable at a glance amongst other contemporary styles and trends. The process of *Kundan* setting is labour intensive and difficult to mechanize, hence ideally suited to Indian conditions. In such situations research can make most meaningful contributions to domain of jewellery.

According to GJEPC (Gem and Jewellery Export Promotion Council, 2005:18) the export of gems and jewellery in the year 2005 was 15.67 billion US Dollars. The target for the year 2007 as stated by the GJEPC chairman was 20 billion US Dollars. Recently, the Exports of Gems and Jewellery during April - November 2011 was 29154.97 million US dollars that was showed. The contribution of *Kundan* jewellery is between 7% to 10% of total fine jewellery segment⁶.

Author visited the India international jewellery show from year 2007- 2011 to have an experience oneself to observe how popular the *Kundan*, as a style is becoming. The ever increasing number of stalls and the material on display clearly indicate a comeback of *Kundan* and it is safe to expect the trend to continue for some time to come. Being a traditional style, there is little chance of it going out of fashion altogether. Nevertheless, it may see its seasonal changes over years.

When we look at an overwhelming number of advertisements appearing in magazines such as timeless jewels, the sheer number of advertisements for *jadau* jewellery tells us the comeback of *Kundan* and becoming popular with connoisseur of jewellery. Some of the advertisements are reproduced for observation, pictures are self evident of popularity as they come from magazine advertisements and publications. Fig.1.2 through Fig.1.7. depicts various articles of relevance of different forms.

Some of these designs are typical in a sense that they replicate one form and adopt it as it is for another purpose, Fig.1.2. is a example where a *bazuband* is adopted as it is as a neck piece with addition of strings and slider. *Bazuband* as an article is no longer in use, as they were

6. Based on a interview with Mr. Ruban Hobday, Director, Southern Region of GJEPC, India.

once upon a time, when they were tied on hand above elbow.



Fig.1.2. *Kundan* article, Times N Style 2005:90.



Fig.1.3. *Kundan* article, Timeless jewels volume-7 issue-3 p127.

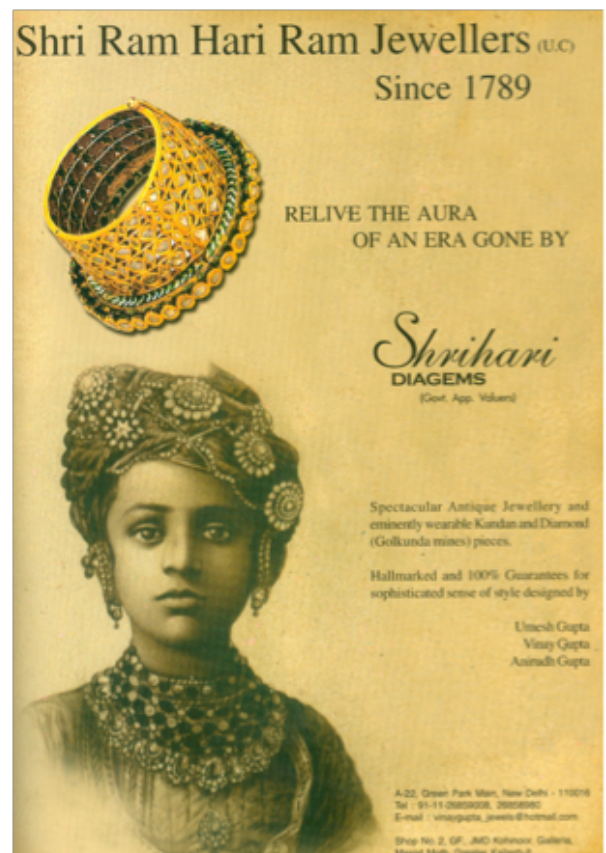


Fig.1.4. *Kundan* article, Timeless jewels volume-7 issue-3 p5.



Fig.1.5. *Kundan* article, Timeless Jewels volume7 issue3 p81.



Fig.1.6. *Kundan* article, Timeless Jewels volume-7 issue-3 p41.



Fig.1.7. *Kundan* article, Timeless Jewels volume-7 issue-3 p123.

1.8. Various Types of Jewellery

There are different ways to look at types of jewellery. For purpose of understanding, the basic difference is the use of material namely precious and semi precious (commercial material cannot have zero value hence the classification is precious and semi precious). Jewellery made of precious material uses bullion metals like gold and silver either alone as metal or along with a variety of precious or semi precious gemstones. The broad classification for jewellery made of bullion metals is Metal Jewellery and Fine Jewellery. In metal jewellery, no gemstones are used while in fine jewellery at least one or more gemstones are used. These can be further classified into regional specialities, traditions, techniques and form⁷.

There are other types of jewellery that came into existence with dawn of movies in Hollywood, which came to be known as costume jewellery. The trend started when a particular dress required a matching article of jewellery to appear real and expensive on screen. Relatively inexpensive materials and synthetic gemstones, imitating the real ones were extensively used. Since the material was not prohibitively expensive like bullion metals and gemstones like diamond, many formal explorations took place in this particular segment.

A holistic picture of how far and wide spread the domain of jewellery is represented by jewellery mandala and polarized convocation of jewels (Untracht, 1985:9-12) is shown in Fig.1.8. These illustrations show alongside gold, silver and major gemstones a host of other materials used in jewellery. It is common to see plastics, aluminium, rubber and stainless steel rapidly gaining acceptance as jewellery. Articles made of these materials possess' extrinsic value in novelty of form and process and little intrinsic value as material as compared to jewellery made of bullion metals that have a high intrinsic value.

There is a technological jump in manufacturing processes and available technology. However, the appeal of handmade jewellery retains its charm. This can be attributed partially, to high intrinsic value that the basic material contains.

7. The usage of the term fine jewellery indicates usage of gemstones in an article, not the overall finesse of work.

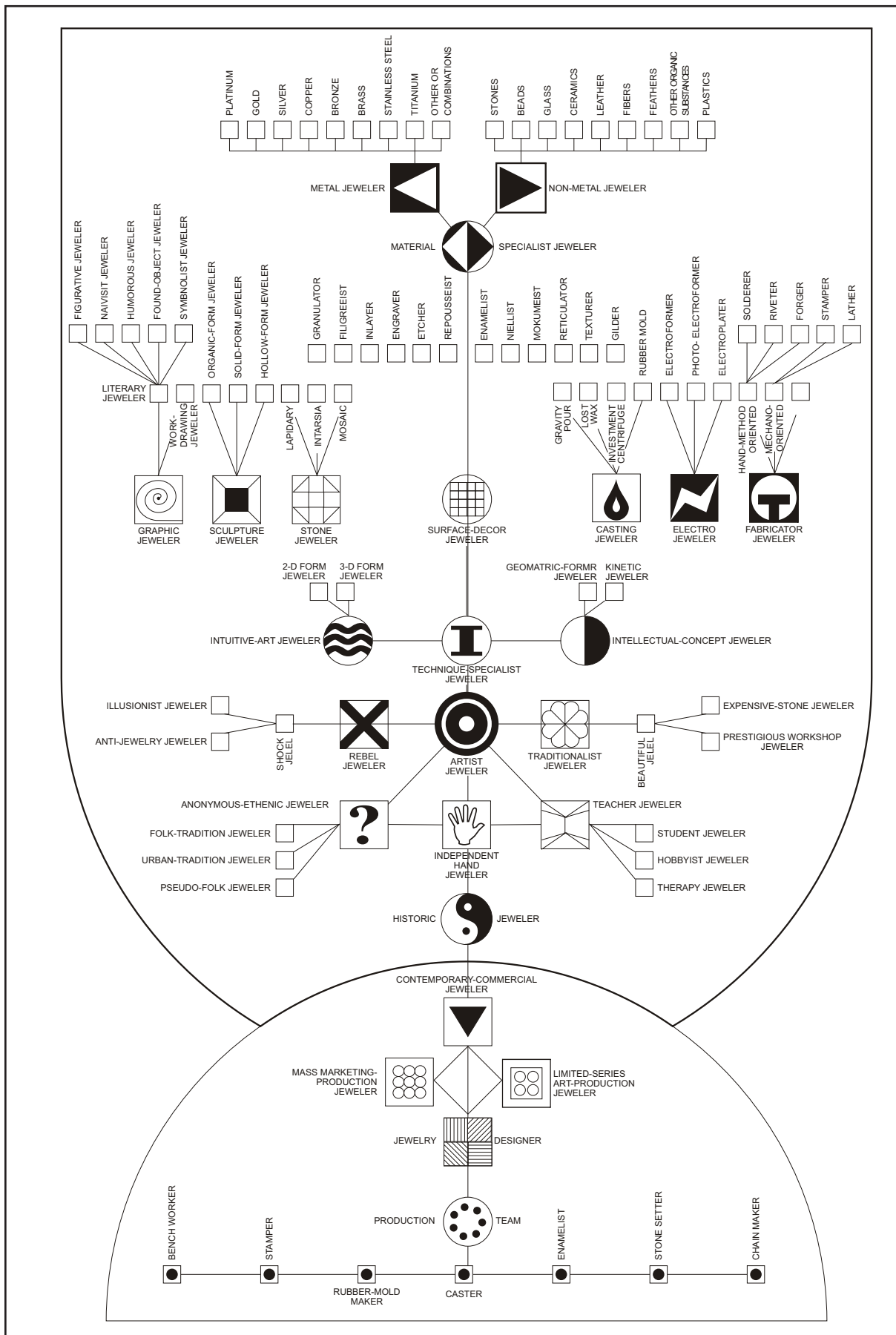


Fig 1.8. A Polarized convocation of Jewellers.(Adopted from Oppi Untracht)

1.9. Structure of *Kundan*

Kundan jewellery is a particular type (of jewellery) that utilizes chips of diamond, raw or minimally polished for the purpose of setting, thereby giving an article its classical look. This type of jewellery is motivated by the old Indian concept of retaining maximum weight of diamonds and gemstones, used as they were naturally found or minimally faceted. This typical use of diamonds and gemstones is in contrast to western concept of polishing them for maximum brilliance or fire, in formal brilliant cuts (Pagel-Theisen 1993:174) (Snowman 1990:182-185). Properties of carat weight and quality of cut (that determines the fire inside the diamond) are diametrically opposite to each other. If a polisher tries to retain weight it compromises optical properties and vice versa.

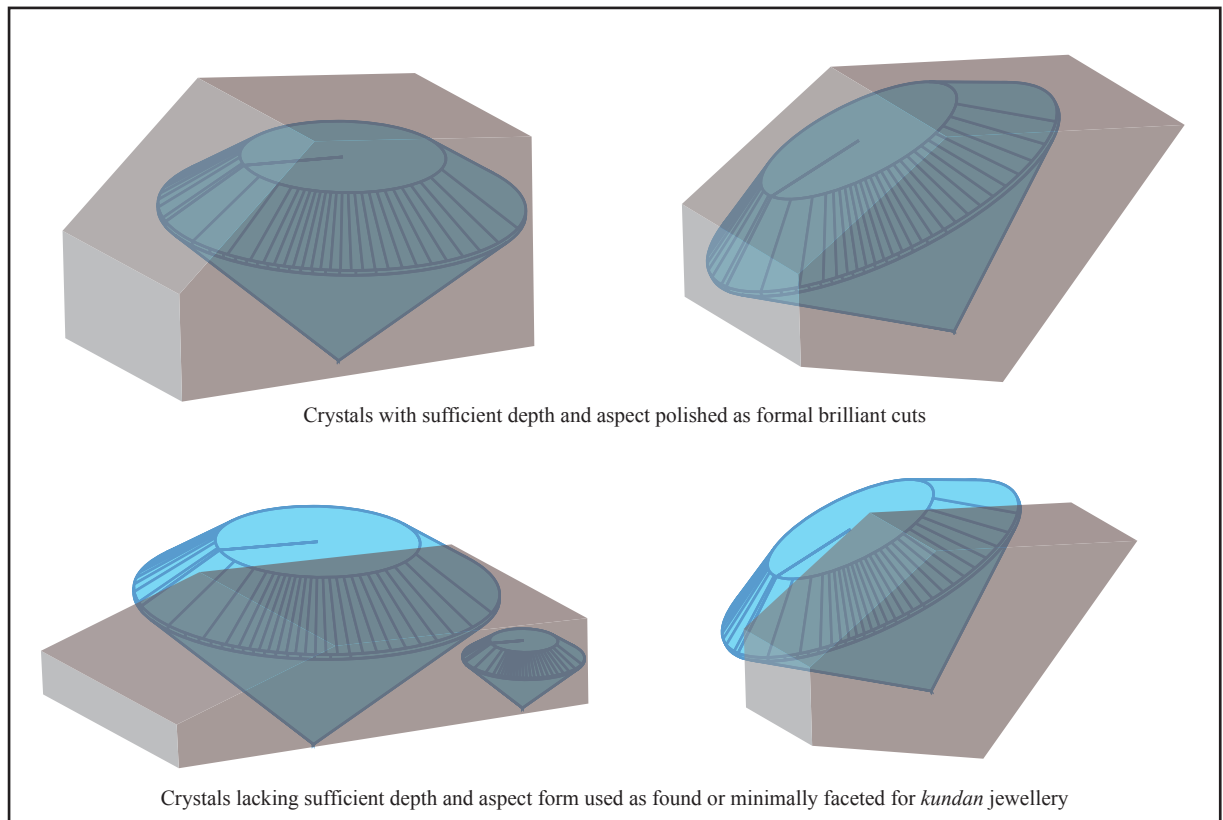


Fig.1.9. A visual comparison of diamond crystals for formal cuts and chips used for *Kundan*.

Diamond is purest form of mineral carbon and has a variety of crystal lattice structure. They range from simple octahedral to dodecahedra with several ingrown, outgrown and twinned forms. The regular forms are often intact crystals, most often found being octahedral. Sometimes, the octahedral form may be cleaved or fractured and these chips are churned and ground in alluvial deposits assuming interesting forms as depicted in Fig.1.9.

Diamond crystals come from mines in variety of regular or irregular forms. The crystals that can be sawn, cleaved or bruited are polished in any of the formal brilliant cuts. The ones lacking sufficient depth for any of the above processes are minimally faceted to remove surface marks or mineral residues and are used for *kundan* setting. These diamond chips are called *vilandi* or *polki* in colloquial language (Fig.1.10). They are also used in flexible and semi flexible structures as dangles shown in Fig.1.11.



Fig.1.10. *Kundan* as a style of setting, using *vilandi* or *polki*.



Fig.1.11. Flexible and Semi Flexible structure in a *Kundan* article.



Fig.1.12. Visual comparison of *Kundan* and western style of settings. Two pictures in the upper half show the example of formal cuts in channel setting, the lower half two picture show example of *kundan* setting.

Kundan jewellery has a structural framework of gold crafted in intricate details. The gemstone is set from the front using a foil of very high purity gold. For the purpose of setting a very thin foil is rolled in a mill, at such fineness and low thickness gold becomes very pliable. Parts and pieces of this foil are pressed in cavities left around the gemstone, partly set with setting paste. By pressing layer after layer of crumpled foils of gold, space around gemstone is slowly filled with solid gold. This pressing is done by a pointed tool that gives good pressure and negotiates tight corners to get a flush stone close setting (Untracht 1985:614). Sometimes mild heat is applied to fuse gold together. Gold surface holding gemstone in place is evened out using an engraver that leaves behind a lustrous surface. This method is also used to make gold patterns over a variety of substrates like conch shell, ivory, precious and semi precious gemstones like agate and marble. To achieve a pattern as if gold is inlaid on surface, first pattern is traced on surface. Thereafter holes are drilled in key locations that act as nodes and anchor points. These points are filled with gold pins (or foils or both) that work as base and anchor for successive gold work⁸. Gold in form of foils is worked on it and layers deposited to get desired

8. Formal brilliant cuts with a well defined outline/ shape of the gemstone is a distinguishing feature of western jewellery. The formal cuts have a form of their own that contributes to overall form of jewellery. As compared to this *Kundan* jewellery gets its look from the gold structure of the semantic unit. These semantic units have forms different from those of the gemstones still, like paved stone designs it creates an interesting overall form.

shape. Excess gold is trimmed using engravers. Ultimately the surface appears as gold is inlaid into it (Sharma ; Varadrajan 2008:111).

Kundan work has a well-defined geometry and amazing level of symmetry is achieved using rough shapes that may not be uniform and symmetrical like round brilliant cuts as shown in Fig.1.12. Work requires excellent craftsmanship and clever arrangement of stones in their place to achieve an aesthetically pleasing composition. “*Janchana*” is a process of looking at composition before actual setting takes place. A Photostat or tracing of design is taken and stone composition is checked over this acting as background. There may be several trials and errors before a stone finds its right place and orientation. Once the craftsman is satisfied with his scheme of things, actual setting takes place.

Backside of *Kundan* jewellery is embellished with hard enamel typically red green(Fig.1.13) and red blue colours. This makes back side of jewellery equally pleasurable to look at, a feature that makes jewellery wearable from both sides, the backside may often be better than front (Sharma ; Varadrajan 2008:21) Enamel also works as security feature for settings which gets disturbed if a stone is taken out and set again with a lower carat or inferior quality stone.



Fig.1.13. Red, green *mina* on the backside of a *kundan* article.

These forms may be geometric or flowing using minimally worked stones. This is a lead over formal brilliant cuts which can fit only in specific cavities. *Kundan* settings are therefore more accommodating in terms of accepting an irregular shaped stone to create a form cluster.

1.10. Need of Research

The absence of good documentation of Indian jewellery, except a few books containing pictures of jewellery of erstwhile maharajas is not sufficient. The need of research is strongly felt during discussions with domain experts and jewellers alike. In absence of empirical research, most of the design and production activities, even those generating profits are a matter of chance and with the huge amount of money at stake, it keeps people in the business sleepless. In absence of empiricism, the advice of professionals, often at best are opinions-sometimes far from facts.

During the search for research subject and focus, *Kundan* emerged as the frontrunner in the vast domain of jewellery, which has a clear need of research. There is severe lack of documentation and no catalogue is available that puts light on subject, that is understanding *kundan* and its form, in a scientific manner. There is lack of authoritative material on subject matter and problem is further aggravated by use of elliptical⁹ language in the field. However one can sense that there is a clear

- Lack of documentation
- Lack of classification
- Lack of depicting possibilities of form or form variations.

It is a need of time that *Kundan* be systematically studied in a methodical manner. This is expected to make communication between clients and designers effective by providing a platform for systematic categorization of *Kundan* jewellery.

1.11. Research Objectives

The primary research objective is to identify areas where methodical research is needed in the domain. Next objective is to identify areas where maximum impact can be made by way of research. There are a few lucid gaps visible in the domain, mainly in research based on formal aspects of jewellery. Intended research starting from the small units inspired from nature

9. The jewellers often use a language that is floral, encouraging and reassuring a person about the choices they made. There is no critical remark and only best aspect of jewellery are presented. It is difficult to find even the basic facts objectively as they are concealed under specific use of language.

to the overall jewellery form, it is also to systematically catalogue the basic units that form the language of jewellery. There are a few leads into the subject matter that are discussed at length in literature review.

One of the objectives is to provide a tool by which various parameters can be measured empirically so as to enable designers and clients to interact and communicate effectively. The nobler objective is to pave way for further research in a relatively uncharted terrain.

The focus area is the form of jewellery on an overall and detailed level, and how it influences the user preferences. This is to understand various parameters and variables in a scientific methodical manner.

Chapter 2

Literature Review

2.1. *Kundan*

The word *Kundan* refers to pure gold, this style derives its name from the metal it is made of. It is used interchangeably for the technique of setting used to hold the gemstone in place, often a “as found” or “minimally faceted” diamond. Some texts refer to the diamond, as *kundan* but that is a misnomer, and the stone is referred as *polki* or *vilandi*. Sometimes *polki* as a word is also used for *kundan* jewellery that uses diamond predominantly. Specifically, it is a sub set of *Jadau*, a word derived from *jadai*, “to hold fast” or to set a gemstone in its place.

The back side of *kundan* is embellished with enamel (*mina*) for the functional reason to protect the precious metal from effects of corrosion due to body sweat, grease and erosion due to friction with skin and grime. The layer of enamel protects the article from wear besides being aesthetically pleasing. This also was a security measure that showed signs of distress if

the gemstone was unset and replaced with a fake one.

Kundan was the Indian style of setting, before introduction of claw setting, a Turkish-European influence and virtually all jewellery was set in this particular style. (Balakrishnan & Kumar 2004:270) The prior forms were the earliest known form of jewellery beads, having a hole, through which a thread could be passed and the article thus created could be worn around neck or tied to a body part. Several beads could be strung together to form, for example a pearl string or a String of any precious or semi precious gemstone. Most of the antique Indian jewellery reflects therefore, examples of *kundan* or beading or a combination of both as a method of holding gemstone in place. So much is *kundan* synonymous with purity, highly appreciated in Indian tradition that often a refined person is compared with *kundan*. (Balakrishnan 2004:276)

“In fact the Indian idiom, the process of *Kundan* making- repeated exposure to fire refines gold into *Kundan* is used as a metaphor to describe sterling character strengthened by the test of tribulations.”

2.2. *Jadau (Jadai Kaam)*

Jadau, literally translates to setting, that is “to set” or “to make firm” a process by which a gemstone is held mechanically in an intricate frame of gold. *Jadau* or *jadai kaam* pertains to mechanically holding the gemstone in place from its rim or the widest section by rolling over metal. This rolling or pressing of metal creates a firm joint and the gemstone gives an aesthetically pleasing appearance.

Kundan, Victorian and *PachchiKam* are three styles that make use of similar motifs and can be mistaken for each other. They are, however, different from each other in use of material and processes. A brief description is as follows:

- 1. *Kundan*** - Uses a framework of gold of high carat purity, and utilizes very fine gold for setting the stone flush. The work is intricate and done by hand with little or no mechanization contributing to effort. Fig.2.1. shows some examples of *Kundan* Jewellery.

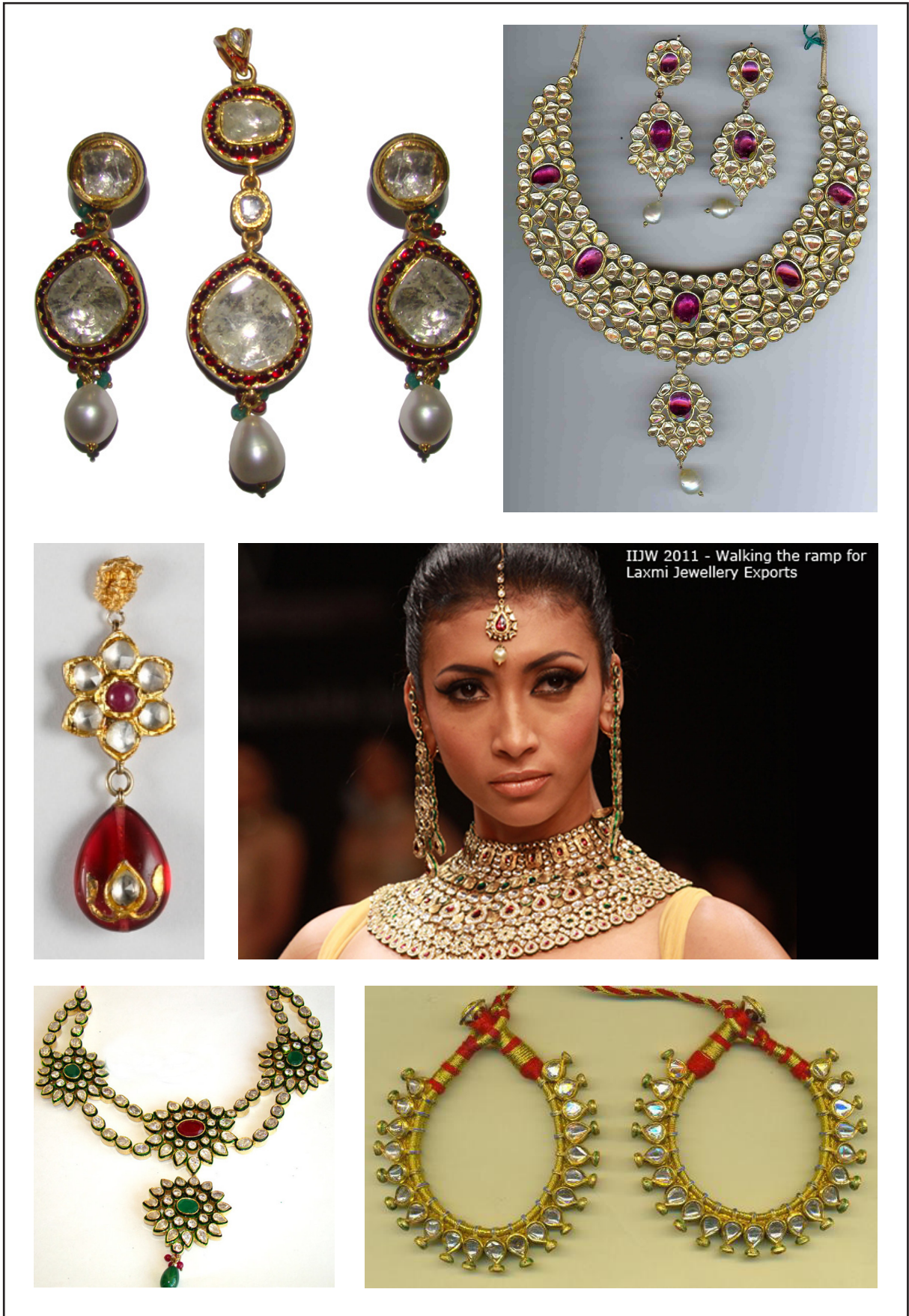


Fig.2.1. Examples of “kundan” jewellery.

2. **Victorian** - on the other hand uses mechanically pressed metal to form cavities in which gemstones can be set as shown in Fig.2.2. It does not use *kundan* as a style of setting and may use diamond imitations in place of authentic ones.



Fig. 2.2. Examples for “victorian” jewellery.

3. **Pachchikam**- uses white metal, silver and copper as a material and the work is relatively less intricate as compared to *kundan* as shown in Fig.2.3.(Balakrishnan 2006:109) This style uses motifs that are similar to that of *kundan* but there is a spatial form to the article. It also uses press worked units with imitation colour stones. The word is a derivative of ‘*pachchikari*’, artistic work.



Fig. 2.3. Examples for “*pachchikam*” jewellery.

It is pertinent to quote here, the exquisite neck ornaments worn by the lead actress, Aishwarya Rai in the movies *Devdas* and *Jodha Akbar* were examples of *pachchikam*, often misquoted as *kundan*

2.3. Stone Setting Techniques

Jewellers from ages find a difficult task at hand when two materials dissimilar in nature need to blend with each other in an aesthetically pleasing manner. Gemstones as material are hard, brittle and transparent or translucent while metals are malleable, ductile and lustrous. Metals can be alloyed, soldered, bent and mechanically manipulated in a variety of ways to achieve a particular form. Gemstones, on the other hand, can only be fashioned by removal of material by cutting or polishing. Interfacing of these two materials poses a technical challenge and jewellers have found a variety of ways to blend these two by binding them.

The binding processes can be broadly classified in two categories, one by cementation of metal and gemstone with a glue, two mechanical holding of gemstone by metal. Cementation uses a third material that is adhesive to both metal and gemstone. Mechanical holding has two broad variations, first is metal massing through body of gemstone as in pearls. Second gemstone being held from outside body either by prongs or close setting techniques.

2.3.1. Setting v/s Beading

As discussed earlier in this chapter, beading and setting are ways to interface metal with a gemstone of mineral origin, like diamond or organic origin, like pearl or coral. (Dubin 1995:11) Beading being the oldest, is also the simplest and requires one mechanical operation of drilling of a 'through and through' hole in the body of gemstone in a strategic location. Through this hole a chord; metallic or none metallic, can pass through and hold the gemstone firmly allowing more to be added to form a length. Once drilled through, the hole is visible in transparent and translucent gemstones (Fig.2.4.). This is undesirable sometimes, when the stone needs to be re-cut or re-set in an orientation different than in original article.



Fig.2.4. Setting and Beading.

In application a flexible material such as silk is used for stringing several beads for neck pieces, while metal linked beads are used for single or a few beads to make dangles and other decorative applications.

Setting on the other hand, holds the gemstone from outside body and therefore allows, to a certain extent, re-cutting and re-setting when the materials are recycled.

2.3.2. Types of Setting

There are several types of setting available to suit various applications. These are variations of the same theme of metal around gem, with different amounts of metal showing (Cogswell 2008:35-149). Three of them are discussed and compared in brief as below.

1. Bezel Setting- This setting technique is specially suited for cabochons, tumbled or stones having one flat side. The stone is surrounded by a ring or hoop of metal with a base plate on which the stone rests. The hoop forms a firm fitting rim around the stone, tall enough to rise just above widest point. Metal is pushed over the stone and burnished to secure stone in place. This type of setting holds stone very securely, but also makes it look smaller. A few variations of this type are gallery and channel setting, as shown in Fig.2.5.

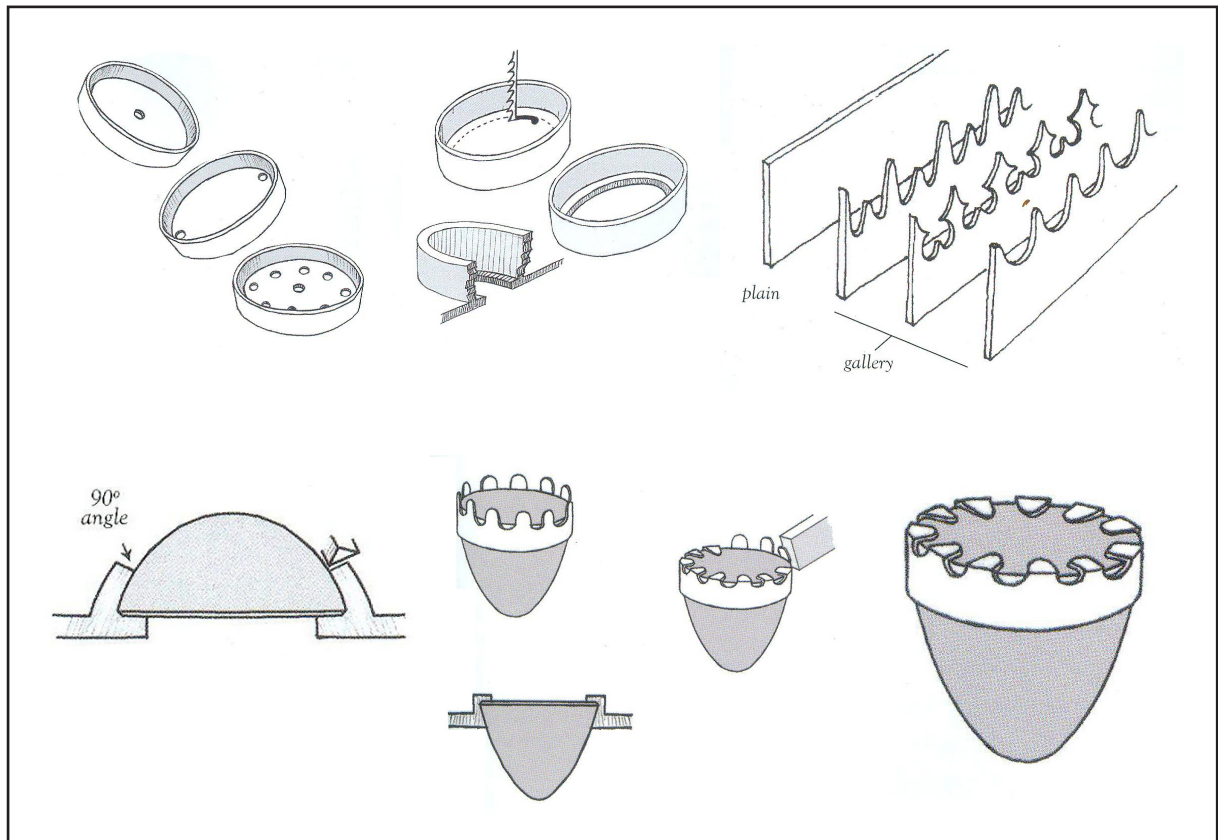


Fig.2.5. Bezel Setting and its variations.

2. Claw Setting- This technique is suited for large and medium sized formally cut stones with a proper, table, girdle and cullet. The stone is held in three or more metal prongs and appears as if held in claw or talons (Fig.2.6.), thereby getting its name. This type of setting reveals the full fire of the gemstone and allows light to reveal facets beautifully. As the holding is in fewer places as compared to bezel setting, this setting requires delicacy in setting and usage. A few variations of this type of setting following similar principle are basket, prong and crown setting.

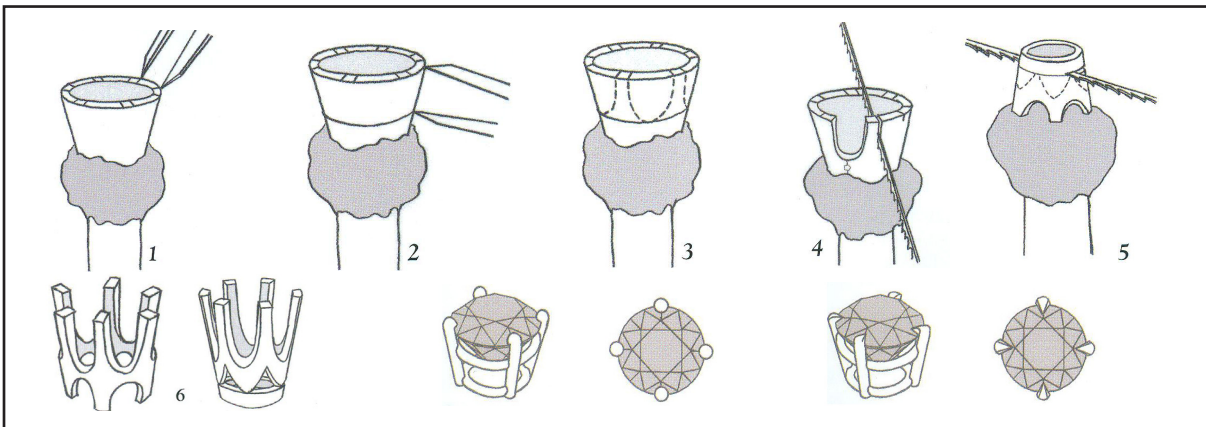


Fig. 2.6. Claw Setting and its variations.

3. Pave Setting- This technique is suited for small size formally cut stones. The stones are set in proximity to each other, with their girdles almost touching each other (Fig. 2.7.), Cumulatively to give an appearance of a larger stone by providing a larger reflective surface in sight. In this type of setting a seat is made to rest the stone and metal surrounding the cavity is pushed over the girdle in from of a hemisphere using a specially formed tool.

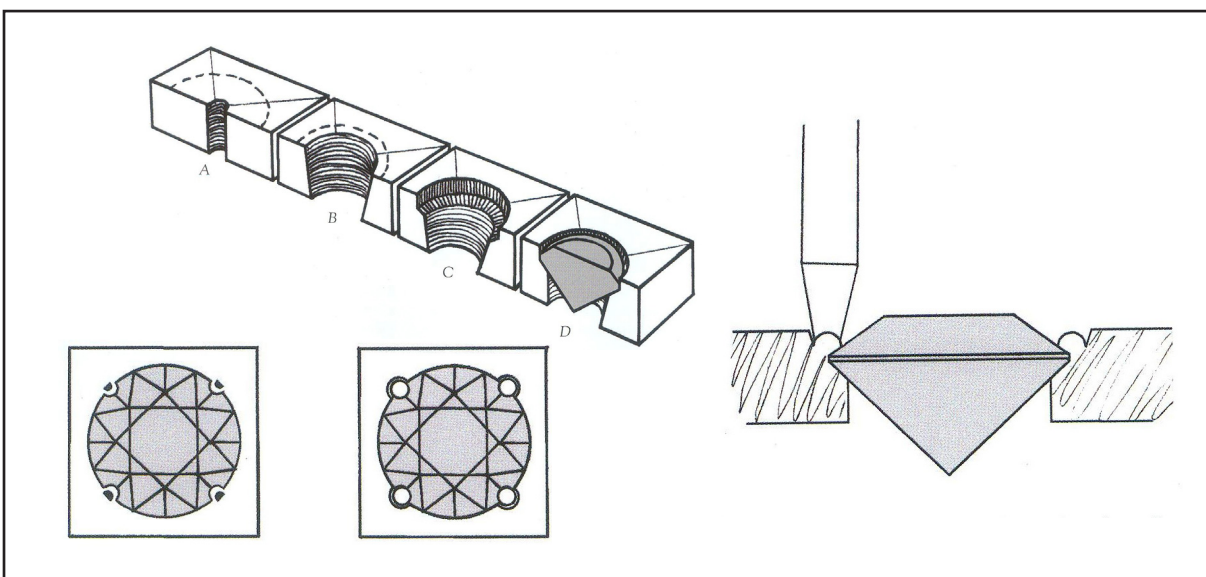


Fig.2.7. Pave Setting and its variations.

A number of settings as variation of the above or a combination of one or more are in practice. However, the basic principle of holding remains same in these specialized settings.

2.3.3. *Kundan* Setting

Kundan is a type of traditional Indian jewellery that uses a framework of gold crafted in intricate details. The gemstone is set from visible front using a foil of very high purity, 24 carat, gold foil. For the purpose of setting a very thin foil (rolled in a mill) is used. At such fineness and low thickness gold becomes very pliable. Parts and pieces of this foil are pressed in cavities left around the gemstone, partly set with setting paste (Fig.2.8. to Fig.2.15). By pressing layer after layer of gold, space around gemstone is slowly filled with solid gold, a pointed tool that gives good pressure and negotiates tight corners does this pressing. Sometimes mild heat is applied to fuse gold together, creating flush stone close setting (Untracht 1985:614). Gold surface holding gemstone in place is evened out using an engraver that leaves behind a lustrous surface. This style of setting was different from the western style of prong or claw setting brilliant cut diamonds and formally cut gemstones (Pagel-Theisen 1993:169, Snowman 1990:174-188), in this style both cabochons and minimally faceted stone are used for flush setting. Backside of *Kundan* jewellery is embellished with hard enamel typically red green and red blue colours. This makes back side of jewellery equally pleasurable to look at. Backs often outshone the front (Sharma & Varadrajan 2008:21), a feature that makes jewellery wearable from both sides

As discussed earlier in the chapter, *kundan* gets its name from the style of setting, the processes is studied in depth. There sequence of pictures show step by step making of an articles,



Fig.2.8 & Fig.2.9 An ornament *ghat* fixed on to a shellac stick to facilitate setting of gems.



Fig.2.10. & Fig.2.11. The gem setter at work burnishing foils with an agate hammer.



Fig.2.12. & Fig.2.13. Lengths of purified gold ribbon, ready to be used for *kundan* setting.

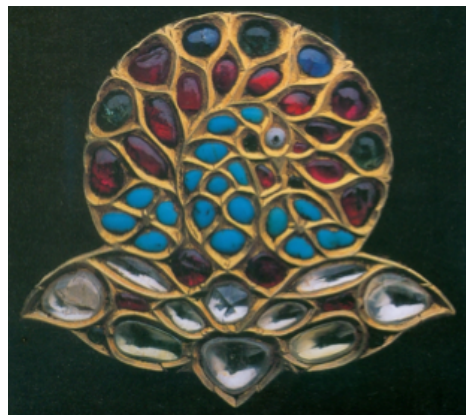


Fig.2.14. & Fig.2.15. Reflective foil, *jaban*, is used behind gem stones to enhance their brilliance.

2.3.4. *Kundan* Setting Details

Following set of pictures show elaborating, with more pictures in between stages specially the grinding of gemstones for setting. Authors own picture focus on the *kundan* setting aspect in depth as follows (Fig.2.16. to Fig.2.39.). These were taken by author during several visits to *kundansaaz* to see work oneself and understand the fine points of the work.



Fig.2.16. & Fig.2.17. Shellac flakes are heated and applied on a base.



Fig.2.18. & Fig.2.19. An article is gently pressed in pliable shellac bed, heat applied for minor adjustments.



Fig.2.20. & Fig.2.21. Stones are placed in cavities to see fit and appearances, process is iterative.



Fig.2.22. & Fig.2.23. Colored stones are custom polished for fitting.



Fig.2.24. & Fig.2.25. Fine grinding of stones begets a good snug fit.



Fig.2.26. & Fig.2.27. Stones are finally fitted in their respective cavities and *surma* is applied to hold them.



Fig.2.28. & Fig.2.29. Mild heat is applied to stones so it takes a proper seat in its bearing.

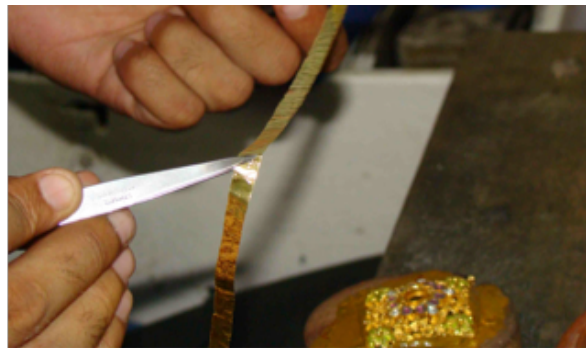


Fig.2.30. & Fig.2.31. Excess material is trimmed off & piece is ready for *kundan* setting.



Fig.2.32. & Fig.2.33. A very thin foil is cut in small pieces and these pieces are pushed in cavities remaining between the stone and bearing.



Fig.2.34. & Fig.2.35. A sharp tool is used for pressing that fuses gold by compression.



Fig.2.36. & Fig.2.37. Gemstones are set in place and excessive gold is trimmed off leaving a lustrous surface.



Fig.2.38. & Fig.2.39. The piece is removed from plate and cleaned.

The following illustration (Fig.2.40.) shows process of *kundan* making in successive stages of fabrication. It depicts various stages in progression from bending a plate to fitting of a gemstone.

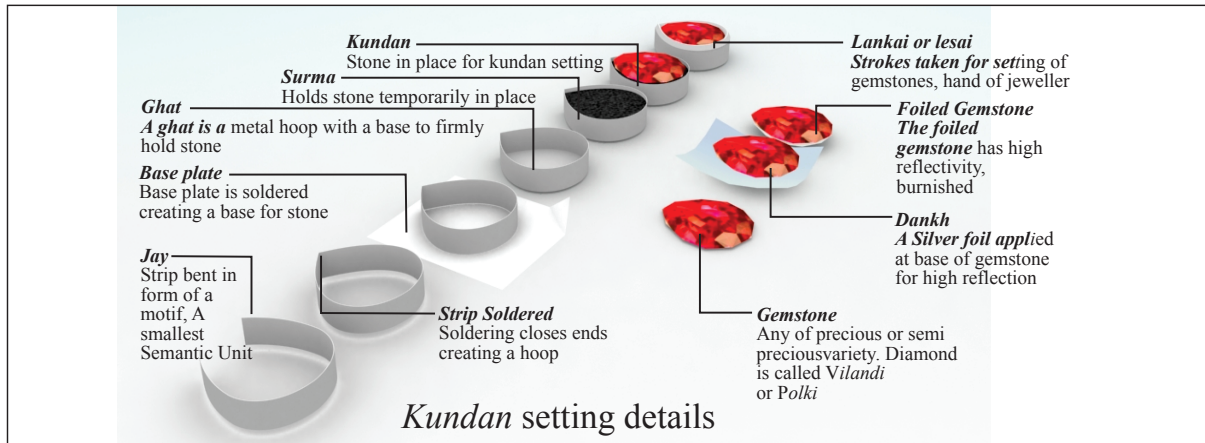


Fig.2.40. *kundan* setting details.

The following illustration (2.41) shows a cross sectional view. It depicts Plate, jay, *nageena*, *dankh*, *surma* in exploded view

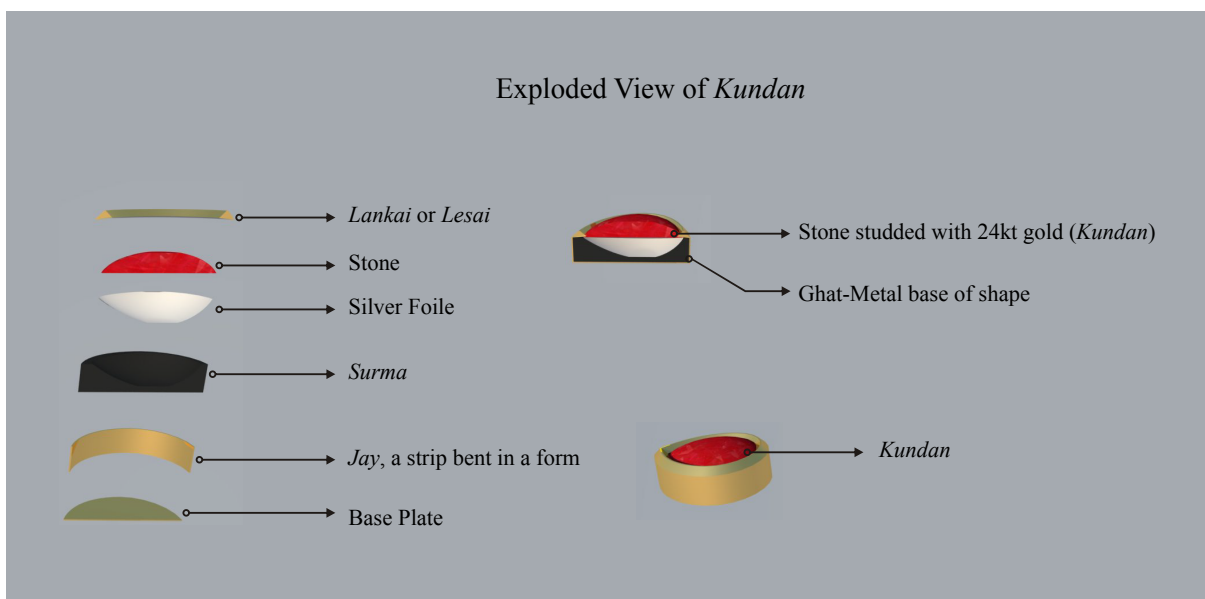


Fig.2.41. The view shows a cross sectional view of setting of a smallest semantic unit.

2.4. Domain Overview

A rich tradition of jewellery continues in India and there are a number of styles of jewellery making in practice. Indian jewellery follows to a large extent the Indian faith of circle of life. Jewellery is created, sustained and finally articles are broken down, dissembled

or recycled to make new designs, as a result erasing both history and design of previous article in the act of recreation of a new article. This journey of an article can also be seen in gemstones like diamonds, often referred as “diamonds are forever”, from generation to generation they are handed down and often the materials are recycled and reconstituted to suit individual taste.

Jewellery making has gone through a rapid transformation in recent years and fine jewellery that so far was only for the affluent class, became affordable to middle class. With the advent of new tools and technology, jewellery making has taken a quantum leap and there are numerous papers published in jewellery making and their various technological aspects (Wright & Corti 1997)(Ravi 1996). In other direction there are metallurgical research publications that cover alloy compositions and their effects on various aspects and visual properties of gold, such as depletion gilding (Grimwade 1999).

However, form based constructivist approach to jewellery has been missing. The formal aspect and combinations of elements, that contribute to expression is barely talked about and held as family secrets. European tradition of master jewellers and jewellery houses like Van- Cleef & Arpels, Cartier and Bulgari (Snowman 1990: 189-251) are not present in Indian traditional jewellery practice, however there is an omnipresent style that follows a distinctively noticeable formal language of forms that is unique to that particular style. *Kundan* is one of such styles of jewellery that is making a comeback in recent past. The subject of *kundan*, one of the finest types of traditional Indian jewellery is majorly not documented and in absence of such works the jewellery forms and clusters are neither recognized nor standardized. This creates difficulty for design intervention and development of a computer based application to be deployed for creation of *kundan* articles.

There is very good documentation and research pertaining to historical angle but not about formal aspects. Research in past and present, in diamond industry along with parts of fine jewellery also are limited to polishing for high reflectivity, weight and metallurgical aspects (Pagel- Theisen 1993:57-290). This study is a step in the direction of identification of basics of *Kundan* with intent to understand and document them in a scientific and methodical manner and present research insights.

2.5. Review to Find Research Gaps

A clear review of literature revealed that studies in *Kundan* so far are limited to documentation of a small number of existing pieces, family heirlooms and collection of royalty published in form of photographic documentation (Kumar & Balakrishnan 2006:80-227). Some have systematically documented according to traditional styles and regional specialities, however the commentaries are historical and touch mythical aspects (Sharma & Varadrajan 2008: 20-117).

Fine jewellery studded with precious and semi precious gemstones had become popular in recent times and clients awareness, thereby, expectations were higher.

There is little information available on semantic aspects of jewellery like what are fundamental constituting units? And is there a visible pattern behind the beautiful aspect visible to eye?

There is also lack of standardization and normalization amongst jewellery fraternity that often leads to conflicts amongst clients and jewellers.

On semantic aspects one can take a look on jewellery as analogous to text. Semantics as word denotes a range of ideas, ranging from the popular to the highly technical. It is often used in common language to denote a problem of understanding that comes down to word selection or connotation. This problem of understanding has been the subject of many formal inquiries, over a long period of time, most notably in the field of formal semantics. In linguistics, it pertains to the study of interpretation of signs or symbols as used by agents or communities within particular circumstances and contexts.

Within this view, sounds, facial expressions, body language, and proxemics have semantically meaningful content, and each has several branches of study. In written language, such things as paragraph structure and punctuation have semantic content. In other forms of language, there is other semantic content and by way of simile the same can be seen in domain of jewellery.

The formal study of semantics interconnects with many other fields of inquiry, including lexicology, syntax, pragmatics, etymology and others. Semantics is a well-defined field in its own right, often it is with synthetic properties. In philosophy of language, semantics and reference are closely connected.

Further related fields include philology, communication, and semiotics. The formal study of semantics is therefore a complex subject. The means is in understanding how meaning attaches to larger chunks of text, probably as a result of the composition from smaller units of meaning, the same can easily be seen in a jewellery form.

In linguistics, semantics is the subfield that is devoted to the study of meaning, as inherent at the levels of words, phrases, sentences, and larger units of discourse termed as texts. The basic area of study pertains to the meaning of signs, and the study of relations between different linguistic units and compounds: homonymy, synonymy, antonymy, hypernymy and similar aspects.

Traditionally, semantics has included the study of sense and denotative reference, truth conditions, argument structure, thematic roles, discourse analysis, and the linkage of all of these to syntax. In this chapter same is applied to study jewellery forms in a similar manner.

2.6. Methodical Surveys of Sources

The following sources were explored for research relevance and its justification. Although, material is scarce and there are several gatekeepers controlling access to privileged information, a few sources were identified that yielded good insights into the subject matter, See Fig.2.42.



Fig.2.42. Various sources explored for research relevance and its justification.

Each of these sources, pertaining to research, are briefly discussed as follows:

- 1. Books and Periodicals** - Available books and periodicals were reviewed for assessment of research potential. There is good documentation of jewellery making techniques available in literature, however little on methodical research pertaining to *Kundan* jewellery. Realizing this scarcity of documentation, author visited practicing *Kundansaaz* themselves and explored with them their source materials. These led to good learning and insights, for this kind of research
- 2. Exploratory and in depth interviews with jewellers and experts** - Exploratory interviews were useful in initial phases where they led to good insights into the domain. It was learnt that the domain has peculiarities of its own and there are gatekeepers to sources of information. Leads in form of keywords were obtained from exploratory interviews that included use of terms to describe small semantic units. It was found that the most effective way is to approach informally without an expectation to find anything. Several exploratory and unstructured interviews were conducted and it was found to be one of the most effective ways to get useful information and insights. Informality and casual talks which made jewellers at ease were found to be most useful.
- 3. Visits to jewellery showrooms/sarafa** - Casual visits to traditional Indian jewellery market or ‘*Sarafa*’ was also very effective in initial learning by observation alone. It is the place where most of the action takes place, interaction of jeweller and clients is best observed while actual selection of articles is taking place. Here again, casual visits without announcements were more useful in observing customer preference in its natural state. These sessions were observed without participation. These observation sessions also led to good insights into subject matter. Detailed discussions with jewellers and jewellery craftsmen helped in understanding work, procedures and things that are best done or to be avoided, basic Do’s & Don’ts of the trade for insights.
- 4. Teaching & Learning** - Teaching and learning simultaneously, jewellery designers and students of design disciplines were also instrumental in probing the domain further. Mutual transaction of information at the shop floor was a source that was very useful subsequently. The patterns intuitively created by students were analysed to find if there is hidden visual grammar, as shown in

(Fig.2.45.(A,B,C & D)) a tool was created for the purpose. The information was of academic interest. As sharing of information leads to enriching the body of research, researcher himself conducted several training sessions at different academic institutes and places in India. However, these sessions led to more insights and often good leads into subject matter.

- 5. Attending/ conducting workshops with *Kundansaaaz*** - A workshop with practicing professionals is found to be one of the best ways to test and see for oneself by actually working on articles. A good amount of knowledge transpires during a workshop in the fraternity of jewellers, by way of demonstration of skills and techniques. It was during a workshop session the idea of a grid system germinated. They are, however, very intense and are suited only for those with some previous background in jewellery and manufacturing techniques.
- 6. Visits to exhibition & trade fairs** - Were found to be useful to see a lot of things in a very short time and space. They are very informative and educating as people otherwise out of reach and located in far corners convene in an exhibition ground that can be seen in a few days. Indian International Jewellery Show(Fig.2.43. and Fig.2.44.) is one of such venues and they were routinely visited from august, 2006 to 2011 to explore research potential. It was also encouraging to see managerial potential present for such kind of research.



Fig.2.43. Visit to exhibition and trade fairs, India International Jewellery Show.



Fig.2.44. Visit to exhibition and trade fairs, India International Jewellery Show various Stalls.



Fig.2.45.(A) Students instinctively exploring forms.

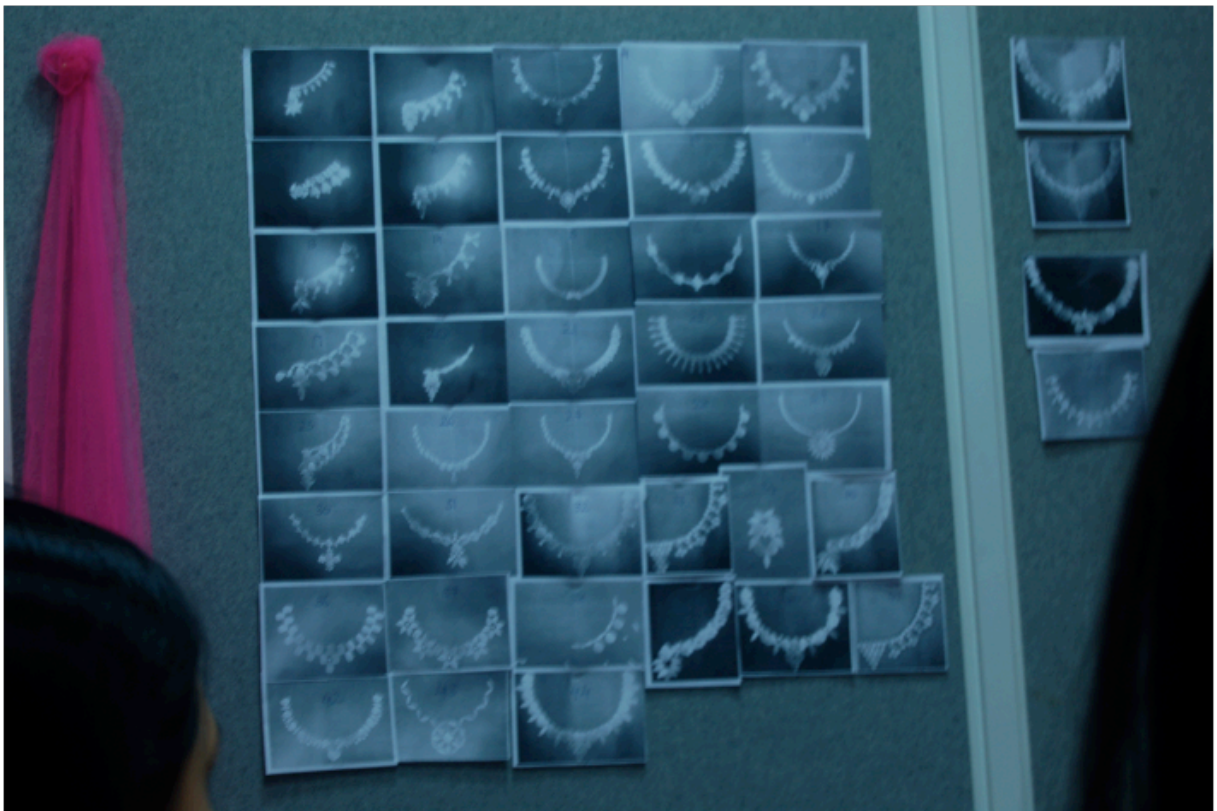


Fig.2.45.(B)

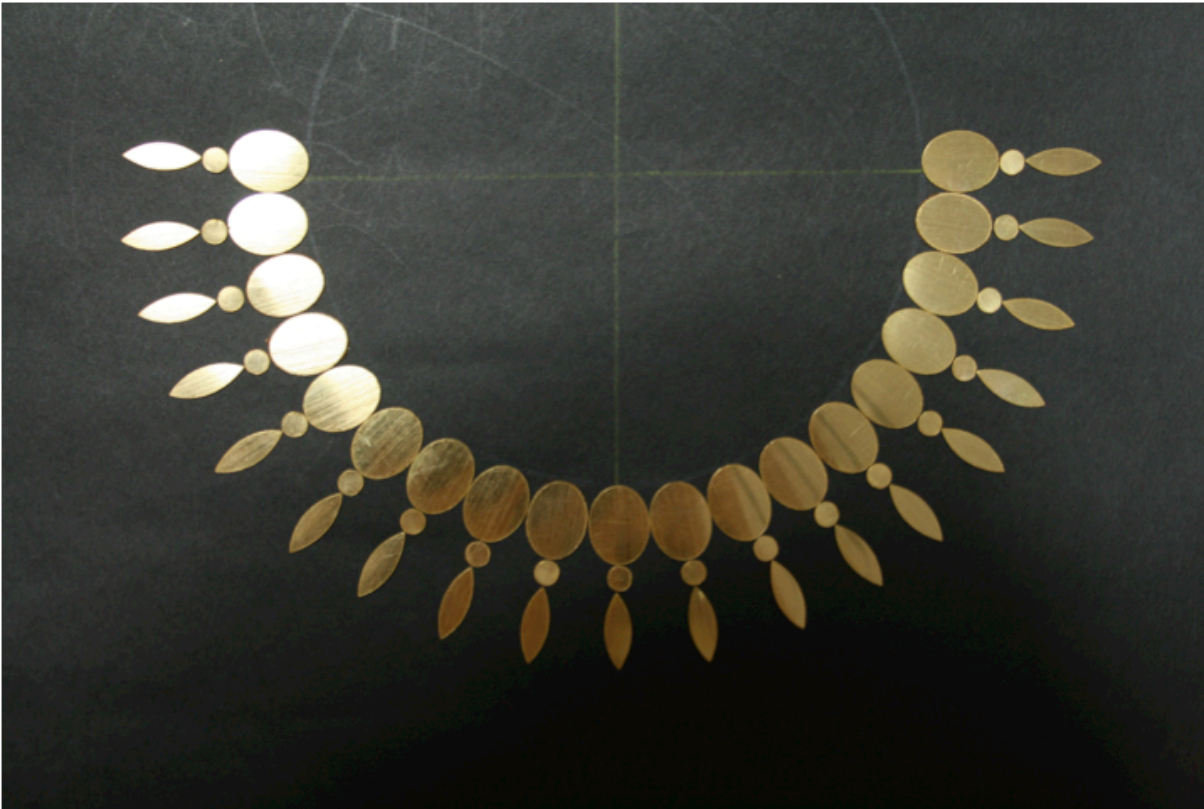


Fig.2.45.(C)



Fig.2.45.(A, B, C & D) – Intuitively created patterns to find natural visual grammar of *Kundan*.

Realizing the fact that *Kundan* is not adequately and systematically documented, combinations of these sources were tried⁹. Listed below in Table 2.1, is a summary of the source along with its particular advantage and limitations.

Table.2.1. A tabulation of respective of different sources explored their Advantage and Limitations.

Sr. No.	Source of Information	Advantage	Limitations	Remarks
1	Books and periodicals	Reliability and firmness of a publication	Often information is as old as publication and not up to date	Expensive in terms of money
2	Exploratory & in depth interviews with jewellers and experts	Contemporary and most recent in terms of events	Information is controlled/ withheld/released in a controlled way	Trust is essential for access
3	Visit to Jewellery showrooms/ <i>sarafa</i>	Most happening place, best for none participant observations	Access controlled by gatekeepers, difficult to get access to right people	Important to know right people
4	Teaching & Learning	Excellent transaction at shop floor, mutually beneficial to jewellers and researchers	Difficult to gauge outcome beforehand, dilute information	Good to get a pedagogic view
5	Attending/ conducting workshops with <i>Kundansaz</i>	Good source of learning while working	Time intensive and physically demanding. Travelling integral with work	Very useful first hand information
6	Visits to exhibition & trade fairs	Good to a variety of things in a short period of time	Only what is displayed is seen other things remain unseen	Demanding in terms of travel and money

Literature was reviewed at length for understanding sectors of jewellery domain in which methodical research is already done or is presently underway. There were a number of papers considered for the present study and there was useful information available in many of them.

For purpose of understanding they are classified in various categories like alloy & gold material, products and uses, analysis and investment casting etc. Their individual contributions are listed in a table contend in appendix II; the table gives a comparative study at a glance.

9. There were no hints available for search of information nor were there leads to sources in early phases. The domain was known but it was difficult to get hold of a thread to begin with. An approach to explore anything and everything was adopted and it proved to be useful in getting leads.

Although there is a lack of available material on research, the World Gold Council has tried to put together some articles from various sources and authors. The work of the council, though sometimes lacking in stringent scientific inclination in some of the articles, is by far the most authoritative source of information.

Vicenza, Italy symposium publications are also a good source of information. These materials from diverse sources are difficult to comprehend. For purpose of understanding they are compiled in table placed in Appendix II, with keywords and major contribution.

2.7. Merits of Methodical Review

Typical merits of a tabulated review are that the gaps present in the domain of jewellery become clearly visible. There is good material available on metallurgical aspects, composition of gold alloys and production technology for basic study. However the literature is unavailable on methodical research on Indian jewellery and a form based approach needs to be investigated. Moreover, Indian jewellery is seldom studied with a scientific point of view where precise measurements and mathematical interpretation of articles under observation were possible. Studies so far are limited to documentation of articles of erstwhile royalty and rich & influential. This also presents a good opening for research.

2.8. Insights From Research Review

India, being one of the largest consumers of gold has tremendous potential, both as a research ground and benefitting directly from the outcome of research. Managerial applications of such nature are expected to be having a high impact. From table contained in Appendix II, there are following openings present in the domain of jewellery, particularly in Indian context, however the same applies to world scenario.

1. There is potential of research in form based approach to jewellery, the literature is silent on this subject. Approaches that are methodical and scientific in move towards the subject need appreciation.

2. There is lack of documentation on semantic aspects of jewellery such as in the way clusters are formed and overall impact on the appeal of jewellery.
3. The fundamental appeal and attraction of jewellery, besides the cash value of bullion metal and gems, needs to be investigated. This aspect may reveal features of form that are preferred as compared to others and give significant clues to designers for adaptation in design.
4. The appeal of jewellery may or may not be all the same across diverse client profiles, this needs to be investigated.

2.9. Summary of Research Review

There are managerial implications of this research that can be summarized in present gaps and potentials for research,

1. Understanding the domain of Indian jewellery better, from a scientific point of view. Perhaps it reveals information hitherto unknown to experts also.
2. Understanding vocabulary and manners of communication between jewellers and clients, fundamental grammar of Indian jewellery.
3. Defining terms used in communication of form amongst jewellers and jewellery fraternity at large.
4. Providing a systematic catalogue of semantic units of traditional Indian jewellery style/ styles.
5. To bring forth latent and dormant knowledge to surface for use by both jewellers and clients alike.
6. A clear gap in form based approach to jewellery research is further emphasized by none availability of such papers and materials.

Chapter 3

Research Methodology

3.1. Research Structure and Evolution

In search for a suitable methodology, several photographs and manuscripts were explored for clues into the various aspects of jewellery. These were done in to understand the process of commissioning of a *kundan* article. It was found for initial selections by a client, a line sketch is made to seek the initial agreement on the overall form. This, after corrections, is sent as a basic template for gold structure. In some cases it is elaborately rendered to visually evaluate a particular combination of coloured gemstones. This single line artwork is basis of selection of an overall form. It serves many purposes; firstly it is a drawing/template for goldsmith, to make a *Ghat* a framework of gold to receive gemstones. Secondly, it is used by *Ghasiya*, a stone polisher to select and polish gemstones providing a visual reference.

In search for a scientific structure investigating reality, it is pertinent to quote (Zukav 2010:63) who observes:

“The scientific idea of truth traditionally had been anchored in an absolute truth somewhere “out there” that is, an absolute truth with an independent existence. The closer that we came in our approximations to the absolute truth, the truer our theories were said to be. Although we might never be able to perceive the absolute truth directly-or to open the watch, as Einstein put it still we tried to construct theories such that for every facet of absolute truth, there was a corresponding element in our theories. The Copenhagen Interpretation does away with this idea of a one- to-one correspondence between reality and theory. This is another way of saying what we have said before. Quantum mechanics discards the laws governing individual events and states directly the laws governing aggregations. It is very pragmatic. The philosophy of pragmatism goes something like this. The mind is such that it deals only with ideas. It is not possible for the mind to relate to anything other than ideas. Therefore, it is not correct to think that the mind actually can ponder reality. All that the mind can ponder is its ideas about reality. (Whether or not that is the way reality actually is, is a metaphysical issue). Therefore, whether or not something is true is not a matter of how closely it corresponds to the absolute truth, but of how consistent it is with our experience. The extraordinary importance of the Copenhagen Interpretation lies in the fact that for the first time, scientists attempting to formulate a consistent physics were forced by their own findings to acknowledge that a complete understanding of reality lies beyond the capabilities of rational thought.”

In search for research direction a good insight is shared by (Hawkins & Mlodinow 2010:18-28) as under:

“According to Aristotle (384 BC-322 BC), it was around that time that Thales first developed the idea that the world can be understood, that the complex happenings around us could be reduced to simpler principles and explained without resorting to mythical or theological explanations.....According to legend, the first mathematical formulation of what we might today call a law of nature dates back to an Ionian named Pythagoras (c. 580 BC-C. 490 BC), famous for the theorem named after him: that the square of the hypotenuse (longest side) of a right triangle equals the sum of the squares of the other two sides. Pythagoras is said to have discovered the numerical relationship between the length of the strings used in musical instruments and the harmonic combinations of the sounds.”

They further propound about laws of nature,

“In modern science laws of nature are usually phrased in mathematics. They can be either exact or approximate, but they must have been observed to hold without exception- if not universally, then at least under a stipulated set of conditions. For example, we now know that Newton’s laws must be modified if objects are moving at velocities near the speed of light. Yet we still consider Newton’s laws to be laws because they hold, at least to a very good approximation, for the conditions of the everyday world, in which the speeds we encounter are far below the speed of light.”

As research in form based approach is in nascence, a new method had to be developed. Pre-research work started by understanding factors that had a bearing on an article of jewellery being selected. The various aspects that revealed themselves during interviews are depicted in diagrams below. These were broadly covering two aspects, form based such as shape, form cluster, construction etc, and social such as marital status, working status, age, etc,. Those found suitable for research are highlighted.

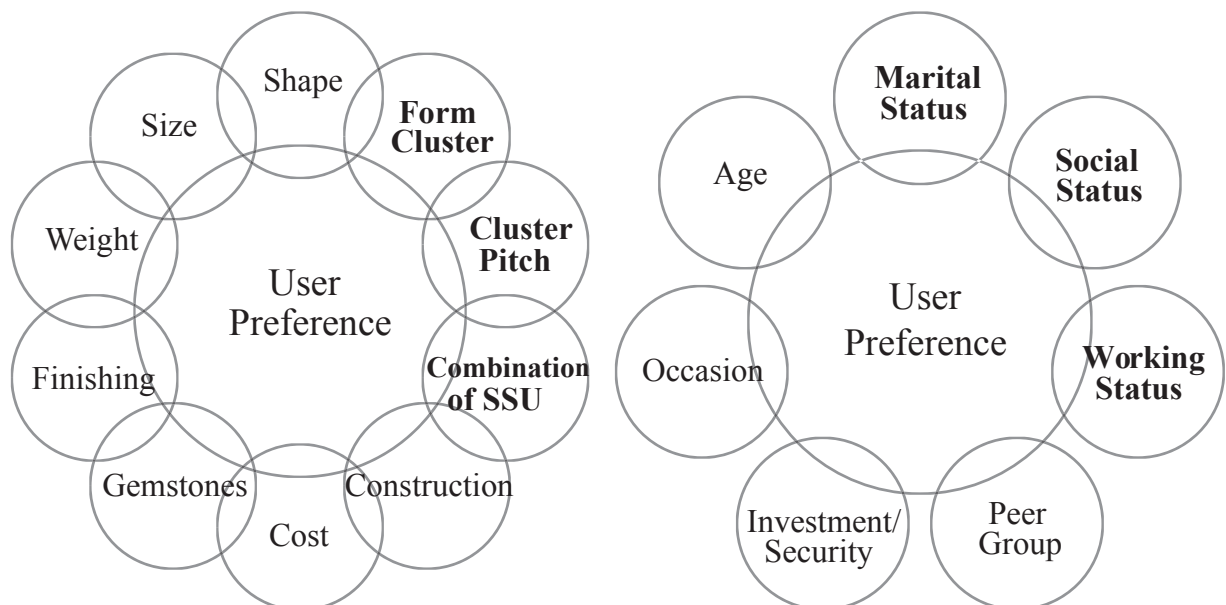


Fig. 3.1. Social and formal aspects influencing user preferences Group A(left) and Group B(right).

Amongst these aspects, which have an impact on preferential likeness Form Clusters, Cluster Pitch and Combination of Smallest Semantic Unit from group A and Marital Status, Social Status and Working Status from group B were taken into consideration for further research.

The methodology adapted for this research started with identification of smallest semantic units and followed a systematic path in due course, leading to design of a tool. Following points give an overview of approach to the subject matter.

- Identification and classification of smallest semantic units
- Study of form clusters that are made of these smallest semantic units
- Design of a tool to study preferential likeness
- Formation of grid to chart preferential likeness for understanding
- A survey by reaching out to people
- Analysis and Synthesis of findings

These point wise articulations also describe focus for each stage of research. As one stage completed it paved way for next stage, thereby progressively developing a strategy. To go over the main points, earliest part of research focussed on identification of diverse semantic units. Once identified these semantic units were put into a table with their individual names. This table was the foundation of following work. For ease of understanding these were classified in five broad categories based on axis of symmetry, particular geometry and form factors such as resemblance to a character of alphabet or another easily identifiable form. This Classification, like Mendeleev's periodic table and its predecessor Octavian tabulations, gave a structure for further study.

Second part focussed on form clusters that were made of these semantic units. These were made by assemblage of a number of smallest semantic units arranged in a definite manner. Various ways to achieve meaningful form clusters were studied. On the whole, the appearance of a form cluster was determined by variation of those factors. A wealth of knowledge was created for this purpose by asking a group of *Kundansaz* to create forms for jewellery. They were asked to do this in a methodical manner by taking first three diverse semantic units at a time and create five variations. These varied from each other in form but united with each other in the simile of having same number of constituting semantic units. The units were chosen from a set of identified semantic units predominantly in use. A set of five such clusters was thus created by an increment of two semantic units at every step, where the largest cluster had eleven semantic units constituting a particular cluster (Vyas & Bapat, 2010). A selection was made by best of three clusters for each form cluster. These basic clusters could be scaled up, or scaled down and also repeated over as copies. Illustrator software was used for the purpose and a single line vector art was made ready to use.

Third part focussed on a number of form clusters, arranged on a mother circle to create a tool for methodical study. A fixed number of semantic units were used to create each form

cluster, progressively number of constituting semantic were increased. These started with three diverse semantic units that were gradually increased to eleven semantic units to form a particular form cluster. With the numbers of clusters being a common factor, it was possible to convert angular measurements to linear measurements for further study.

These form clusters were arranged in a predetermined number, with progressively finer cluster pitches to create a gradient of coarse to fine. The count started with five¹⁰ clusters gradually increasing to 21 by an increment of two on each side. From these different levels of fineness available for appreciation, a particular one could be chosen in visual comparison. These sets of form clusters arranged in progressive increment in number of semantic units from front to back and cluster pitch becoming progressively finer from left to right, in a virtual three dimensional space created a grid. This grid gave a reference point to study effect of various factors in comparison to each other. Inter group and intra group study thus became possible with reference to this virtual space. Getting a feel of directions in which preferential likeness falls, therefore became objective and quantifiable to a large extent.

In survey for visual research, several presentation plates (Mokashi, 2008) were made. A collection of these are in Appendix III. These were printed on medium gauge white paper and a portfolio was prepared. This portfolio of 125 designs (a set of five cluster diversity, with increasing finesse) was presented for visual appreciation and selection. A pilot survey was done and it was found that placing a card on a particular design was a preferred way of marking a preference. This left no marks on the presentation plate and hence was adapted and incorporated for main survey. Simple medium sized book marks and hard paper cards were used for this purpose, the process is elaborated in chapter 6.

The selection was initially for twelve articles in level one of selection, just about one in ten, from all available for appreciation, thereafter the subjects were asked to select six from initial twelve refining selection in level two. Further up in selection process, from six articles, subjects were asked to narrow down their likeness to two articles in third level of selection. Finally, they were asked to select one from two at level four of selection. This stage wise selection emulated a typical jewellery selection process in a *Sarafa*. Besides it provided progressively decreasing numbers, where if at level four, if a convincing numbers of responses

10. Odd numbers were found to be preferred as they appear incremental and discourage divisibility, a trend that can be seen in currency denominations gifted by people on social occasions, they are 11,21, 101. Odd numbers being difficult to divide equally as compared to even numbers are believed to dissuade divisions and keep family together.

were not available, a previous stage with more number of responses was available to draw some conclusions. However, at the end of research clear preferences began to emerge. For being parsimonious and to avoid being lugubrious only first level and fourth level are incorporated in study. These two stages in selection, level one indicates an ability to draw attention and level four of selection indicates a potential to convert into a successful sale/approval of design.

Level one of selection with more open options reflect initial exploratory stages of preference, while level four is a committal stage where opinion of a prospect client has sufficiently formed. This grid had a distinct advantage of large variety in various levels of finesse to make their selection from.

The portfolios were presented to subjects in their home setting, in amicable manner fitting their comfort zone. Often presentation was over dining table or coffee table, where initial brief was given and subjects were familiarized with subject matter. In some cases subjects had to be assured about academic nature of survey. Their names and contact numbers were taken for further contacts, however in respect for their privacy names were replaced with numbers. Above mentioned process was found suitable for this type of research. It had two distinct merits of being parsimonious and giving a fairly good idea of overall forms and proportions. This was readily adapted for research work, after discussions with domain experts.

The data was recorded in a form as given in Appendix III. Sometimes numbers were written in diaries or paper, if subjects showed signs of discomfort, forms were filled in immediately after the session.

It is of importance to mention that in such kind of research¹¹, recording devices or forms filling of any sort are viewed gravely even disliked. Often sessions may be terminated with a politically correct excuse or normative answering follows.

Overall structure of research can be seen in the flow diagram as in Fig. 3.2. It started with broad identification of subject after exploratory interviews and literature review. After validation through experts specific subjects and sequence were decided. Data was collected and analysed finally leading to learning and documenting.

11. This research methodology was adopted for main body of work. However, specific methodologies are discussed within chapters.

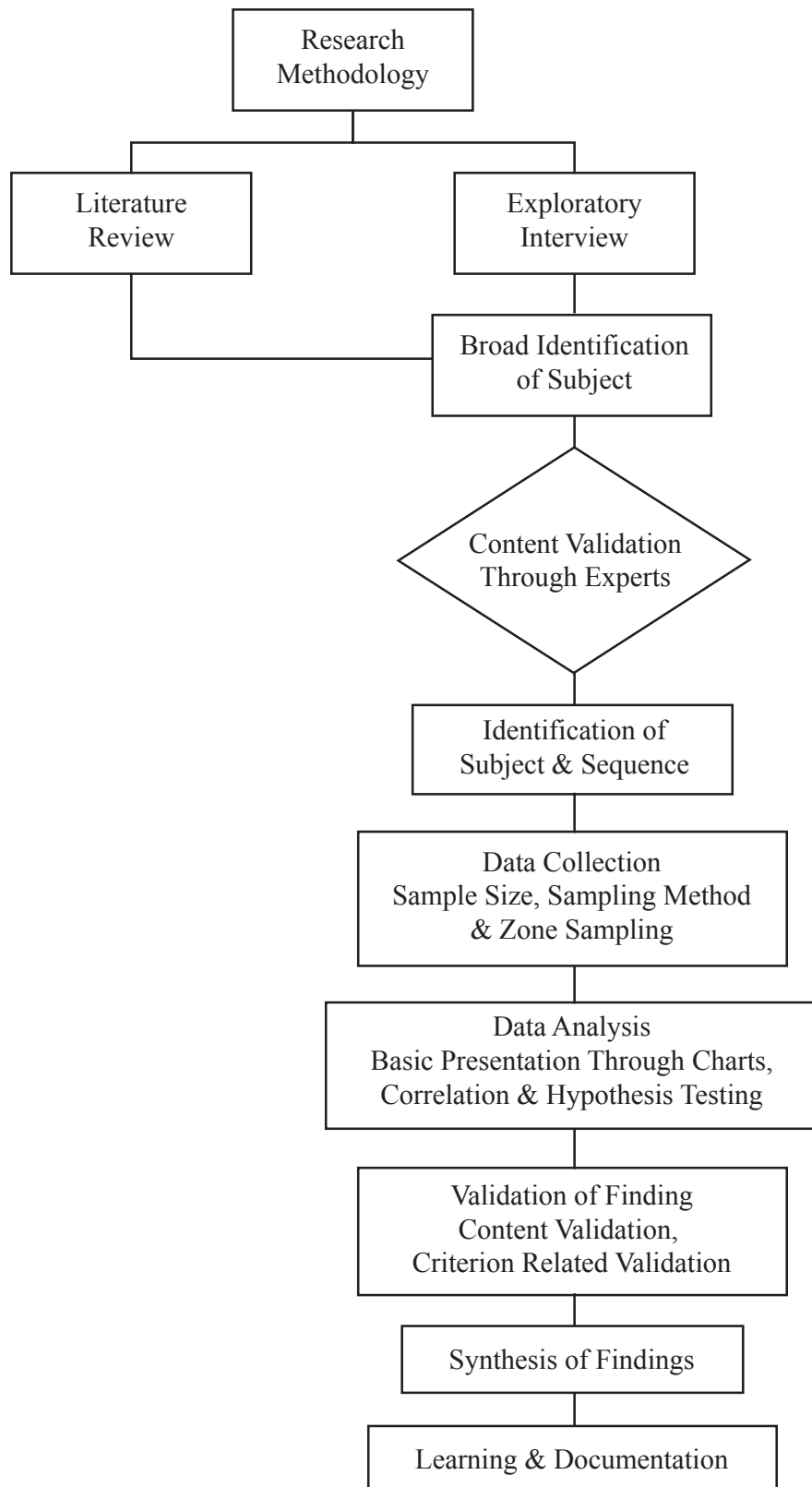


Fig. 3.2. Research methodology schematic diagram.

3.2. *Kundan* Revival

Kundan jewellery has made a comeback in recent years and re-established as a classical style. The work is intensive both in terms of efforts and material. There is a vacuum of methodical study in domain of *Kundan*. Some material was available in the form of photographic documentation or in books on jewellery (Balakrishnan 2006:103-141). Other source for *Kundan* was jewellers in possession of material either in form of designs or articles (ready and semi finished) they were initially reserved in sharing the same. This style of jewellery has a visual language of its own but no cataloguing is available, to understand and describe, in a systematic manner.

3.3. Methodology for Identification of Smallest Semantic Unit

Research in domain of jewellery needed an approach demanding delicacy and subtlety. Information and resources are not easily available and rather protected for the fear of competition by other jewellers. This research was conducted by adopting proven research methodology, as suggested by researchers (Hair et al. 2005; Kothari 2002) from time to time for different cases. In present study, Jewellers and *Kundanssaz* were approached for preliminary learning. Every approachable person was interviewed at length to understand subject matter. These were intended for following purpose

A) To understand the importance of *Kundan* Jewellery in India

B) Understand their visual features, their usage in *Kundan* and application in design.

An in depth study on the shop floor was very educating both in terms of first hand experiencing the articles being made in front of oneself and appreciating an intense work by a *kundanssaz*. This method of gaining an access to a workshop and spending time there is highly recommended for this type of research.

The steps followed in identification of semantic units is as follows

- Identification
- Reproduction as single line artwork
- Search name / association
- Confirmation of name by expert group
- Amendment
- Formalization and tabulation

It took time, efforts and confidence building measures to win their trust to have access to these resources. These interviews helped in better understanding of subject from professional's point of view.

For purpose of study, material from various sources was collected and studied (Shajahan 2004:137). Primary sources were photographs in books, photographs of articles, sketches and renderings by those practicing *Kundan*. Study material from various sources were compiled and studied in a methodical way by labelling individual semantic units and tabulate them. This whole exercise led to identification of a total of 99 basic semantic units along with their basic descriptions. These findings were validated by series of experts (four Jewellers, five *Kundansaaz* and four designers) practicing *Kundan* Jewellery. Finally 99 units were retained, while those found to be replicating in terms of shape or not carrying unique design measures, were deleted. A chart of these semantic units was prepared as a foundation for further classification.

3.4. Smallest Semantic Units to an Article

A smallest unit of jewellery that has a name and meaning associated with it often has a significance as a motif. For example a fish is a fertility motif. Therefore a smallest identifiable unit that has a name and significance can be called a smallest semantic unit. If this unit is further broken down to curves the meaning is lost and it becomes a simple curve devoid of meaning.

Jewellery has an overall form for any given article like ring, pendent, bracelet, neck piece or ear pieces. This overall form is a collection of sub assemblies as form clusters (Fig.3.3). A form cluster in turn is made of units that are geometric or inspired by nature. These are “smallest semantic units” elemental building blocks of jewellery, they are used alone or in combination with other such units an aesthetically pleasing composition to make a “form cluster”.

A progression from basic curves that make smallest semantic units to a set of jewellery comprising of various articles could be seen as curves forming smallest semantic units that in turn make form clusters, these in turn make jewellery (overall form) and a article following a coherent theme creates a set of articles.



Fig. 3.3. *Kundan* Necklace, smallest semantic units & form.

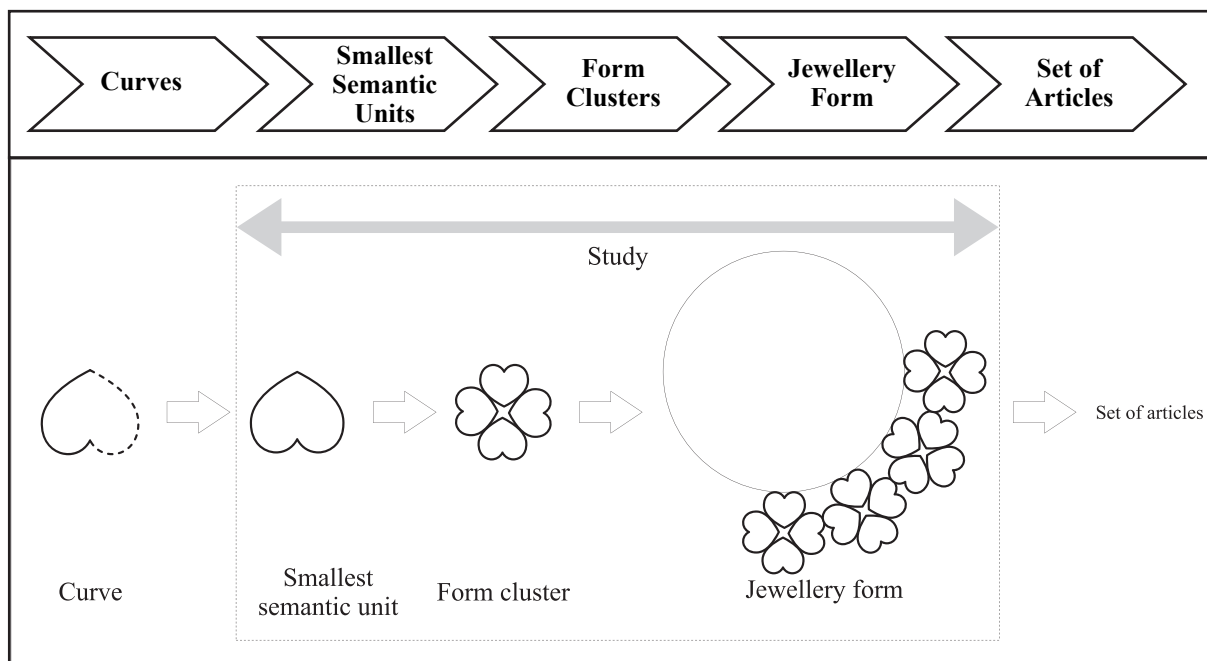


Fig. 3.4. Progression from basic curves that make smallest semantic units to a set of jewellery.

Illustration (Fig.3.4) is to articulate length and breadth of research, which is from smallest semantic units to overall jewellery form. Accordingly, Semantic units identifiable by names are basic units of construction of jewellery, if further divided into curves, meaning is lost. Semantic units have their own symbolism and draw inspiration from nature, both plant and animal (Sharma ; Varadrajan 2008:10). In this study 99 smallest semantic units are identified that were individually identifiable by their names like *Koile*, *Daudi paan* and *Jau* etc. These smallest semantic units, by way of analogy of letters (and ligatures) of alphabet, were used in combination with other semantic units to constitute form clusters (words), these in turn are used to form the article (sentences) and sets (paragraphs as, several coherent lines on a theme). Jewellery articles, a neck piece, two bangles, a *mangteeka* and a pair ear rings constitute a basic set.

3.5. Tabulation of Smallest Semantic Units

The semantic units were recognized by their names; it was derived by their particular geometric shapes and used in communication among *Kundansaz* community. The rational was based on resemblance to a known geometric shape like polygon, closed curve or forms from nature like birds, flowers and leaves.

This identification of a smallest semantic unit with a name makes description and articulation of a design more effective, illustrated as follows (Fig.3.5).

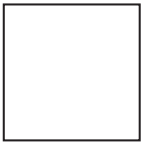
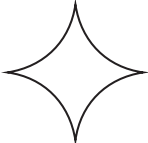
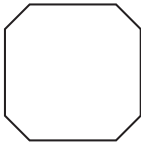
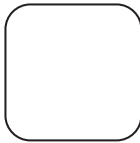
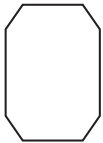
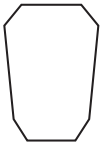
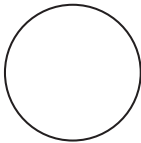
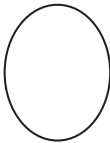
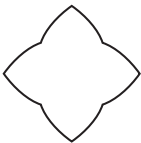
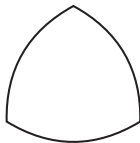
Smallest - Semantic Units & Names				01
01 	02 	03 	04 	
Choki	Tikhi Choki	Austpel / Austpehal	Gole Choki	
05 	06 	07 	08 	
Lamba Austpel	Tikha Austpel	Gole	Nim Gole	
09 	10 	11 	12 	
Tikha Chofuliya	Gole Chofuliya	Gole Chhakliya	Daudi	
13 	14 	15 	16 	
Teda Daudi Pan	Tikha Daudi Pan	Keri Daudi	Keri	
17 	18 	19 	20 	
Keri Dandi	Keri Choful	Siru / Bund	Gole Trikon	

Fig.3.5. Smallest semantic units and their names.

Smallest - Semantic Units & Names				02
21 	22 	23 	24 	
Tikha Pyala	Daudi Pyala	Pyala Patti	Pyala Patti 1	
25 	26 	27 	28 	
Pyala Patti 2	Pyala Patti 3	Ful Pyala	Shankhala	
29 	30 	31 	32 	
Shankh Ful	Chhipla	Chhipla 1	Chhipla 2	
33 	34 	35 	36 	
Chand	Teda Chand	Chidi 1	Chidi 2	
37 	38 	39 	40 	
Chidi 3	Shiru Pan	Pankh	Jo	

Fig.3.5. Smallest semantic units and their names.

41 	42 	43 	44 
Koyali	Koyali 1	Lamb Koyali	Koyali Dandi
45 	46 	47 	48 
Dand Koyali	Koyali Mindi	Gole Koyali	Daudi Koyali
49 	50 	51 	52 
Koyali Khanch Gole	Khanch Koyali 1	Khanch Koyali 2	Khanch Koyali 3
53 	54 	55 	56 
Gole Koyali Dandi	Tikoyali Mindi	Tikoyali	Koyali Pankh
57 	58 	59 	60 
Koyali Pankh 1	Koyali Patti Pyala	Koyali Ful	Mirchi

Fig 3.5. Smallest semantic units and their names.

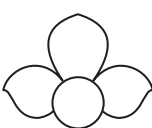
Smallest - Semantic Units & Names				04
61  Kalli	62  Kalli Patti	63  Dandi Kalli	64  Patti Dandi	
65  Ful Patti	66  Ful Patti 1	67  Ful Dandi	68  Mindi Jo	
69  Bel Patti	70  Pandadi	71  Jasud Patti	72  Gole Patti	
73  Teda Daudi Patti	74  Nim Patti	75  Kamal	76  Adha Ful	
77  Khanch Nakhiya	78  Nakhiya	79  Parag Raj	80  Bati	

Fig.3.5. Smallest semantic units and their names.

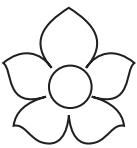
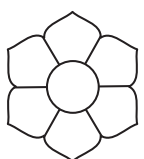
Smallest - Semantic Units & Names				05
81 	82 	83 	84 	
Batak	More	Chidi Patti	Patti 1	
85 	86 	87 	88 	
Pnach Patti Ful	Tikha Chhe Fulliya	Pattiya	Ful	
89 	90 	91 	92 	
Kamal Patti	Ful Pyala	Machhli	Cut Patti	
93 	94 	95 	96 	
Gole Pyala	Mindi Dandi	Patang	Tikha Pan	
97 	98 	99 		
Mindi S	Ful Kalli	Gole Trikon 1		

Fig.3.5. Smallest semantic units and their names.

3.6. Classification of Smallest Semantic Units

A cataloguing provides a platform for further study that acts as reference. This tabulation is a register from which semantic units are further classified into five broad categories for ease of understanding. These are as under

1. Two axis of symmetry
2. One axis of symmetry
3. Rotational symmetry
4. Sphenoid
5. Conjoined

In diamond polishing industry, a manner of naming based on appearance and resemblance to a known form (Fig.3.6. A & B) was followed in classification of fancy brilliant cut diamonds (Pagel ; Theisen 1993:171-173). Drawing reference, this classification was based on basic geometric shape or resemblance. These categories provide a methodical way to look at them as a group following similar geometric ideology (Pagel ; Theisen 255-258),

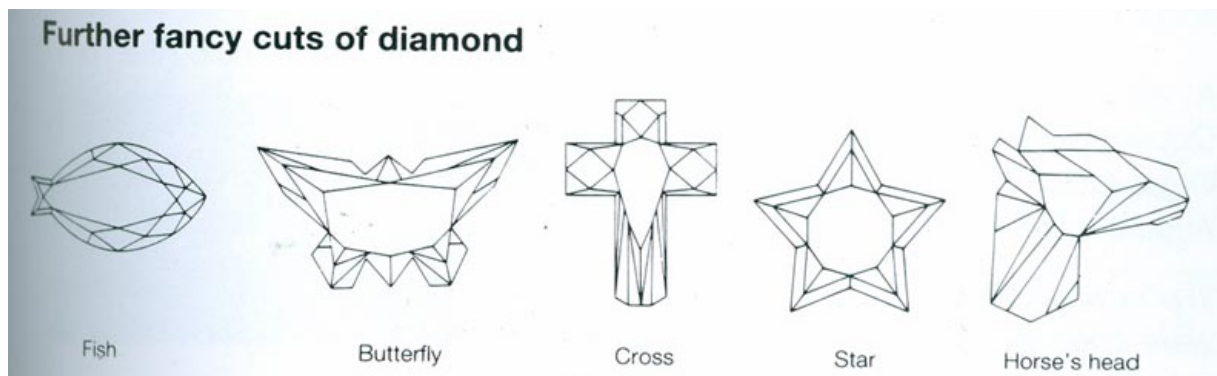


Fig.3.6.(A) Naming based on appearance and resemblance

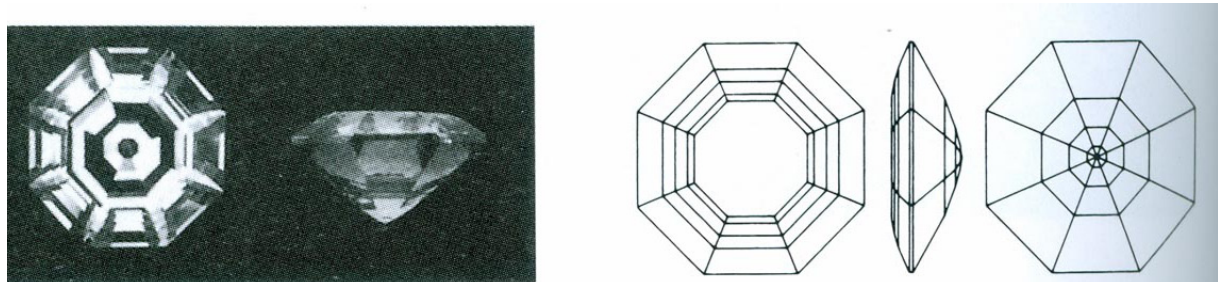


Fig.3.6.(B) Naming based on appearance and resemblance

This method of classification was found suitable and adapted for classifying Semantic units used in *Kundan* jewellery. Identified 99 semantic units were classified into five broad categories. Category of sphenoid was a relatively large category hence, further divided in four sub categories. A brief description of five categories is as follows

1. Two Axis of Symmetry- These smallest semantic units had two axis of symmetry ie., they were symmetric around two axes, vertical as well as horizontal. Conics (Circle& ellipses) and various uniform polygons fall in this category. Forms that were made by replacing sides of an even sided polygon by a modified curve also come under this category. Following Fig.3.7., depicts an example,

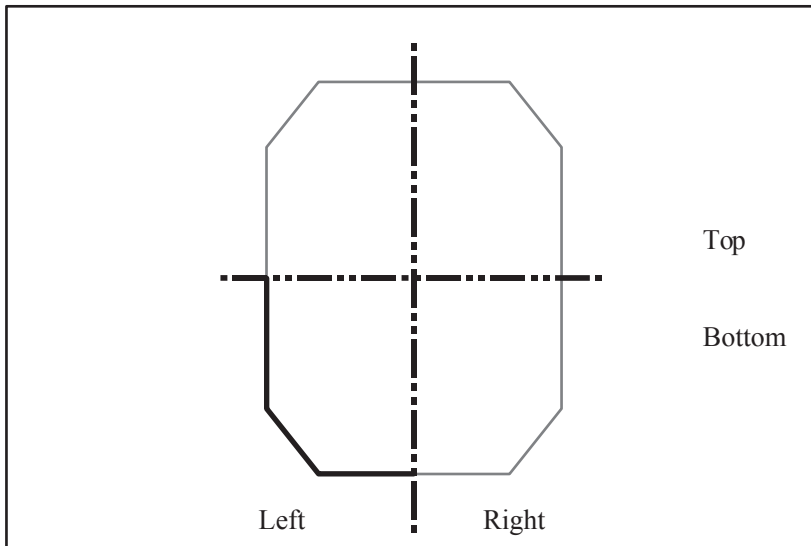


Fig.3.7. Smallest semantic units with two axes of symmetry.

2. One Axis of Symmetry- These smallest semantic units had one axis of symmetry, either vertical or horizontal. Shapes like Heart, club, spade, cup, half moon and polygons with unequal opposing sides fell in this category. Following Fig. 3.8. depicts an example,

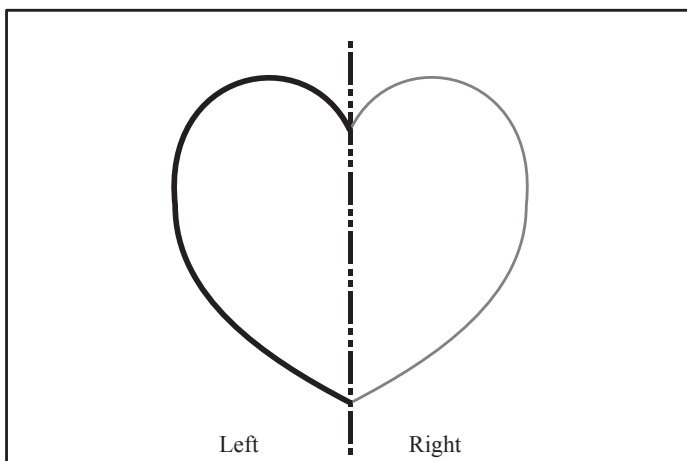


Fig.3.8. Smallest semantic units with one axis of symmetry.

3. Rotational Symmetry- These smallest semantic units were made up of floral motifs that were having rotational symmetry (inversion around a point is visible). Indian swastika is a classical example of such an inversion, in this study there was one such member *kery chowfuliya*. Following Fig. 3.9. depicts an example

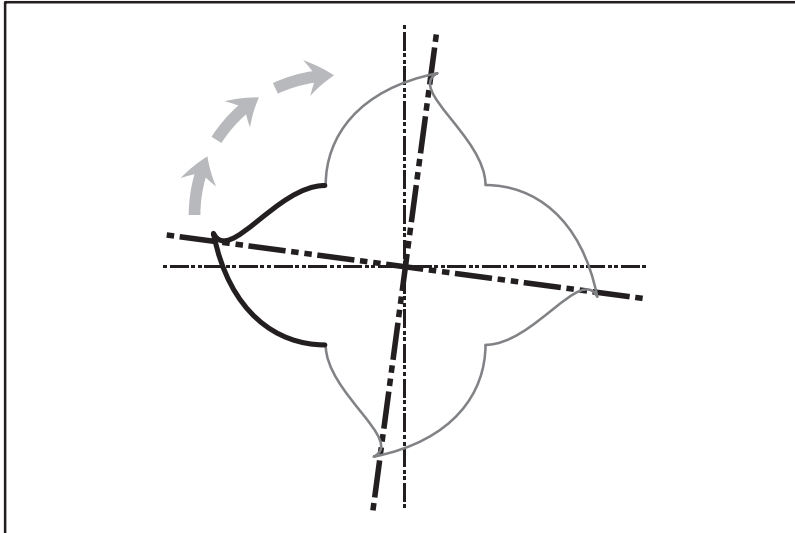


Fig.3.9. Smallest semantic units with rotational symmetry.

4. Sphenoid- These smallest semantic units were made up of splines that follow shape of an alphabet (s,c &n) or a wing. *Koilee*, *Pankh*, *Phool* and *Phool kali* constitute this category. This is a large group that was further divided into four sub categories as the name of alphabet suggests S-shape, N-shape, C-shape and Fan shape. This sub classification was driven by the semblance of the shape of alphabet and visual flow of smallest semantic unit. Following Fig.3.10. depicts an example,

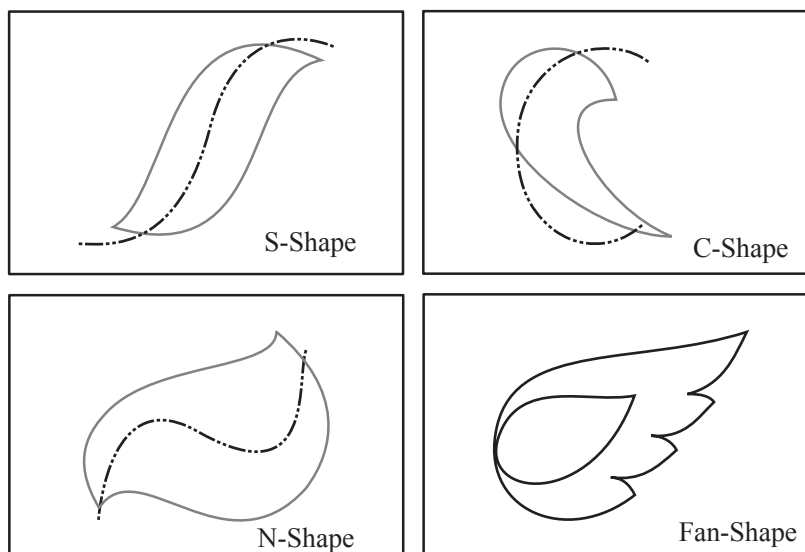


Fig.3.10. S, C, N, and Fan shape Smallest semantic units.

5. Conjoined- These semantic units were an assemblage of more than one individual unit, which acquire a meaning of their own and are treated as a smallest semantic unit. They had a full thought encompassed within themselves, reflecting in their name. *Kamal*, *chidi* and *machhli* are such semantic units. Following Fig. 3.11. depicts an example,

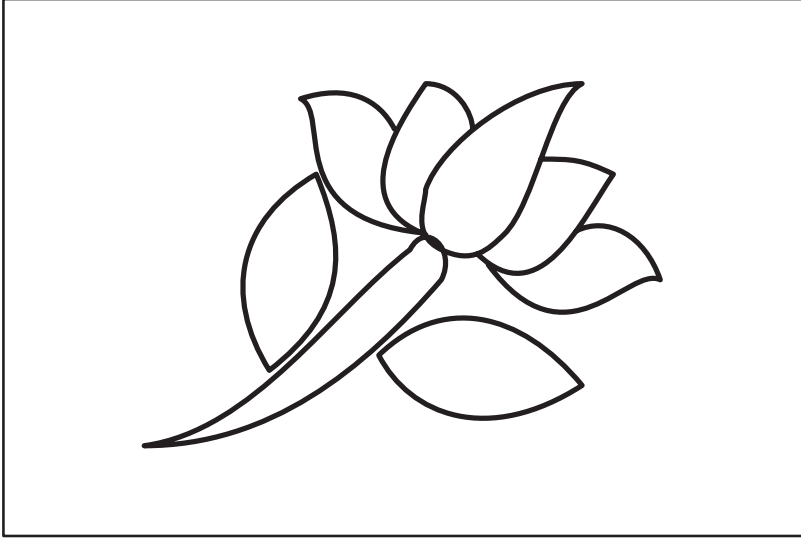


Fig.3.11. Conjoined Smallest semantic units with two axes of symmetry.

These semantic units by analogy, for purpose of understanding could be compared to *Sanyuktakshar* or *beej mantra* (seed syllable) that is a syllable and a mantra within itself¹². In western terminology of typefaces ligatures or glyph as shown in Fig.3.12. (Baines & Haslam 2005:114)

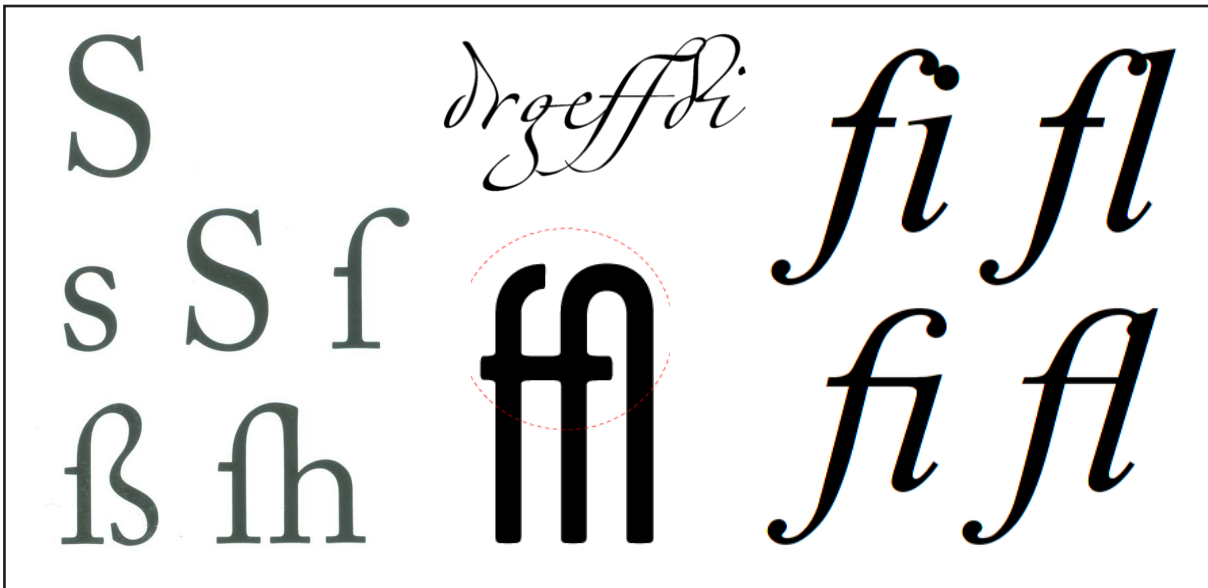


Fig.3.12. Characters and ligatures

12. The *Beejakshara* or *Beejmantra*, a seed syllable can be broken down to *akshar*, *anuswar* and *matra* e.g. “Hum” or “Hrim”. They have a meaning and encompass a full thought within themselves.

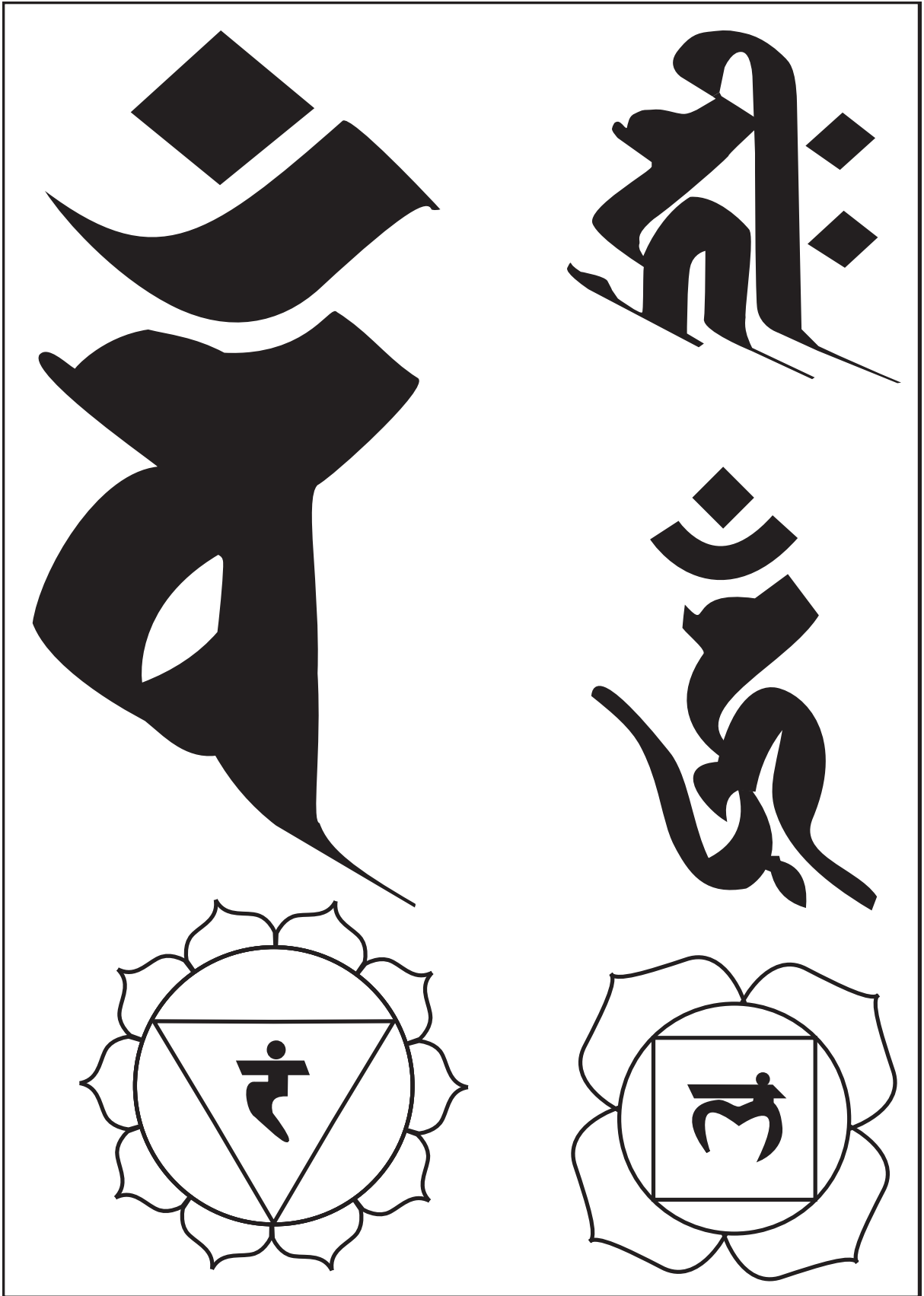
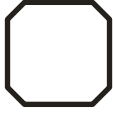
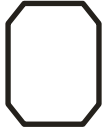
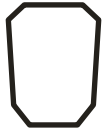
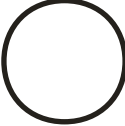
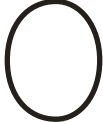
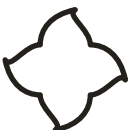
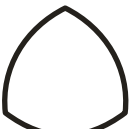


Fig.3.13. Sanyuktakshar & Beej Mantra (Adopted from “Sacred Calligraphy of the East”)

Table.3.1- Smallest semantic units, description and classification

Sr. No.	Name	Semantic Units	Description	Classification
1	Choki		A square, used in both vertical and slant configuration	Two axis of symmetry
2	Tikhi Choki / Shakkar Para		A square with concave curve forming sharp points	Two axis of symmetry
3	Austpel / Austpehal		An octagon with equal sides & chamfer	Two axis of symmetry
4	Gole Choki		A square with liberal fillets	Two axis of symmetry
5	Lamba Austpel		An octagon with adjoining unequal but equal opposing sides & chamfer	Two axis of symmetry
6	Tikha Austpel		A trapezoidal octagon with two equal opposing sides other two long and short	One axis of symmetry
7	Gole		A circle	Two axis of symmetry
8	Oval / Nim Gole		An ellipse or a pillow shape with major axis used vertically	Two axis of symmetry
9	Tikha Chofuliya		A floral motif with four petals made of two concave curvatures meeting at a point	Two axis of symmetry
10	Gole Chofuliya		A floral motif with four petals	Two axis of symmetry
11	Gole Chhakliya		A floral motif with five or more petals or cluster of petals	One axis of symmetry
12	Heart/ Daudi		A heart shape resembling a beetle leaf	One axis of symmetry

Sr. No.	Name	Semantic Units	Description	Classification
13	Teda Daudi Pan		A heart shape with point tilted to one side	Sphenoid C Shape
14	Tikha Daudi Pan		A beetle leaf shape, skewed and compressed, also called teekha paan	Sphenoid S Shape
15	Keri Daudi		A shape with two pointed ends and a bulge in between	Sphenoid C Shape
16	Keri		A mango shape, a often used form in all major styles	Sphenoid C Shape
17	Keri Dandi		A mango shape, a often used form in all major styles, one point slightly elongated to resemble stem of fruit	Sphenoid S Shape
18	Keri Choful		A floral motif with four petals made of two concave curvatures meeting at a point and tilted in a direction	Rotational symmetry
19	Siru / Bund		A Drop or Pear Shape shaped like a pendeloque	One axis of symmetry
20	Gole Trikon		A triangle or trilobite made by replacing sides of a triangle by an arc of a circle	One axis of symmetry
21	Tikha Pyala		A cup shape resembling a goblet or chalice top, one point made of two concave curves	One axis of symmetry
22	Daudi Pyala		A cup shape roughly resembling a goblet or chalice top, slight skew to one side	Sphenoid C Shape
23	Pyalapatti		A shape resembling a combination of a chalice and a leaf	Sphenoid C Shape
24	Pyalapatti l		A shape resembling a combination of a chalice and a leaf, slender and skewed to a side	Sphenoid N Shape

Sr. No.	Name	Semantic Units	Description	Classification
25	Pyala Patti2		A shape resembling a combination of a chalice and a leaf, stylized	Sphenoid S Shape
26	Pyala Patti3		A shape resembling a combination of a chalice and a leaf, elongated and skewed to a side	Sphenoid S Shape
27	Ful Pyala		A cup shape resembling a goblet or chalice top, one point made of two concave curves, asymmetric and skewed	Sphenoid C Shape
28	Shankhala		A conch shape bulbous on top and pointed to bottom	One axis of symmetry
29	Shankh Ful		A conch like spiral shape growing outwards	Sphenoid C Shape
30	Chhipla		A shape resembling a lobe of pearl oyster	Sphenoid S Shape
31	Chhipla 1		A shape resembling a skewed lobe of pearl oyster	Sphenoid S Shape
32	Chhipla 2		A shape resembling a lobe of pearl oyster with a depression on one side	Sphenoid N Shape
33	Chand		A Half moon shape like a sickle blade	One axis of symmetry
34	Teda Chand		A skewed half moon shape	Sphenoid C Shape
35	Chidi 1		An abstract bird in flight shape	Sphenoid S Shape
36	Chidi 2		An abstract bird in flight shape, elongated	Sphenoid S Shape

Sr. No.	Name	Semantic Units	Description	Classification
37	Chidi 3		An abstract bird in flight shape, steep skew vertically	Sphenoid S Shape
38	Shiru Pan		A leaf shape sans vein, made of skewed drop	Sphenoid C Shape
39	Pankh		A wing shape with detail cuts depicting individual feathers	Sphenoid Fan Shape
40	Jau		A shape resembling wheat or barley seed made of two arcs of a circle	Two axis of symmetry
41	Koyali		A shape resembling leaf made of two sinewy curves	Sphenoid S Shape
42	Koyali1		A shape resembling leaf made of two sinewy curves, with a slight bulge on one side	Sphenoid N Shape
43	Lamb Koyali		A shape resembling leaf made of two sinewy curves, with a lean appearance	Sphenoid N Shape
44	Koyali Dandi		A stylized koyali with a taper towards top, heavy bottom	Sphenoid N Shape
45	Dand Koyali		A stylized koyali with a taper towards top, heavy bottom, one point slightly elongated to resemble stem	Sphenoid N Shape
46	Koyali Mindi		A stylized koyali with point slightly elongated to resemble stem terminating in one circle called mindi	Sphenoid N Shape
47	Gole Koyali		A stylized koyali with a prominent bulge to accommodate large stones	Sphenoid N Shape
48	Daudi Koyali		A stylized koyali with partial features of daudi paan	Sphenoid N Shape
49	Koyali Khanch Gole		A stylized koyali with a prominent bulge to accommodate large stones and a notch to one side	Sphenoid N Shape

Sr. No.	Name	Semantic Units	Description	Classification
50	Khanch Koyali 1		A stylized koyali with a notch to one side	Sphenoid N Shape
51	Khach Koyali 2		A stylized koyali with slender appearance and a notch to one side	Sphenoid S Shape
52	Khach Koyali 3		A stylized koyali with partial features of daudi paan with a prominent s shape	Sphenoid S Shape
53	Gole Koyali Dandi		A stylized koyali with a mindi fused in body	Sphenoid S Shape
54	Tikoyali Mindi		A stylized koyali with three prominent apex showing in one with a mindi fused in body shape	Sphenoid C Shape
55	Tikoyali		A stylized koyali with three prominent apex showing in one shape	Sphenoid C Shape
56	Koyali Pankh		A stylized koyali with three prominent apex showing in one with a mindi fused in end, fan like appearance	Sphenoid S Shape
57	Koyali Pankh 2		A stylized koyali with two prominent apex showing in one shape with fan like appearance	Sphenoid Fan Shape
58	Koyali Patti Pyala		A chalice shape with three prominent apex, sharing partial features of a koyali and a patti	Sphenoid C Shape
59	Koyali Ful		A flower shape composed from a combination of koyalies	Conjoined
60	Mirchi		A shape resembling a chilli pod stylized like a	Sphenoid C Shape
61	Kalli		A shape resembling a flower bud just opening	Sphenoid S Shape
62	Kalli Patti		A shape resembling a flower bud with partial features of a leaf	Sphenoid S Shape

Sr. No.	Name	Semantic Units	Description	Classification
63	Dandi Kalli		A shape resembling a flower bud with end stylized and elongated to resemble stem	Sphenoid C Shape
64	Patti Dandi		A leaf shape with end stylized and elongated to resemble stem	Sphenoid S Shape
65	Ful Patti		A shape resembling a flower petal with partial features of a leaf	Sphenoid S Shape
66	Ful Patti 1		A shape resembling a skewed flower petal with partial features of a leaf	Sphenoid S Shape
67	Ful Dandi		A floral motif with two petals and one stylized point elongated to resemble a bud	Sphenoid S Shape
68	Mindi Jo		A shape resembling wheat or barley seed with partial features of koyli and mindi	Sphenoid N Shape
69	Bel Patti		A leaf shape with a long and stylized stem	Sphenoid N Shape
70	Pandadi		A leaf shape with a prominent bulge to accommodate large stones	Sphenoid N Shape
71	Jasud Patti		A shape like petal of a hibiscus flower	Sphenoid C Shape
72	Gole Patti		A leaf shape with an apex and two lobes	Sphenoid N Shape
73	Patti		A shape resembling a broad leaf with a vein	One axis of symmetry
74	Nim Patti		A shape resembling a neem leaf with a vein and cuts	Sphenoid C Shape
75	Kamal		A stylized lotus shape with five apex	One axis of symmetry

Sr. No.	Name	Semantic Units	Description	Classification
76	Adha Ful		Flower with three petals and one mindi	One axis of symmetry
77	Khach Nakhiya		A shape like an animal nail with a depression to one side	Sphenoid C Shape
78	Nakhiya		A shape like an animal nail with a depression to one side stylized like tiger claw	Sphenoid C Shape
79	Parag Raj		A shape like stamen of a flower	Sphenoid C Shape
80	Bati		A shape resembling a flame of a clay lamp	Sphenoid C Shape
81	Batak		A bird shape resembling a duck or swan	Sphenoid C Shape
82	More		A stylized peacock motif made of paan, koeli mindi and kali	Conjoined
83	Chidi Patti		A shape like a club in cards, with one lobe having an apex	Conjoined
84	Patti		A highly stylized leaf, opening like fern shoots	Conjoined
85	Panch Patti Ful		A symmetrical flower with five pointed petals top petal centrally placed with or without a hollow centre	Conjoined
86	Tikha Che Fulliya		A symmetrical flower with six pointed petals top petal centrally placed with or without a hollow centre	Conjoined
87	Pattiya		Cluster of leaves usually three or more	Conjoined
88	Ful		A highly stylized flower blossoming	Conjoined

Sr. No.	Name	Semantic Units	Description	Classification
89	Kamal Patti		A lotus motif with or without stem and leaves	Conjoined
90	Ful Pyala		A floral motif with two petals and lamba pyala	Conjoined
91	Machhli		A highly stylized fish motif	Sphenoid N Shape
92	Cut Patti		A leaf cut from the sides	Sphenoid C Shape
93	Gole Pyala		A cup shape resembling a goblet or chalice with a round top	Sphenoid C Shape
94	Mindi Dandi		A shape resembling a comma made of a mindi and a dandi	Sphenoid C Shape
95	Patang		A kite shape made of two convex and two concave arches	One axis of symmetry
96	Tikha Pan		A beetle leaf shape, skewed and compressed, with three apex	Sphenoid N Shape
97	Mindi Style		A stylized s mirrored and terminating into two mindi shaped	Sphenoid N Shape
98	Ful Kalli		A flower and a bud shape stylized termination	Conjoined
99	Gole Trikone 1		A triangle or trilobite with rounded corners	One axis of symmetry

3.7. Potential Application- Cataloging

This research provided besides a cataloguing, an understanding of semantic units that can be applied to design (Table.3.1). It sometimes happens that a client is not entirely satisfied with the outcome when article is ready and cannot articulate grounds for that. Jewellers attempt to understand is not effective in absence of common word sets and grammar to describe form or thought. Cost of reworking, in event of dissatisfaction with final article, is high and therefore undesirable by both client and jeweller.

There was no definite method available to understand and articulate which part of article was liked or disliked. This cataloguing provides a basis for communication by making known, a part of, visual language of *Kundan*. Used in the form of a visual aid, this can make communication better between a jeweller and his clients.

3.8. Summary

Study continues into domain to understand form clusters created by these semantic units. Their uniqueness and their interplay with each other create overall form of jewellery. The form clusters, using a mother circle are developed as a research tool to gauge user preference. This study is expected to provide a way to mathematically interpret aspects of design, which have a positive influence on liking of that article.

Chapter 4

Smallest Semantic Units and Form Clusters

4.1. Fundamental Building Blocks

A smallest semantic unit, often identifiable by a name, is fundamental building block of *Kundan* jewellery. An assemblage of these put together in a certain manner constitutes a form cluster, which in turn by repetition, constitute an article, Fig.4.1. A theme created by a form cluster is carried to various pieces in a particular set, typically neck pieces (or *Kanthi*/necklaces), wrist pieces (*Kangan*), ear pieces (*Latkan*) and rings (*Angoothi*).

A neck piece is one of the largest in terms of individual size and heaviest article amongst a set¹³. It often has the largest size of form clusters constituting its overall form. Worn on the neck, prominently in line of sight, it is therefore the most visible and suitable item for visual research.

13. The neck piece owing to its weight and size, is also the most expensive item in a particular set.



Fig.4.1. *Kundan* Necklace, smallest semantic units & form Source: Balakrishnan R. U., 2004, *Dance of The Peacock*



Fig.4.2. A tear drop forming a neck piece Source: Balakrishnan R. U., 2006, *Jewels of the Nizam*

Semantic units and their symbolism draw inspiration from nature, both plant and animal (Flora & Fauna) (Balakrishnan & Kumar 2004) (Balakrishnan & Kumar 2006). In a study by Vyas and Bapat, 99 of such smallest semantic units were recognized (Vyas & Bapat 2010) and systematically tabulated and catalogued. These smallest semantic units, by way of analogy

of letters (and ligatures) of alphabet, were used in combination with other semantic units to constitute form clusters (words), these in turn were used to form the article (sentences) and sets (paragraphs as, several coherent lines on a theme). As shown in Fig.4.3. the study develops one step further.

As discussed in the previous chapter, progression from basic curves that make smallest semantic units to a set of jewellery comprising of various articles could be seen as- Curves forming Smallest semantic units that in turn make Form clusters, these in turn make Jewellery (overall form) and an article following a coherent theme creates a Set of articles.

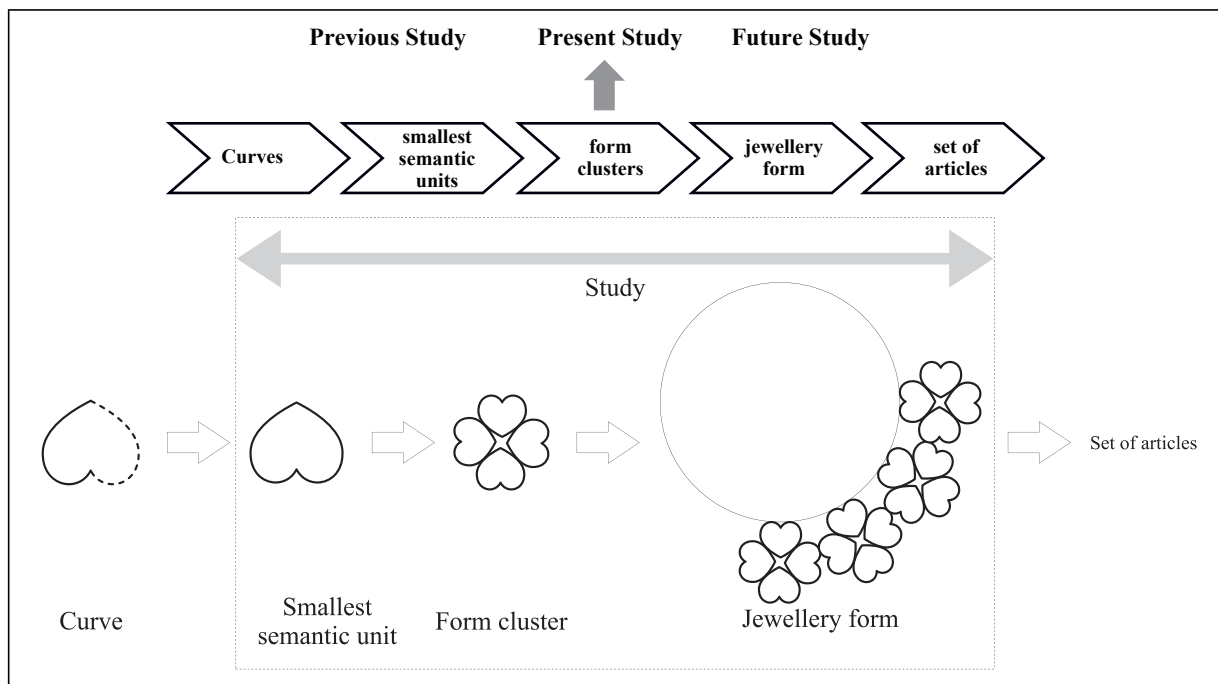


Fig.4.3. Progression from basic curves that make smallest semantic units to a set of jewellery

Curves which created smallest semantic units were kept out of study as they acquired a pertinent name and meaning only as a smallest semantic unit. Similarly, sets were also kept out of study as the same visual language of a necklace was carried to other articles like bangles and ear pieces (*Latkan*).

1. Form Clusters

As observed, in a previous study, 99 semantic units were identifiable by their names. These as basic building blocks were used in creation of *Kundan* articles. The semantic units, aesthetically pleasing themselves, were even more interestingly presented in combination with others. At a glance there appeared a vast number of possibilities even with a limited number of smallest semantic units. In practice, it was found, certain principles and guidelines are

followed in structure of *Kundan* articles. There were four particular ways in which a meaningful combination of a form clusters, a right *Gothavani* was achieved. There are several combination possibilities by altering following facet either alone or in combination, as follows

1. Variety in proximity, Fig.4.4.(A)
2. Numbers, Fig.4.4.(B)
3. Orientation, Fig.4.4.(C)
4. Size (of semantic units), Fig.4.4.(D)

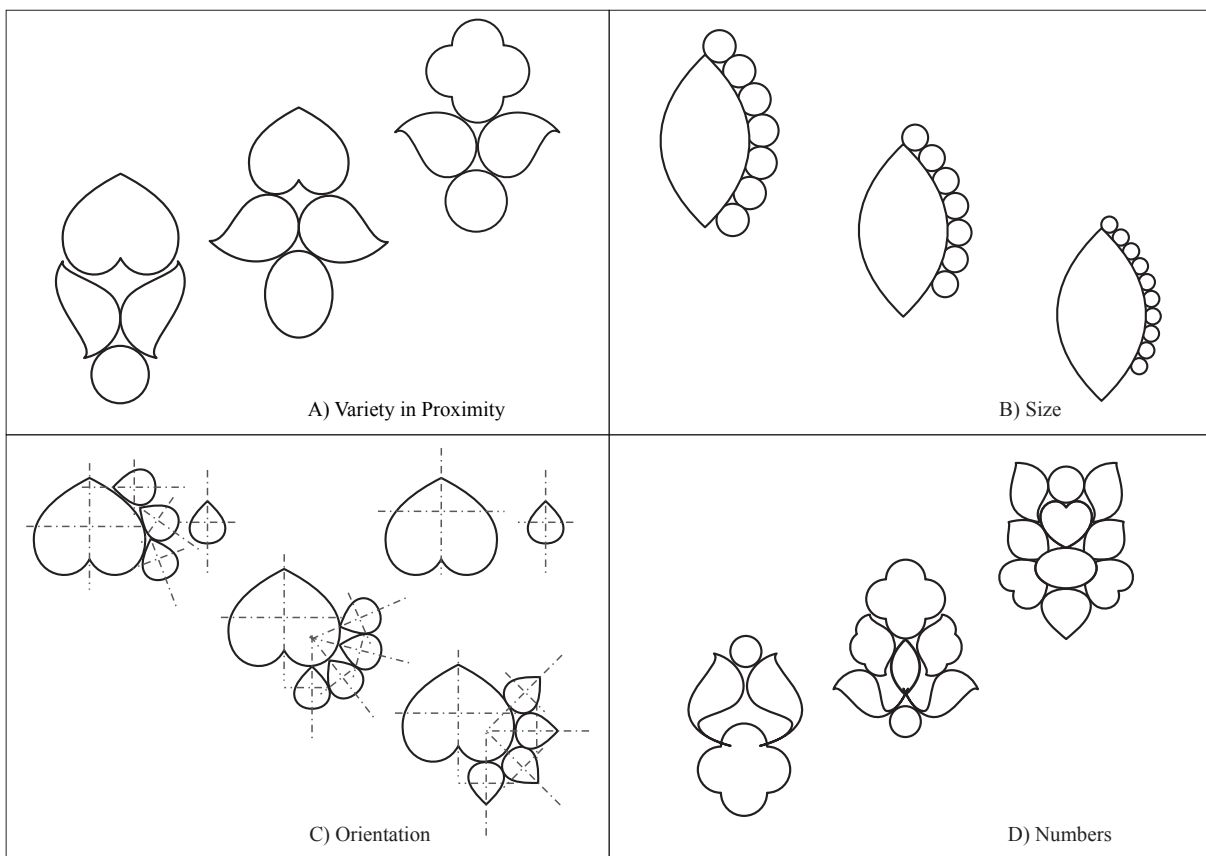


Fig.4.4.(A, B, C & D). Ways to achieve a meaningful form cluster, *Gothavani*

There existed an order in which semantic units have a natural inclination to gel with a select few, whereas it may not gel as effectively with others. Following these guidelines meaningful combinations, that are aesthetically pleasing, are achievable.

An unsystematic use does not lead to a meaningful and significant form clusters, form clusters therefore are made of combination of semantic units in a manner that is having an important visual effect. Combinations that had the right *Gothavni* result into a meaningful form cluster.

2. *Gothavani*

Gothavani is a process in which an aesthetically pleasing combination is achieved. A form cluster has a focal semantic unit, usually placed centrally or slightly larger. Other constituting semantic units that gel well with the theme were placed around that central unit in proximity, orientation and size that is appealing to eye.

Process of strategically placing these semantic units, fulfilling these objectives, to achieve a pleasing composition is good *Gothavani* as demonstrated by example in Fig.4.5.

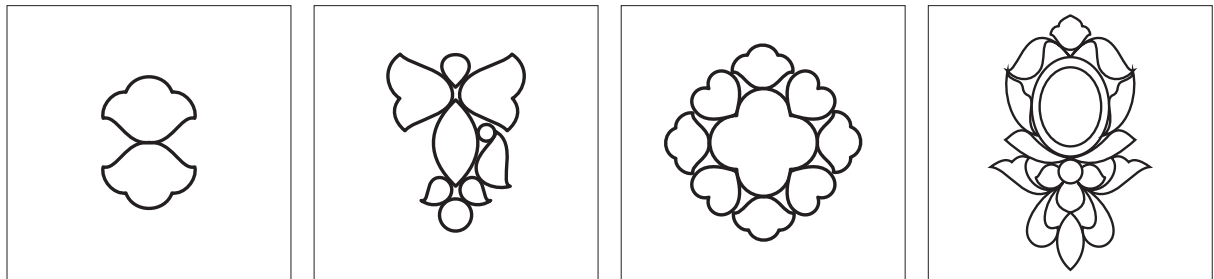


Fig. 4.5. Compositions of Semantic units that gel well, *Gothavani*

Gothavni as a concept is explained with illustrations, a central member is chosen in form of a particular semantic unit and two combinations are drawn depicting combinations marked titled aesthetically pleasing (Fig.4.7 to Fig.4.9.) and not so pleasing compositions¹⁴. The pleasing combinations were due to a rhythmic motion, while the other had something that hits the eye as something out of place, depicted in Fig.4.6.

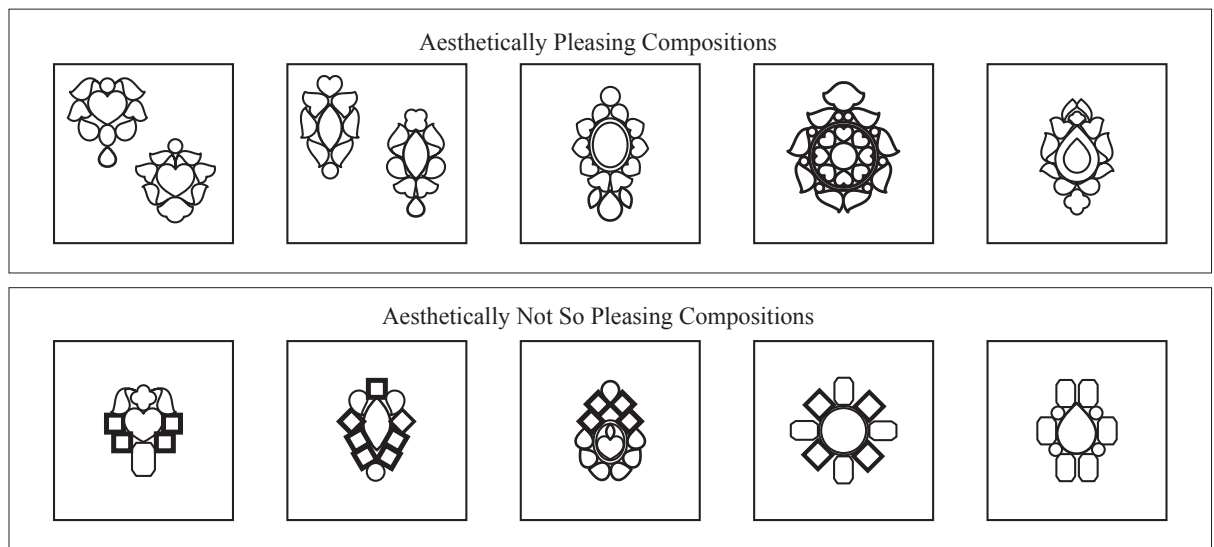
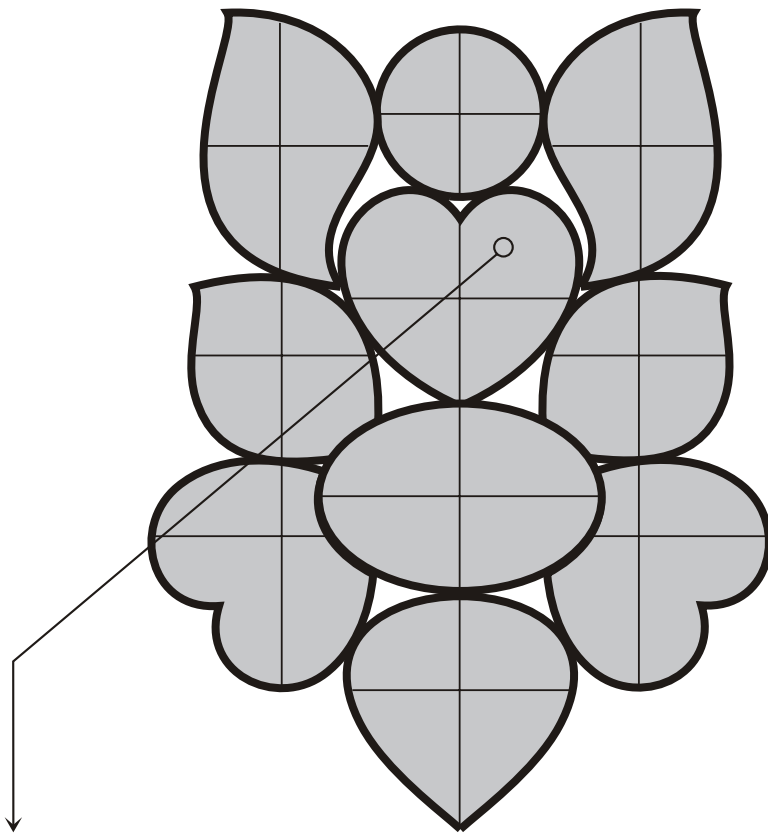


Fig. 4.6. Examples of aesthetically Pleasing and not so pleasing compositions

14. Although a symmetrical composition was maintained in not so pleasing clusters, there appeared an out of order visual cadence. These units appear as if symmetry was forced onto a focal member rather than a rhythmic interaction of smallest semantic units. Geometry was followed in an exacting sense, but a fluid poetry seems to be missing. A strong word like ‘displeasing’ was deliberately avoided to reflect the tentative approach taken by jewellers in shops. A good article is enthusiastically praised but nothing, even rarely, is criticized. The border line that distinguishes these two remains a matter of full scale research.



Bharavdaar, Bhara-Bhara

Shape sized in equal visual weight and placed closely packed

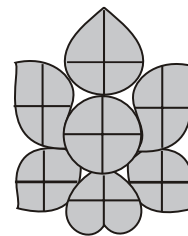
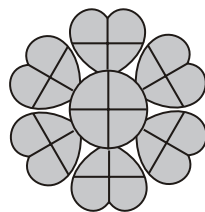
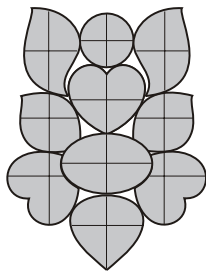


Fig.4.7. *Bharavdaar* form clusters with little counter space in between.

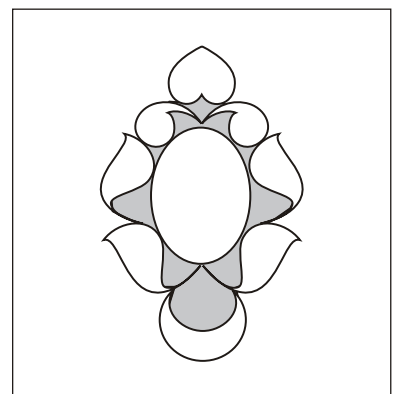
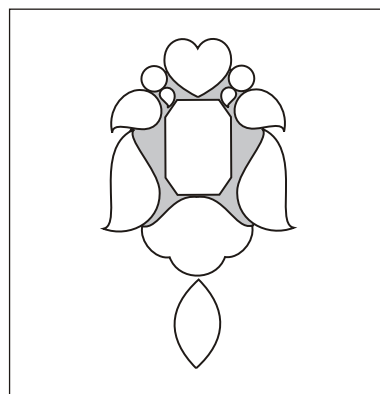
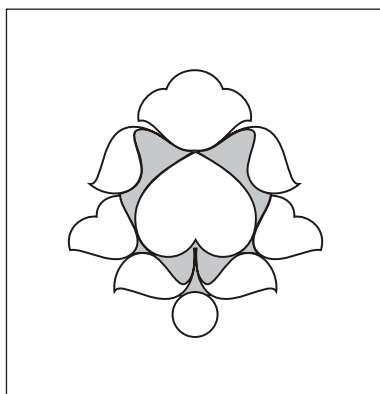
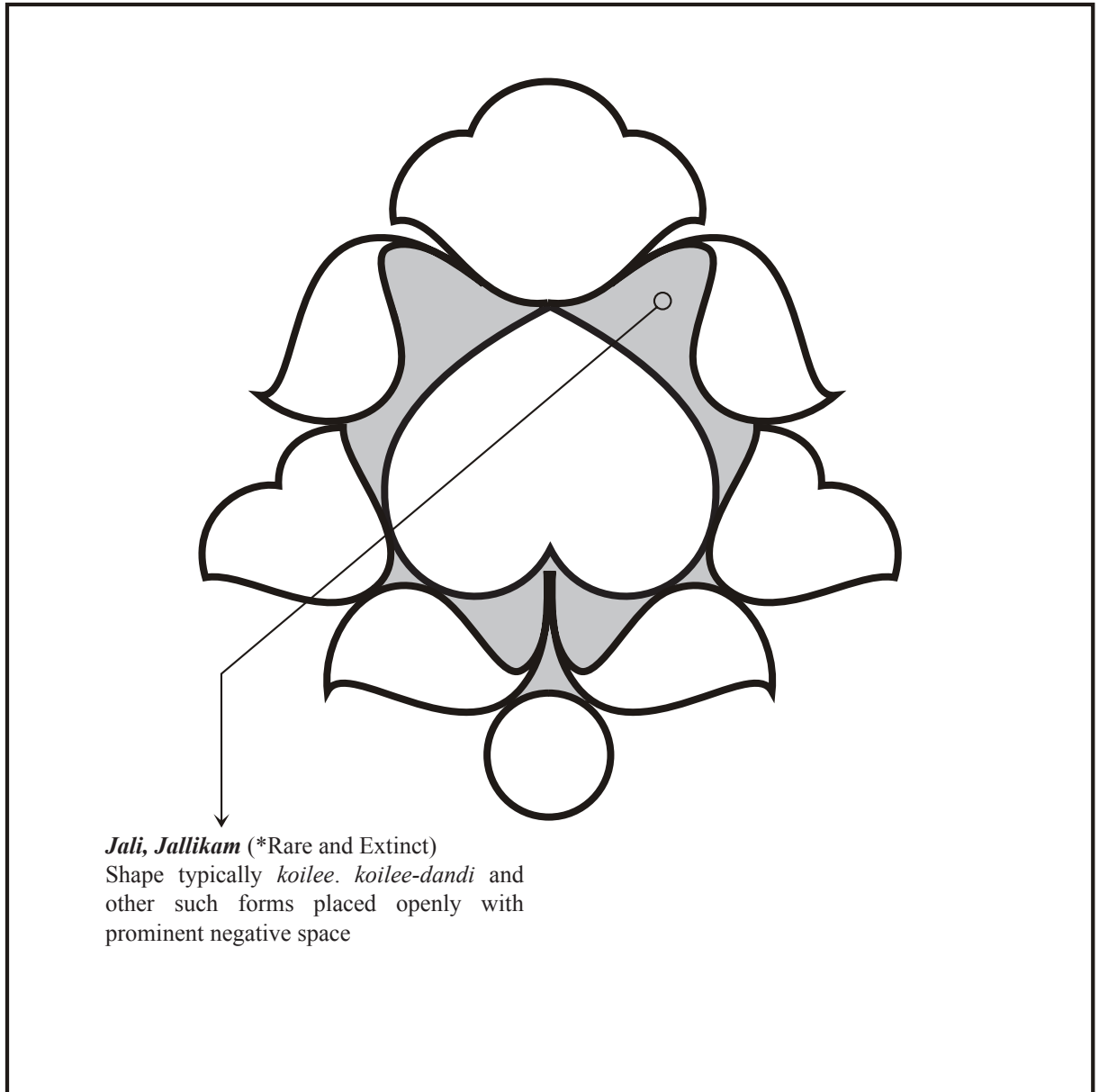


Fig.4.8. *Jaalikaam* form clusters with more counter space in between.

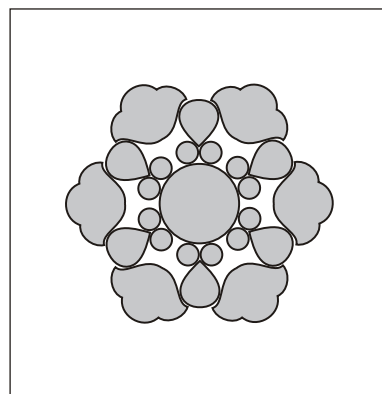
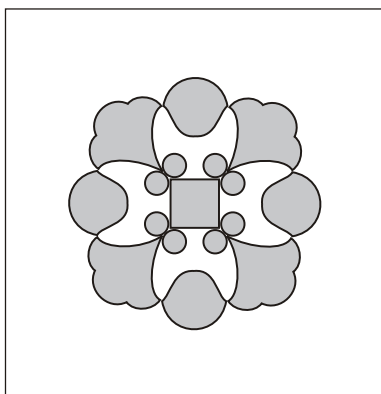
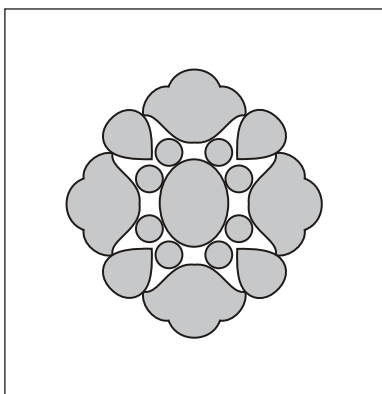
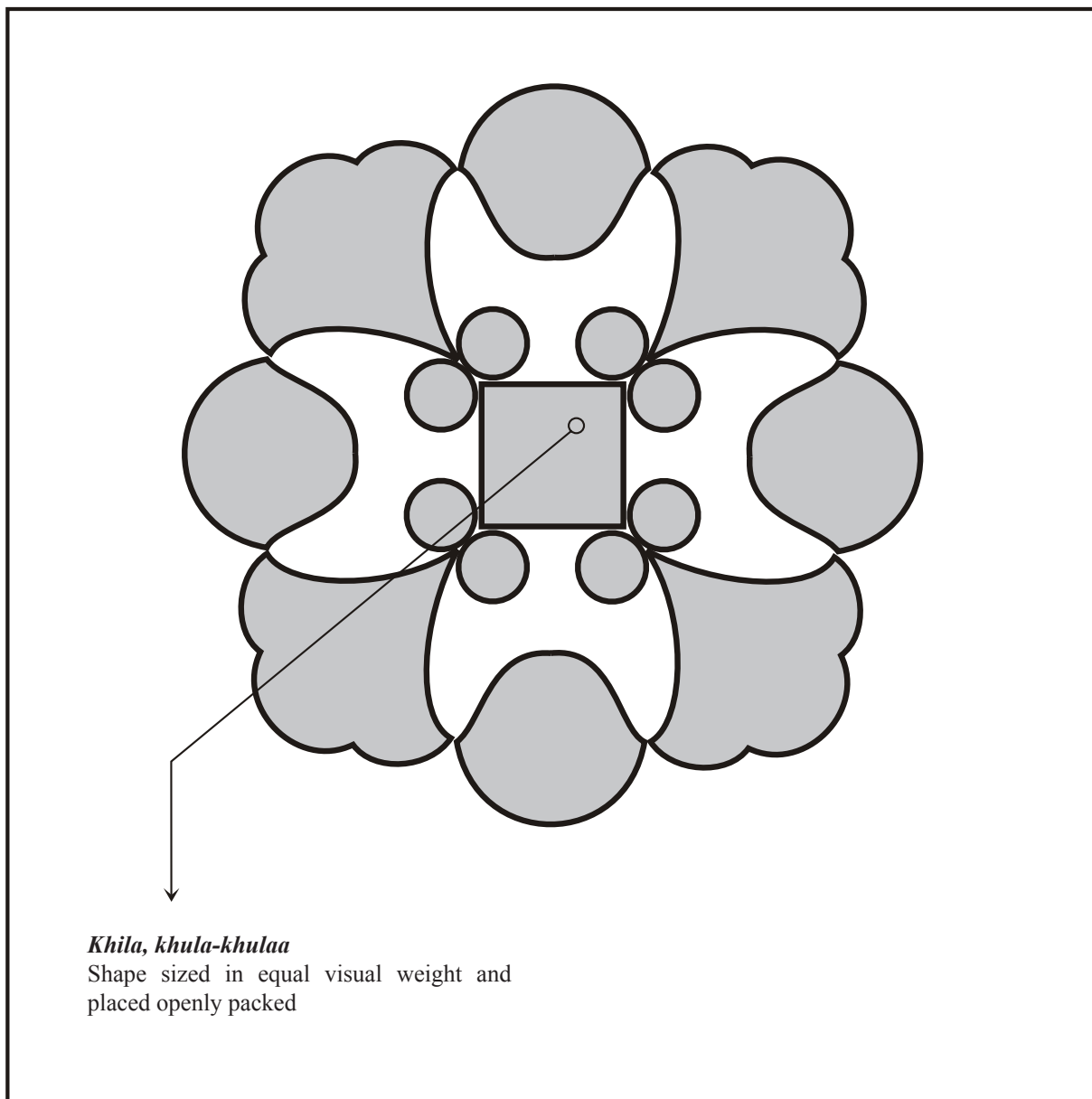


Fig.4.9. *Khila* form clusters with pronounced counter space in between.

4.2. Methodology to Find Most Frequently Used Semantic Units

From initial studies, inductively, it was found that there are some semantic units that are more frequently used as compared to others. This was further investigated to see if there are reasons for preferential semantic units. Literature was silent on existing methodologies for this type of research, so new techniques were worked out. The research though in early stages was path breaking and significant. For this purpose, a sample of fifty five neck pieces in form of sketches, was collected from books, photographs and ongoing works (Untracht 1997). Collecting ongoing works proved to be the most difficult part as information and resources are not easily available and rather protected for the fear of competition by other jewellers. Jewellers and *Kundansaaz* were approached with a request to share line arts or photographs of live works and it took considerable time, effort and confidence building measures to win their trust. Once convinced about academic nature of research they started sharing information and resources. Material collected from these ongoing works had merits of being contemporary and up to date with time spirit (Shajahan 2004:99).

To methodically study photographs, renderings and shop floor presentation montages were meticulously traced out and converted into vector artworks. The vector artworks had a technical drawing like quality, were drawn in form of single line, free from perspective. A full frontal picture was taken for the purpose of conversion to artworks, that gave maximum details and effective angle of presentation. A folio in form of 55 artworks was created that were independent of depiction of colour and fuzzy boundaries in photography. This method had a merit in studying overall form and at the same time minute details like cluster forms could be studied. Interplay of smallest semantic units with other semantic units was revealed with clarity.

Each artwork was then labelled and various semantic units used in construction of that article were tabulated. This was done on a DIN A3 size paper providing ample space for labelling and listing of semantic units, as depicted in Fig.4.10. These tables contained name, that particular semantic unit was identified with and number of times the same were used in construction of that particular article.

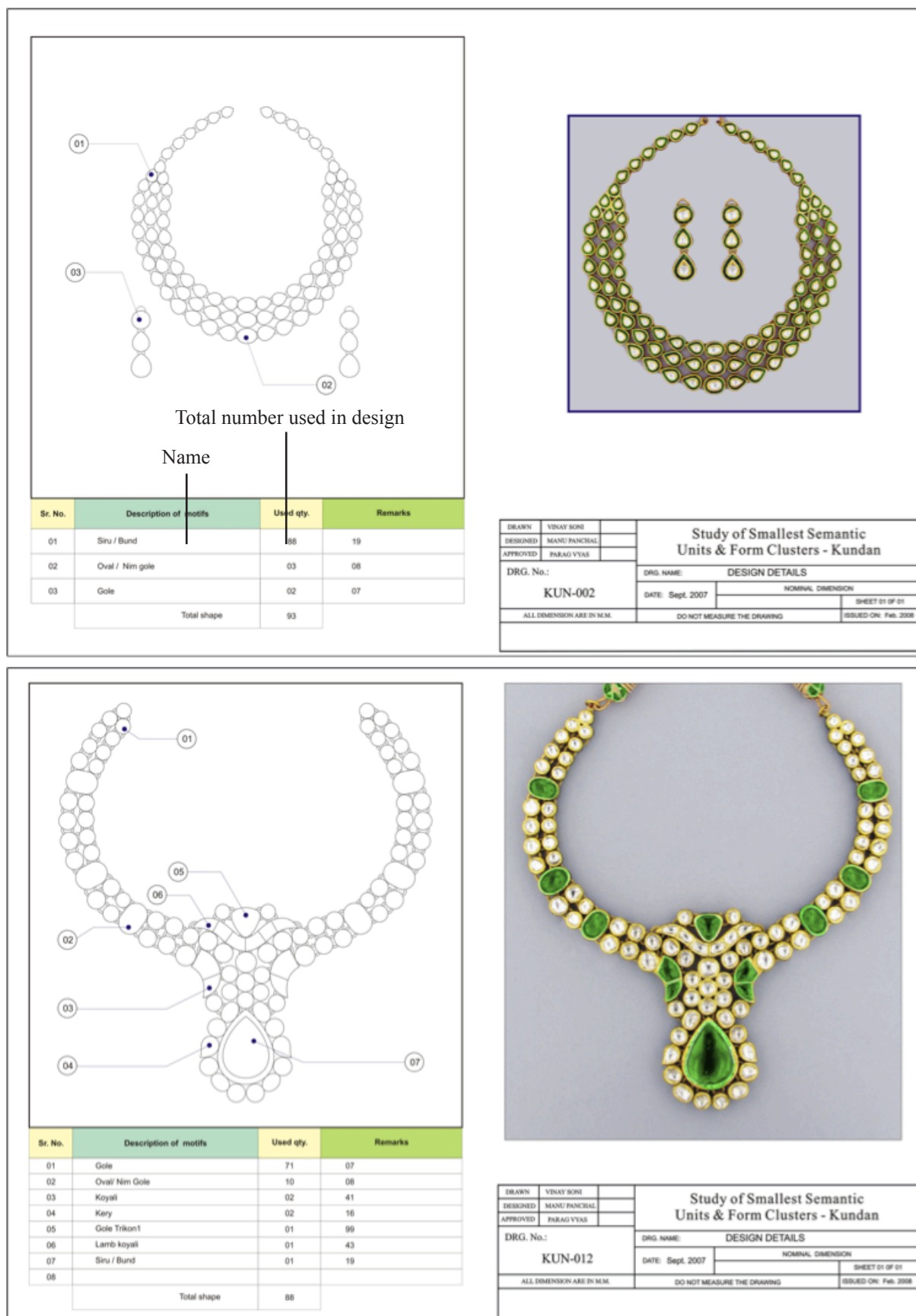


Fig. 4.10. Labelled Artworks for methodical study

The contents of these tables were compiled in excel sheet, frequency distribution was used to determine frequently used semantic units. Most frequently used semantic units reveal a preferential inclination towards symmetric forms. As methodical research in domain of jewellery was in its early emerging stages, findings were presented to a panel of five *Kundan* experts for validation. Panel consisted of three *Kundansaaz*, one jeweller and one designer to cover identified aspects. Findings were discussed at length and a concurrence of views was evident. Their suggestions were incorporated in study. Fig.4.11, shows most frequently used semantic units, these were used for development of form clusters for further studies.

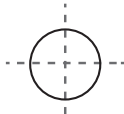
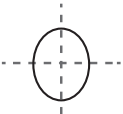
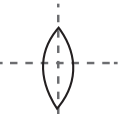
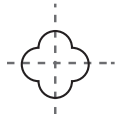
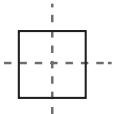
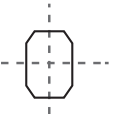
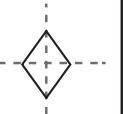
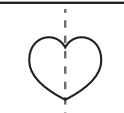
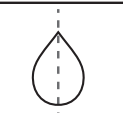
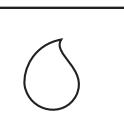
							
Gole	Nim Gole	Jo	Gole Chofuliya	Choki	Lamba Auastpel	Shakkar Para	
							
Daudi	Gol Pyala	Siru					
							
Koyali Dandi	Koyali 1	Chhipla 2	Teda Chand	Keri	Daudi Pyala	Lambi Koyali	Chidi 2

Fig. 4.11. Preferred semantic units, primarily having symmetry

It is evident that smallest semantic units, having two or one axis of symmetry were more preferred. In list there were 7 with two axis of symmetry and 3 with one axis of symmetry. There is a plausible explanation for this occurrence on two levels. These units were not only familiar shapes but they were also ‘fabrication friendly’, due to their simple geometry.

These semantic units were used primarily for creation of form clusters and thereafter patterns in further research to gain insight into factors influencing user preferences.

4.3. Form Cluster and Pattern Creation

A dark background made of wax was used as a surface by jewellers to test overall form of an article. A colour such as, Prussian blue, from carbon papers was used to provide good contrast against metallic gold. They drew a curve (*Chaap*) as a visual reference and scribed a vertical central line prior to placing semantic units to make a form cluster as central piece. The same was repeated to left and right of the centre line to achieve overall jewellery form. This approach was adaptable to be developed as a research tool.

This was further explored to find out geometry of these curves. They were found to be best fitting between two circles of diameters 108 to 125 millimetres. The most frequently used had a diameter of 115 millimetres, as depicted in Fig.4.12.

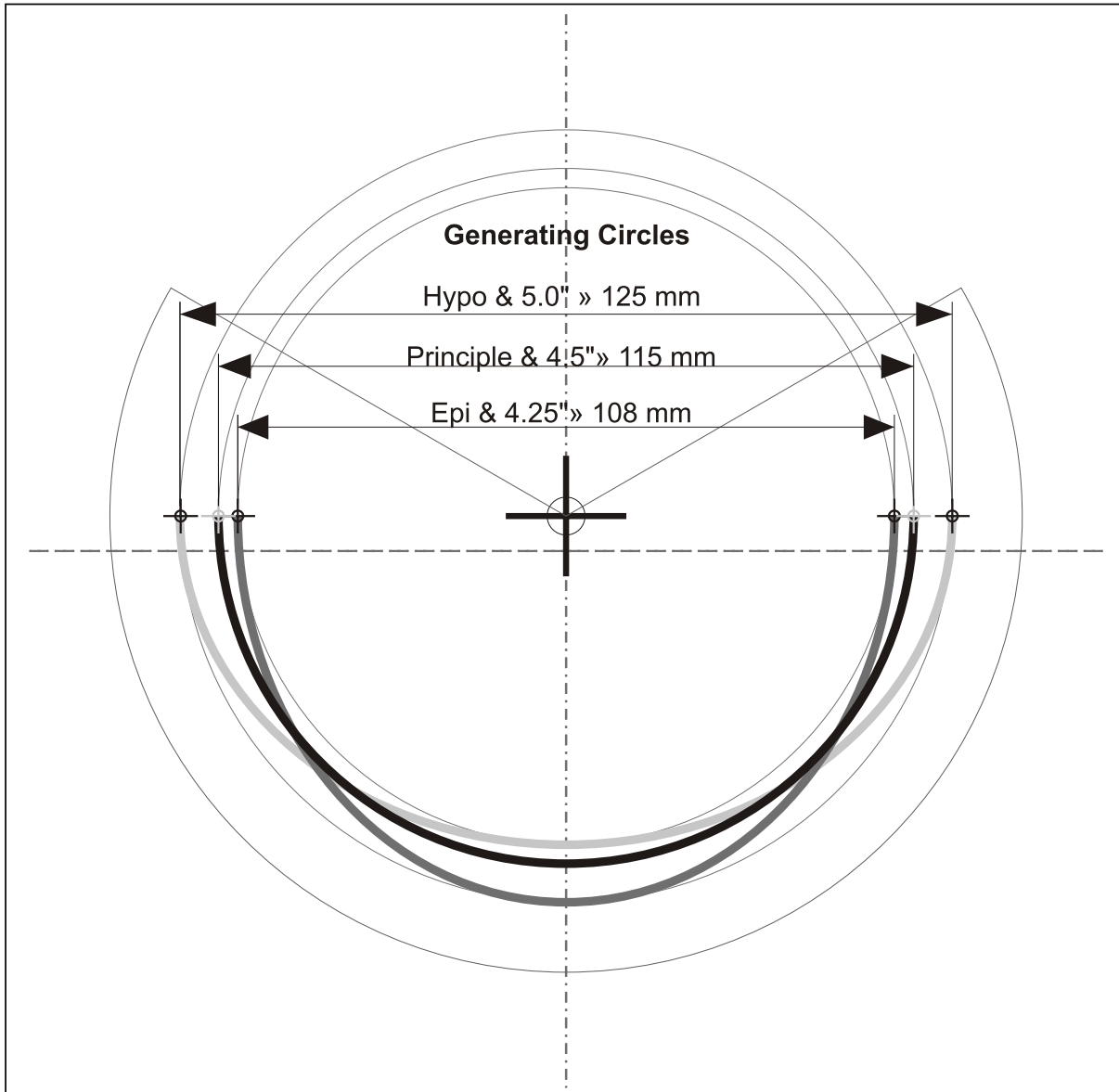


Fig. 4.12. Geometry of curves, best fitting circles

These dimensions were found to be in conformance with Anthropometric dimensions (for ergonomic design practice) for Indian population of women (Chakrabarti 1997:68). Quarter to two third, of an arc of this circle is used for compositions. It is an established practice to use a central form cluster and add even numbers to left and right sides, making it symmetrical around a central axis. This arrangement regardless of numbers on either side, always gave an odd number ($2n+1$, an additive odd number generator was used, considered auspicious in traditionally held beliefs). A more rational explanation was a focal attraction of a central piece, with a visual balance achieved by symmetry.

Articles with a heavy appearance having larger size of constituting semantic units, form clusters were used in fewer numbers. Articles with a dense appearance constituted of relatively smaller semantic units, form clusters were used more in numbers as in Fig.4.13.

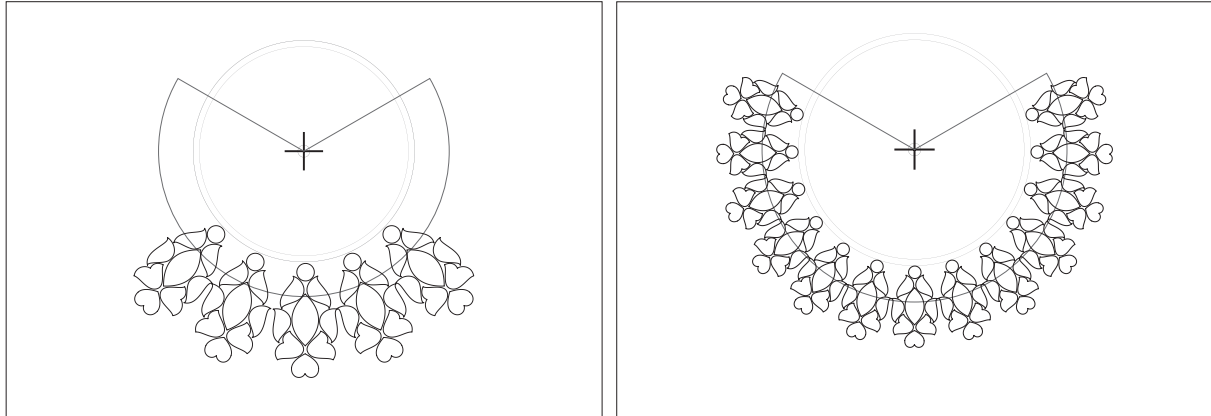


Fig.4.13. Articles with a heavy and dense appearances

Kundan jewellery is normally made as a complete set which comprises of a necklace, a pair of bangles, a pair of ear pieces and a *Mangteeka* having same visual language. Jewellers start composition of form clusters to create neck pieces, as they are best viewed from the front having largest area and are the heaviest article in terms of weight. Once most pleasing appearance is created in a neck piece, Form clusters are scaled down to create ear pieces and bangles. A necklace, therefore, was a natural choice, well suited for development as a research tool.

A design method followed for making overall form was establishing a centre line and scribing an arc as mother curve, as reference. At the intersection of centre line and mother curve, first form cluster is drawn and epitomized visually for the right size. Having achieved a visual balance same form cluster was repeated on either sides to complete neck piece. This covers a quarter to two third arc of a circle, and the rest of the perimeter required for fitting users neck is covered by a silken tassel with a slider for adjustments¹⁵. The slider was moved to backside, creating space to pass over head. Once the piece is worn and sits well in place, the slider is slid back.

15. A neck piece is designed for frontal viewing, directly in line of sight of a observer. If the whole perimeter of the circle is covered with form clusters, many of them will climb over the shoulder to the back side. There they will be covered by the long hair worn by women in India.

It makes good sense to limit the form clusters in the area where visibility is maximum and they can reveal their full beauty to the observer.

It is therefore, a good judgement of design to optimize the form clusters to a sector of the curve, rather than going all around like a chain.

4.4. Proposition of a Tool

Jewellers have to struggle with this interpretation of ‘a little bigger’, ‘a little smaller’, ‘a little closer’ or ‘a little loose’ often, ironically, translating them into precise instructions for fabrication. There was a strongly felt need to have a tool which made measurements possible, enabling mathematical interpretation of these feedbacks expressing needs. The inspiration came in form of stone mason’s marks (Mollerup 2004:34) which was used as underlying mother grid as base to make identification marks as in Fig.4.15. In top part of the illustration, the figures appear random and without any correlation. However once the grid is superimposed they reveal a meaning and grammar.

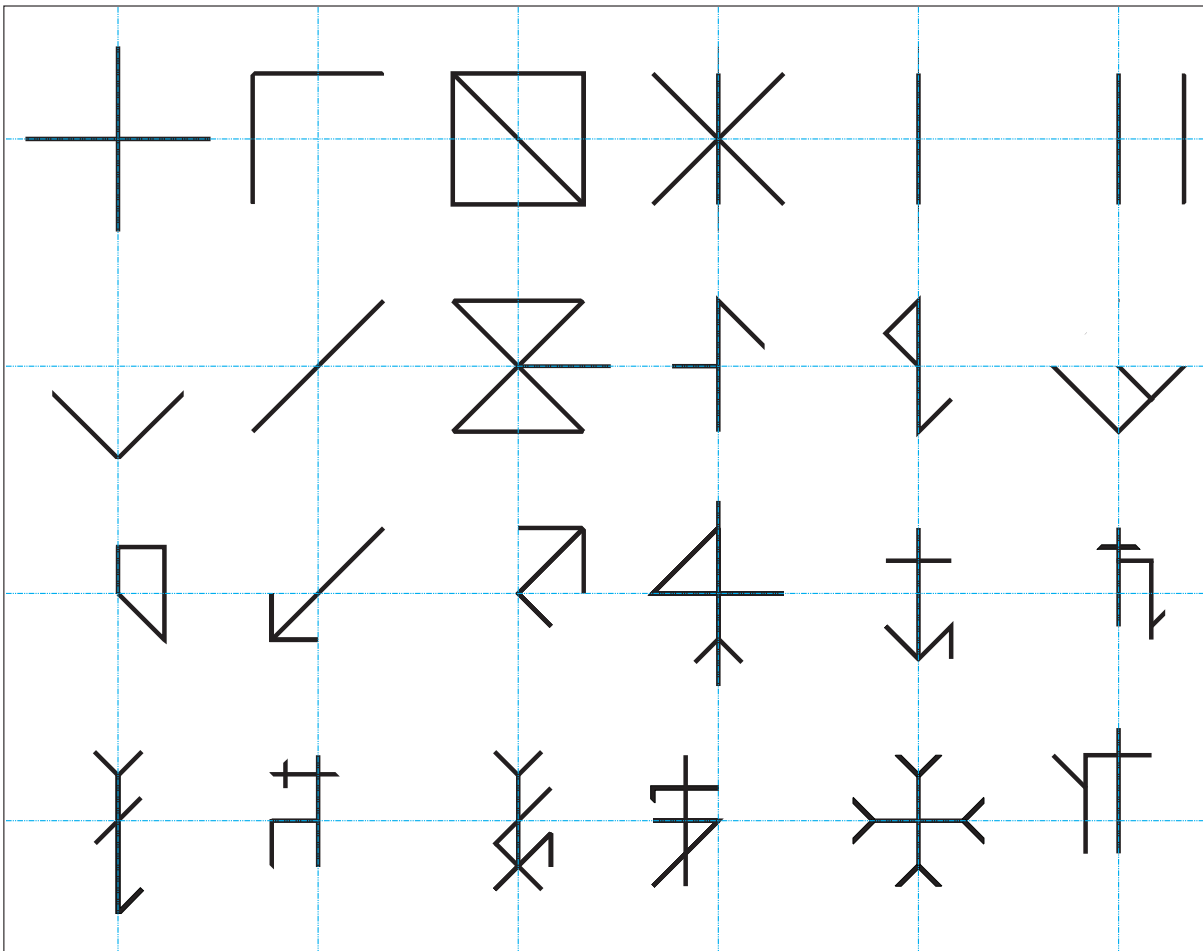


Fig.4.14. Stonemasons grid as without underlay Source: Mollerup P.,2004, Marks of Excellence-The history and taxonomy of trademarks.

A mother circle is proposed as an underlay reference grid to measure these aspects empirically. Three concentric circles were drawn, depicting maximum and minimum range around a central principle circle of diameter 115 millimetres, this circle was the measurement

most often found in use on shop floor. The circle inside this is called epi-circle the one outside is called hypo-circle for purpose of understanding. They draw inspiration from words epi and hypo cycloids. A cross wire was laid in the centre of these circles and a two third sector of the principle circle was marked out as guideline for placing the semantic units.

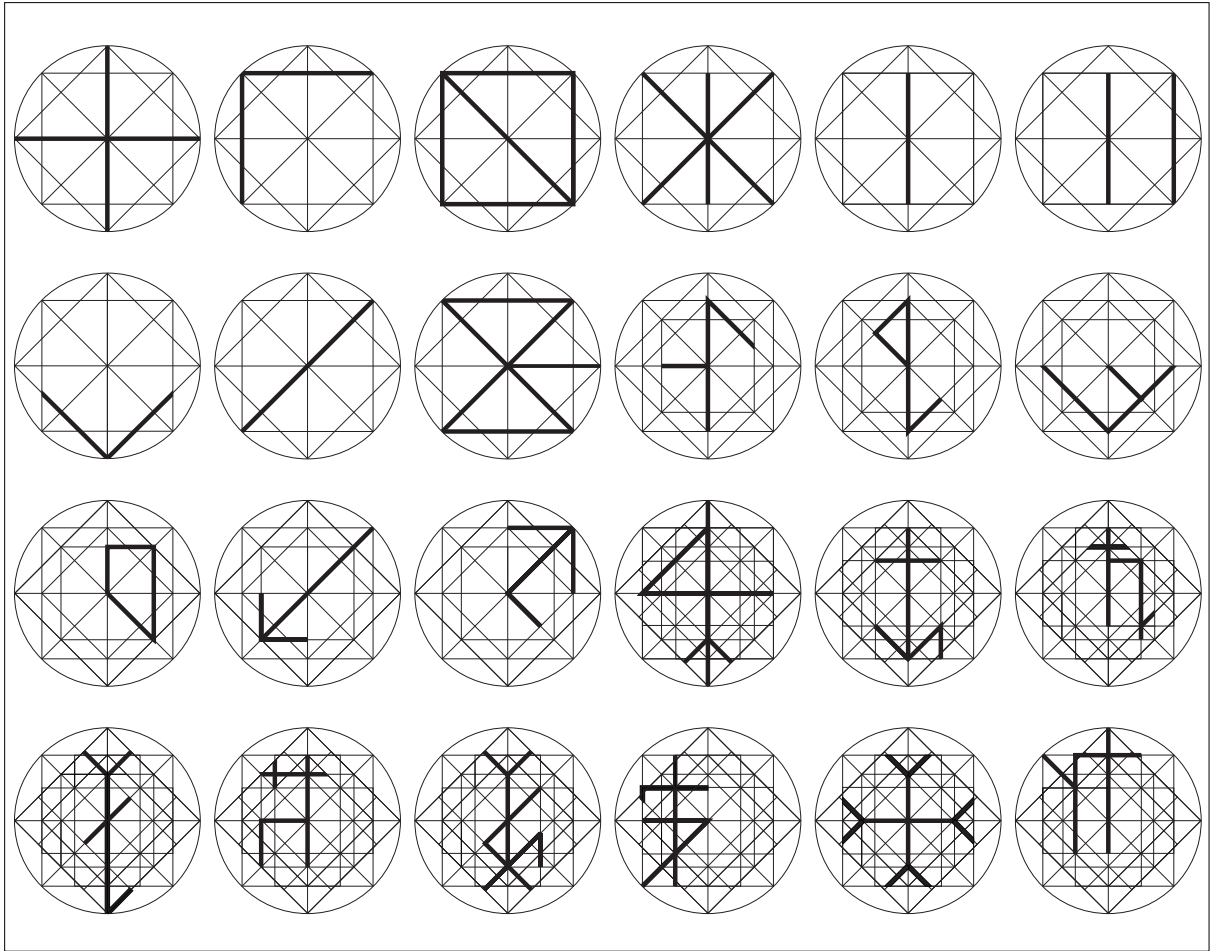


Fig.4.15. Stonemasons grid as underlay Source: Mollerup P.,2004, Marks of Excellence-The history and taxonomy of trademarks.

For testing the effect of numbers of constituting semantic units in a form cluster, a form cluster was created using three smallest semantic units. A set of five form clusters as in Fig.4.14. and Fig.4.15., was created progressively by increment of two semantic units at a time, thus creating a scale to gauge preferences amongst form clusters made of three semantic units to eleven semantic units.

A meaningful form cluster that followed *Gothavani* was placed on the principle circle with its apex touching the bottom of principle circle, centre aligned. This form cluster was rotated around the centre of principle circle to create overall form of the necklace. This point, where the apex touched the principle circle was called the point of contact and for calculation

of cluster pitch the angular distance between two points of contact was converted to linear measurement as in, Fig.4.16.

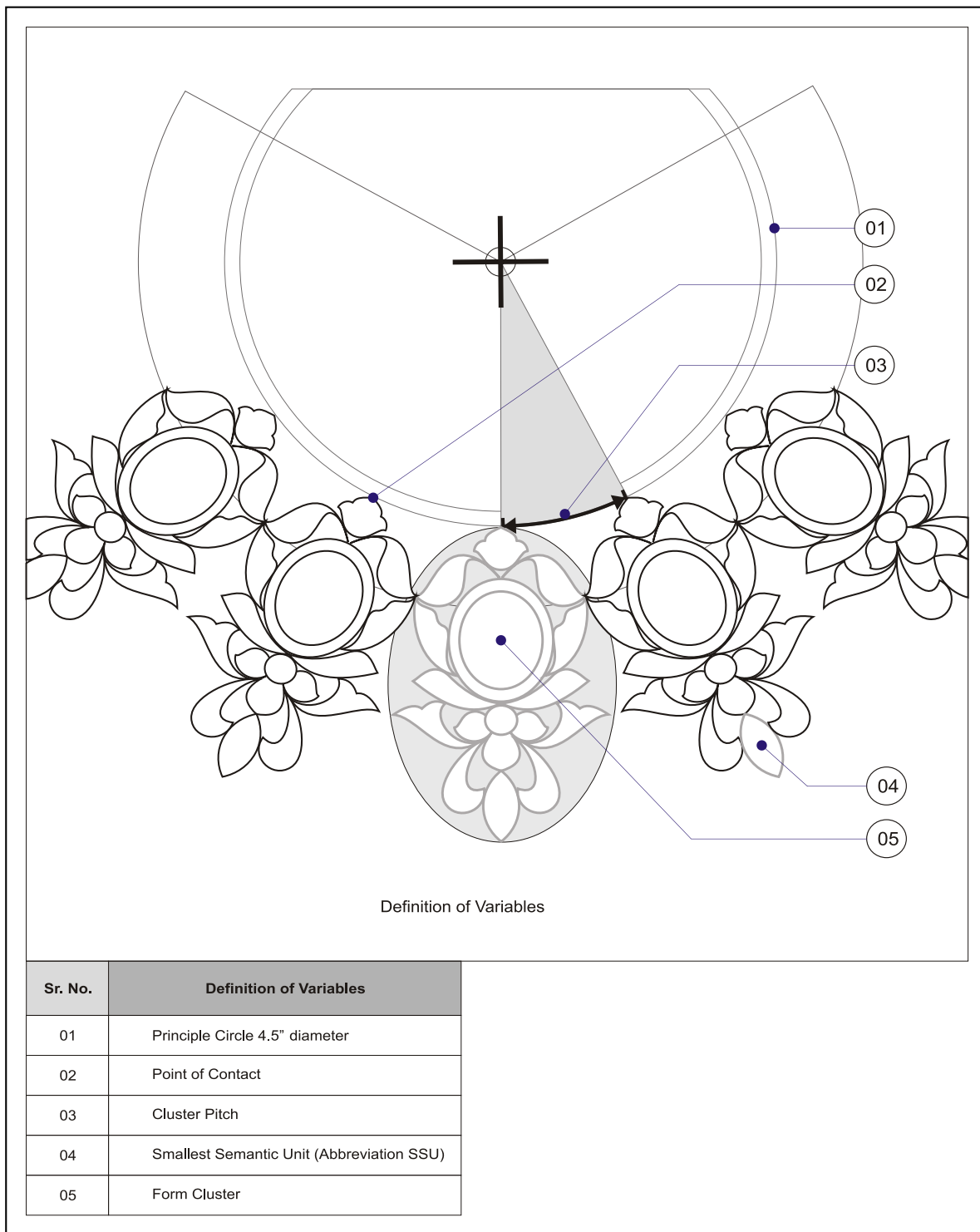


Fig.4.16. Principle circle, form cluster and cluster pitch

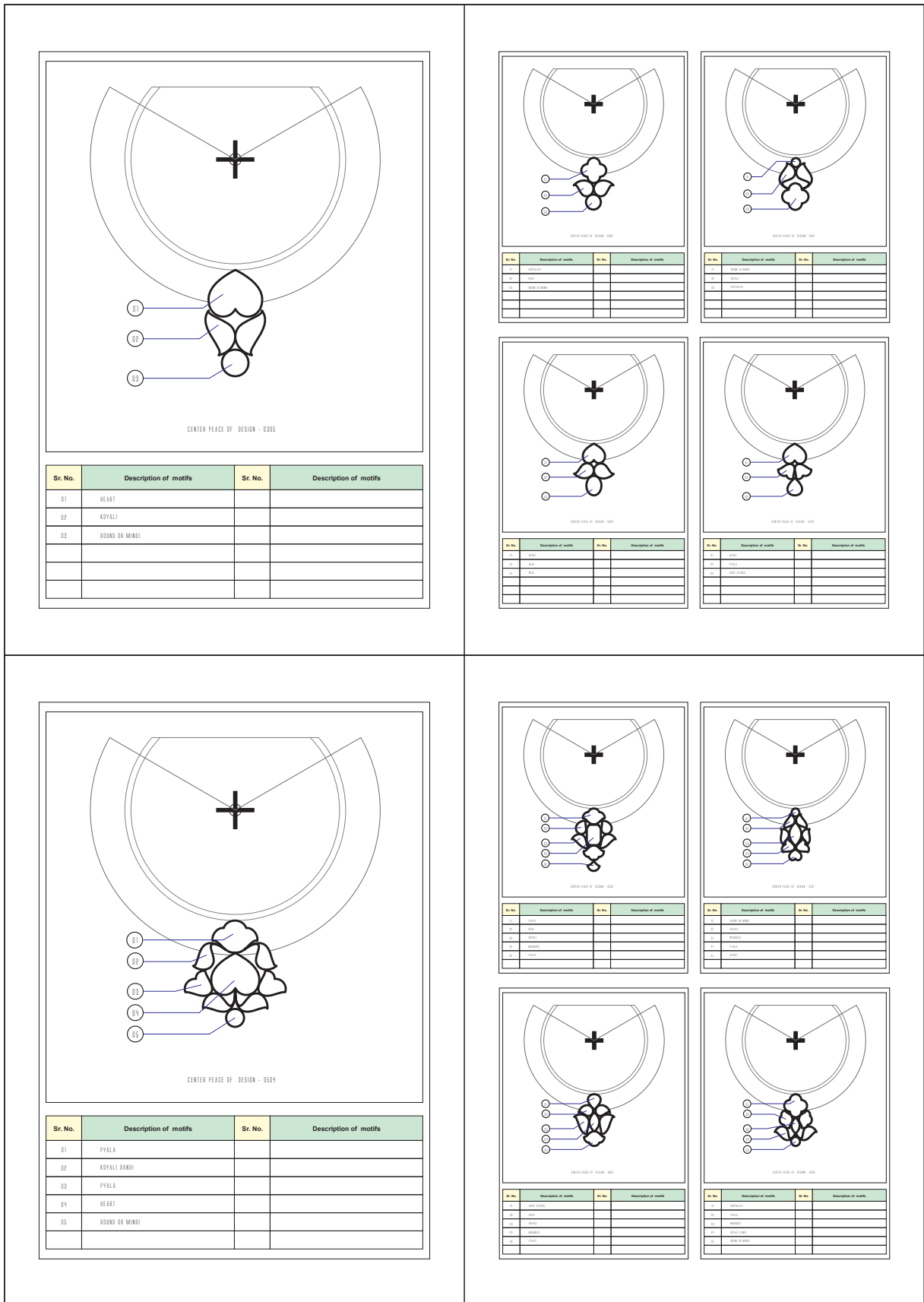


Fig.4.17. Diverse SSU

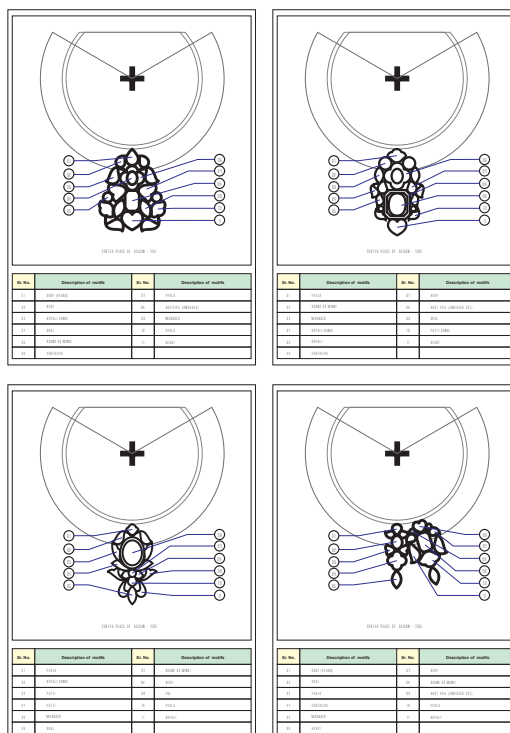
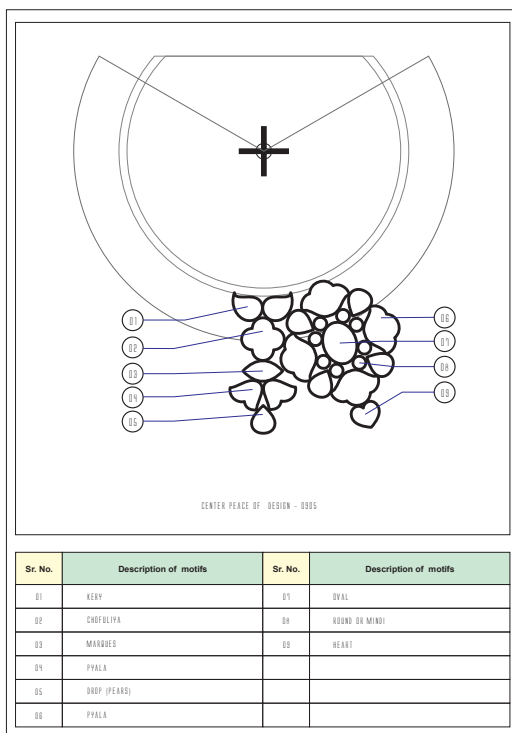
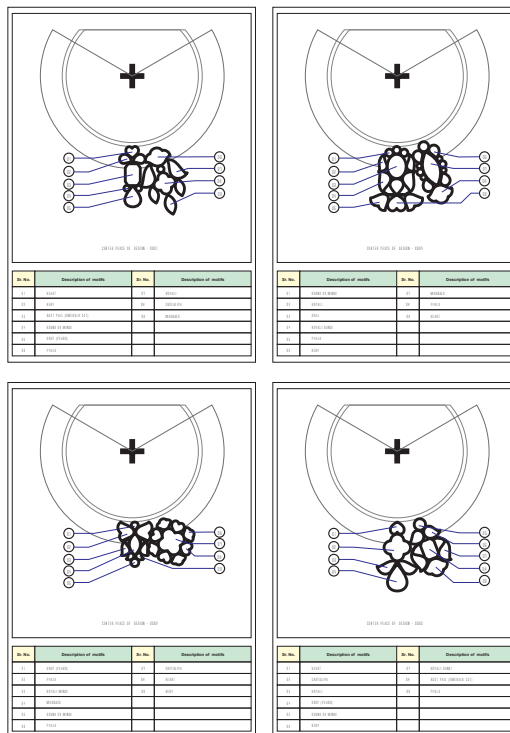
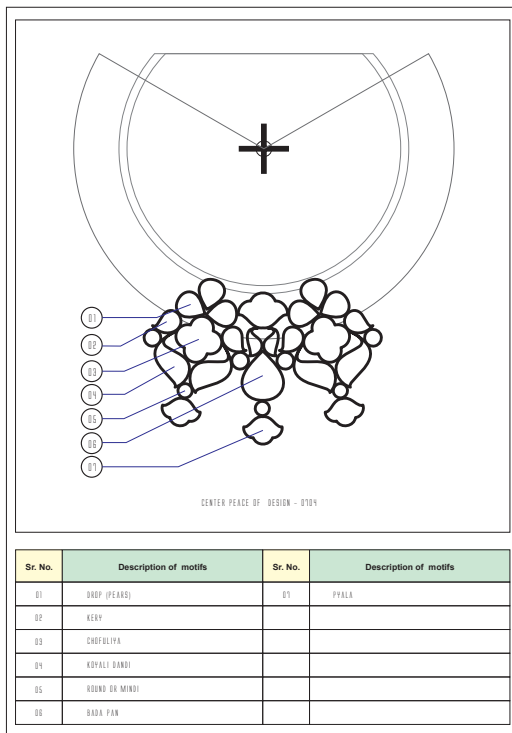


Fig.4.17. Diverse SSU

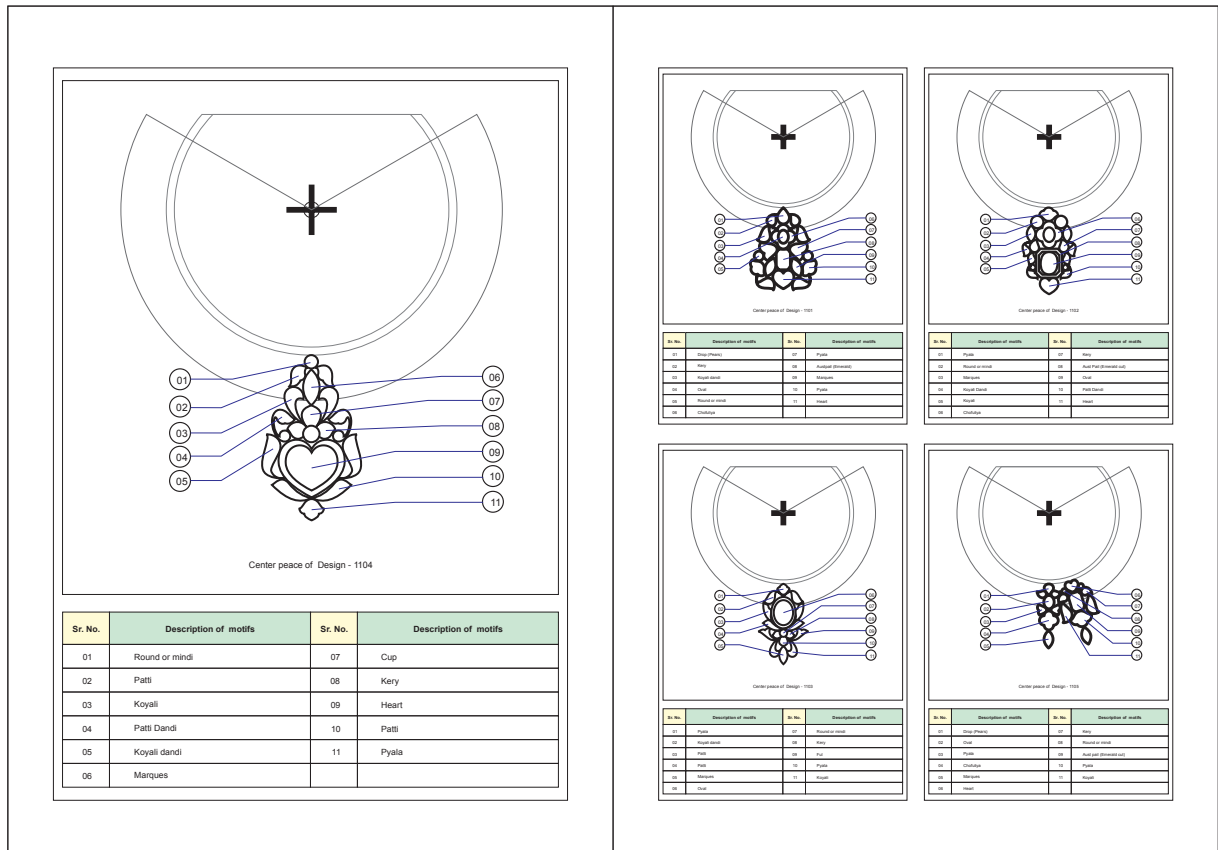


Fig.4.17. Diverse SSU

The maximum angular limit was set at two third of the overall circle. With use of a principal circle as a basic grid, different levels of fineness and diverse SSU (Fig.4.17.) were made by making size of the cluster larger or smaller, as in Fig.4.18.(Vyas & Bapat 2011) A larger size of form cluster required lesser number to cover the arc while a smaller size called for more numbers to be repeated.

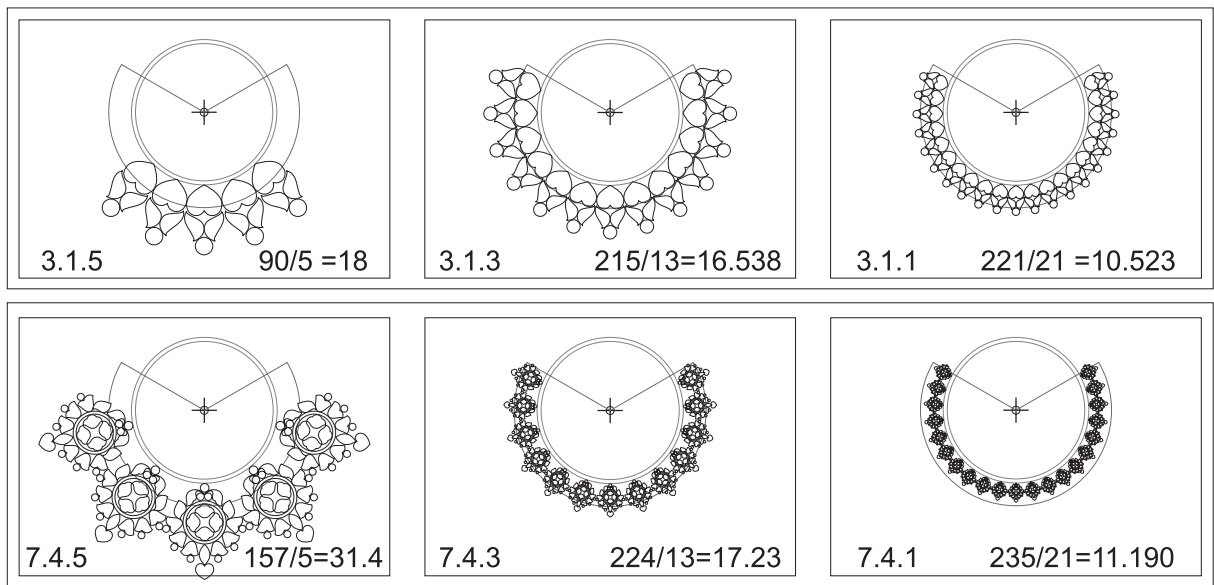


Fig.4.18. Different levels of fineness of cluster pitch

With this approach cluster pitch from conceptual description thus became defined and measurable. Typical advantages and merits of this scientific method were as follows.

1. Cluster pitch became calculable by conversion of angular measurement to linear measurement. The arc length covered by form clusters divided by total number of form clusters gives a cluster pitch in millimetres. It became possible to study effect of altering the same with firmness.
2. Cluster size became measurable in vertical as well as horizontal dimensions, calculable as box dimensions (along with other features like orientation and relative placement).
3. A total number of clusters can be predetermined for purpose of calculations.
4. Within a cluster the variety, size, orientations and numbers became controllable.
5. It gave a visual comparison, in form of proportion, with reference to the principle circle.

4.5. Limitation of the study

Meticulous work was carried out in form of illustration and cataloguing, still there were limitations felt during study. Primary limitation was even with a controlled number of semantic units plausible combinations of form clusters were numerous. This was, to an extent, controlled by making three form clusters, within given parameter of numbers of semantic units. These were deliberated upon by *Kundansaaz* before selecting one for development as a tool. Second limitation was effect of gradually reducing size within a neck piece. However, even sized form clusters became contemporary practice for ease of manufacturing, preferred by both jewellers and customers.

The effects of colour of metallic gold and gemstones were not part of present study. It presents again a huge potential to be explored in form of colour, transparency, glaze levels and their combinations. A single necklace with a variety of three gemstones itself presents numerous plausible combinations for study.

4.6. Preferred Semantic Units

There was a noticeable preference found during the first part of study for smallest semantic units having symmetry around two or one axis. These were often used both as central semantic unit as well as embellishment around them. *Koilee* was a preferred form and three of its variations were amongst preferred semantic units, however, this particular semantic unit was used more as embellishment around rather than a central unit. Teardrop was by far the most preferred smallest semantic unit and was used both as a central unit creating a theme as well as embellishment around.

4.7. Summary

These studies articulate various factors pertaining to configuration of form clusters and their interplay that has an impact on preferential likeness of articles of jewellery. The study further continues into development of a tool to study preferential likeness of articles using mother grid and form clusters in a methodical manner. This tool being developed is expected to be portable, thus able to cover large number of subjects, as jewellery cannot be carried freely due to logistics and security purposes.

Methodology used in these studies can be adapted for form-based research in design for small and miniature size products besides jewellery, where small details play a key role.

Chapter 5

Testing Grid

5.1. Concept of a Testing Grid

A smallest semantic unit, often identifiable by a name, is the fundamental building block of *Kundan* jewellery. An assemblage of these put together in a certain manner constitutes a form cluster, which in turn by repetition, constitute an article, as in Fig.5.1. A theme created by a form cluster is carried to various pieces in a particular set, typically neck pieces (or necklaces), wrist pieces (*kangan*), ear pieces (*latkan*) and rings (*angoothi*). Technically the stones were flush stone close set, as compared to claw setting of western master jewellers using formal cut gemstones (Pagel & Thiessen 1993:169)(Snowman 1990:174-188).

Semantic units have their own symbolism and draw inspiration from nature, both flora and fauna (Sharma & Varadrajan 2008:21). As Boral observes, “Indian jewellery frequently turns to nature for inspiration. Many designs derive from flower, seeds and fruit which can

be strung and worn as such or copied in metal” (Boral & Taylor 1997:106). These smallest semantic units, by way of analogy of letters (and ligatures) of alphabet, are used in combination with other semantic units to constitute form clusters (words), these in turn are used to form the article (sentences) and sets (paragraphs as, several coherent lines on a theme). Jewellery articles namely a neck piece, two bangles, a *Mangteeka* and a pair of ear rings constitute a basic set, contemporarily (Balakrishnan & Kumar 2004)(Untracht 1997).



Fig.5.1. *Kundan* Necklace, smallest semantic units & form , front and back.

A progression from basic curves that make smallest semantic units to a set of jewellery comprising of various articles could be seen, as depicted in Fig.5.2. This illustration defines length and breadth of present research, thereby curves creating semantic units is beyond scope of this research, likewise combined effect of several articles assembled together in various combinations is a matter for future research.

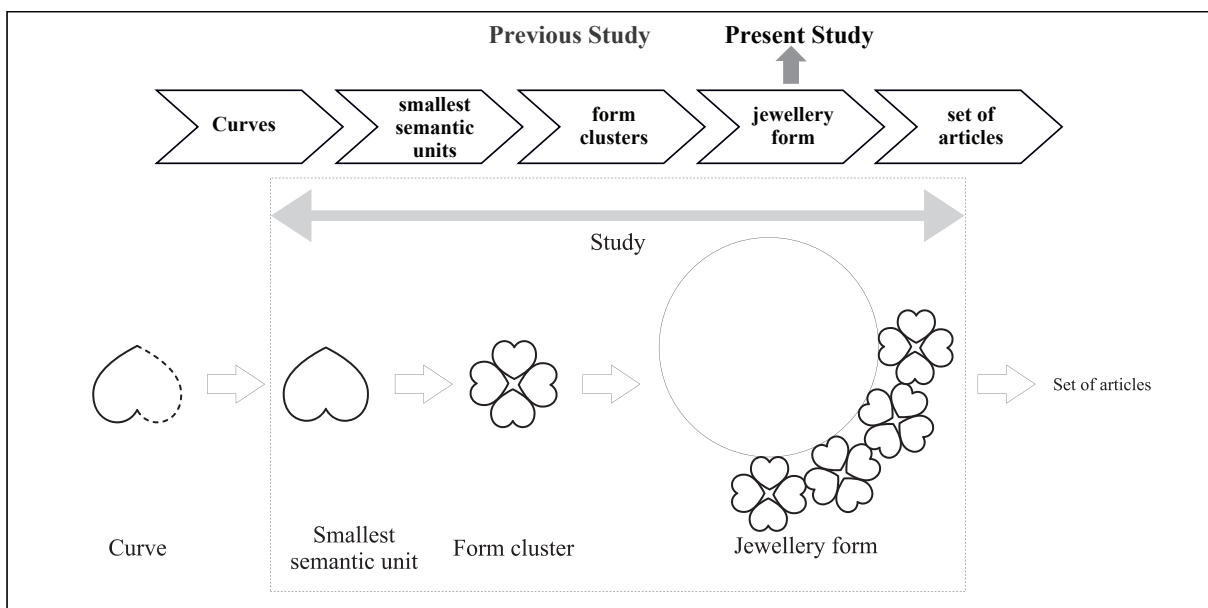


Fig.5.2. Progression from basic curves that make smallest semantic units to a set of jewellery.

5.2. Design of a Tool for Mathematical Interpretation

Indian jewellery is seldom studied with a scientific point of view where precise measurements and mathematical interpretation of articles under observation were possible. Studies, so far are limited to documentation of existing pieces, family heirlooms and collection of royalty published in form of photographic documentation (Balakrishnan & Kumar 2006). Literature was silent on methodical research, in the domain of jewellery and no existing scientific methodologies to conduct such research were available. New research techniques had to be developed for this purpose. However, in a recent study by Vyas & Bapat, 99 smallest semantic units were identified and documented (Vyas & Bapat 2010). *Kundan* jewellery had become popular in recent times and client's awareness and expectations were higher. In practice it was observed that Gold framework before setting was shown to clients for approval in semi finished stage, feedback though genuine often lacked clarity. Jewellers had to struggle with this interpretation of 'a little bigger', 'a little smaller', 'a little closer' or 'a little loose' often, ironically, translating them into precise instructions for fabrication. These expressions though precise in articulating the need, did not define how much of 'little bigger' was big enough or how close 'a little closer' meant. There was a strongly felt need to have a tool which made measurements possible, enabling mathematical interpretation of the expressions of these needs expressed by present and prospective clients.

The cost of reworking in case of disagreement with client is prohibitively expensive and counterproductive and at present there is no method available to articulate, let alone measure the various aspects of feedback. The need was also highlighted during review of literatures and affirmed by professionals.

5.3. Development of a Tool (Methodology)

The proposed tool and its design were driven by the need for measurements of visual variety in proximity of/with their numbers and cluster pitch. As a preliminary thought, encompassing these variables in a cube was proposed to makes orientation and location with

reference to a point (Untracht 1985:759), as depicted in Fig.5.3. After deliberations it emerged into a testing grid in form of a conceptual parallelepiped. Proposed test grids conceptually had:

1. Fineness/ Coarseness on x axis
2. Numbers of constituting semantic units on y axis
3. Varieties in proximity on z axis

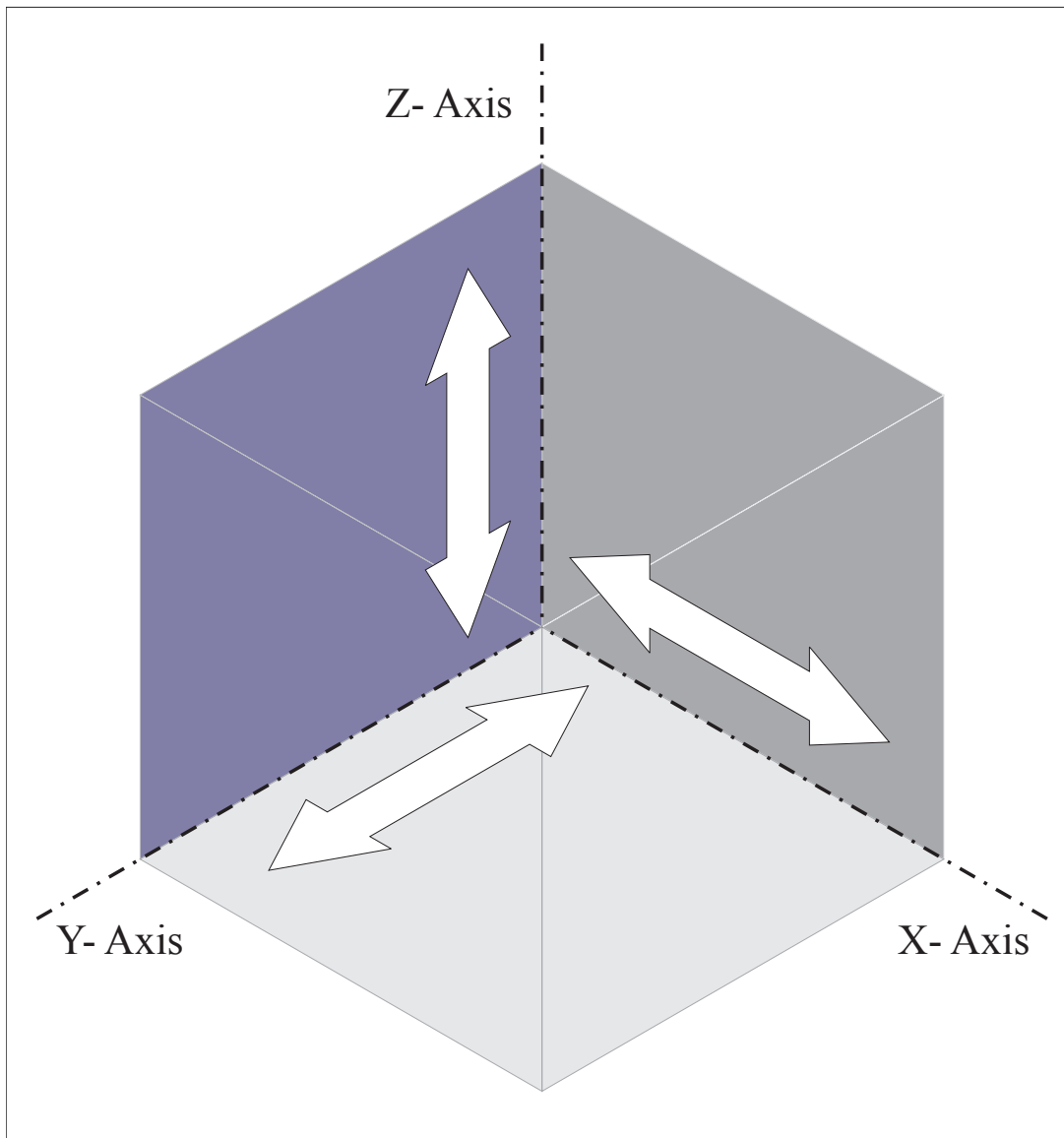


Fig.5.3. Variables Encompassed in a cube, with reference to a point.

Following the conceptual model grid they were placed on three axis of a parallelepiped, enabling a 'more-less' interpretation of two of the factors cluster pitch and numbers constituting a form cluster as depicted in Fig.5.4 (A & B) abstractly (Vyas & Bapat 2011) (Shajahan 2004:89). Visual variety in proximity was nominal, yet providing insights into combinations and their interplay. This was further developed for precise articulation of constituting factors, in form of array of five by five presentation plates on DIN A3 papers.

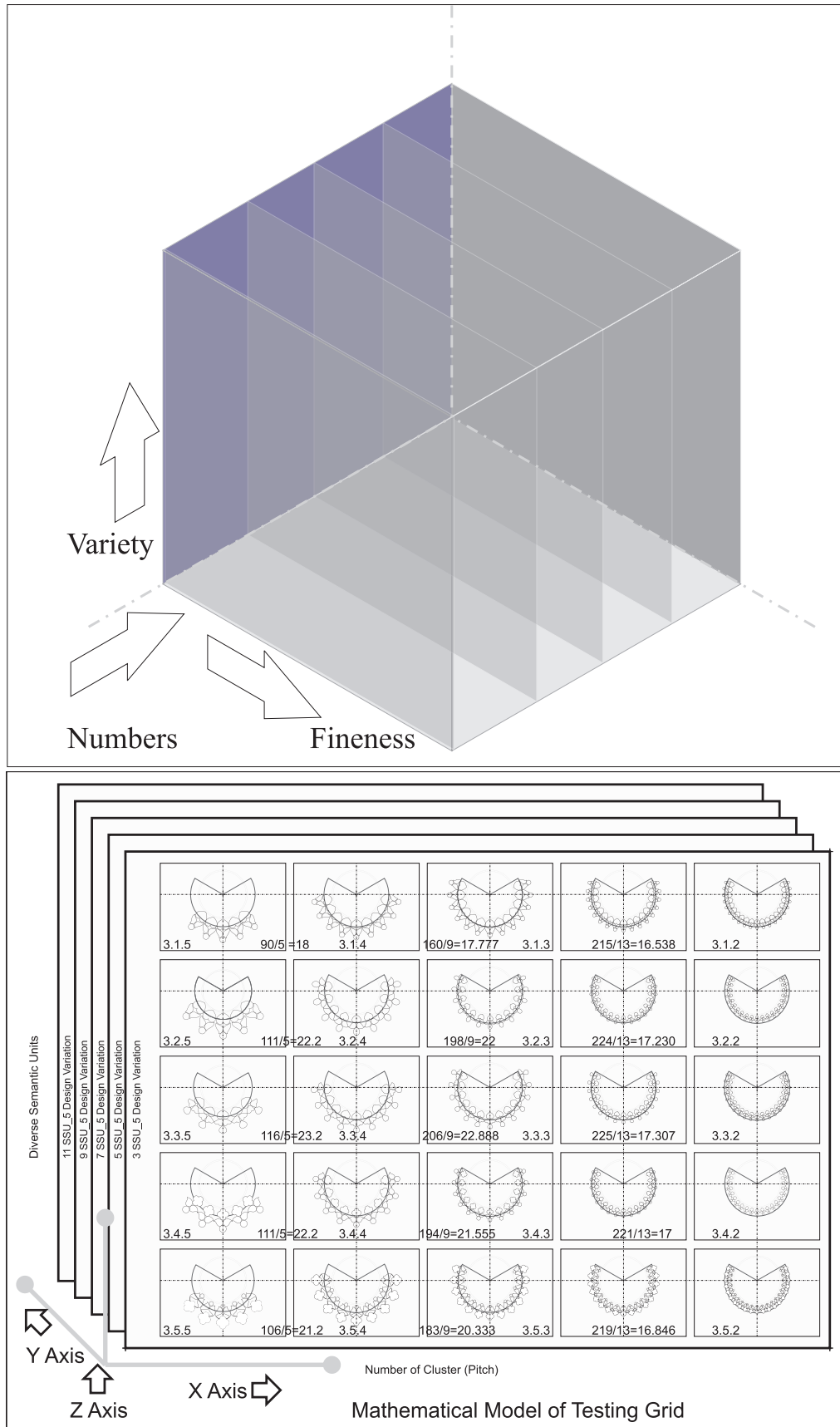


Fig.5.4 (A & B). Fineness/ coarseness on x axis, Numbers of constituting semantic units on y axis & Varieties in proximity on z axis.

5.3.1 Cluster Pitch, as Levels of Fineness/Heaviness Measured on X-Axis

With use of a principal circle as a basic grid, different levels of fineness were made by making size of the cluster larger or smaller (Chakrabarti 1997:68). A larger size of form cluster required lesser number to cover the arc while a smaller size called for more numbers. On the x axis the form clusters became coarse to fine progressively from left to right, as depicted in Fig.5.5.

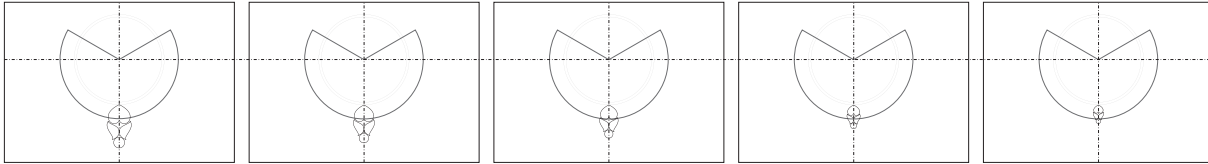


Fig.5.5. Form clusters becoming progressively finer, left to right.

Heaviest appearing neck piece was made up of five form clusters that were gradually increased, two on each side, to create five levels of fineness. The finest was made up of twenty one form clusters. The cluster pitch thus became measurable in millimeters, enabling mathematical interpretation possible, Fig.5.6 (A, B & C). Cluster pitch represents how finely form clusters are packed per unit length. A higher pitch number depicts a rarer packing of form clusters as compared to a lower pitch number.

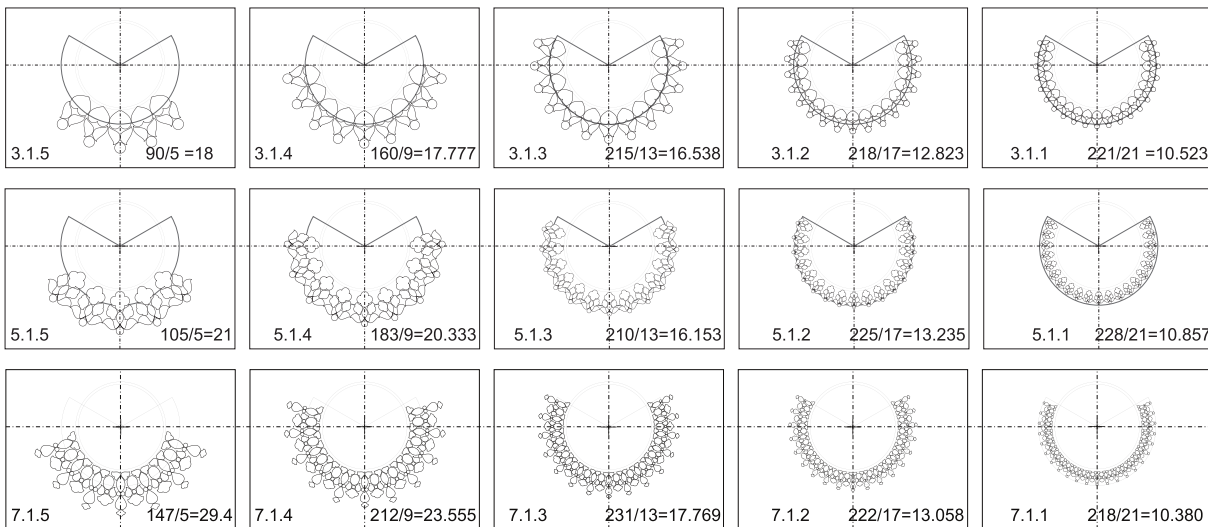


Fig.5.6(a, b & C). Cluster pitch and its mathematical interpretation, form clusters packed per unit length.

5.3.2 Numbers of Constituting Smallest Semantic Units in a Form Clusters Measured on Y-Axis

For testing the effect of number of constituting semantic units in a form cluster, test clusters were created using three smallest semantic units. A set of five form clusters was created progressively by increment of two semantic units at a time, thus creating a scale to gauge preferences amongst form clusters made of three semantic units to eleven semantic units Fig.5.7.

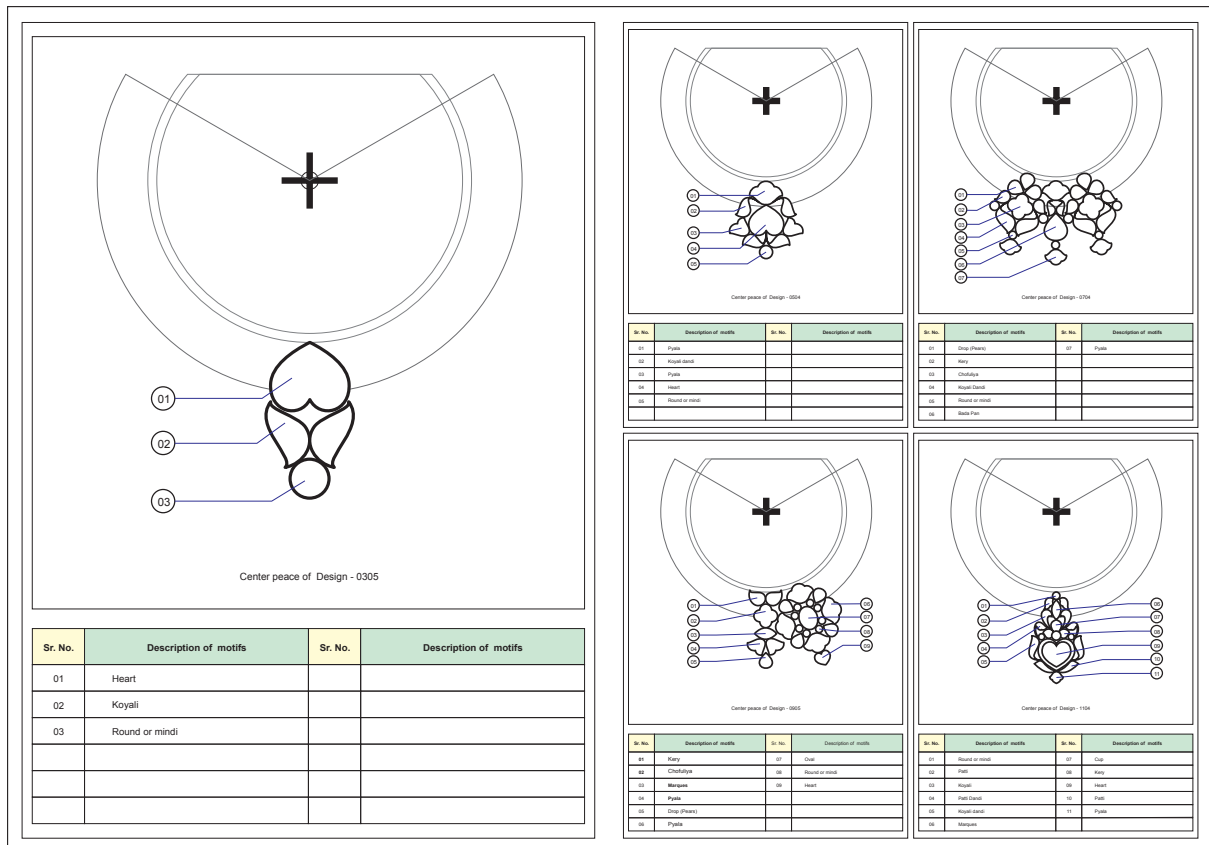


Fig.5.7. A scale to gauge preferences amongst form clusters comprising of three to eleven Smallest Semantic Units.

This point, where the apex touched the principle circle was called the point of contact and for calculation of cluster pitch the angular distance between two points of contact was converted to linear measurement.

5.3.3 Varieties in Proximity, Diverse Constituting Smallest Semantic Units in a Form Clusters Compared, Z-Axis

The variety in proximity pertains to form clusters made of same number but different semantic units. The simplest cluster starts with three semantic units, five different clusters are made with a different combination of semantic units, keeping the number limited to three within each cluster.

Gradually the numbers of constituting semantic units is increased to eleven in five stages, with an increment of two at every stage as shown in Fig.5.8. This number is a measure of visual variety present for observation. A higher number is an indicator of more variety present for observation as compared to a lower number.

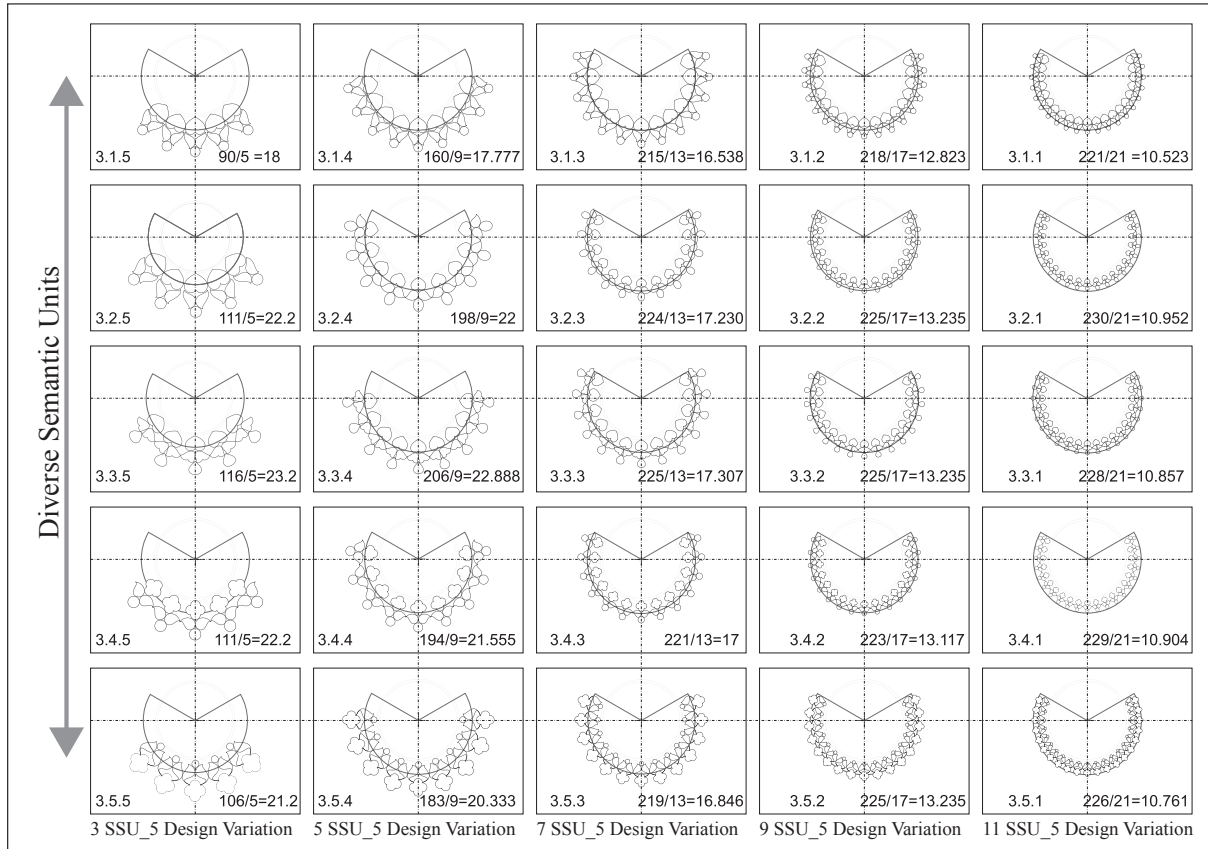


Fig.5.8. Diverse semantic units, a section showing gradually increasing visual variety.

5.4. Merits of Testing Grid

As a research tool testing grid comprises of set of total 125 designs to choose from. As depicted in model they were in five levels of fineness, five different designs with five stages (increasing number) of semantic units in a form cluster, conceptually an array of 5x5x5 for selection.

DIN A3 printouts of *Kundan* artworks full size were taken on white paper of adequate thickness. This was used as presentation plates for visual appreciation by subjects Fig.5.9.(A & B).

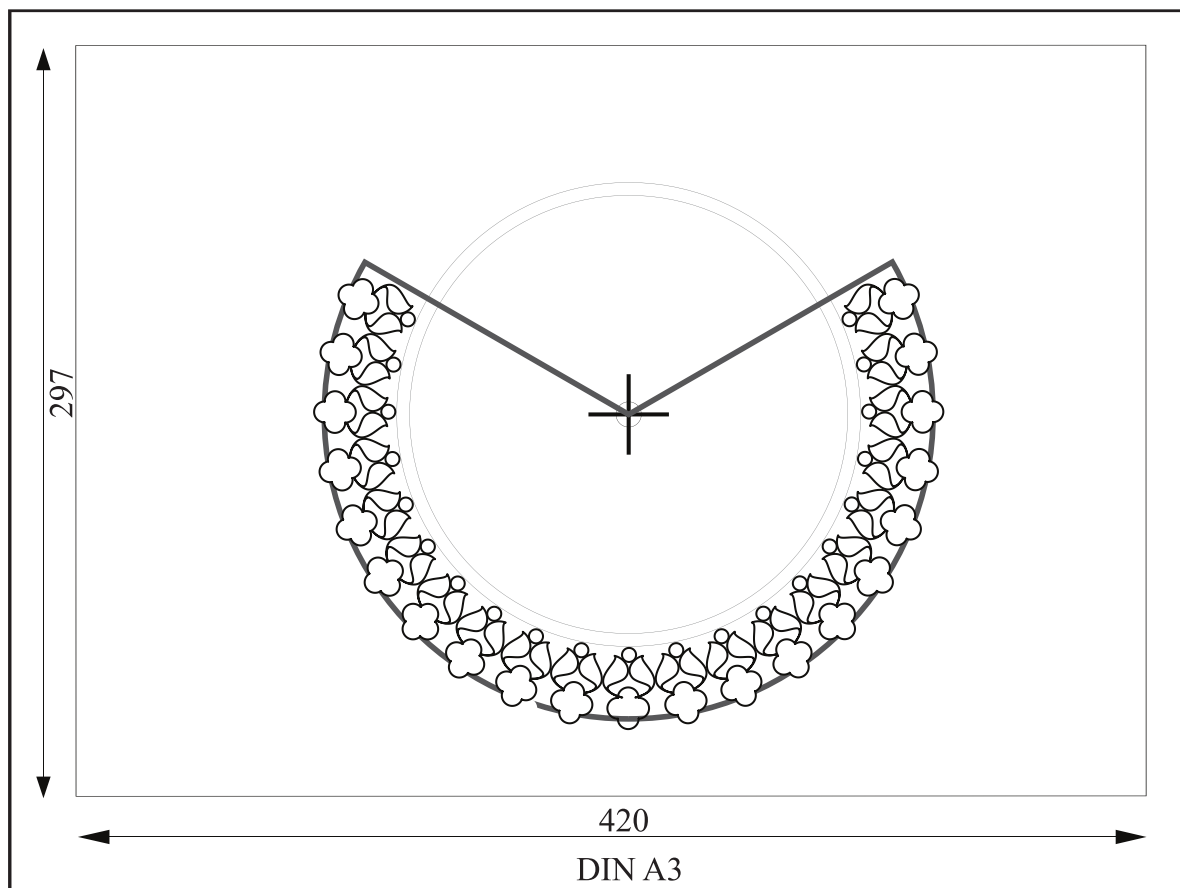
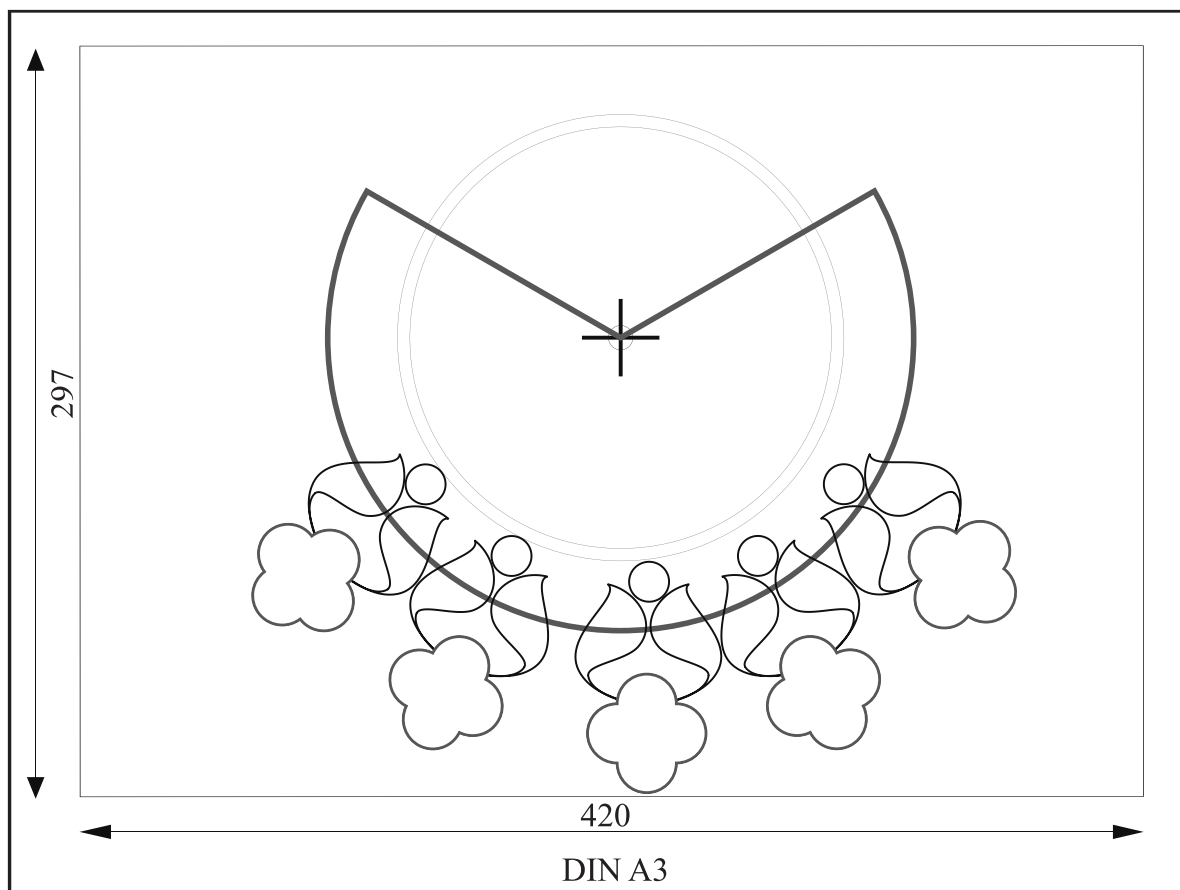


Fig.5.9 (A & B). *Kundan* artworks as presentation plates.

In initial stages of research it was found that to cover a number of subjects, an effective research methodology and a tool that could be taken to subjects, preferably, at their place was essential. Familiar surroundings of their home were ideally suited for conducting interviews. This grid as a tool besides being precise was portable and it was possible to take it to subjects for the purpose of research. Presentation to the subjects was practicable in form of folios containing presentation plates. Use of paper separators was proposed to mark liking of a particular design. Using this grid real process could be emulated where early agreements on design of an article are sought on sketches for purpose of estimation.

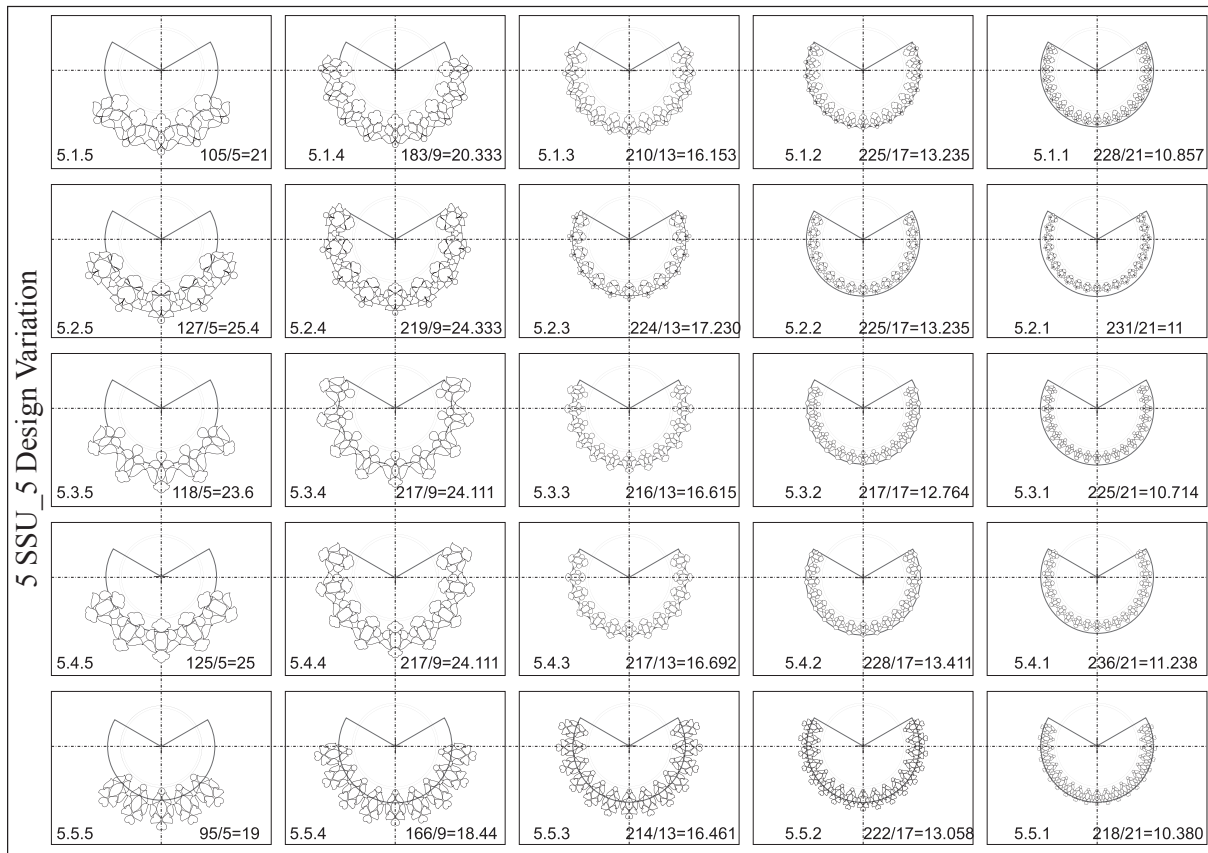


Fig.5.10. Section of complete grid as an array

A typical section of the complete grid appears like an array of five by five, containing five different combinations of a predetermined number of semantic units, each in five levels of fineness Fig.5.10.

A test grid is a way to understand, scientifically, features that affect likeness in a positive way. Feedback of a client though genuine but may be difficult to interpret this test grid, facilitates an interpretation of abstract feedback like ‘a little more’ in measurable terms.

In a pilot study with the testing grid a stage wise selection was tested. In first stage twelve articles were selected from the complete set of designs. Amongst first selection of twelve designs, subjects were asked to narrow down preferential liking to six designs. This was followed by narrowing selection down to two and finally one.

5.5. Limitations of Testing Grid

The testing grid although an effective tool to study formal aspects, was slightly bulky in handling. It was due to use of heavy paper to counter effect of wearing. However, a full size replication had its merits in being closest to reality. They also illustrated minute details of smallest semantic units as there was no loss of details due to scaling.

The effects of colour of metallic gold and gemstones were not part of present study. It presents again a huge potential to be explored in form of colour, transparency, glaze levels and their combinations. Future research can be focussed on these aspects identified during present studies. These aspects present a vast uncharted research area with potential of professional applications in domain of jewellery design.

5.6. Application of Tool and its Implications

There are a number of potential applications of this module of research in *Kundan* the most promising one is an effective communication tool between a client and jewellers. It is especially effective in initial stages of design where the adjustments and modifications that were done at the stage before setting, when the gold framework was ready, could be done in presence of a client. Once a cluster is made and agreed upon, a right size can be achieved using illustration software such as Corel draw and the form cluster can be rotated around the centre of principle circle to observe the overall effect, Fig.5.11 shows adaptation by a designer based in Ahmadabad. In case of “a little bigger” or “a bit smaller” appropriate action can be taken immediately. Prior to this tool such corrections needed elaborate reworking on form clusters already fabricated in gold.



Fig.5.11. Mother (or Master) Grid in use by designer Source: Author

It also presents a good potential as a projection on a larger screen to discuss minute details as shown in Fig.5.12. A discussion on minute details of jewellery is often with the help of a magnification device called jewellers loupe. A designer, client and *Kundansaz* while discussing an article often miss a point as only one is observing the article at a time. Enlarged projection of this mother grid on the screen can facilitate concurrent viewing of details in an enlarged form and many of sensitive fitting details can be resolved. It is also expected to help making decisions about details like hinge points and joining details, these can be discussed on screen eliminating need of real framework to be ready.

This tool gives a way to measure and articulate cluster pitch and individual size of semantic units, thereby making communication between client and jeweller effective and efficient. It is expected to reduce disagreements and conflicts considerably by facilitating mathematically precise measurements. The tool will also make feedback and corrections easier as a qualitative feedback like ‘a little smaller’ can now be made quantitative in prevailing units of measurement e.g. so many millimeters .

As multiple printouts of this testing grid can be taken, parallel interviews by more than one interviewer is possible for the research, which otherwise was not possible. For pilot study data was collected by snowball technique where one reference led to others. Data analysis was by frequency distribution, the preferential likeness based on various client profiles based on Age, Marital status, Social status and working- none working status of women leads to a series of full length papers reflecting analysis of likeness and their inter group comparisons.



Fig.5.12. Projection to see details enlarged. Source: M.K. Panchal & Vinay S., Ahmedabad

The study further continues to a full scale interview with subjects using the testing grid. The subjects from the age group of 20 to 59 years comprising (divided into four age groups of 10 years each) representing girls to be married or recently married, women in early years of marriage to those planning marriage of a daughter or relative are to be interviewed with the help of this tool.

5.7. Summary

Kundan articles being prohibitively expensive, jewellers and owners alike are reluctant about them being carried around or displayed freely. Portability of several articles at a time for presentation to subjects was a big hindrance. The proposed tool is expected to overcome these problems and facilitate further research.

This tool is expected to reveal the areas of this grid in which their individual preferences are centred. The outcome of research is expected to be of use to jewellers and designers alike.

Chapter 6

Investigation of Preferential Likeness

6.1. Survey to Investigate Preferential Likeness

A survey was carried out to find out preferential likeness of clients about *Kundan* articles. A testing folio of 125 articles was used in form of a testing grid for investigation.

Potential subjects were briefed about *Kundan* and were found to possess sufficient knowledge about subject matter for the purpose of interview. Their responses were taken down in a format for tabulation and analysis later (Appendix IV).

In order to develop valid and reliable measure, the data so collected need to be tested for its reliability. Reliability pertains to the consistency or stability of a measure and is inversely related to the degree to which a measure is contaminated by random error (Bollen, 1993). Reliability indicates dependability, stability, predictability, consistency and accuracy, and

refers to the extent to which a measuring procedure yields the same results on repeated trials (Kerlinger, 1986). Reliability is assessed after data collection. The most common method used to estimate reliability is internal consistency method (Froza, 2002)

The internal consistency method uses various algorithms to estimate the reliability of a measure from measure administration at one point in time. It assesses the equivalence, homogeneity and inter-correlation of the items used in a measure. This means that the items of a measure should hang together as a set and should be capable of independently measuring the same construct. The most popular test within the internal consistency method is the Cronbach coefficient alpha (Cronbach, 1951). Alpha values (α) of 0.7 or higher are considered acceptable, with 0.6 being acceptable for new scales (Nunnally, 1978; Flynn et al., 1990).

Cronbach's Alpha coefficient depicts the reliability of the data being analysed. For the first time research, 0.6 and above is acceptable. In present study, it is 0.849 which is reasonably acceptable in such type of research being conducted. A summary of results is as follows

List wise deletion based on all variables in the procedure.

Reliability Statistics	
Cronbach's Alpha	N of Items
0.849	12

Case Processing Summary			
		N	%
Cases	Valid	101	84.2
	Excluded	19	15.8
	Total	120	100.0

An analysis of data was done by classifying and comparing them based on marital status, social status, etc. Following ways provide part wise a reference to be mapped on testing grid.

For comparison of preferences, respondent statistics is represented on bar charts showing their individual proportions within the group. Respondent statistics based on Married v/s unmarried status is depicted in Fig.6.1., Respondent statistics based on Working v/s None Working Women is depicted in Fig.6.2., Respondent statistics based on Social Status - High, High-Middle and Middle is depicted in Fig.6.3., and like wise Fig.6.4. shows Respondent statistics based on Age Groups.

In the initial stages of trial surveys the appointments were sought with the reference and

help of a gatekeeper, a person with good social network and access. The opinion of the person was taken into consideration while placing a subject into an income category.

This in was based on location/ownership of house, employment of spouse/subject and overall appearance of the house décor. A good sense developed amongst surveyors on how to place a subject into a particular category.

The sound judgment of the surveyors was the final call on the subject. Direct questioning about the financial status leads to normative answering, and therefore this type of assessment by surveyors was found to be best-suited option for such research initiatives.

Part I - Based on Marital Status of Women : Married v/s Unmarried

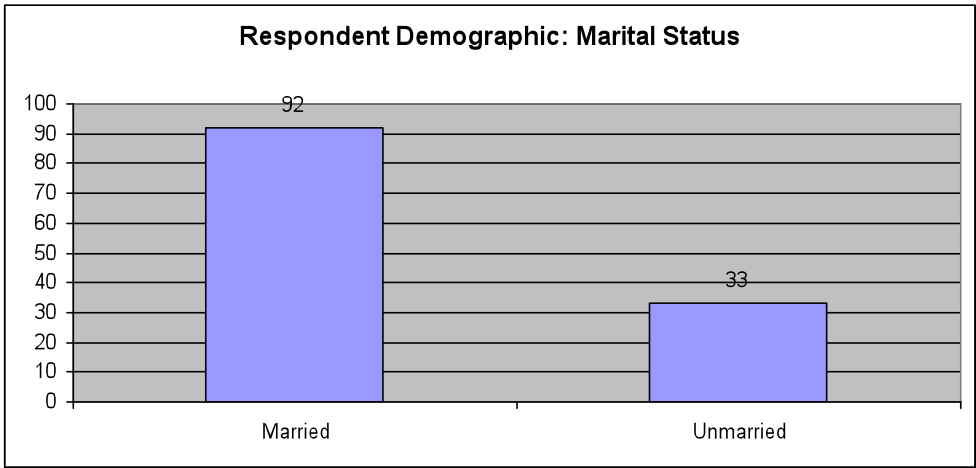


Fig.6.1. Respondent statistics based on Married v/s Unmarried.

Part II - Based on Working v/s Non Working Women

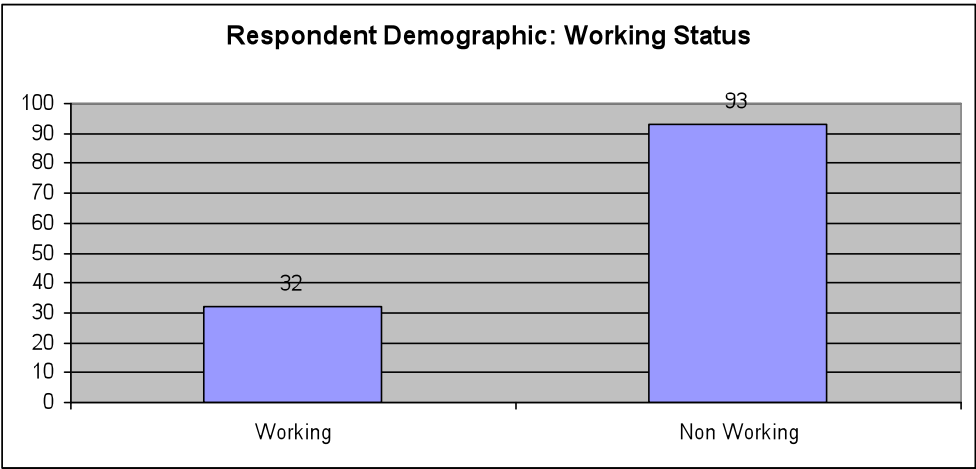


Fig.6.2. Respondent statistics based on Working v/s Non Working Women

Part III - Based on Social Status - High, High-Middle and Middle

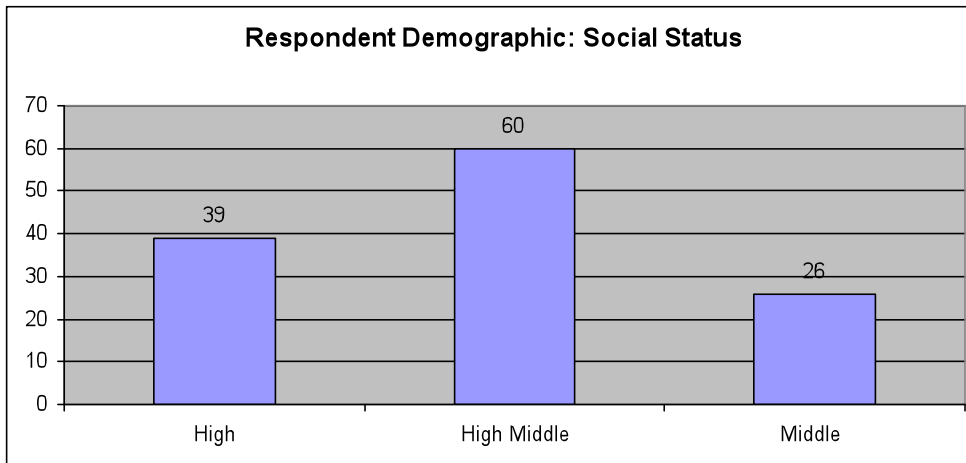


Fig.6.3. Respondent statistics based on Social Status - High, High-Middle and Middle

Part IV - Based on Age Group 1. 20-29, Group 2. 30-39, Group 3. 40-49 and Group 4. 40-49 Year

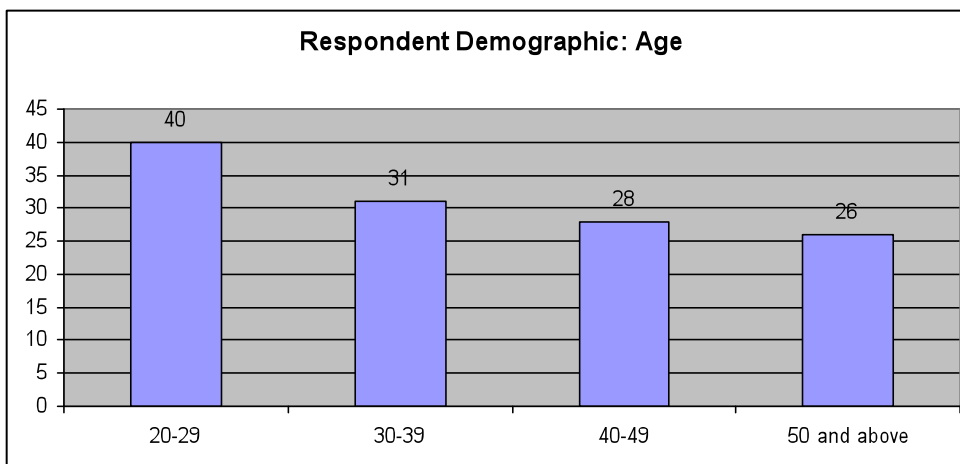


Fig.6.4. Respondent statistics based on Age Group

The following mapping of preferential likeness on testing grid reveals model (of mean, mode, median) class for *Kundan* jewellery, that is the most frequently appearing articles under that particular class comparison (Fig.6.5.). This by way of analogy of other products in body contact (eg. Shirts, shoes), are those sizes that are stocked by shopkeepers, to get the best fits to the largest portion of the population by keeping the minimum number of articles. This exercise reduces inventories effectively, and increases the effectiveness of the stocks held. (e.g. The model class for typical shoes is size 8 and shirts is 42 and 40)

6.2. Motivational Factors

1. Married as compared to unmarried is a group that has different motivations driving their preferences. For unmarried often marriage is around corner and it is this event in mind a selection is made. For the married group, often an investment or saving is a motivational factor
2. Working as compared to Non Working is again a group with different motivations driving their preferences. Working women having independent income of their own may exercise more control and thereby may prefer differently. Non working outside home, women still have surplus in form of saving and gifts which may drive their preferences differently.
3. Social - Was divided in three groups' high, high-middle and middle. As *kundan* was a relatively expensive proposition, it was difficult that a person from the lower social status would possess or commission a piece. Hence, a decision was made after discussion with experts in domain to limit it to these three groups.
4. Age was a predominant factor, as women in age group 20-29 were recently married or had marriage on horizon. 30-39 were early in marriage and settling in life. 40-49 were settled well. While 50-59 were relatively free from important family responsibilities and constituted an interesting group.

In order to understand preferential likeness in light of above mentioned groups we need a frame of references. Our concept of reality as Model dependent realism makes it simple and comprehensible by having a structure for understanding things around us. The beauty of a model is in its simplicity and how closely they agree with observations. Both of these are met by a way of partial fulfilment of objectives, or by finding a golden balance. One can use whichever model is more convenient in the situation under consideration. Model dependent realism applies to conscious and subconscious mental models we create in order to interpret and understand the everyday world.

Form of an article of jewellery which is the first visual interaction with a prospective client has a high influence on the client's decision in selection process. It is one of the most important aspects that influence the preferential choice of the client. When it comes to study forms in a constructivist approach, literature is silent on the subject.

There are varieties of forms existing in jewellery, the choice available to a potential buyer is enormous. With variants and creative embellishments kundan neck pieces present virtually limitless options to the observer. A large variety of objects demand some reference for methodical study, for example the modern form of periodic table and its predecessors gave some sort of a structure for studying the elements with references to each other as well as classifying them into various groups.

A mental model is created by observer in everyday life in order to understand everyday world. Perceptions and hence the observations on which a theory is based is shaped by interpretive structure of human brain. A model therefore is a help to understand a complex thing with relative ease. However, this simplification is by way of compromise, so proposed models have their applications and limitations.

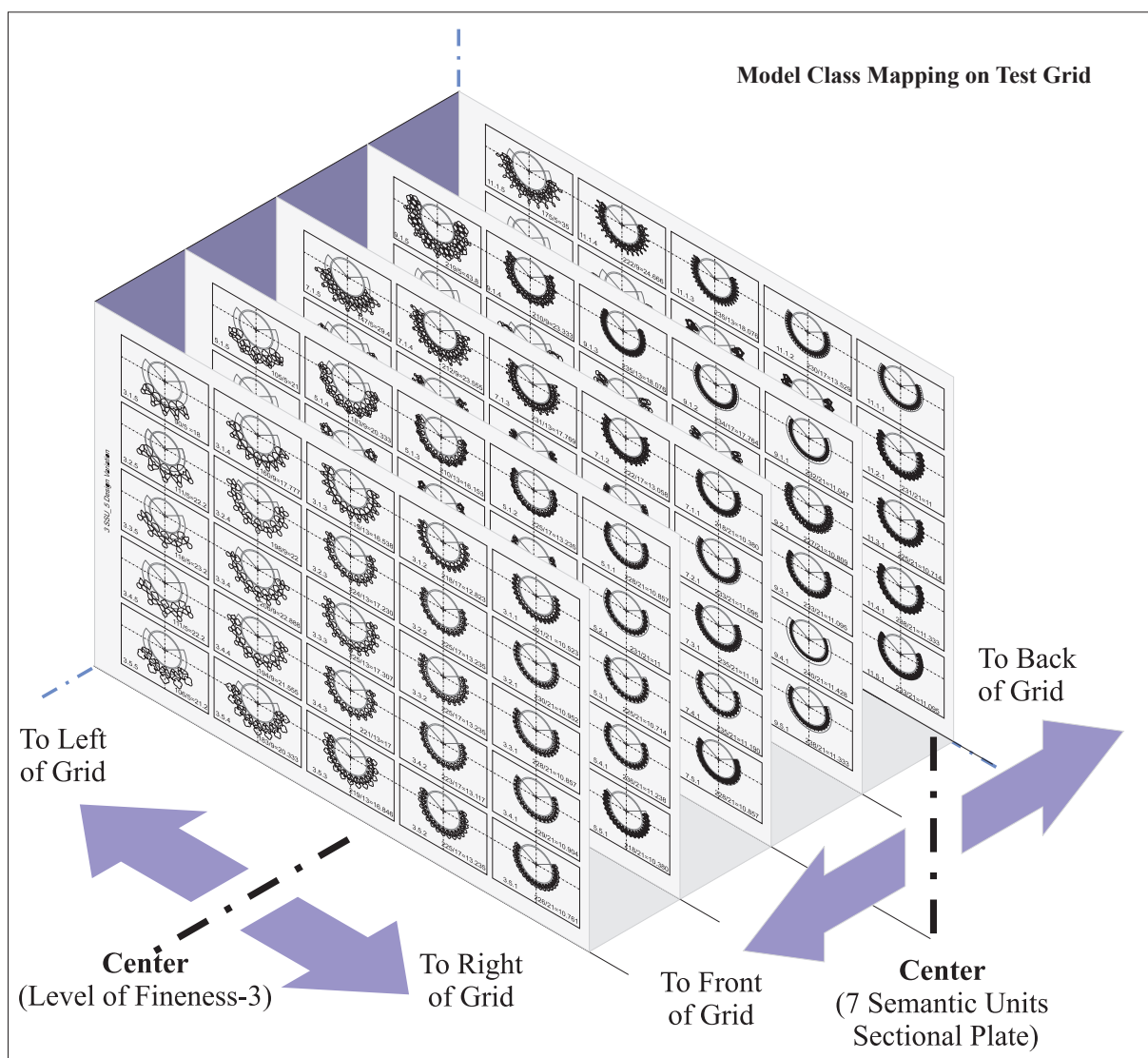


Fig.6.5. A schematic three quarter profile of testing grid

Above model gives a frame of reference for study in a domain governed by subjective opinions often lacking in clarity. As observed by (Hawkins & Mlodinow 2010:49-51)

“The question of whether it makes sense to say quarks really exist if you can never isolate one was a controversial issue in the years after the quark model was first proposed.....Over the years, however, as the quark model led to more and more correct predictions, that opposition faded.Model-dependent realism can provide a framework to discuss question.”

They observe further,

“A model is a good model if it:

1. Is elegant
2. Contains few arbitrary or adjustable elements
3. Agrees with and explains all existing observations
4. Makes detailed predictions about future observations that can disprove or falsify the model if they are not borne out”

However, there may be aspects unknown so far that cannot be accounted for in a model that is being proposed. This concept of hidden dimensions within dimensions is described by (Hawkins & Mlodinow 2010:116)

“That is the picture string theorists have of the extra dimensions- they are highly curved, or curled, on a scale so small that we don’t see them. In string theory the extra dimensions are curled up into what is called the internal space, as opposed to the three-dimensional space that we experience in everyday life.”

Proposed model is best appreciated in light of these observations. Following Fig.6.6 and Fig.6.7 illustrates mapping of diverse parameters and inclinations with the help of a radar diagram. They show variety available for visual appreciation and fineness of form clusters respectively.

The groups mentioned as A and B represent typical target group for example married v\s unmarried or working v\s nonworking. Their can be several groups mapped on same radar diagram as in case of four age groups.

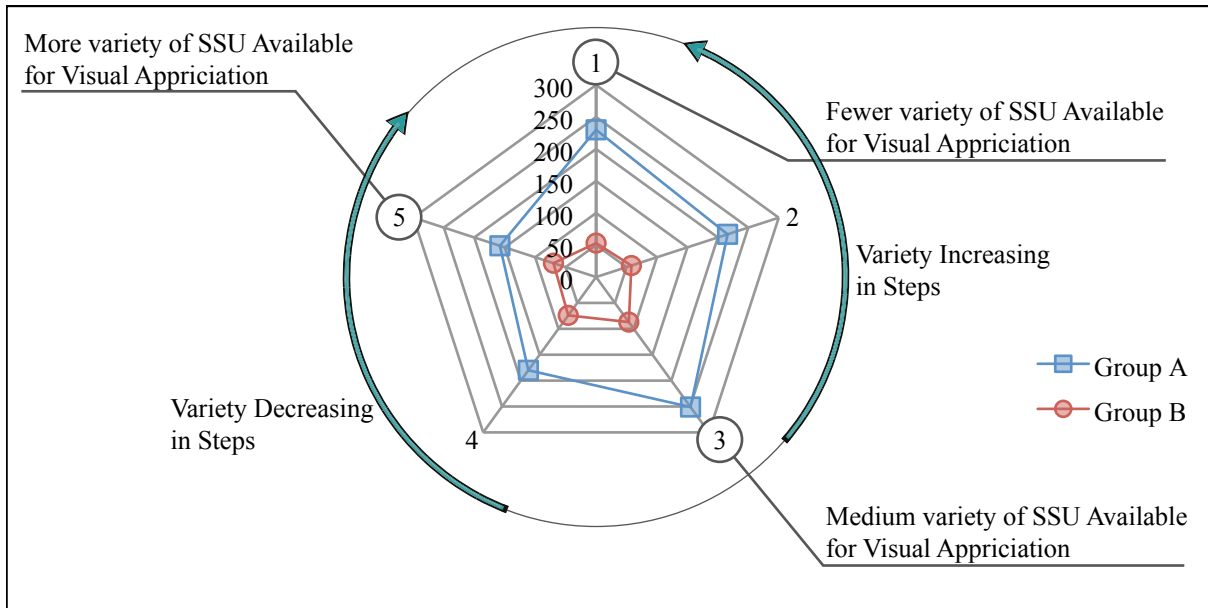


Fig.6.6. A radar diagram depicting preferential likeness based on variety of smallest semantic units available for visual appreciation.

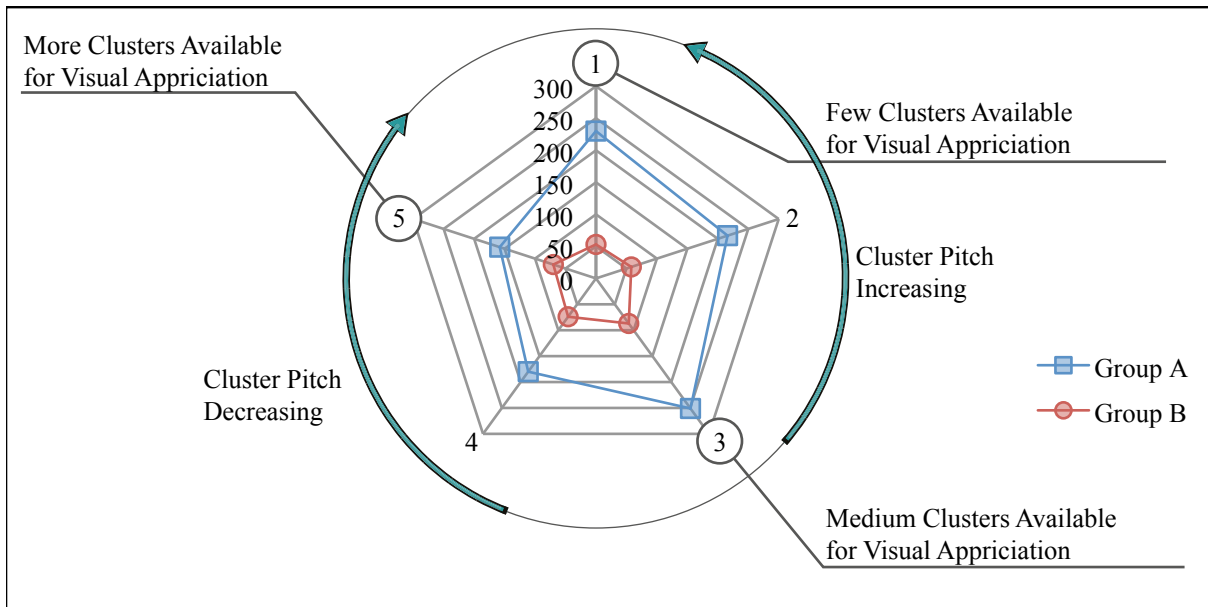


Fig.6.7. A radar diagram depicting preferential likeness based on finesse of form clusters.

Part I - Based on Marital Status of Women : Married v/s Unmarried

6.3. Preferential likeness based on form cluster sectional plates

This comparison is an overall assessment of preferential likeness of articles between married and unmarried¹⁶ groups of women. The location of preference on a particular plate reveal number of semantic units constituting a form cluster that was liked by subjects. Word 'plate' in table refers to the section of testing grid that is made of a particular number of smallest semantic units. Word 'Likeness' refers to number of positive responses on that particular plate.

Selection at level 1 were articles that drew the attention of a client in first glances, while selection at level 4 were articles that were finally selected, resulting into a probable purchasing of article theoretically.

16. Unmarried women, typically about to be married, has a marriage ceremony on horizon and their preferential likeness is influenced by one of the most important upcoming event, the marriage ceremony. This event of marriage is a demonstration of all the wealth in form of jewellery and fineries possessed by women, often, in an attempt to outclass collections of friends, relatives and acquaintances.

This is a major occasion for heavy jewellery purchasing, both for the purpose of individual use as well as gifts.

6.3.1. Percentages of preferential likeness of married / unmarried group at level 1 are tabulated in Table 6.1.

Table 6.1. Comparison of Preferences Level 1 of selection: Married v/s Unmarried

Section Plate	Married Group		Unmarried Group	
	Responses	%	Responses	%
3 SSU Clusters	230	22.22	53	15.50
5 SSU Clusters	216	20.87	58	16.96
7 SSU Clusters	251	24.25	87	25.44
9 SSU Clusters	180	17.39	74	21.64
11 SSU Clusters	158	15.27	70	20.47
	1035	100	342	100

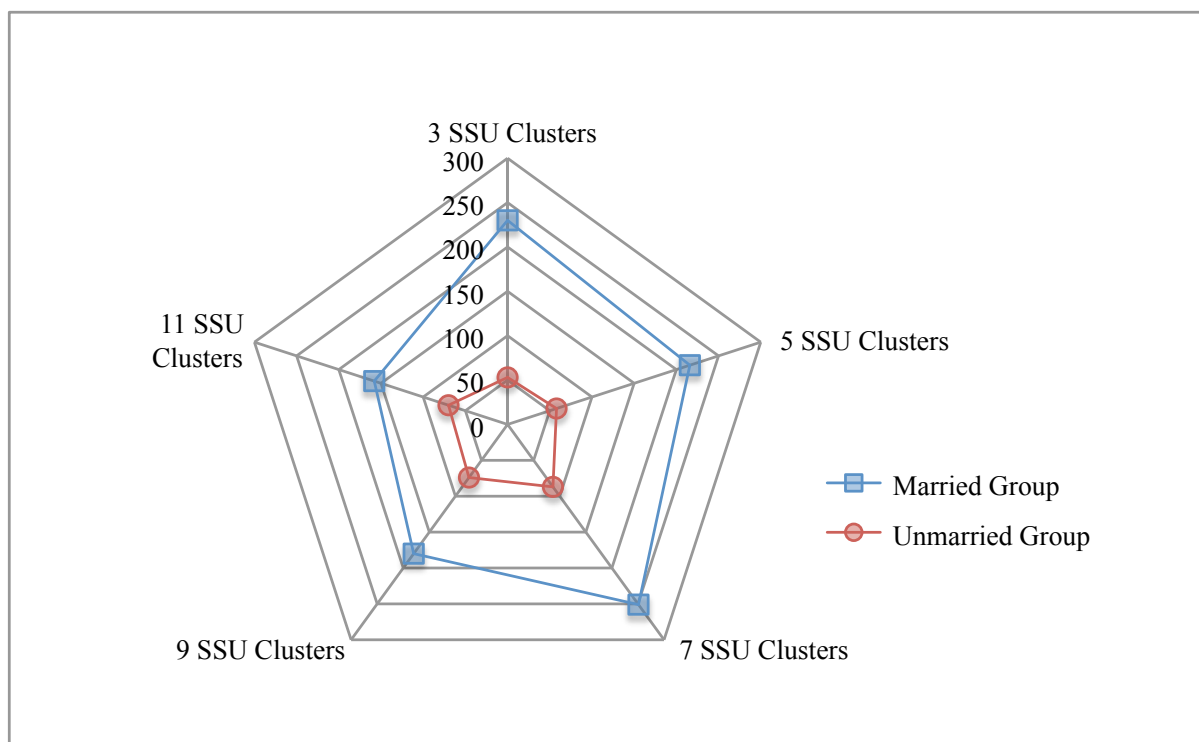


Fig.6.8. Comparison of Preferences Level 1 of selection: Married v/s Unmarried

Inferences

There are few inferences that can be drawn from the above table

1. Married women preferred, initially form clusters that were made of 7 (24.25%), 3(22.22%) followed by 5 (20.86%) semantic units. As compared to this, unmarried women preferred initially form clusters that were made of 7 (25.44%), 9(21.64%) followed by 11 (20.47%) semantic units.

2. In group of married women, the above group of 7, 3 & 5 constitute 67.33% that is two third of overall number of articles (A jeweller can fulfil majority of the needs of this group by stocking articles in this model class.). While in group of unmarried women, the group of 7, 9 & 11 semantic units cluster plates constitute 67.55%, that is two third of overall number of articles (A jeweller can fulfil majority of the needs of this group by stocking articles in this model class).
3. Highest preference was towards form clusters that were made of 7 semantic units in both the groups' married group 24.25% as well as unmarried group 25.44% (A medium size jeweller can stock most of goods in this class to fulfil about a quarter of needs of prospect clients). Highest preference was towards form clusters that were made of 7 semantic units that depict a centralizing tendency to centre of grid in both groups.
4. Married women preferred initially, articles that were towards the front of testing grid. A shift to front is evident (A front shift from centre of grid). Unmarried women on the other hand preferred initially, articles that were towards the back of testing grid. A shift away from front is evident (A back shift from centre of grid) .

The radar diagram illustrates above statements in a comprehensive way, where unmarried group is a subset of the married group that is by stocking articles for the married group most of the demands of the unmarried group can be met.

Selection at level one is an indicator of what is liked when a large variety is present for display, such as in a display case. This can be interpreted as a variety that a jeweller must keep in order to draw attention of potential clients (to make a good impression) for appreciation. The clusters made of seven semantic units are clearly present in both groups and is appreciated by both groups equally.

6.3.2. Percentages of preferential likeness of unmarried/married group at level 4 is tabulated in, Table 6.2.

Table 6.2. Comparison of Preferences Level 4 of selection: (Married v/s Unmarried)

Section Plate	Married Group		Unmarried Group	
	Responses	%	Responses	%
3 SSU Clusters	10	13.33	1	4.17
5 SSU Clusters	6	8	3	12.50
7 SSU Clusters	21	28	8	33.33
9 SSU Clusters	20	26.67	3	12.50
11 SSU Clusters	18	24	9	37.50
	75	100	24	100

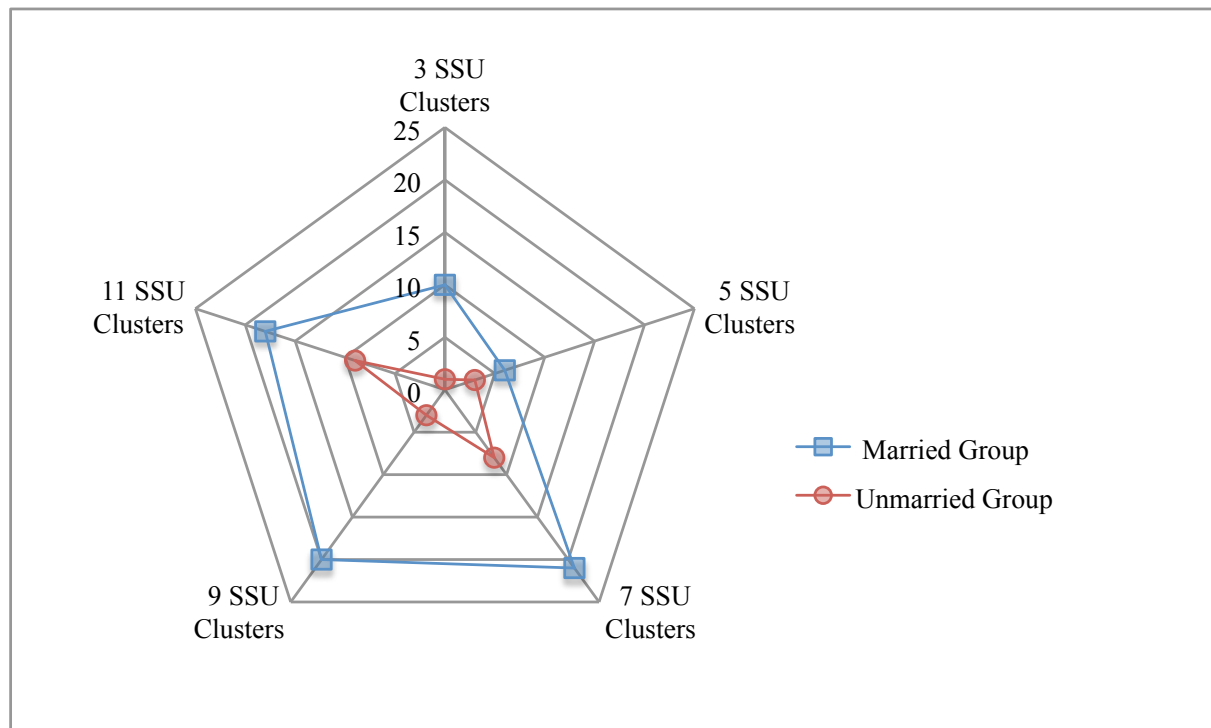


Fig.6.9. Comparison of Preferences Level 4 of selection: Unmarried Group (Married v/s Unmarried)

Inferences

There are few inferences that can be drawn from the above table

1. Married women preferred initially form clusters that were made of 7 (28%), 9(26.66%) followed by 11 (24%) semantic units. As compared to this, Unmarried women preferred initially form clusters that were made of 7 (33.33%), 11(37.5%) followed by 5, 9(12.5%) semantic units.

2. In group of Married women, they constitute 78.66% that is about four fifth of overall number of articles (A jeweller can fulfil decisive majority 4/5, of the needs of this group by stocking articles in this model class). While in a group of unmarried women, together 7 and 11 constitute 70.83% that is more than two third of overall number of articles (A jeweller can fulfil decisive majority 2/3, of the needs of this group by stocking articles in only two model class).
3. Highest preference was towards form clusters that were made of 7 semantic units in both the groups' married group 28% as well as unmarried group 33.33%. Highest preference was towards form clusters that were made of 7 semantic units (A medium size jeweller can stock most of goods in this class to fulfil about a third of needs of prospect clients).
4. Married women preferred finally, articles that were shifted towards the back of testing grid. A preference for more than average (i.e. five) visual variety is evident (A back shift from centre of grid). Unmarried women on the other hand preferred finally, articles that were shifted towards the back of testing grid. A preference for more than average (i.e. five) visual variety is evident. A marked preference for more complex pieces (A back shift from centre of grid).

6.4. Preferential likeness based on Fineness

This comparison is an assessment of preferential likeness of articles at various levels of fineness. Fineness of an article, depicted by cluster pitch, is a measure of how closely form clusters are packed per unit length. The locations of preference on a particular level of fineness reveal a cluster pitch in millimeters that was appreciated by subjects.

Selections at level 1 were articles with a particular cluster pitch that drew the attention of a subject, emulating a prospect client, in first glances. While selection at level 4 were articles that were finally selected, resulting into a probable purchasing of article.

6.4.1 Percentages of preferential likeness based on fineness (Married v/s Unmarried group) at level 1 is tabulated in, Table 6.3.

Table 6.3. Comparison of Preferences Level 1 of selection based on fineness: Married v/s Unmarried

Cluster fineness	Married Group		Unmarried Group	
	Valid responses	%	Valid	%
Fineness 1(5)	196	18.77%	50	15.38%
Fineness 2(9)	330	31.61%	65	20.00%
Fineness 3(13)	352	33.72%	102	31.38%
Fineness 4(17)	136	13.03%	80	24.62%
Fineness 5(21)	30	2.87%	28	8.62%

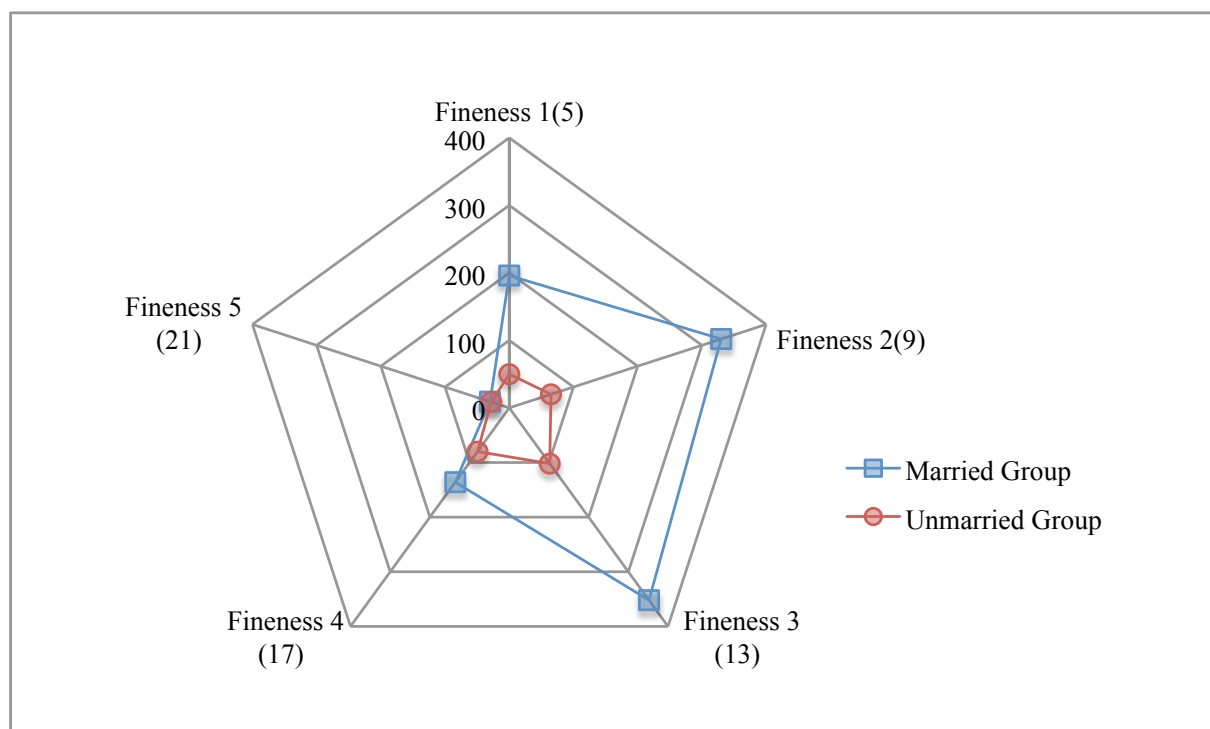


Fig.6.10. Comparison of Preferences Level 1 of selection based on fineness: Married v/s Unmarried

Inferences

There are few inferences that can be drawn from the above table

1. Married women preferred, initially, neck pieces that were made of form clusters 13 (33.72%, fineness 3), 9(31.61%, fineness 2) followed by 5 (18.77%, fineness 1), in numbers. On the other hand, Unmarried women preferred, initially, neck pieces that were made of form clusters 13 (31.38%, fineness 3), 17(24.62%, fineness 4) followed by 9 (20.00%, fineness 2), in numbers.

2. In group of married women, fineness 3 and 2 constitute 65.33% that is about two third of overall number of articles (A jeweller can fulfil decisive majority $\frac{2}{3}$, of the needs of this group by stocking articles in only two model class. A designer can improve chances of an articles getting selected by taking inspiration for specific use of semantic units). While in the group of unmarried women, Together fineness 3, 4 and 2 constitute 76% that is three fourth of overall number of articles (A jeweller can fulfil decisive majority $\frac{3}{4}$, of the needs of this group by stocking articles in these model class. A designer can improve chances of an articles getting selected by taking inspiration for specific use of semantic units).
3. Highest preference was towards level fineness 3 with 13 form clusters, in both the groups' married group 33.72% as well unmarried group 31.38% (A medium size jeweller can stock most of goods in this class to fulfil about a third of needs of prospect clients/ inspiration to designers).
4. Married women preferred finally, articles that were inclined towards the left of testing grid. A preference for less than average (i.e. thirteen form clusters) large size clusters is evident. A marked preference for larger clusters (A left inclination from centre of grid). Unmarried women on the other hand preferred finally, articles that were inclined towards the right of centre of testing grid. A preference for more than average (i.e. thirteen form clusters), smaller size clusters is evident. A marked preference for larger clusters(This indicates more exploratory trend in this group).
5. In group of women, articles with a large number, but small size clusters were least appreciated by prospect clients, emulated by subjects (2.87%) (Hence, too small a cluster size may be avoided altogether). While in group of unmarried women, articles with a large number, but small size clusters, fineness 5, were least appreciated by prospect clients, emulated by subjects (8.62%) (Hence, too small a cluster size may be avoided altogether).

6.4.2. Percentages of preferential likeness based on fineness at level 4 is tabulated in, Table 6.4.

Table 6.4. Comparison of Preferences Level 4 of selection based on fineness: Married v/s Unmarried

Cluster fineness	Married Group		Unmarried Group	
	Valid responses	%	Valid	%
Fineness 1(5)	15	20.27%	5	21.74%
Fineness 2(9)	21	28.38%	4	17.39%
Fineness 3(13)	19	25.68%	7	30.43%
Fineness 4(17)	15	20.27%	5	21.74%
Fineness 5(21)	4	5.41%	2	8.70%

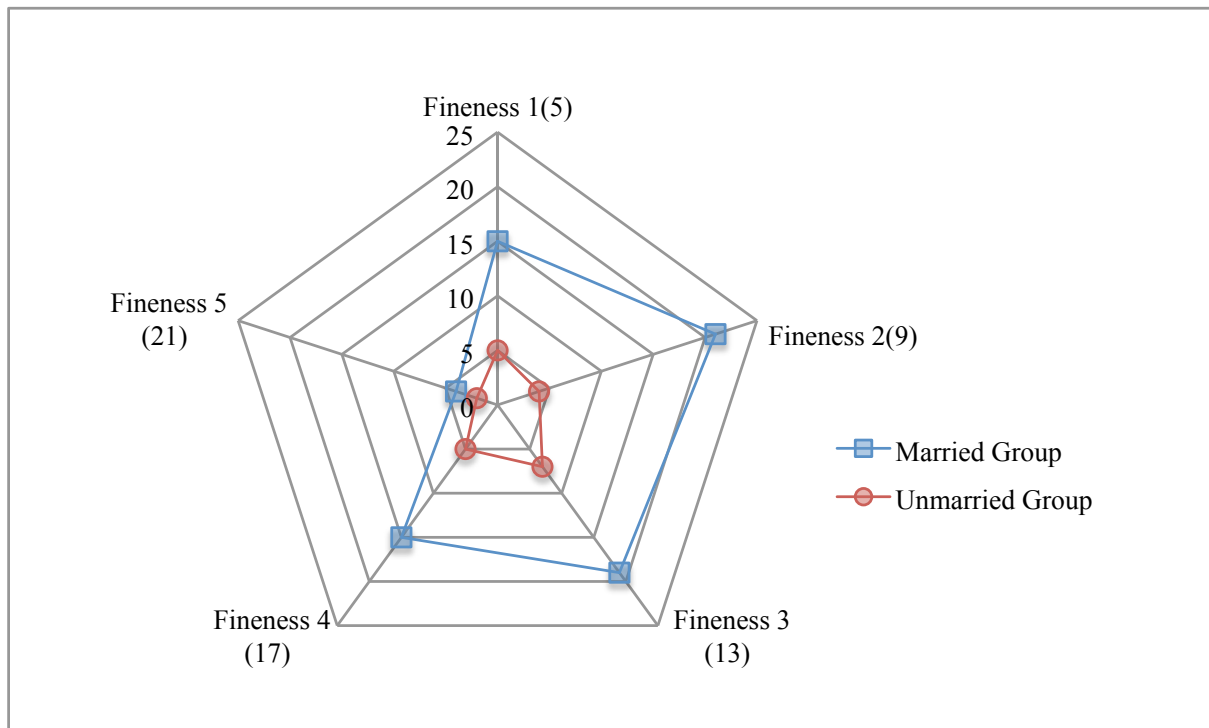


Fig.6.11. Comparison of Preferences Level 1 of selection: Married v/s Unmarried

Inferences

There are few inferences that can be drawn from the above table

1. Married women preferred, initially form clusters that were made of 7(24.25%), 3(22.22%) followed by 5(20.86%) semantic units. As compared to this, unmarried women preferred initially form clusters that were made of 7(25.44%), 9(21.64%) followed by 11(20.47%) semantic units. Although, 7 semantic units.
2. In group of Married women, together the above group of 7, 3 & 5 constitute 67.33% that is two third of overall number of articles (A jeweller can fulfil majority of the

- needs of this group by stocking articles in this model class). While in group of unmarried women, together the group of 7, 9 & 11 semantic units cluster plates constitute 67.55%, that is two third of overall number of articles (A jeweller can fulfil majority of the needs of this group by stocking articles in this model class).
3. Highest preference was towards form clusters that were made of 7 semantic units in both the groups' married group 24.25% as well as unmarried group 25.44% (A medium size jeweller can stock most of goods in this class to fulfil about a quarter of needs of prospect clients). Highest preference was towards form clusters that were made of 7 semantic units that depict a centralizing tendency to centre of grid in both groups.
 4. Married women preferred initially, articles that were towards the front of testing grid. A shift to front is evident (A front shift from centre of grid). Unmarried women on the other hand preferred initially, articles that were towards the back of testing grid. A shift away from front is evident (A back shift from centre of grid).

The radar diagram illustrates above statements in a comprehensive way, where unmarried group is a subset of the married group that is by stocking articles for the married group most of the demands of the unmarried group can be met.

Selection at level one is an indicator of what is liked when a large variety is present for display, such as in a display case. This can be interpreted as a variety that a jeweller must keep in order to draw attention of visiting potential clients (to make a good impression) for appreciation. The clusters made of seven numbers of semantic units are clearly present in both groups and is appreciated by both groups equally.

Part II - Based on Working v/s Non Working Women

6.5. Preferential likeness based on form cluster sectional plates

This comparison is an assessment of preferential likeness between two groups of subjects. Selection of working women is compared to that of nonworking in this section. The location of preference on a particular sectional plate, reveal number of semantic units constituting a form cluster that was liked by subjects.

Selection at level 1 were articles that drew the attention of a client in first glances, while selection at level 4 were articles that were finally selected, resulting into a probable sale of the article.

6.5.1. Percentages of preferential likeness of Working / Nonworking women group at level 1 is tabulated in, Table 6.5.

Table 6.5. Comparison of Preferences Level 1 of selection: Working v/s Nonworking

Plate	Working Group		Nonworking Group	
	Valid responses	%likeness	Valid responses	%likeness
3 SSU Clusters	70	21.02	213	20.38
5 SSU Clusters	74	22.22	200	19.14
7 SSU Clusters	81	24.32	258	24.69
9 SSU Clusters	54	16.22	200	19.14
11 SSU Clusters	54	16.22	174	16.65

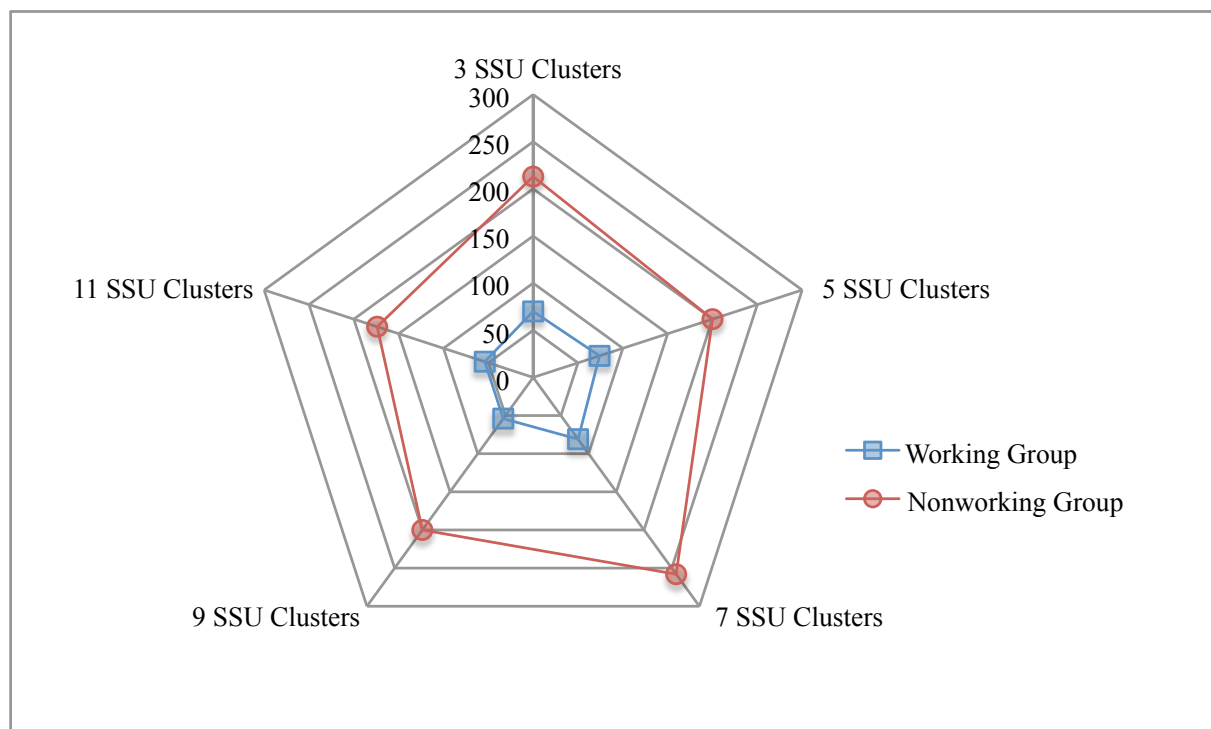


Fig.6.12. Comparison of Preferences Level 1 of selection: Working v/s Nonworking

Inferences

There are few inferences that can be drawn from the above table

1. Working women preferred initially form clusters that were made of 7 (24.32%), 5 (22.22%) followed by 3 (21.02%) semantic units. On the other hand, Nonworking

women preferred initially form clusters that were made of 7 (24.69%), 3 (20.38%) followed by 3, 9 (19.14% each) semantic units.

2. In working group, together they constitute 67.56% that is two third of overall number of articles (A jeweller can fulfil majority of the needs of this group by stocking articles in this model class). While in nonworking group, together 7 and 3 section plates constitute 45.07% that is almost half of overall number of articles (A jeweller can fulfil majority of the needs of this group by stocking articles in this model class).
3. Highest preference was towards form clusters that were made of 7 semantic units, in both the groups' working group 24.32% as well nonworking group 24.69% (A medium size jeweller can stock most of goods in this class to fulfil about a quarter of needs of prospect clients).
4. Working women preferred initially, articles that were towards the front of testing grid. A shift to front is evident (A front shift from centre of grid). While on the other hand, Nonworking women preferred initially, articles most from the centre.
5. Section plate with 11 semantic units was least appreciated by nonworking group.

6.5.2. Percentages of preferential likeness of working v/s Nonworking women group at level 4 is tabulated in, Table 6.6.

Table 6.6. Comparison of Preferences Level 4 of selection: Working v/s Nonworking

Plate	Working Group		Nonworking Group	
	Valid responses	%likeness	Valid responses	%likeness
3 SSU Clusters	2	7.69	9	12.50
5 SSU Clusters	2	7.69	7	9.72
7 SSU Clusters	10	38.46	19	26.39
9 SSU Clusters	6	23.08	17	23.61
11 SSU Clusters	6	23.08	20	27.78

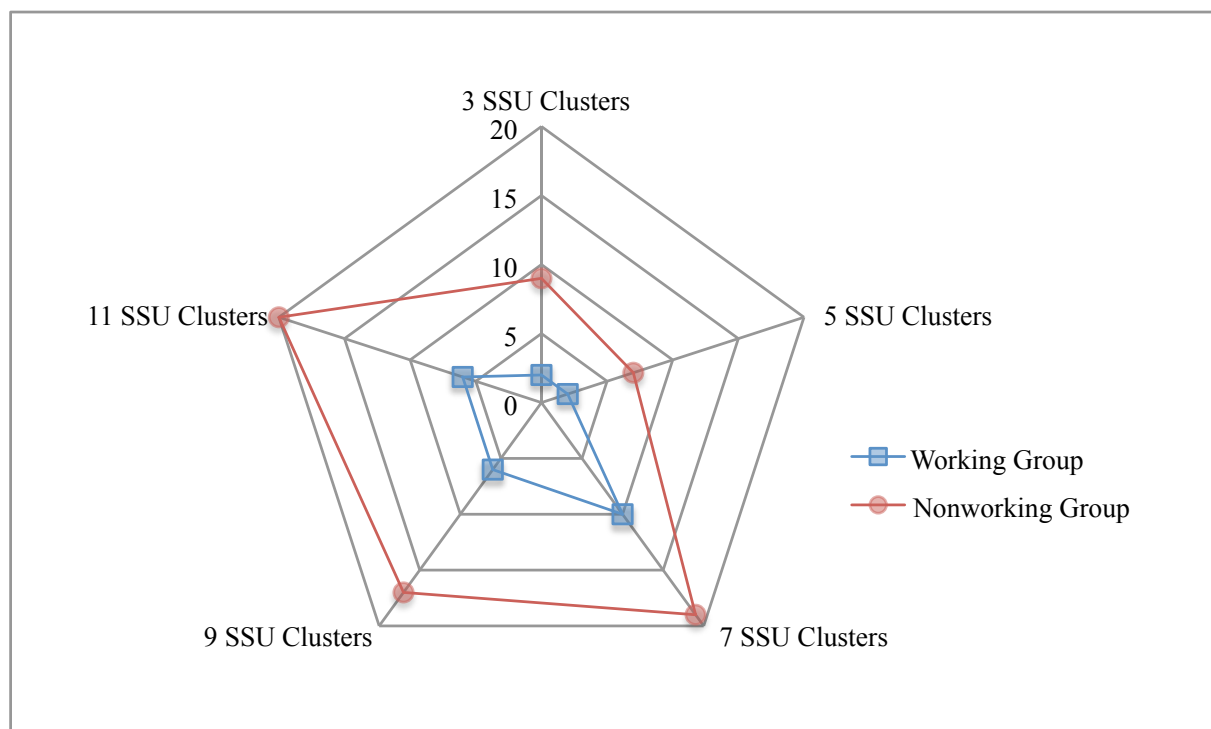


Fig. 6.13. Comparison of Preferences Level 4 of selection: Working v/s Non-Working

Inferences

There are few inferences that can be drawn from the above table

1. Working women preferred finally form clusters that were made of 7(38.46%), followed by 9, 11(23.07692% each) semantic units. While on the other hand, Non Working women preferred finally form clusters that were made of 11(27.78%), 7(26.39%) followed by 9(23.61% each) semantic units. (11 is more but 7 is almost equal)

2. In working women group, together these section plates constitute 84.6% that is 5/6 th of overall number of articles. While in nonworking women group, together these section plates constitute 77.78% that is three fourth of overall number of articles (A jeweller can fulfil majority of the needs of this group by stocking articles in this model class).
3. Highest preference 38.46% was towards form clusters that were made of 7 semantic units, in working group. While in none working group, highest preference 27.78% was towards form clusters that were made of 11 semantic units, but it was closely followed by 7 (26.39%) (A medium size jeweller can stock most of goods in this class to fulfil about a quarter of needs of prospect clients).
4. Working women and nonworking women both preferred finally, articles most from the centre and later the choices shifted to the back of test grid.
5. Section plate with 3 and 5 semantic units was least appreciated 7.69% each by working women group, while in nonworking women group Section plate with 5 semantic units was least appreciated 9.72%.

6.6. Preferential likeness based on Fineness

6.6.1. Percentages of preferential likeness, based on Fineness of Working / Nonworking women group at level 1 is tabulated in, Table 6.7.

Table 6.7. Comparison of Preferences based on Fineness Level 1 of selection: Working v/s Non-Working

Plate	Working Group		Nonworking Group	
	Valid responses	%likeness	Valid responses	%likeness
Fineness 1	102	30.45	154	14.74
Fineness 2	77	22.99	307	29.38
Fineness 3	94	28.06	365	34.93
Fineness 4	51	15.22	169	16.17
Fineness 5	11	3.28	50	4.78

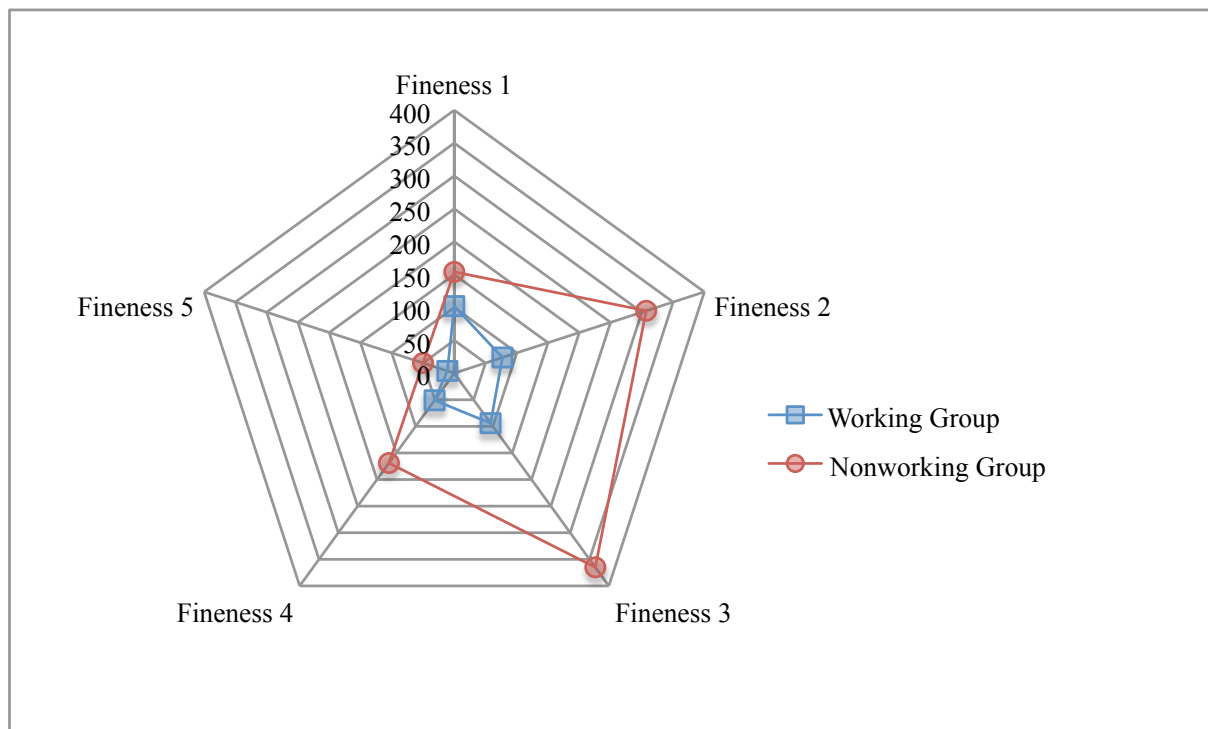


Fig.6.14. Comparison of Preferences based on Fineness Level 1 of selection: Working v/s Non-Working

Inferences

There are few inferences that can be drawn from the above table

1. Working women preferred fineness 1 (30.45%), fineness 3 (28.06%) followed by fineness 2 (22.99%), while on the other hand Non Working women preferred fineness 3 (34.93%), fineness 2 (29.38%) followed by fineness 4 (16.17%)

2. In working women group, together these section plates constitute 81.47% that is four fifth of overall number of articles. While on the other hand in Nonworking women group, together these section plates constitute 80.46% that is four fifth of overall number of articles (A jeweller can fulfil majority of the needs of this group by stocking articles in this model class).
3. Highest preference 30.44% was towards fineness 1, in working women group. While in nonworking women group, highest preference 34.92% was towards fineness 3 followed by 2.
4. Working women preferred finally, articles most from the centre and later the choices shifted to the back of test grid. On the other hand, Non Working women preferred initially articles most from the centre and right of test grid.
5. Sections with fineness 5 were least appreciated by subjects 3.28 % by working women group, and 4.78 % by nonworking women group.

6.6.2. Percentages of preferential likeness, based on Fineness of Working / Nonworking women group at level 4 is tabulated in, Table 6.8.

Table 6.8. Comparison of Preferences based on Fineness Level 4 of selection: Working v/s Non-Working

Plate	Working Group		Nonworking Group	
	Valid responses	%likeness	Valid responses	%likeness
Fineness 1	10	38.46	9	12.68
Fineness 2	1	3.85	24	33.8
Fineness 3	5	19.23	23	32.39
Fineness 4	8	30.77	12	16.9
Fineness 5	2	7.69	3	4.23

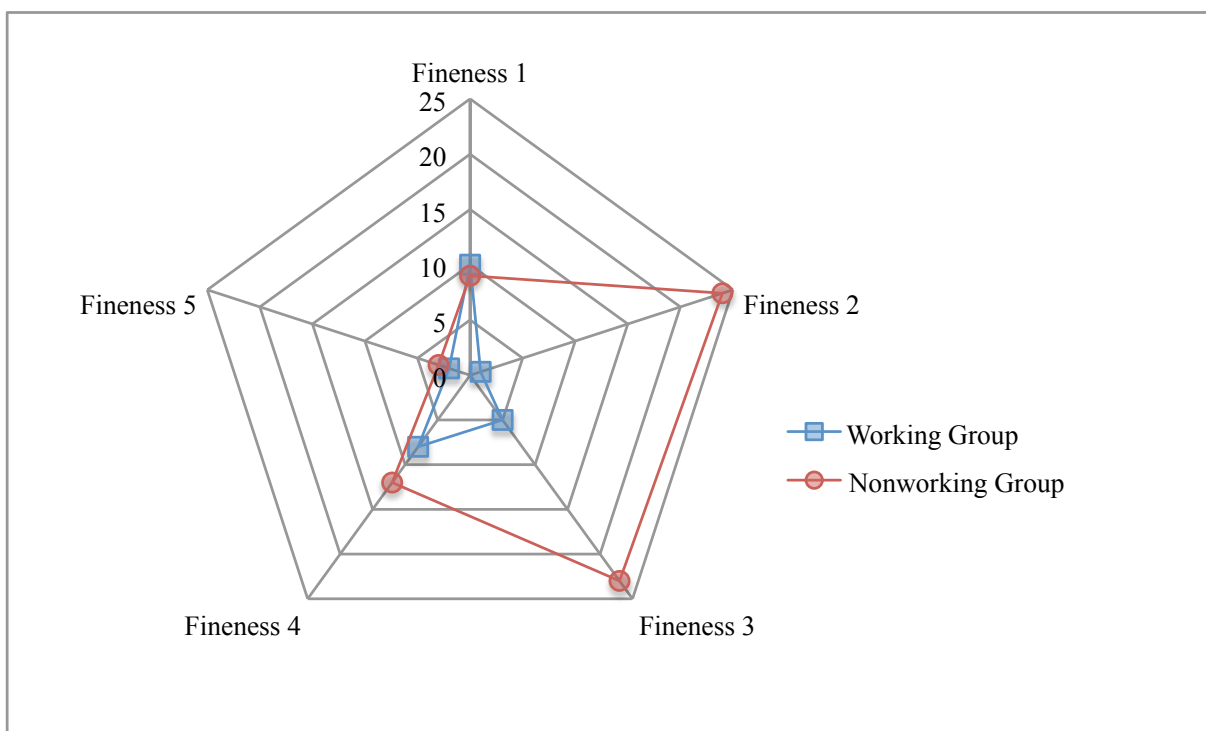


Fig.6.15. Comparison of Preferences based on Fineness Level 1 of selection: Working v/s Non-Working

Inferences

There are few inferences that can be drawn from the above table

1. Working women preferred finally, fineness 1 (38.46%), fineness 4 (30.77%) followed by fineness 3 (19.23%), while on the other hand Non Working women preferred finally, fineness 2 (33.80%), fineness 3 (32.39%) followed by fineness 4 (16.90%).

2. In working women group, together these section plates constitute 88.46% that is about nine tenth of overall number of articles. While on the other hand in nonworking women group, together these section plates constitute 82.99% that is about four fifth of overall number of articles (A jeweller can fulfil majority of the needs of this group by stocking articles in this model class).
3. Highest preference 38.46% was towards fineness 1 followed by 4, in working women group. While in nonworking women group, highest preference 33.80% was towards fineness 2 followed by 3.
4. Working women group preferred initially articles most from left extreme of test grid, while nonworking women group preferred initially articles most from centre of test grid.
5. Sections with fineness 2 were least appreciated by subjects 3.85 % by working women group, while by nonworking women group, Sections with fineness 5 were least appreciated by subjects 4.23 %.

Part III - Based on Social Status - High, High-Middle and Middle

6.7. Preferential likeness based on form cluster sectional plates

This comparison is an assessment of preferential likeness between three groups of subjects based on their social status. Selection of working women is compared among high, High- middle and middle class social status. The relevance of above comparison gains importance as their motives for buying *Kundan* may be driven by different needs and their fulfilments.

A middle class prospect client possibly is a one time buyer during marriage or may have received the article by gift. High- middle may go for a second and repeat buy or invest in a more expensive article. High class may commission multiple pieces over the years, sometimes to counter ravages of inflation, as a good investment for surplus cash. The likeness behaviours may be influenced by factors such as frequent use, heirloom and investment in bullion (of surplus resources).

The location of preference on a particular sectional plate, plate reveal number of semantic units constituting a form cluster that was liked by subjects.

Selection at level 1 were articles that drew the attention of a client in first glances, while selection at level 4 were articles that were finally selected, resulting into a probable sale of the article.

6.7.1. Percentages of preferential likeness, on sectional plates of social status 1(high), social status 2(high middle) and social status 3 (middle) women group women group at level 1 is tabulated in, Table 6.9.

Table 6.9. Comparison of Preferences based on sectional plates Level 1 of selection: social status 1(high), social status 2(high middle) and social status 3 (middle) women group

Plate	Social status 1(high)		Social status 2(high middle)		Social status 3 (middle)	
	Likeness	%	Likeness	%	Likeness	%
3 SSU Clusters	99	20.97	140	20.99	44	18.41
5 SSU Clusters	86	18.22	137	20.54	51	21.34
7 SSU Clusters	119	25.21	167	25.04	53	22.18
9 SSU Clusters	93	19.7	111	16.64	50	20.92
11 SSU Clusters	75	15.89	112	16.79	41	17.15

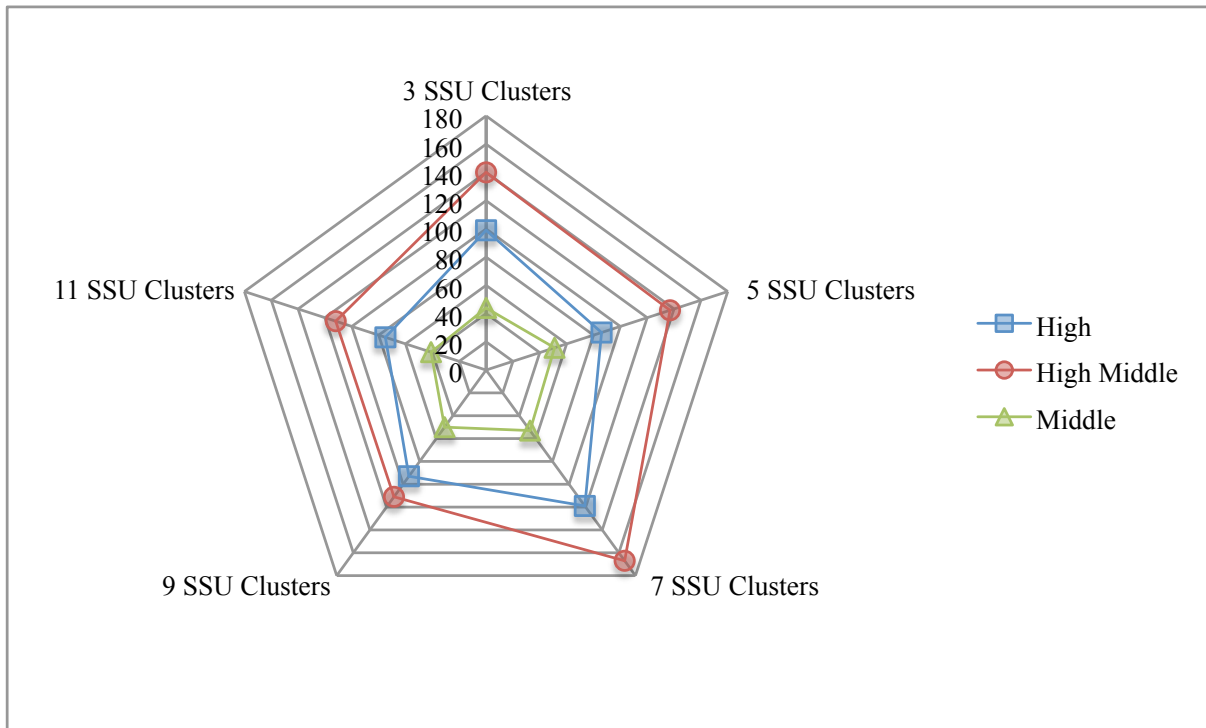


Fig.6.16. Comparison of Preferences based on sectional plates Level 1 of selection: social status 1(high), social status 2(high middle) and social status 3 (middle) women group

Inferences

There are few inferences that can be drawn from the above table

1. High social status women preferred initially, form clusters that were made of 7(25.21%), semantic units, 3(20.97%) followed by 9(19.70%), on the other

hand High Middle social status women preferred initially, form clusters that were made of 7(25.04%), semantic units, 3(20.99%) followed by 5(20.54%) and Middle social status women preferred initially, form clusters that were made of 7(22.18%) semantic units, 5(21.34%) followed by 9(20.92%)

2. In high social status, together these section plates constitute 65.88% that is about two third of overall number of articles, while in high middle social status, together these section plates constitute 66.57% that is about two third of overall number of articles, and on the other hand, middle social status, together these section plates constitute 64.44% that is about two third of overall number of articles (A jeweller can fulfil majority of the needs of this group by stocking articles in this model class).
3. Highest preference was towards form clusters made of 7 semantic units, in all social status' in high social status 25.21%, while in middle social status 25.04% and on the other hand in middle social status 22.18%
4. Women preferred initially articles most from centre of test grid in all the social status, high social status, high middle status and in middle social status.

6.7.2. Percentages of preferential likeness, on sectional plates of social status 1(high), social status 2(high middle) and social status 3 (middle) women group at level 4 is tabulated in, Table 6.10.

Table 6.10. Comparison of Preferences based on sectional plates Level 4 of selection: social status 1(high), social status 2(high middle) and social status 3 (middle) women group

Plate	Social status 1(high)		Social status 2 (high middle)		Social status 3 (middle)	
	Likeness	%	Likeness	%	Likeness	%
3 SSU Clusters	3	8.33	7	15.22	1	5.88
5 SSU Clusters	2	5.56	4	8.7	3	17.65
7 SSU Clusters	9	25	15	32.61	5	29.41
9 SSU Clusters	13	36.11	7	15.22	3	17.65
11 SSU Clusters	9	25	13	28.26	5	29.41

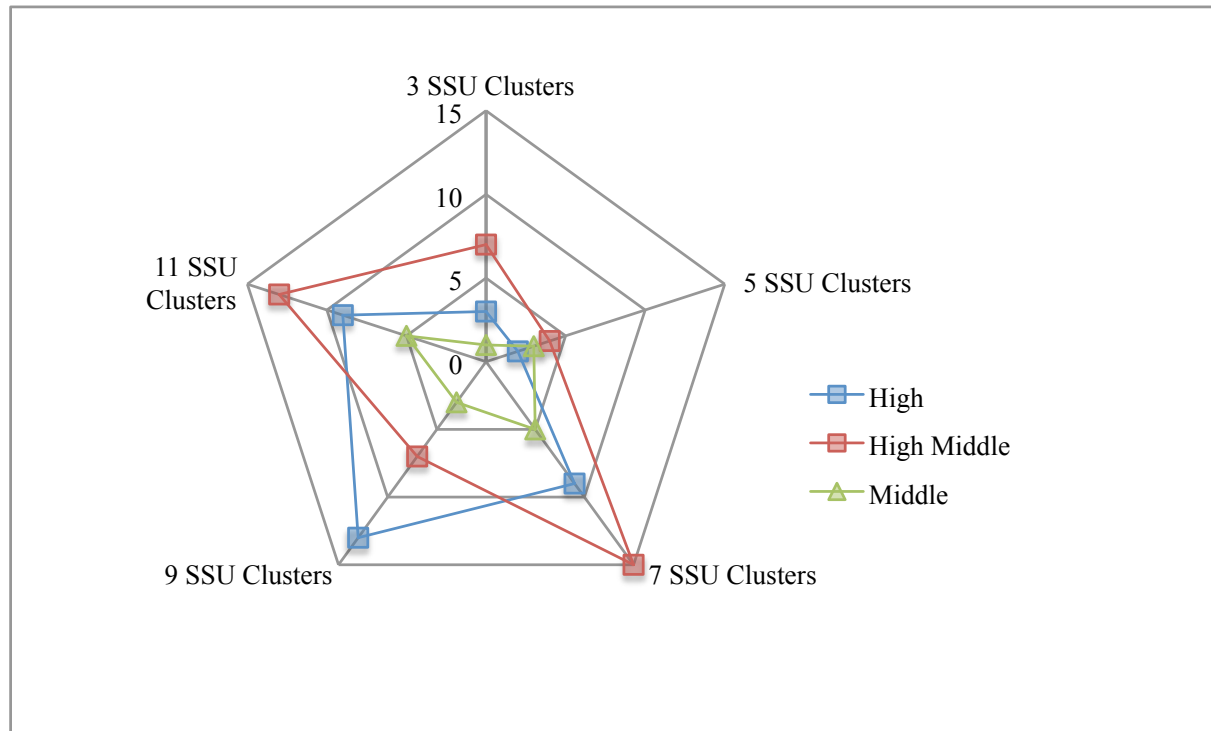


Fig.6.17. Comparison of Preferences based on sectional plates Level 4 of selection: social status 1(high), social status 2(high middle) and social status 3 (middle) women group

Inferences

There are few inferences that can be drawn from the above table

1. High social status women preferred finally, form clusters that were made of 9(36.11%) semantic units, 7 and 11(25.00%) each, while in High middle social status women preferred finally, form clusters that were made of 7(32.61%)

semantic units followed by 11(28.26%) and in Middle social status women preferred finally, form clusters that were made of 7 and 11(29.41%) semantic units followed by 5 and 9 (17.65%).

2. In high social status, together these section plates constitute 86.11% that is about four fifth of overall number of articles, on the other hand in high middle social status, together these section plates constitute 60.87% that is about two third of overall number of articles and in middle social status, together 7 and 11 section plates constitute 58.82% that is almost about two third of overall number of articles (A jeweller can fulfil majority of the needs of this group by stocking articles in this model class).
3. Highest preference 36.11% was towards form clusters made of 9 semantic units by high social status women, while by high middle social status women, highest preference 32.61% was towards form clusters made of 7 semantic units and by middle social status women, highest preference 29.41% was equal between and towards form clusters made of 7 and 11 semantic units.
4. Finally Women preferred articles most from back to centre of test grid, in all High social status, High middle social and middle social status women.
5. By high social status women, clusters with 5 semantic units were least appreciated 5.56%, on the other hand, by high middle social status women, clusters with 5 semantic units were least appreciated 8.70% and by middle social status women, clusters with 3 semantic units were least appreciated 5.88%.

6.8. Preferential likeness based on Fineness

6.8.1. Percentages of preferential likeness, based on fineness, status 1 (high), social status 2 (high middle) and social status 3 (middle) women group at level 1 is tabulated in, Table 6.11.

Table 6.11. Comparison of Preferences based on fineness Level 1 of selection: social status (high), social status 2(high middle) and social status 3 (middle) women group

Plate	Social status 1(high)		Social status 2(high middle)		Social status 3(middle)	
	Likeness	%	Likeness	%	Likeness	%
Fineness 1	77	16.31	150	22.42	29	12.13
Fineness 2	130	27.54	183	27.35	71	29.71
Fineness 3	159	33.69	212	31.69	88	36.82
Fineness 4	79	16.74	98	14.65	43	17.99
Fineness 5	27	5.72	26	3.89	8	3.35

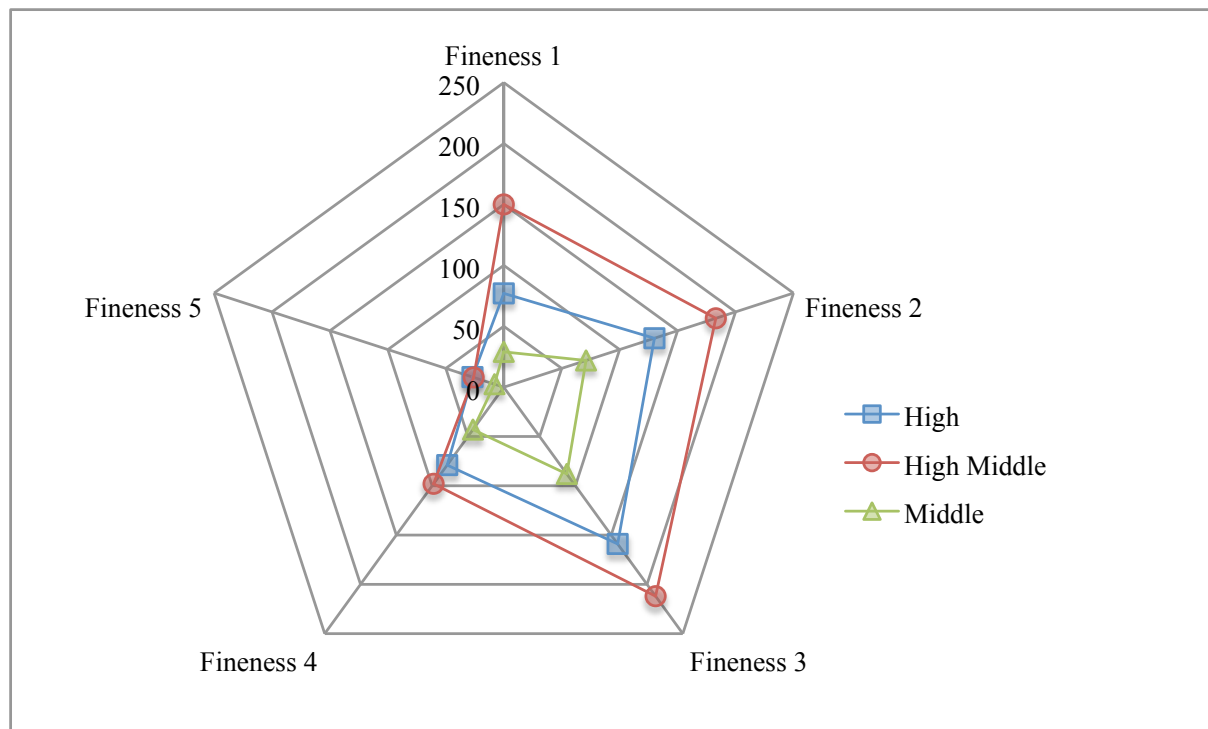


Fig.6.18. Comparison of Preferences based on fineness Level 1 of selection: social status1 (high), social status 2(high middle) and social status 3 (middle) women group

Inferences

There are few inferences that can be drawn from the above table

1. High status women preferred initially, fineness 3 (33.68%), followed by fineness

2 (27.54%), while in High status women preferred initially, fineness 3 (31.68%), fineness 2(27.35%) followed by fineness 1(22.42%) and Middle status women preferred initially, fineness 3(36.82%), fineness 2(29.70%) followed by fineness 4(17.99%).

2. In High status women, together these section plates constitute 61.22% that is about two third of overall number of articles, on the other hand by high status women, together these section plates constitute 81.45% that is about four fifth of overall number of articles and by middle status women, together these section plates constitute 84.51% that is about four fifth of overall number of articles (A jeweller can fulfil majority of the needs of this group by stocking articles in this model class).
3. Highest preference was towards fineness 3 in all social status, in high social status 33.68% , in high middle social status 31.68% and in middle social status 36.82%.
4. Women preferred initially articles most from centre of test grid in diverse social status, high social status, high middle social status and middle social status.
5. Sections with fineness 5 were least appreciated by subjects, in high social status 5.72 %, in high middle social status 3.88% and in middle social status 3.34%.

6.8.2. Percentages of preferential likeness, based on fineness, status 1 (high), social status 2 (high middle) and social status 3 (middle) women group at level 4 is tabulated in, Table 6.12.

Table 6.12. Comparison of Preferences based on fineness Level 4 of selection: social status1 (high), social status 2(high middle) and social status 3 (middle) women group

Plate	social status 1(high)		social status 2(high middle)		social status3 (middle)	
	Likeness	%	Likeness	%	Likeness	%
Fineness 1	6	17.14	13	28.26	1	5.88
Fineness 2	9	25.71	10	21.74	5	29.41
Fineness 3	10	28.57	11	23.91	7	41.18
Fineness 4	8	22.86	9	19.57	4	23.53
Fineness 5	2	5.71	3	6.52	0	0.00

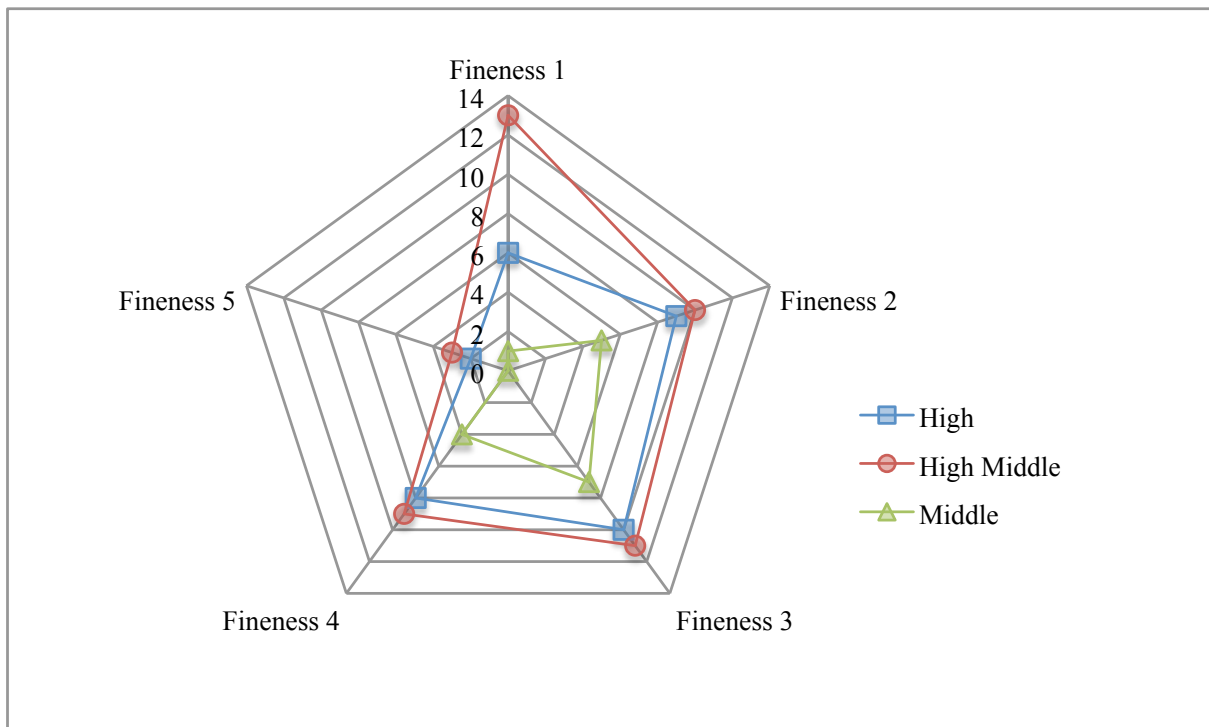


Fig.6.19. Comparison of Preferences based on fineness Level 4 of selection: social status1 (high), social status 2(high middle) and social status 3 (middle) women group

Inferences

There are few inferences that can be drawn from the above table

1. High status women preferred finally, fineness 3(28.57%), fineness 2(25.71%) followed by fineness 4(22.85%), while in High middle status women preferred

finally, fineness 1(28.26%), fineness 3(23.91%) followed by fineness 2(21.73%) and in Middle status women preferred finally, fineness 3(41.17%), fineness 2(29.41%) followed by fineness 4(23.52%)

2. In high status, together these section plates constitute 77.13% that is about three fourth of overall number of articles, while in high middle status, together these section plates constitute 73.90% that is about three fourth of overall number of articles and middle status, together these section plates constitute 94.10% that is more than nine tenth of overall number of articles (A jeweller can fulfil majority of the needs of this group by stocking articles in this model class).
3. Highest preference 28.57% was towards fineness 3 in high status, while in high middle status highest preference 28.26% was towards fineness 1 and in middle status highest preference 41.17% was towards fineness 3.
4. High status, high middle status and middle status women preferred initially articles most from centre of test grid while high middle status women also preferred articles from right of test grid.
5. Sections with fineness 5 were least appreciated by subjects, by high status 5.71%, while by high middle status 6.53% and by middle status 0.00%.

Part IV - Based on age Group 1. 20-29, Group 2. 30-39, Group 3. 40-49 and Group 4. 40-49 year

6.9. Preferential likeness based on form cluster sectional plates

This comparison is an assessment of preferential likeness between four groups of subjects based on their age. Selection of women is compared among following age group

1. Group 1. 20-29
2. Group 2. 30-39
3. Group 3. 40-49 and
4. Group 4. 50-59 years respectively

The relevance of above comparison gains importance as their motives for buying *Kundan* are driven by different needs such as use by oneself, investment or gift to others and their fulfilments.

20-29 are yet to be married or early into marriage

30-39 are recently married and settling

40-49 are well settled and investing/ buying for marriage of daughter/ in-laws

50-59 are well settled and are advisors/ opinion makers/ approvers

6.9.1. Comparison of Preferences based on sectional plates Level 1 of selection based on age group

Table 6.13. Comparison of Preferences based on sectional plates Level 1 of selection based on age group

Plate	AGE 1		AGE 2		AGE 3		AGE 4	
	Likeness	%	Likeness	%	Likeness	%	Likeness	%
3 SSU Clusters	70	17.95	73	20.68	58	18.71	82	28.87
5 SSU Clusters	76	19.49	72	20.40	64	20.65	62	21.83
7 SSU Clusters	107	27.44	88	24.93	74	23.87	70	24.65
9 SSU Clusters	47	12.05	63	17.85	64	20.65	39	13.73
11 SSU Clusters	90	23.08	57	16.15	50	16.13	31	10.92

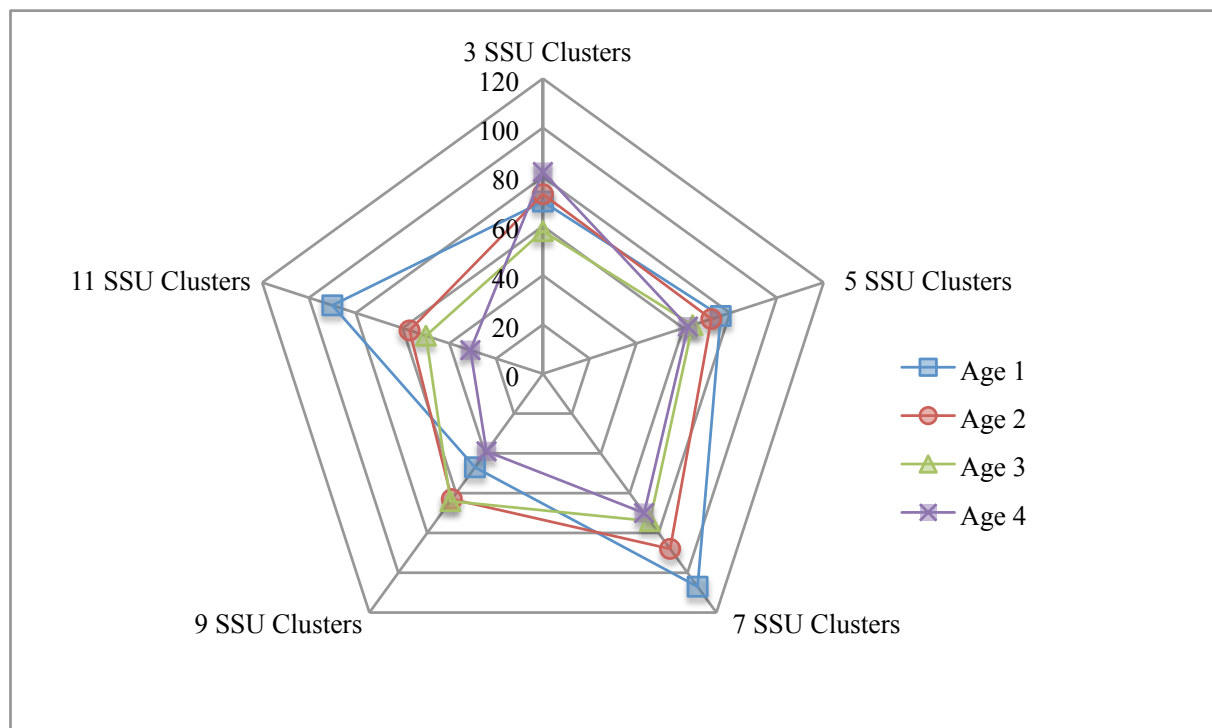


Fig.6.20. Comparison of Preferences based on sectional plates Level 1 of selection based on age group

Inferences

There are few inferences that can be drawn from the above table

1. Women in groups Age 1, 2 & 3 preferred initially, articles form clusters that were made of 7 semantic units that is 27.44%, 24.93% & 23.87% respectively. While women in group age 4 preferred articles form clusters that were made of 3 semantic units that is 28.87%.
2. However, women in age group 4 preferred differently, they chose from section plates with 3 semantic units, 28.87%. This is a shift from routine preferential consistency of selecting from section plates 7 semantic units, and can present a possibility for a new range. This also can be interpreted as higher age group women becoming experimental again like, working women.
3. In group age 1, together these section plates constitute 70.01% that is about three fourth of overall number of articles, while in group age 2, together these section plates constitute 66.01% that is about two third of overall number of articles, in group age 3, together these section plates constitute 65.17% that is more than two third of overall number of articles and in group age 4, together these section plates constitutes 75.35% that is about three fourth of overall number articles (A jeweller can fulfil majority of the needs of this group by stocking articles in this model class).
4. Highest preference 27.44% was towards fineness 7 in group age 1, while in group age 2 Highest preference 24.93% was towards fineness 7, in group age 3 highest preference 23.87% was towards fineness 7 and in group age 4 highest preference 28.87% was towards fineness 3.
5. Group age 1, 2 and 3 women preferred initially articles most from 7 semantic unit of test grid while group age 4 women preferred articles from 3 semantic of test grid

6.9.2. Comparison of Preferences based on sectional plates Level 4 of selection based on age group

Table 6.14. Comparison of Preferences based on sectional plates Level 4 of selection based on age group

Plate	AGE 1		AGE 2		AGE 3		AGE 4	
	Likeness	%	Likeness	%	Likeness	%	Likeness	%
3 SSU Clusters	2	6.45	2	8.70	2	9.09	5	23.81
5 SSU Clusters	4	12.90	1	4.35	3	13.64	0	0.00
7 SSU Clusters	9	29.03	9	39.13	3	13.64	7	33.33
9 SSU Clusters	5	16.13	7	30.43	6	27.27	5	23.81
11 SSU Clusters	11	35.48	4	17.39	8	36.36	4	19.05

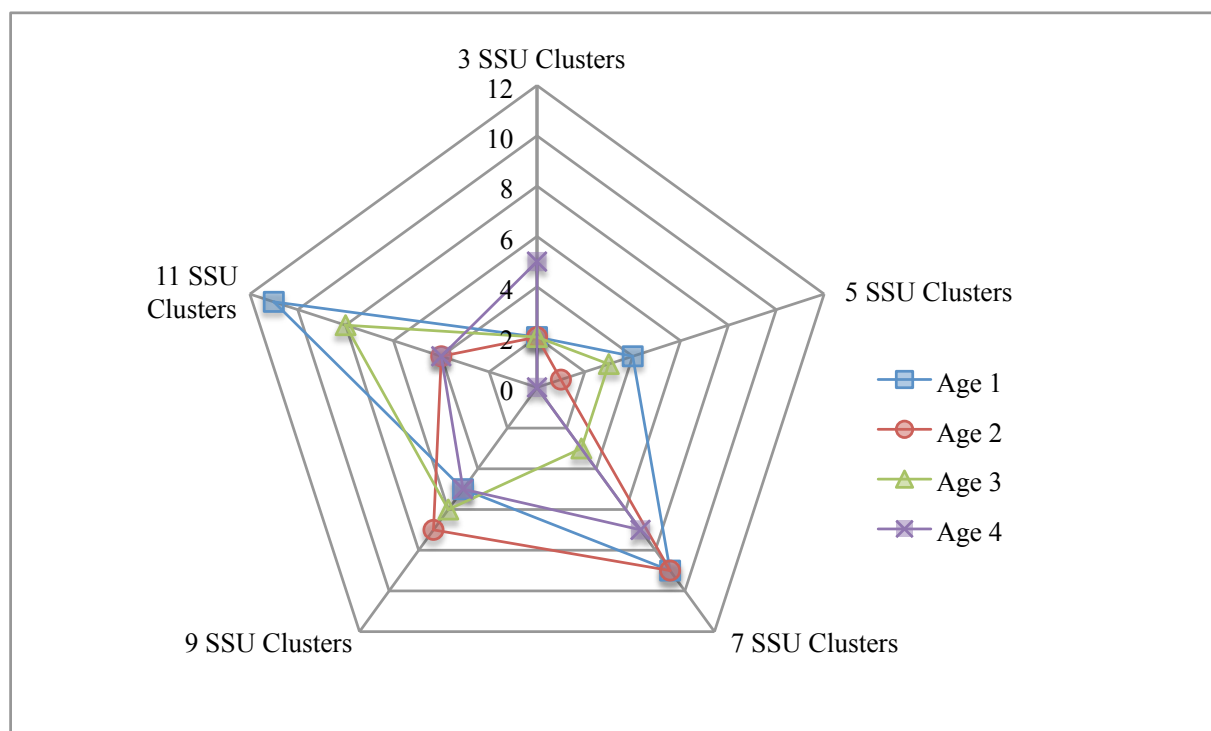


Fig.6.21. Comparison of Preferences based on sectional plates Level 4 of selection based on age group

Inferences

There are few inferences that can be drawn from the above table

1. Women in groups Age 1 & 3 preferred initially, articles form clusters that were made of 11 semantic units that is 35.48% & 36.36% respectively. While women in group age 2 and 4 preferred articles form clusters that were made of 7 semantic units that are 39.13% and 33.33%.

2. In group age 1, together these section plates constitute 80.64% that is about four fifth of overall number of articles, while in group age 2, together these section plates constitute 86.95% that is about four fifth of overall number of articles, in group age 3, together these section plates constitute 77.27% that is more than three fourth of overall number of articles and in group age 4, together these section plates constitutes 80.95% that is about four fifth of overall number articles (A jeweller can fulfil majority of the needs of this group by stocking articles in this model class).
3. Highest preference 35.48% was towards fineness 11 in group age 1, while in group age 2 highest preference 39.13% was towards fineness 7, in group age 3 highest preference 36.36% was towards fineness 11 and in group age 4 highest preference 33.33% was towards fineness 7.
4. Group age 1 and 3 women preferred initially articles most from fineness 11 of test grid while group age 2 and 4 women preferred articles from fineness 7 of test grid.

6.10. Preferential likeness based on Fineness

6.10.1. Comparison of Preferences based on fineness of selection based on age group

Table 6.15. Comparison of Preferences based on fineness of selection based on age group

Plate	AGE 1		AGE 2		AGE 3		AGE 4	
	Likeness	%	Likeness	%	Likeness	%	Likeness	%
Fineness 1	82	19.03	85	23.94	28	9.03	61	24.5
Fineness 2	94	21.81	101	28.45	92	29.68	97	38.96
Fineness 3	123	28.54	114	32.11	136	43.87	86	34.54
Fineness 4	95	22.04	45	12.68	49	15.81	31	12.45
Fineness 5	37	8.58	10	2.82	5	1.61	9	3.61

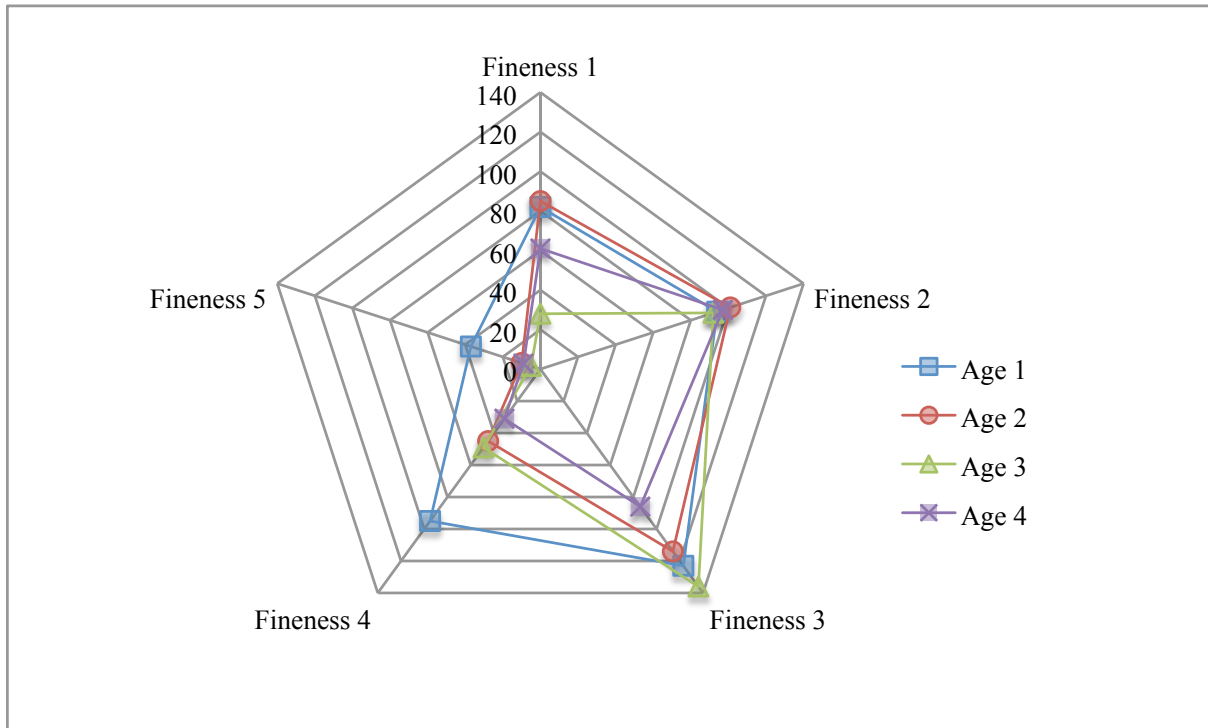


Fig.6.22. Comparison of Preferences based on fineness of selection based on age group

Inferences

There are few inferences that can be drawn from the above table

1. Women in groups Age 1, 2 & 3 preferred initially, articles form clusters that were made of fineness 3. That is 28.54%, 32.11% & 43.87% respectively. While women in group age 4 preferred articles form clusters that were made of fineness 2 that is 38.96%.

2. In group age 1, together these section plates constitute 72.39% that is about three fourth of overall number of articles, while in group age 2, together these section plates constitute 84.50% that is about four fifth of overall number of articles, in group age 3, together these section plates constitute 89.36% that is more than nine tenth of overall number of articles and in group age 4, together these section plates constitutes 73.5% that is about three fourth of overall number articles (A jeweller can fulfil majority of the needs of this group by stocking articles in this model class).
3. Highest preference 28.54% was towards fineness 3 in group age 1, while in group age 2 highest preference 32.11% was towards fineness 3, in group age 3 highest preference 43.87% was towards fineness 3 and in group age 4 highest preference 38.96% was towards fineness 2.
4. Group age 1, 2 and 3 women preferred initially articles most from fineness 3 of test grid while group age 4 women preferred articles from fineness 2 of test grid.

6.10.2. Comparison of Preferences based on fineness Level 4 of selection based on age group

Table 6.16. Comparison of Preferences based on fineness Level 4 of selection based on age group

Plate	AGE 1		AGE 2		AGE 3		AGE 4	
	Likeness	%	Likeness	%	Likeness	%	Likeness	%
Fineness 1	9	29.03	6	27.27	0	0.00	4	17.39
Fineness 2	5	16.13	4	18.18	7	31.82	9	39.13
Fineness 3	9	29.03	7	31.82	8	36.36	4	17.39
Fineness 4	7	22.58	4	18.18	6	27.27	4	17.39
Fineness 5	1	3.23	1	4.55	1	4.55	2	8.70

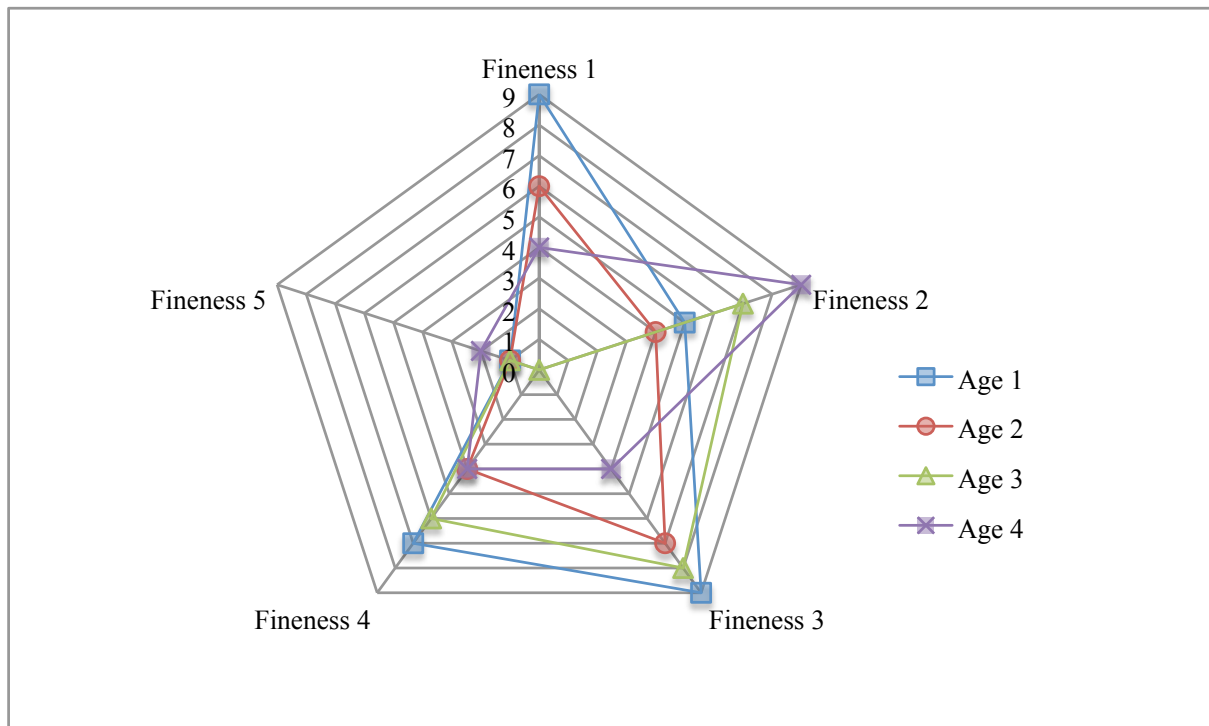


Fig.6.23. Comparison of Preferences based on fineness Level 4 of selection based on age group

Inferences

There are few inferences that can be drawn from the above table

1. Women in groups Age 1, 2 & 3 preferred initially, articles form clusters that were made of fineness 3. That is 29.03%, 31.82% & 36.36% respectively. While women in group age 1 and 4 preferred articles form clusters that were made of fineness that is 29.03% and 39.13%.
2. In group age 1, together these section plates constitute 80.65% that is about four fifth of overall number of articles, while in group age 2, together these section

plates constitute 77.27% that is about three fourth of overall number of articles, in group age 3, together these section plates constitute 95.45% that is more than nine tenth of overall number of articles and in group age 4, together these section plates constitutes 73.91% that is about three fourth of overall number articles (A jeweller can fulfil majority of the needs of this group by stocking articles in this model class).

3. Highest preference 29.03% was towards fineness 3 in group age 1, while in group age 2 Highest preference 31.82% was towards fineness 3, in group age 3 highest preference 36.36% was towards fineness 3 and in group age 4 Highest preference 39.13% was towards fineness 2.
4. Group age 1, 2 and 3 women preferred initially articles most from fineness 3 of test grid while group age 4 women preferred articles from fineness 2 of test grid.

6.11. Preferred Cluster Pitch

It was also found that there were some cluster sharing similar pitch amongst the preferred ones. The preferred cluster pitches were distributed and cantered around measurements that approximated 11 to 18 mm. This also matched with shop floor experience as these dimensions were approximating half an inch and three fourth of an inch within a range of plus minus one sixteenth of an inch (about 1.5 mm). This made good sense as jewellery fraternity still, to a large extent, follows and prefers foot and inch system in practice¹⁷. For example, bangles sizes are referred as *sava do anni*, *do char aani*, *do chheh anni* that is two and a quarter of an inch, two and a half inch and two and three quarter of an inch respectively. The machine or handmade chains to be worn in neck, are still measured in inches

17. Many other trades besides jewellery also, conduct business in imperial system as it is still extensively in practice in India. In some cases this system of measurement is preferred over metric system, like timber trade which prefers calculating in running feet and cubic feet. Land and real estate also follow along, where square feet measures are well-liked, rather preferred over square meters. Steel rules generally are graduated both in metric and imperial systems to facilitate measurements and switching between the two systems.

6.12. Validation of Findings by Experts

The findings of the research were taken up for in depth discussion with *kundan* experts for a deeper insight into subject. The experts were asked to share their insight by offering their point of view on selected articles.

They were given a printout of the design on a DIN A4 size paper and asked to write and draw on plates, the factors that in their opinion led to selection of that particular article.

They were given an assortment of sketching material for this purpose. There was a special request for a very fine tipped inking pen to draw out intricate details within body of a smallest semantic unit. Experts took time for reflections and communicated within themselves exchanging opinions. They used drawing, sketching as well as written words to effectively communicate thoughts. Fig.6.24. is selection of articles by people and Fig.6.25. is selected by experts themselves for reflection. Ten designs by subjects and five designs by experts are taken into consideration for this purpose.

Their opinion is reproduced as it is for observation. A scanning of worksheets is incorporated for observation. The expert group was in agreement with findings, they further used their vocabulary to describe what makes these designs appealing from a *kundansaa* point of view.

These articulations are tabulated in (Table.7.1.) scope for future work and present a huge potential for research in that particular.

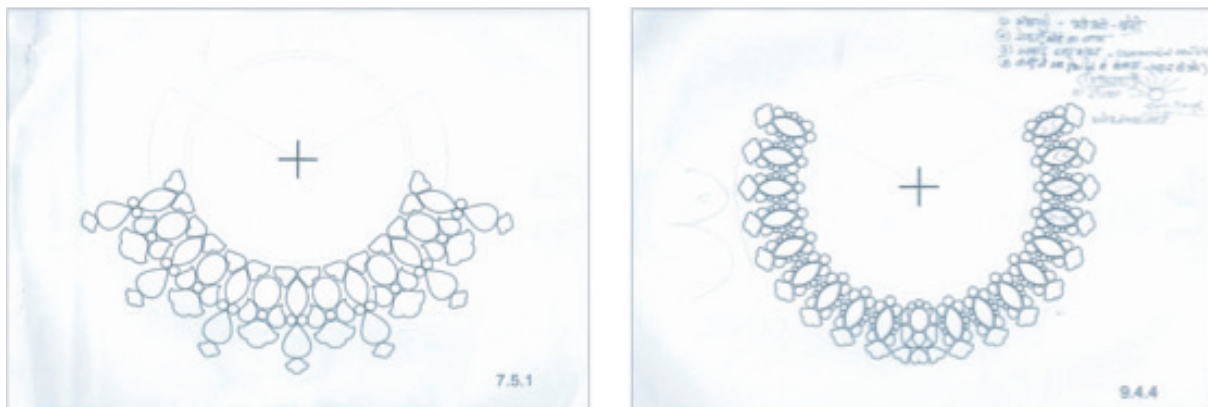


Fig.6.24. Articles selected by experts for reflection in form of written words and pencil/ink sketching view of the experts were found to be in concurrent

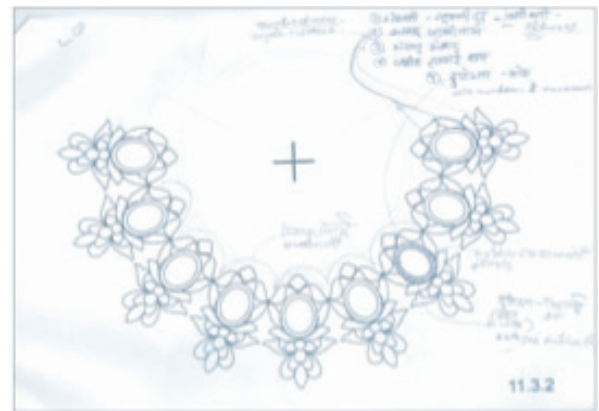
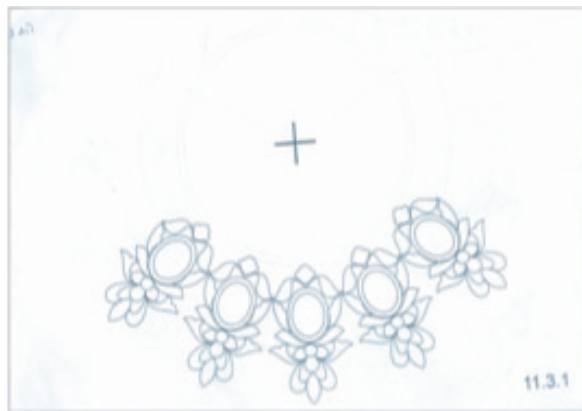
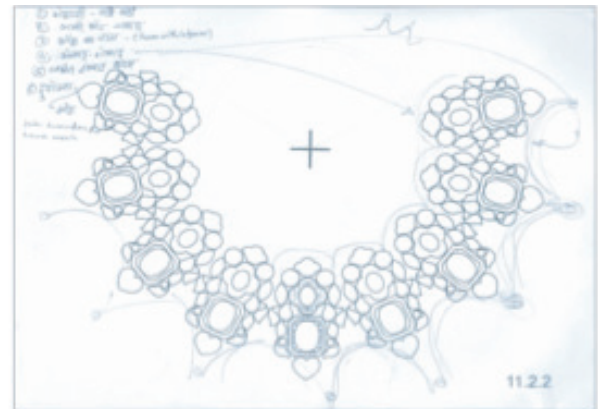
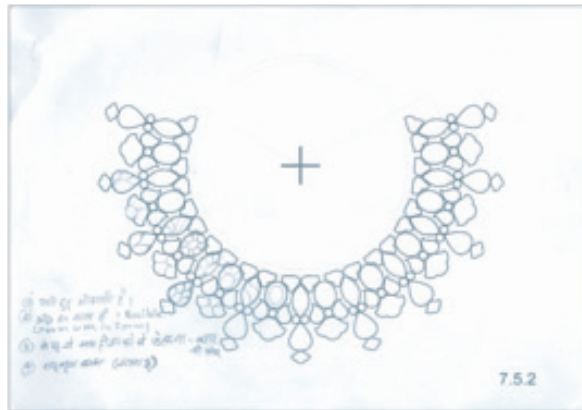
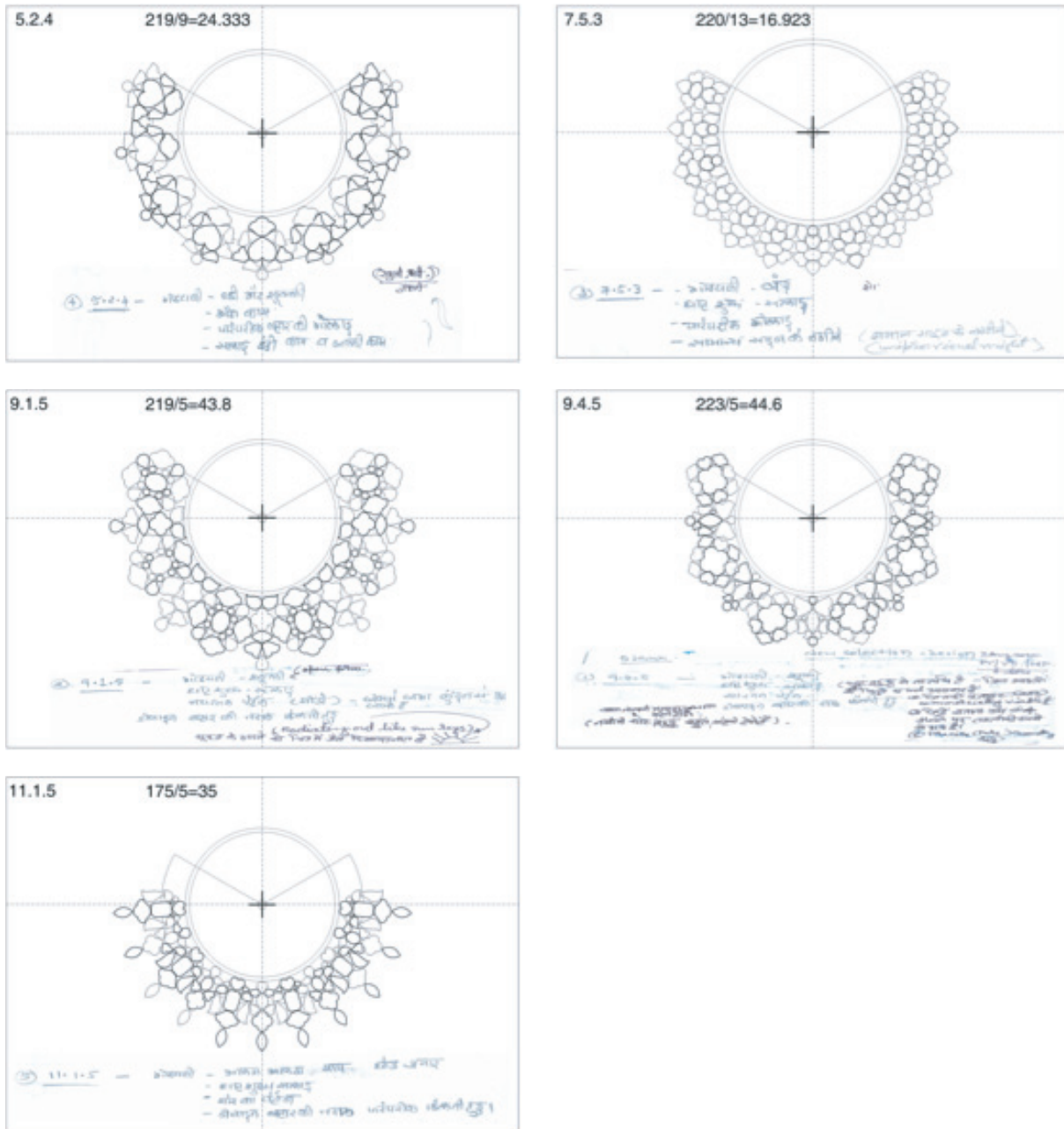


Fig.6.24. Articles selected by experts for reflection in form of written words and pencil/ink sketching view of the experts were found to be in concurrent.



6.13. Summary

Chapter gives an understanding of directions in which preferential likeness gyrated according to diverse user profiles such as age and marital status. It also further elucidates these preferences based on cluster fineness and number of smallest semantic units contained therein. It becomes possible to draw some tips and directions for design for a specific target group or client. In light of these findings it is possible to have a inter group comparison of preferences as well as understand the similarities and differences.

Chapter 7

Summary and Conclusion

7.1. Major Findings of Research

Jewellers and designers could observe and envisage to a certain degree, preferences of articles, as well as trends in individual class, changes in fineness, dimension and cluster pitch to identify probable preferences of different categories of prospect clients.

The study attempted and developed a validated methodology to understand and categorize design preferences of various groups segments of customers. In depth questionnaire was developed and various design preferences were requested from the respondents. The

data so collected was analysed using proven statistical tools and procedures. Selected major contributions are summarized as follows.

1) The investigations were carried out to understand the design clusters preferences for married and unmarried women on the form cluster selection plates. The results summarized,

- Holistically analysing the data it seems that married women have preferred design clusters with SSU'S followed by 9 and 11 smallest semantic units. It can be envisaged that the married women seems to prefer a higher number of semantic units in design.
- The preferential analysis for unmarried women shows no strong preferential singular design preference. However, they also preferred higher number of semantic units in design. (Based on their preference towards clusters made of 11 smallest semantic units)(The results for the unmarried women section need to be further analysed for getting the preferential allocation for design)

The study resulted in some notable finding for the jewellery manufacturer as below:-

- The married women initially preferred a lower number of smaller semantic unit clusters (3,5 and 7 plates) and finally selecting out of (7, 9 & 11) plates design.
- The unmarried women seem to have more clarity on the selection for their preferences, and they initially narrowed to (7, 9 & 11) & finally narrowed to (7 & 11).

2) Further the investigation was carried out to understand the preferences for fineness of form clusters- the observations are summarized below,

- The preferential selection pattern for married women seems to surround towards fineness 2 & 3, although relatively acceptable fineness is also seen for fineness 1 & 4. It can be inferred from the results that there seem to have very low preferences for fine design having very small form clusters in large numbers.
- The results on data collected for unmarried women showed a clear preferential selection towards fineness 3, while appreciating the fineness 1 & 4. Fineness 2 & 5 seem to have drawn very less support from unmarried women group.

The implications for jewellers for the data collected on fineness of the design are,

- Married women showed a preferential inclination towards fineness 1, 2 & 3 and they remain fairly consistent in the choices for the fineness.
- Unmarried women also towards fineness, the results are consistent i.e., They also showed their acceptability of fineness 2, 3 and 4 and for the final the final selection of design, these findings are consistent.

3) The present study also attempted to understand the design likeness preferences for working and non working women, the findings are summarized below,

- Holistically analysing the data it seems that working women have preferred design clusters with SSU'S 7, 9 and 11 followed by smallest semantic units. It can be envisaged that the working women seems to prefer a higher number of semantic units in design.
- The preferential analysis for nonworking women also shows preferential design preference towards design clusters with SSU'S 7, 9 and 11.

The clear preferential selection of working and non working women towards design clusters with 7, 9 and 11 SSU'S clearly highlight the sale pattern and hence possible strong implication for jewellery designers.

4) Further contributions of initial preferential selection for the jewelry design, which may become a strong guideline for designers, are summarized as,

- Working women initially preferred the design clusters with SSU'S 3, 5 and 7, and their preferential selection finally constrained to a later size plates, it means that they shift preferences and finally purchase a jewelry with design clusters with SSU'S 7, 9 and 11.
- Nonworking women, initially remained not focused and showed their design likeness preferences towards plate 7, but for other plates also, they showed nearly equal preferences. Finally they also select a design with clusters 7, 9 and 11.

The analysis was also carried for understanding the fineness preferences for working and non working women. The findings are:

- Majority of the working women preferred jewellery with fineness 1 and fineness 4 and their preferences seems to be concentrated with these two designs.
- Where as majority of non working women preferred jewellery with fineness 2 and fineness 3. Their seems a differentiation in the design likeness preferences for working and non working.

The results of this study are also supporting the view that working women would like to have a less complex and simple design where as non working women prefers a bit more complex and fine design.

5) The findings also have implications for jewellery designers as,

- The analysis showed clearly that working women would like to prefer initially also a design with fineness 1, 2, and 3 and finally accepting a design amongst this segment only. Owing to the nature of jobs small/fine parts may fall out during working and hence their preferential likes is justified.
- For the nonworking women, they initially also preferred designs with fineness 2, 3 and 4 and finally stabilizing on design fineness 1, 2 and 3. They also seem to be fairly consistent on the design preferences.

6) Similar type of analysis was carried for their social status (High, Medium and low). i.e. Attempts were extended to judge the design likeness preferences (both on SSU'S and fineness) based on the social status of women. The findings are summarized below,

- High status women seem to have preferred a design with higher SSU'S (typically design with clusters 9).
- High Middle status women have a preferential alignment towards a design with clusters 7 and 11.
- Middle status women also have preferred a design with clusters 7 and 11. It seems that preferences of high middle and middle women are nearly similar.

7) For understanding these findings for jewellery designers, an attempt has been made to analyse the initial design preferences for the above categories, the observations are,

- High social status women preferred initially, form clusters that were made of 7, 3 followed by 9 semantic units.
- Highest preference was towards form clusters made of 7,5 and 3 semantic units, high middle status class women
- Middle status women preferred the design with clusters 5, 7 and 9 issue's.

In general the women of all status group preferred design cluster 7, which emerged as a modal class for all the design groups.

8) Similarly the fineness preferences for different social status were also studied and the findings are,

- Regarding fineness initial preferences, the women of high status preferred designs with fineness 3 and 2. High middle status women preferred design with fineness 3, 2 and 1 and the Middle status women preferred the design with fineness 3 and 2.
- Analysing the data towards the final selection preferences of thee above category for all these category women's their final preferences seem to concentrate and replicate the initial design preferences as above.

9) The attempt has also been extended to study the design preferences changes with reference to age . The age group 1 constitutes a younger women of age group 20-29 where as age group 4 constitutes women of age 50-59. The following findings are observed.

- The initial design likeness preference of age group 1 seems to surround towards design SSU'S 7,11 and 5 where as of age group 2 seems to concentrate on SSU'S 7,5 and 3 and for the age group 3 it resulted in a preferences towards design SSU'S 7 ,9 and 5 and finally more mature women of age group 4 preferred a simpler design of SSU 3, 7 and 5.
- For the final selection of design the analysis resulted as : the age group 1 seems to have preferences towards SSU 3, 4 and 2.

7.2. Case Study/Testing of the Tool

There came an opportunity to test out testing grid during validation with experts. One of the subjects indicated a willingness to see designs with intent to commission a *Kundan* necklace. The subject was married housewife and from high middle class background, age 35 years.

Subject arrived at the studio of author at the appointed hour, escorted by her husband. They were briefed about subject matter and found to be willing to participate in research, however photography during session was specifically denied. Discretion and secrecy were demanded by husband on rational grounds pertaining to family matters in a Hindu undivided family.

They were presented the grid in form of presentation plates used during survey. They were asked to go through selection process as followed in survey. The time taken by subject was minimal and immediately took liking to the article depicted in Fig.7.1. To eliminate possibility of a rash decision they were requested to still find alternatives. To the above request reaction from the spouse was that we are unnecessarily prolonging the session.

One of the experts used rendering techniques devised by author to create photorealistic rendering with the gemstones in place. Upon observation of photorealistic rendering of necklace, there came a request for matching ear pieces, and they too were created on same presentation plate for approval. Final approval was sought and an immediate request was made for on the spot costing by the spouse.

For purpose of estimation on the spot

- 1) A list of (various) numbers of gemstones was calculated for a form cluster, this multiplied by number of clusters gave total number.
- 2) Sizes of setting (*ghat* and gemstones) were measurable in the illustrator software as well as on grid as a result of systematic work. A telephone call was made to the studio of designers to seek prevailing rate of gemstones for purpose of estimation.
- 3) In consultation with author gold was estimated as one gram per gemstone setting, with an expectation of plus/ minus ten percent.
- 4) An estimate of labour was calculated by prevailing rates on per gram basis, estimated gold weight.

- 5) Time estimate was three weeks but owing to prevailing customs delivery is sought before *Deepawali*, specifically on the auspicious constellation of *Dhanteras*.
- 6) This prompt estimate was accepted after a few summary questions and a word of caution about discretion.
- 7) This exercise led to a business of rupees 6,50,000.00/- concluded in less than two hours. An advance of rupees 1,50,000.00/- was paid as advance same evening.



Fig.7.1. Articles made using grid approach, a photo realistic rendering for client's approval.



Fig.7.2. *Kundan* article made using the tool and the grid approach, neck piece.



Fig.7.3. *Kundan* article made using the tool and the grid approach, neck piece back side *minakari*.



Fig.7.4. *Kundan* article made using the tool and the grid approach, extended to bracelet.



Fig.7.5. *Kundan* article made using the tool and the grid approach, extended to ear pieces.

7.3. Snapshots and Documentation of Case Study

A few snaps were taken during use of testing grid for reflection as shown in Fig.7.6. and Fig.7.7. Further, *Kundan* expert is requested to take as many pictures during execution of work at every critical stage for reference.

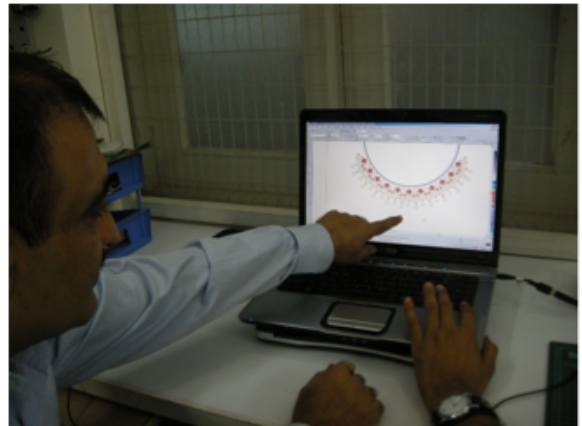
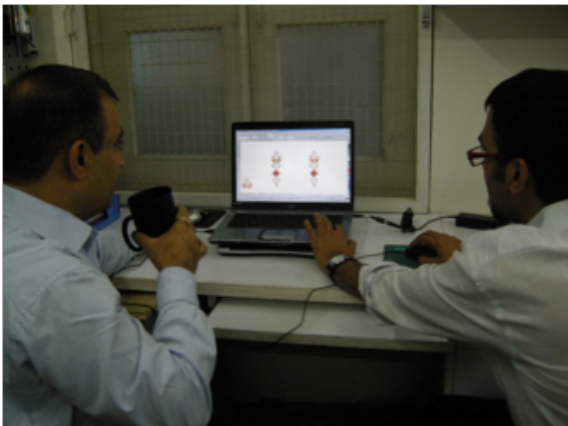


Fig.7.6. Articles being made using grid approach.



Fig.7.7. Articles estimation and costing.

7.4. Key Contribution

Key contributions are summarized in two parts primary and secondary,

7.4.1. Primary Contribution of Research

- 1) Identification of 99 smallest semantic units of *kundan* and their classifications in six categories for ease of study.
- 2) Visual material compilation and development of a method to study the same by converting photographs to vector art.
- 3) Classification into 5 major groups nomenclature.
- 4) Development of suitable methodology to categorize smallest semantic units and classify them in a manner based on scientific rational with justification.
- 5) Defining form clusters in a methodology with its various variables like cluster pitch, cluster diversity etc, well defined.
- 6) Using scientific principles and knowledge developed a standardized methodology for analysis of a jewellery articles.

Main contribution was towards the definition of various terms used in jewellery with justification and validation. That makes a mathematical interpretation possible. First time internationally a form based approach to jewellery is taken to develop a visual tool.

- 7) Model can be used for other types of jewellery world over in tight segment. Say for example diamond studded jewellery made for export to Christmas markets.
- 8) Creation of variations is possible effortlessly as a good repository of various designs, available for visual reference.

- 9) The model is validated and field-tested; it is scalable in 3 axis directions with adjustments for various parameters.
- 10) Assay sensitivity can be increased or decreased by taking a 7x7x7 or 9x9x9 any other unidirectional modification of model. To have insights more precisely between intervals, number of sectional plates can be increased.

7.4.2. Secondary Contribution of Research

- 1) Identification of *kundan* as an area of research by methodical tabulation of material available and finding it by negation.
- 2) Classification of literature on jewellery in different categories and listing out their individual contribution and keywords for search.
- 3) Compilation/review of visual material and number of articles on jewellery.
- 4) Development of a statistically validated methodology for such research.
- 5) Personal visit to different *Kundansaaz* and jewellers, situated at Ahmadabad, Bombay, Delhi, Jaipur, Bikaner, Indore, Ratlam and other key places and identifying useful sources and people for *kundan* that may prove useful for further research.
- 6) Identification of *Kundan* in presentation plates, historical paintings and photographs & old manuscripts (properly validated).
- 7) Illumination of the subject for jewellers as a whole where individuals were working on parts in a compartmentalized manner lacking a overview.
- 8) Defining the parameters of a form cluster, etc(Fig.7.8. to Fig.7.10).
- 9) Selection preference of various combination of what goes with what and can be adopted for various jewellery articles like bangles, etc proportionate sizes.

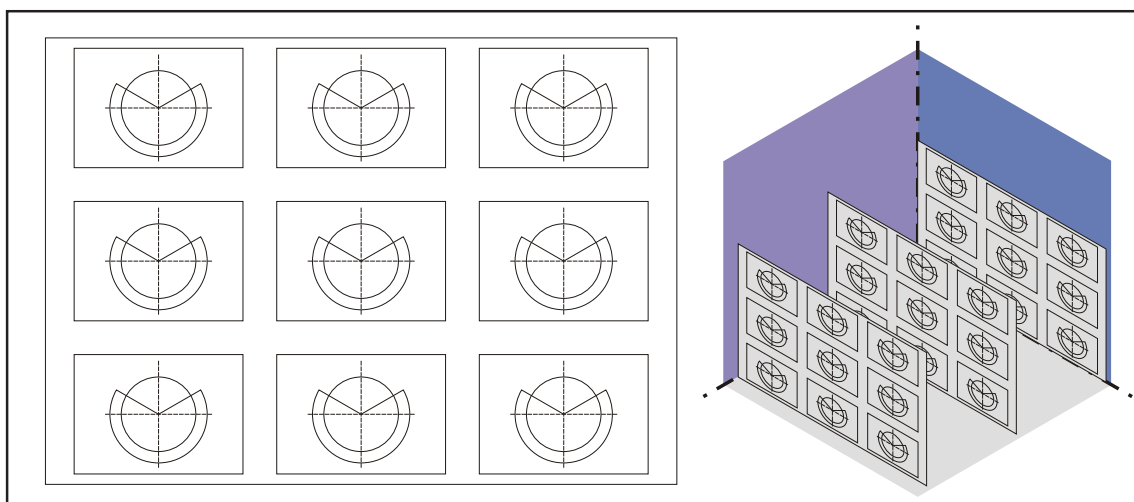


Fig.7.8 A less sensitive, more decisive version of tool.

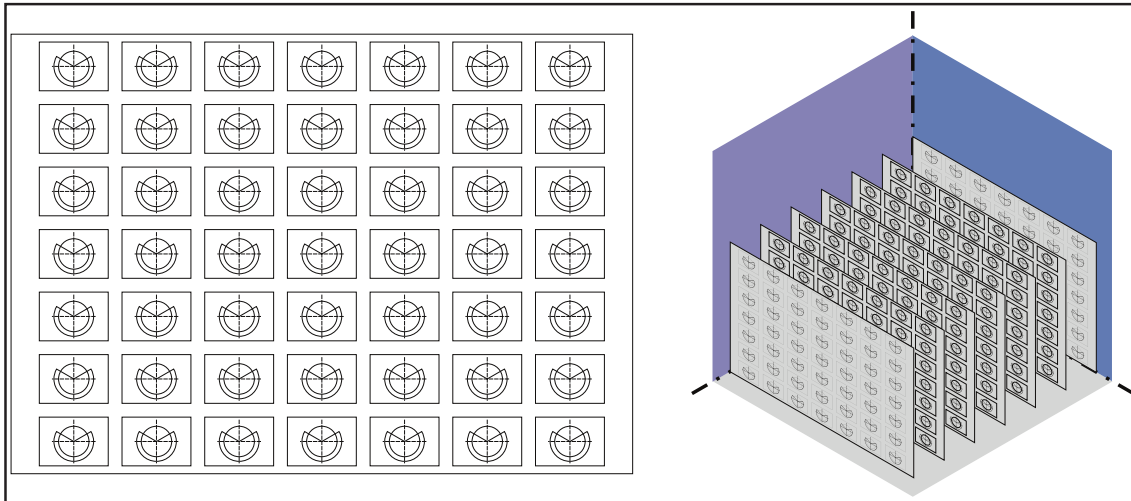


Fig.7.9 A more sensitive, more detailed version of tool.

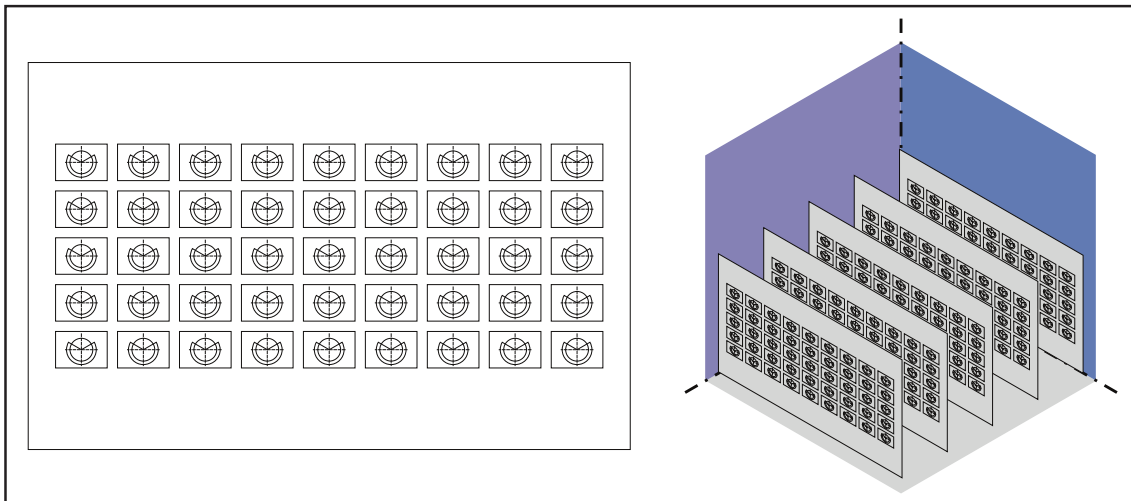


Fig.7.10 One dimensional increment for more sensitivity in investigation of cluster pitch more finely.

7.5. Implication of Work

The implication of work are separately discussed under two heads pertaining to client and designers. The tool can be used for both present and potential clients.

7.5.1. Managerial Implications for Clientele

- 1) Preferential assessment tool is based on compilations of use of several prospect customers (Working/ Non-working Female, Married/Unmarried Women, Social Status High/High Middle/Middle and Age Group) and it can give an immediate useful orientation to users.
- 2) Exposure to selective number of design with modal class identifications will help them to select appropriate design and incorporate desirable changes at design

stage eliminating expensive reworking before setting.

- 3) The design preference narrowing down through standard clustering and grid approach will help in devising manufacturing/ marketing strategy for specific audience.
- 4) Suitable discount and marketing strategies can be planned as the margins for reworking and iteration are expected to reduce, a portion of this saving can be passed on to clients.
- 5) Designers can focus on details, workout specifications and estimate on paper without waiting for gold structure to be ready.
- 6) Work, time and material estimates can be more precise as the grid provides a mathematical measurement of different variables as opposed to an approach of trial and error in practice now.

7.5.2. Managerial Implications for Designers

- 1) The study can provide a point of reference for jewellery design for groups already studied.
- 2) The jewellery designers may use the finding of this study as a foundation preferential assessment of jewellery design for different groups of specific potential clients. (eg. Non Resident Indian's have huge potential)



Fig.7.11. Mother Grid in use by designer, Source: Author

- 3) Jewellers and designers could observe (Fig.7.11.) and envisage to a certain degree,

preferences of articles, as well as trends in individual class, changes in fineness, dimension and cluster pitch to identify probable preferences of different categories of prospect clients. The test can be periodically (Fig.7.12) applied and a trend can be traced.

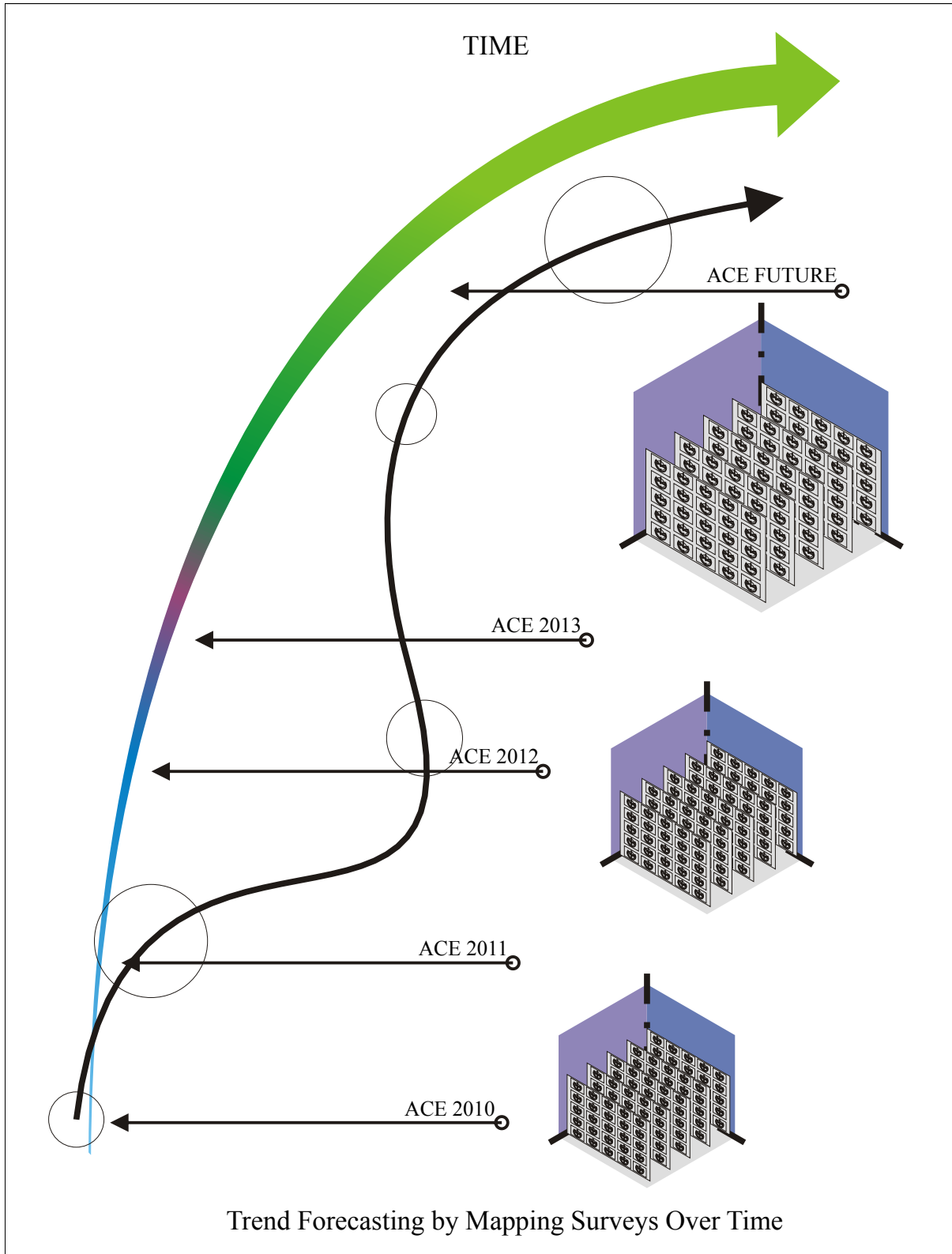


Fig.7.12. Trend forecasting by periodic application of the tool over years.

4) Design Implications of Research Example Fig.7.13.

The gemstones can be polished more precisely by giving contours to clusters, that is giving an optimal fit (*Ghat Shuddh*)

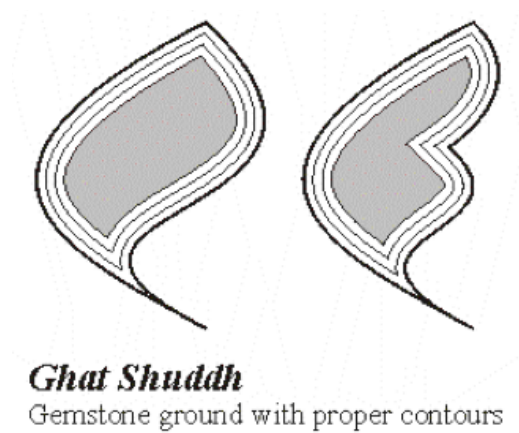


Fig.7.13. A contoured printout can be used as a underlay and control over grinding a gemstone.

- 5) The tool developed for study with students can be used as a media for making form clusters by clients to express their idea to the designer effectively. This is especially important for clients who have inputs to give but cannot draw effectively. Using the laser cut units they can assemble a basic form cluster of their choice for expressing ideas to designers (Fig.7.14.).



Fig.7.14. Form clusters created by clients to express their ideas to designers.

7.5.3. Academic Implications

A validated framework is now available for researchers to conduct further research in domain of jewellery.

The grid approach gave a unique direction to the way jewellery design and making functions. Following a methodical approach it is possible to work with precision and articulation in a domain that so far relied on intuition and gut feeling. With a repository of vector artworks of ninety nine units available, as a result of this research, it is possible to create a huge number of variations of form clusters. These can be presented in a form readily acceptable to the client before it goes to shop floor for fabrication.

The best advantage a soft copy allows is quick scaling up or down, functions like skew, rotate compounded with controlled distortion allows limitless possibilities. The numerous options it provides simply by the basic set being available to a designer are factorial ninety nine, a virtually inexhaustible number. Few *kundansaaz* as of now use all semantic units in their designs, often their hand can be recognized by use of select few units in their design. An access to large number of smallest semantic units in their designs will enrich their design pool by providing larger possibilities of designs being available at same place.

It is possible, now to modify each smallest semantic unit, at the level of nodes and splines to achieve a very specific shape with precision and smoothing of curves. This can lead to a higher level of craftsmanship evolving at shop floors in domain of jewellery, due to mechanical precision of drawings.

New forms can be created by modifying the semantic units in such a way that retains essence, still a new interpretation or edge detail can open up new formal possibilities. This can be applied to polygonal as well as floral forms, as a whole or to specific parts thereof. A new language of ‘modern *Kundan*’ can be created by defining a particular modification to be applied on a particular edge or formal aspect. This is expected to open new interpretations of form that follow same visual language of a traditional jewellery style.

Possibilities of formal exploration by client increases phenomenally, as following a grid approach it is very easy to change, modify, adopt, mix and match diverse form clusters readily available. It also allows new form clusters to be created specifically desired by client, by using

any and all semantic units documented. Since it can be done with client present, with precision control of various aspects like cluster size, cluster pitch etc. Satisfaction is guaranteed. A whole new experience of client being a part of design team can be easily achieved. Clients can have a heightened sense of ownership as a result of their participation in selection of semantic units, form clusters and thereafter an article.

7.6. Limitations

Although all possible efforts were taken, still the form clusters used in study are made of a few select. The domain of jewellery is so far and wide that at best this can be called a modest beginning of methodical research.

The sheer numbers of combinations with 99 semantic units identified so far is factorial 99, which itself is a number beyond comprehension. However, this model can be adopted for other combinations as and when desired as it is scalable in various dimensions.

The simple size of subjects taken for the research, though substantial and justifiable, has limited valid responses. These rapidly taper down as selection progresses from initial to final selection. However, fewer numbers of responses give a sharp and decisive pronouncement.

The effect of colour stones is not contained in the scope of present study and presents a good opportunity for future research

7.7. Scope for Future Work

The following Table.7.1 articulates few key features used by domain experts to explain some features of form in their own language, as it is used on shop floor. For example the word *Ghat Shuddha* refers to a certain level of ease of manufacturing and therefore preferred.

Similarly word *Salai* refers to availability of a specially formed mandrel for making that particular form. This is an indicator to that particular form being popular and therefore a tool is made to make that form quickly, easily and effectively.

A list of such potential areas that can open portals of information in domain of jewellery are listed to act as lead for future research.

Table.7.1. Explanation and Elaboration

Sr. No.	Design Number	<i>Gothavani</i>	Overall design	Ease of Manufacturing	Adjective
Subjects' selection					
1	7.5.2	<i>Bharawdaar</i>	<i>Autha</i>	<i>Ghat Shuddha</i>	<i>Vikiran</i>
2	7.4.3	<i>Bharawdaar/jali</i>	<i>Saral/size</i>	<i>Salai/ dandi</i>	<i>Vikiran</i>
3	7.4.4	<i>Bharawdaar/jali</i>	<i>Saral</i>	<i>Salai/ dandi</i>	<i>Vikiran</i>
4	11.2.2	<i>Bharawdaar/Bhari</i>	<i>Autha/Duposta</i>	<i>Jameen takkar/ Jali/ Salai</i>	<i>Vikiran/ Gokhrugolai</i>
5	11.3.1	<i>Khula/ Khila Big size</i>	<i>Autha/Duposta</i>	<i>Jameen takkar/Jali/ Salai</i>	<i>Gokhrugolai</i>
6	11.3.2	<i>Khula/ Khila</i>	<i>Autha/Duposta</i>	<i>Jameen takkar/Jali/ Salai</i>	<i>Gokhrugolai</i>
7	11.4.3	<i>Khula/ Khila</i>	<i>Autha/Duposta</i>	<i>Jali/ Salai/Dandi</i>	<i>Aandar Teekhi Gokhrugolai</i>
8	11.4.4	<i>Khula/ Khila</i>	<i>Autha/Duposta</i>	<i>Jali/ Salai/Dandi</i>	<i>Aandar Teekhi Gokhrugolai</i>
9	7.5.1	<i>Bharawdaar</i>	<i>Autha</i>	<i>Ghat Shuddha</i>	<i>Vikiran</i>
10	9.4.4	<i>Bharawdaar Small size</i>	<i>Autha</i>	<i>Ghat Shuddha/Salai</i>	<i>Vikiran</i>
Kundansaaz choice					
11	9.4.5	<i>Khula/ Khila</i>	<i>Navratan pattern</i>	<i>Ghat Shuddha/Salai</i>	<i>Vikiran</i>
12	9.1.5	<i>Khula/ Khila</i>	<i>Navratan pattern</i>	<i>Ghat Shuddha/Salai</i>	<i>Vikiran</i>
13	7.5.3	<i>Bharawdaar</i>	Size gemstones	<i>Ghat Shuddha/Salai</i>	Traditional <i>Golai</i>
14	5.2.4	<i>Khula/ Khila Big size</i>	<i>Autha</i>	<i>Jali/ Salai/Dandi</i>	Traditional <i>Golai</i> Outside
15	11.1.5	<i>Bharawdaar/Cheed Utaar</i>	Peacock pattern	<i>Ghat Shuddha/Salai</i>	Design spreading out

1) Explanation and Elaboration

- ***Ghat Shuddha***- is used to describe the semantic units and their combination that are used in that particular form cluster and have following attributes,
 1. Forms that have triplets (*salai*) available as ready tools.
 2. Making these in desired quantity is commercially feasible.
 3. Making is technically possible, technique is tested.
 4. Forms follow simple geometry, typically polygons and conics.
- ***Autha***- is used to describe a form that presents possibilities of other forms within that form to cover the surface area presented.
- ***Duposta*** (double or double fold) - works that have a contour within the form to effectively control size of gemstone and allow a surface for embellishment.
- ***Vikiran***- Overall form appears radiating out as sun rays depicted in general illustrations.

- ***Gokhru***- This is a general curvilinear outline of the neck piece that is shaped like a sprocket visually. It may have several projections radiating out as well as inside.
 - ***Jameen Takkar***- Designs of stones creating a background.
 - ***Cheed Utaar***- Size differentials creating undulations.
- 2) Illustration of selected design on half page approximately half size on mother grid.
- 3) Its technical specifications (Fig.7.15) in form of number of semantic units with names, their specifications/ application, number of clusters, cluster pitch, tabulated in left column.

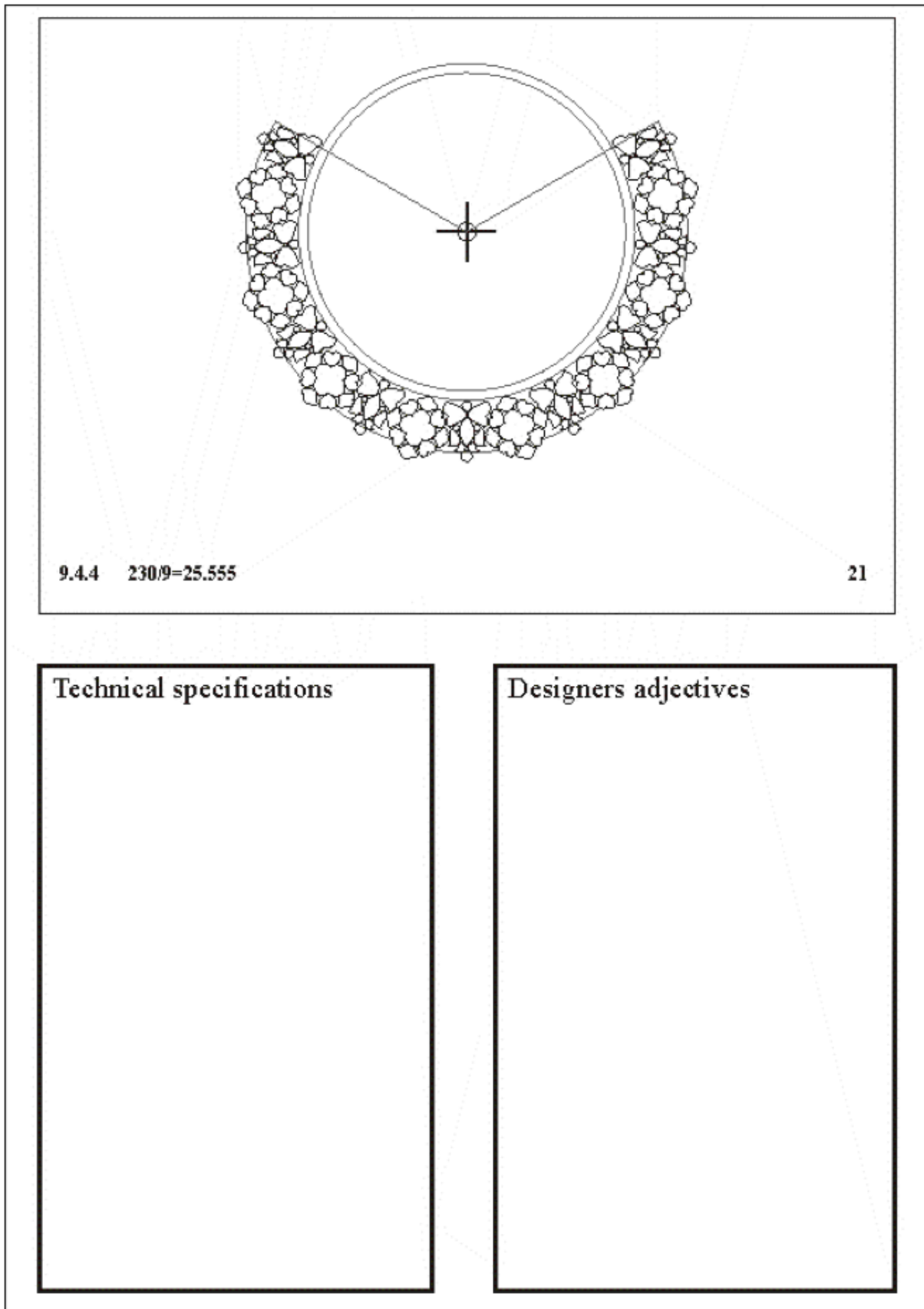


Fig.7.15. Structure of Proposed design source book

- 4) Designers inputs as adjectives/ descriptive words – *Gokhru golai, vikiran, bharawdaar* etc.
- 5) A web based design tool can be created to make preferred design.

7.8. Future Directions

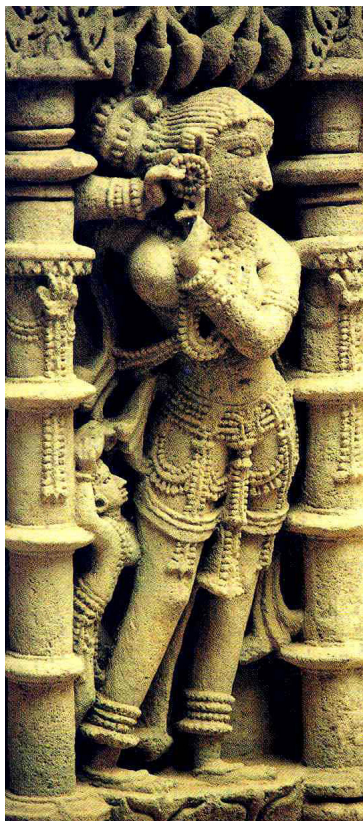
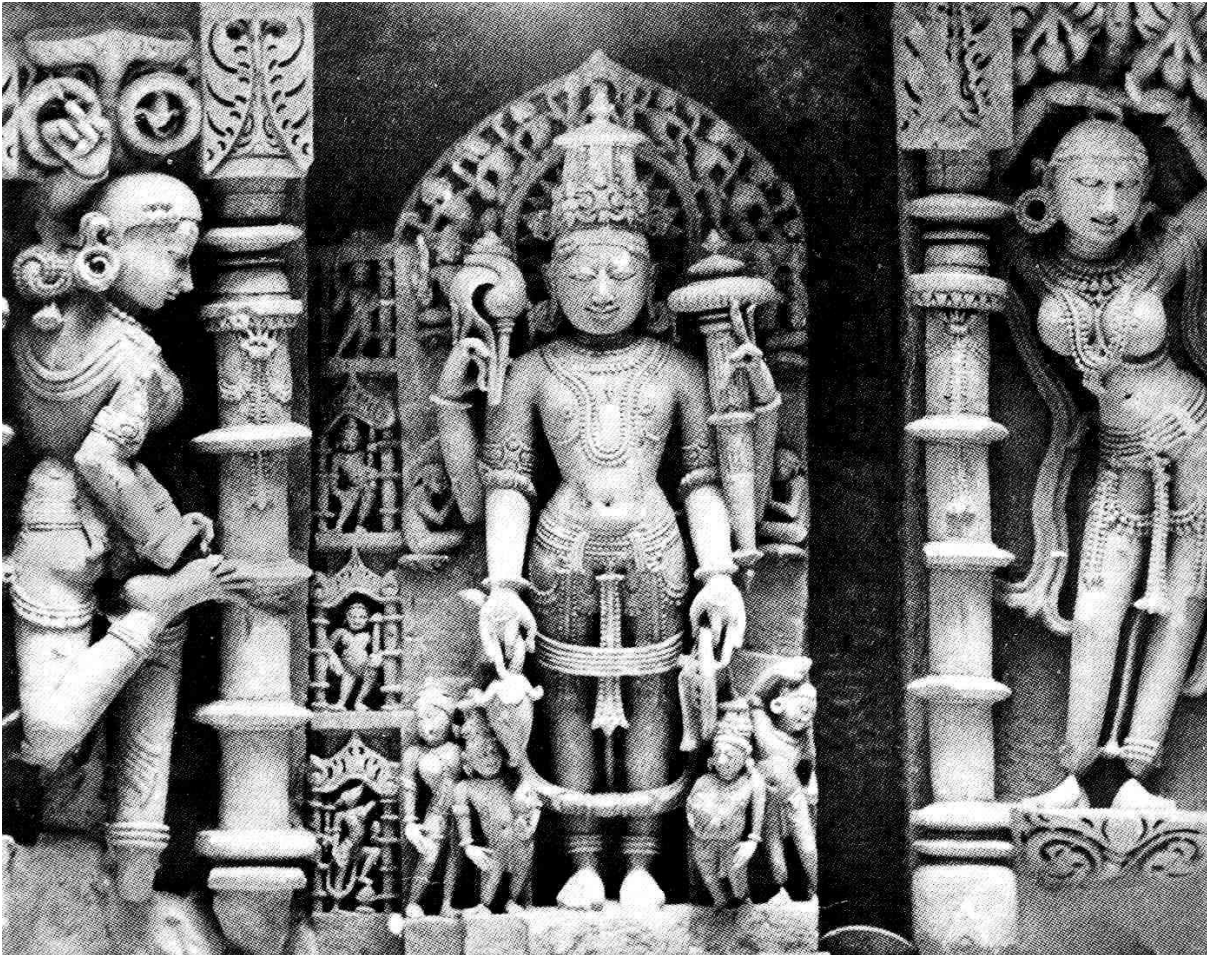
- 1) The study can also be administered, periodically, to observe transformation in *Kundan* jewellery designing trends.
- 2) The jewellery design templates can be used periodically to measure the preferential assessments of prospect clients by altering key parameters.
- 3) The grid can be modified in specific regions and is scalable in its construct.
- 4) The testing grid can be used to compare/measure/monitor jewellery designs or different *kundansaaz* working in same vicinity.
- 5) This proposed methodology can be used as a tool of benchmarking and help in formulating right policy for subsequent improvements.
- 6) The directions received from this study may help the organizations/jewellers /*kundansaaz* to focus on the right type of preferential decisions which can effectively and efficiently provide profitability to all stakeholders.

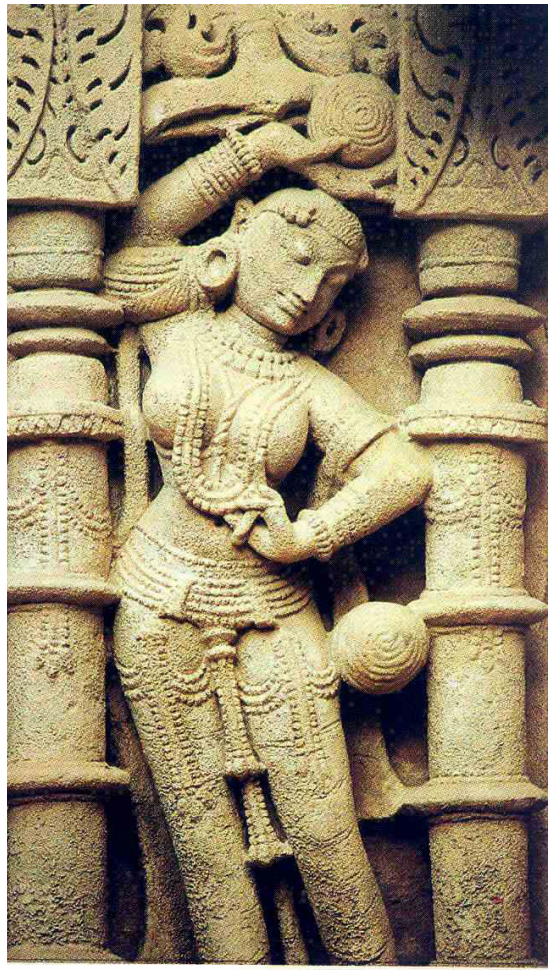
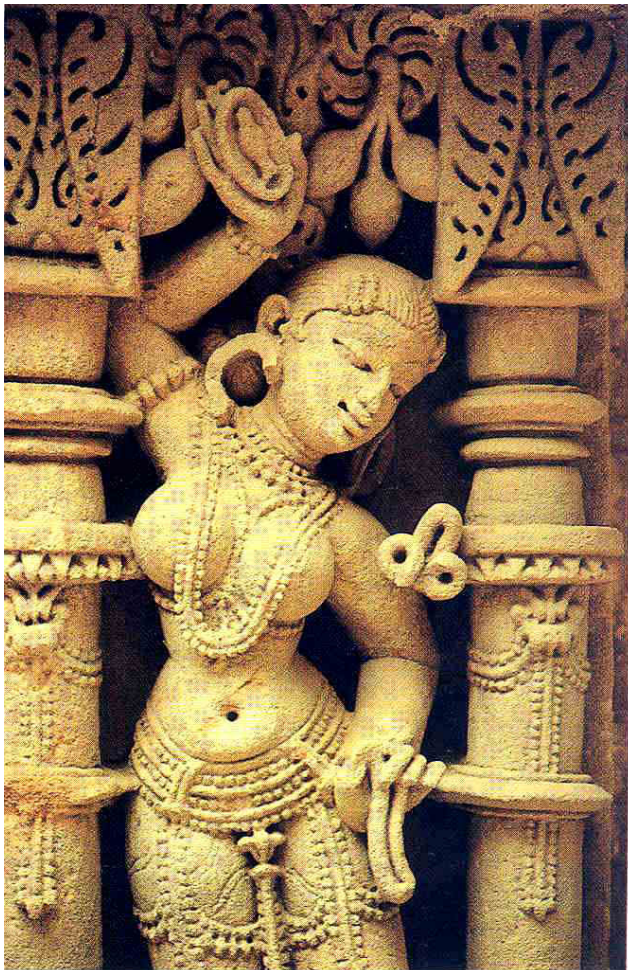
Appendix I

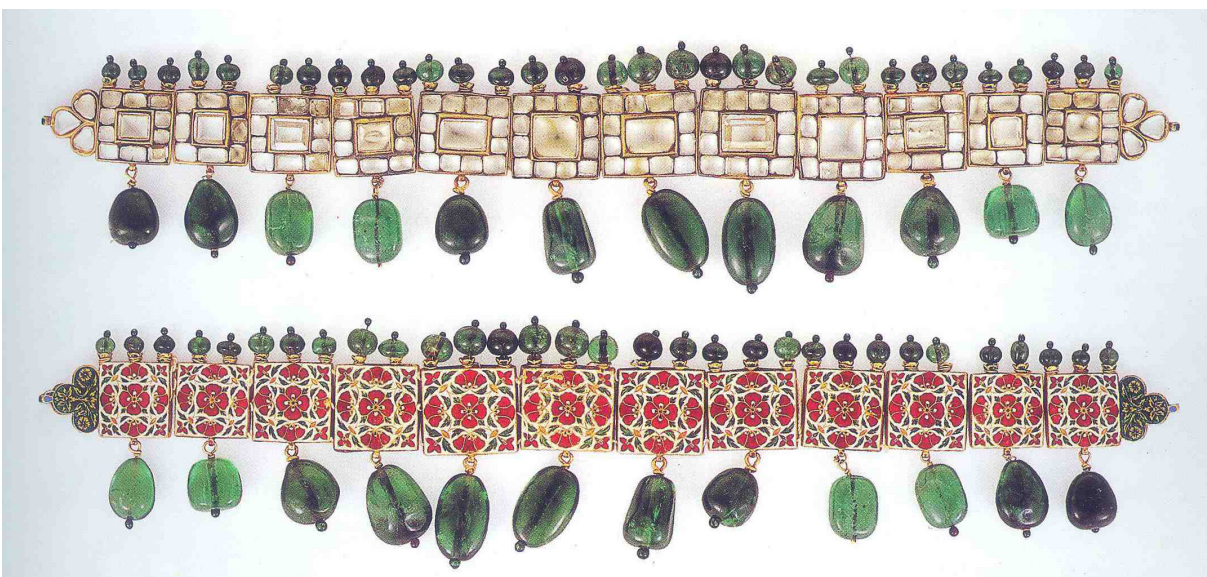
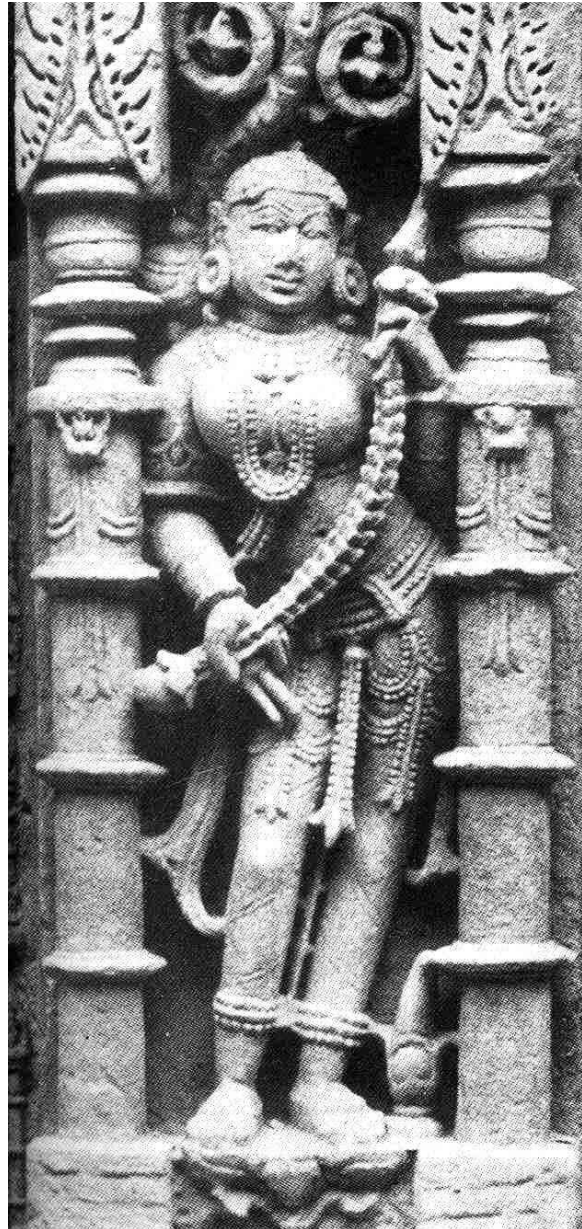
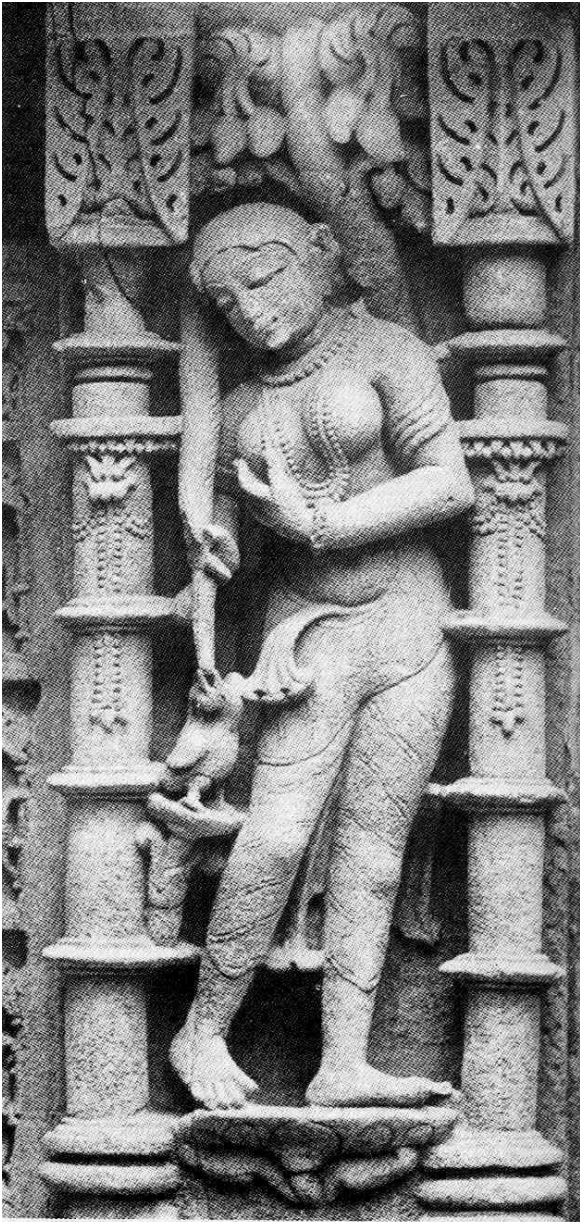
The images and photographs in this appendix were used in initial stages of this study for visual research. Ancient jewellery forms were studied to get an insight into subject matter.

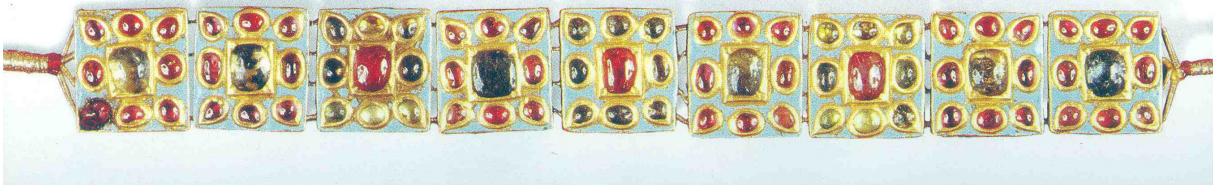
With research domain focus coming to *Kundan* jewellery, the relevant images were studied. This part has various articles ranging from *Sarpench*, *Kanthis*, and allied neck pieces. They are kept in this document for they formed an important part of initial exploratory phases.

Images are taken from books the Dance of the Peacock, The Jewels of the *Nizam* and hand crafted Indian enamelled jewellery. Some are from author's collection of images.

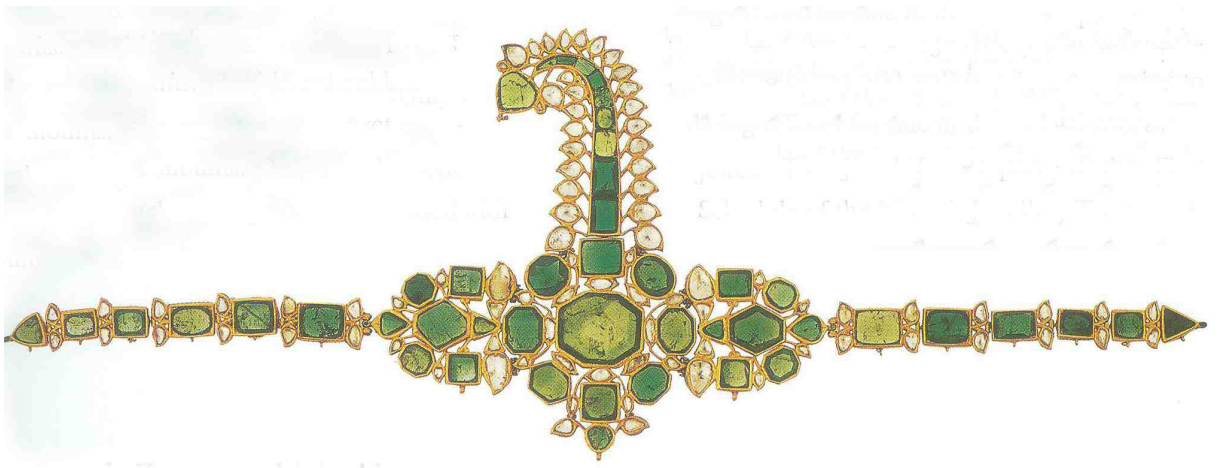
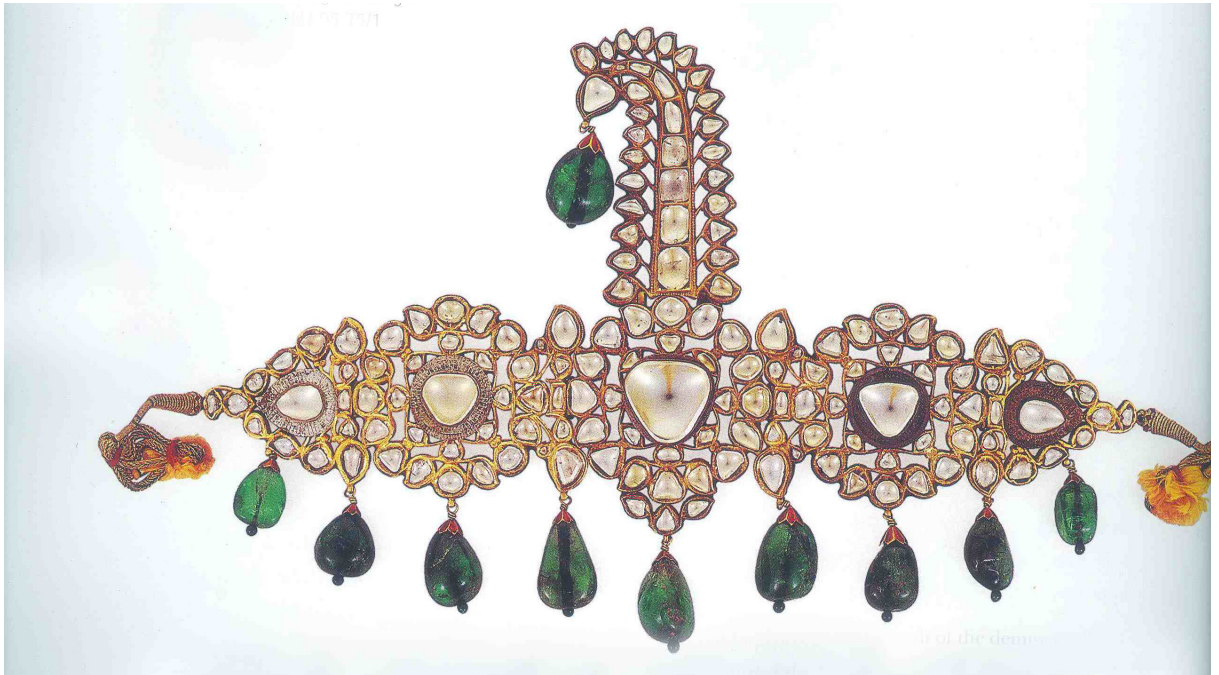


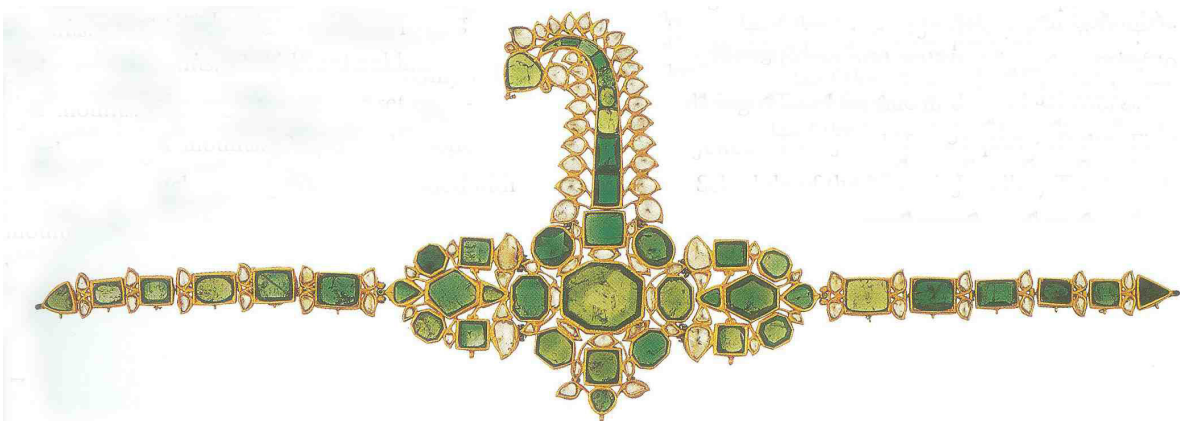






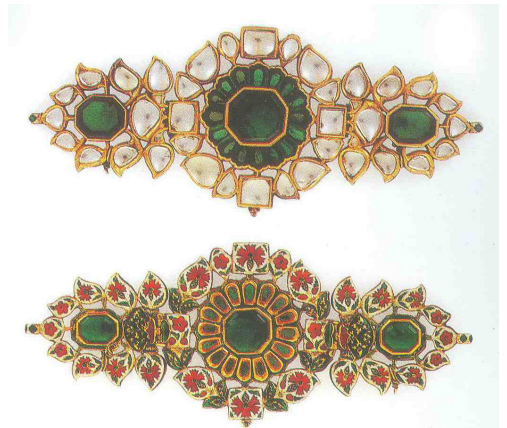








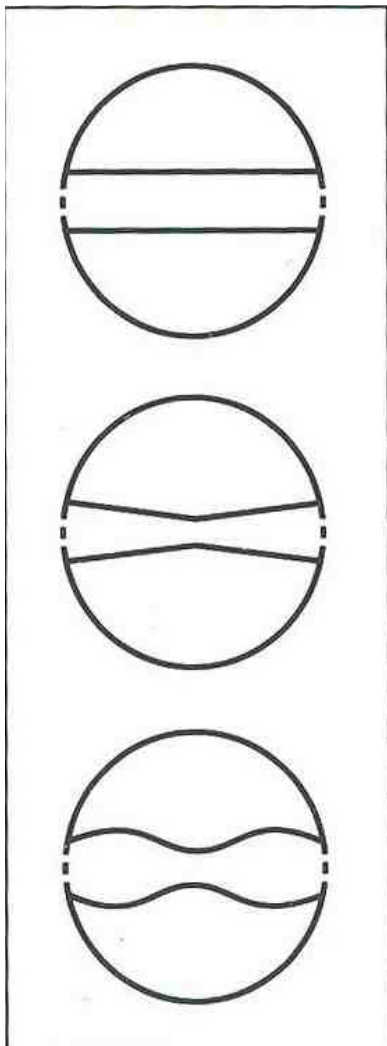
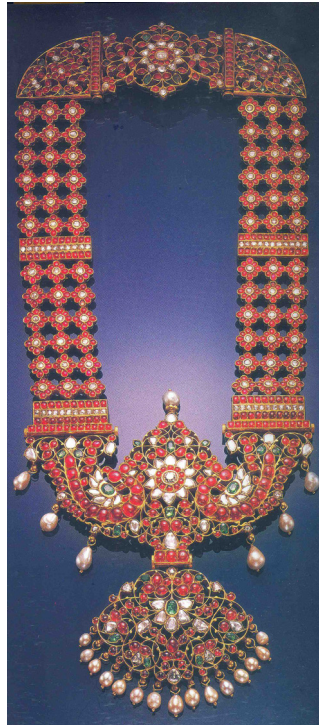


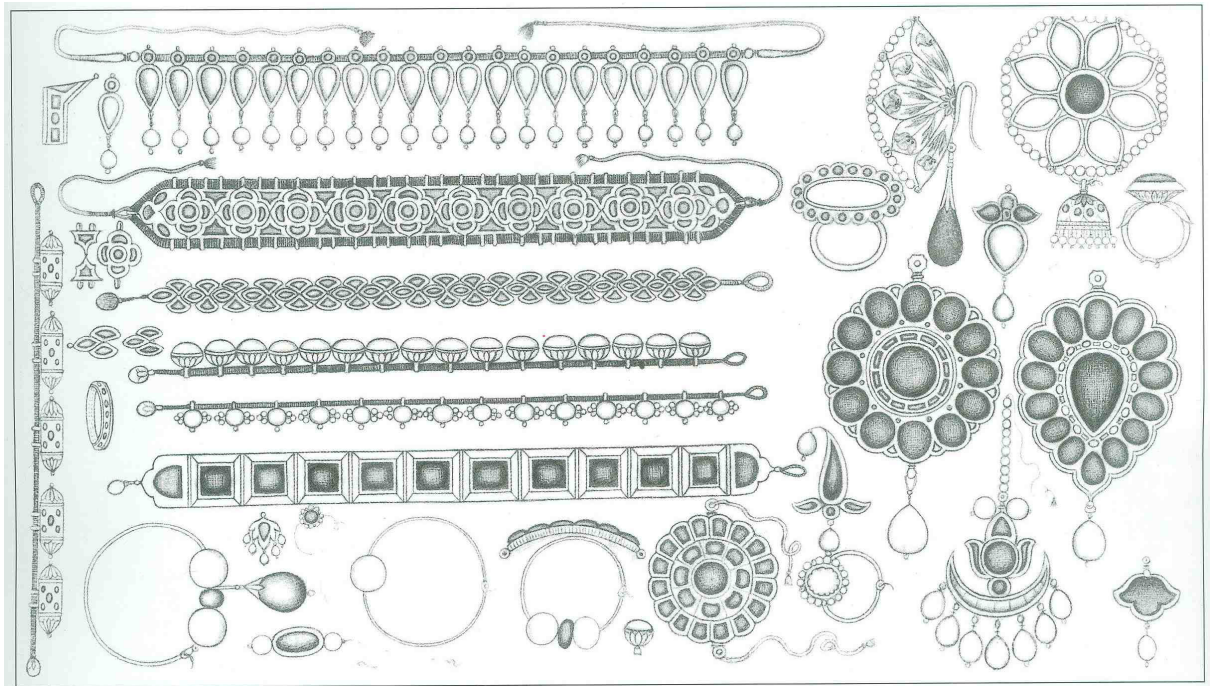
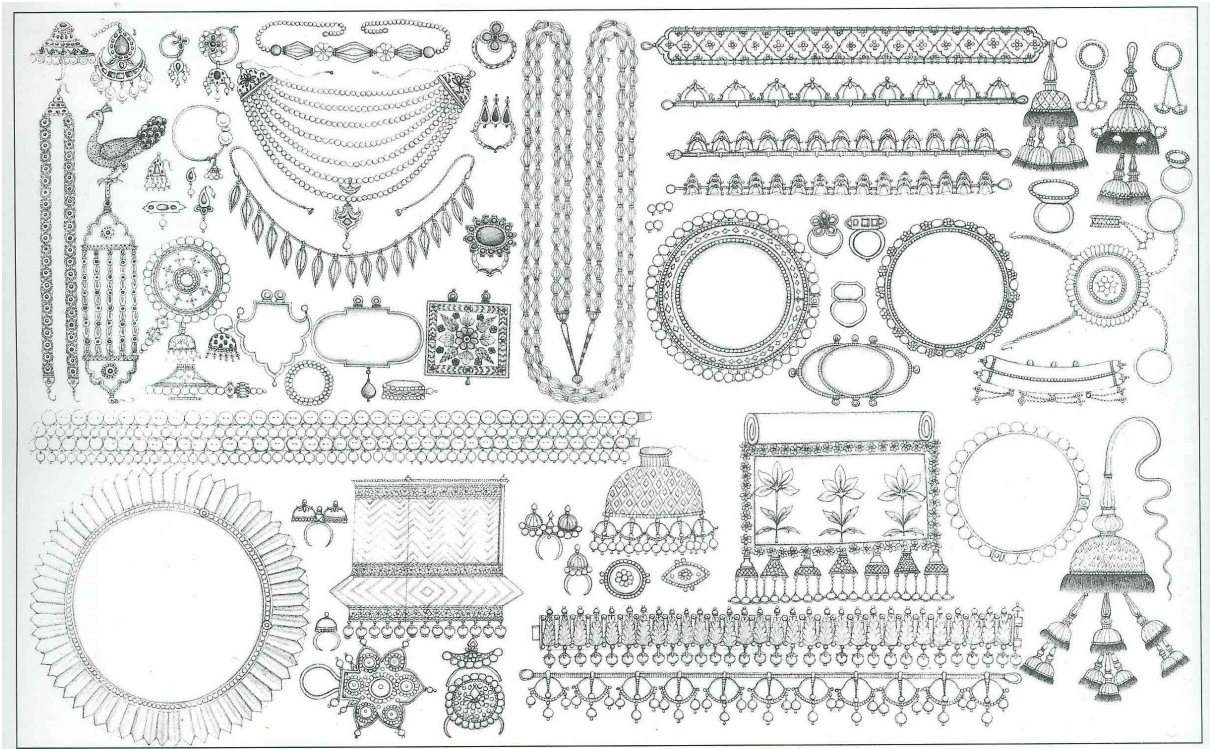


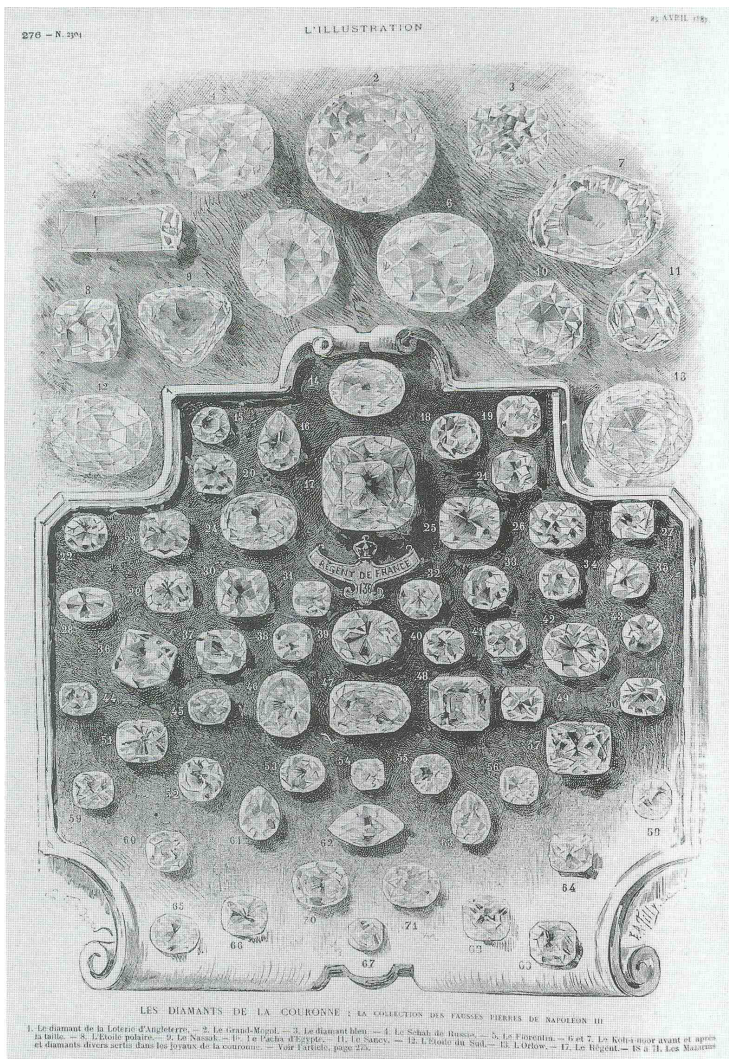
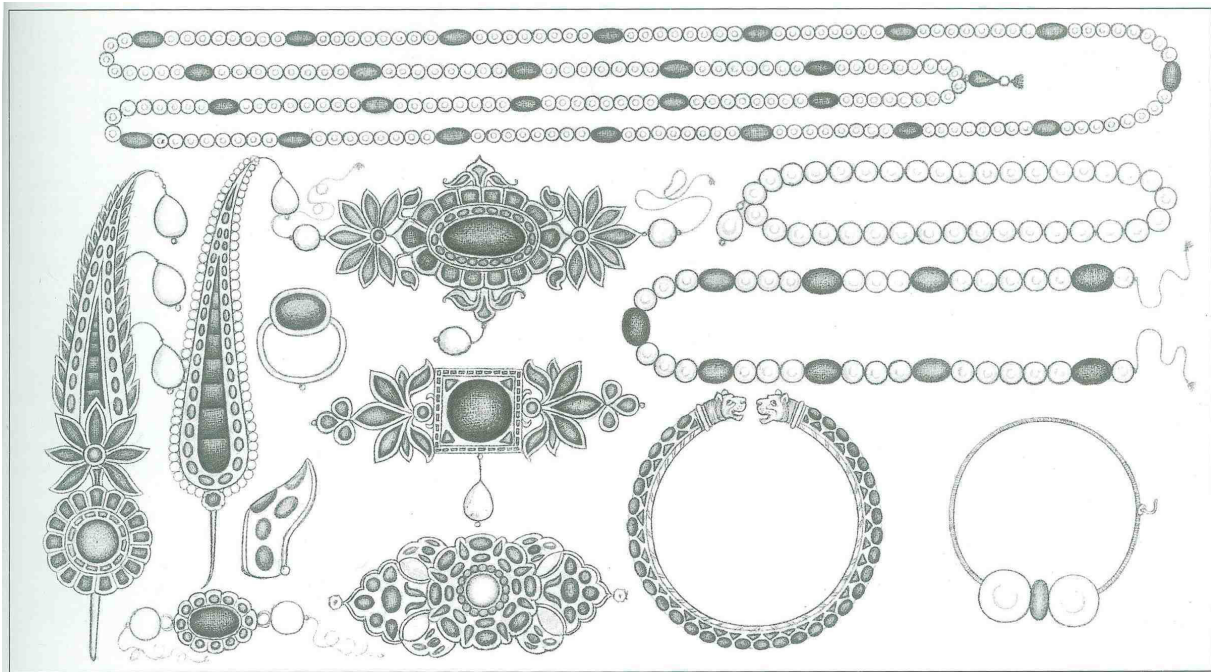


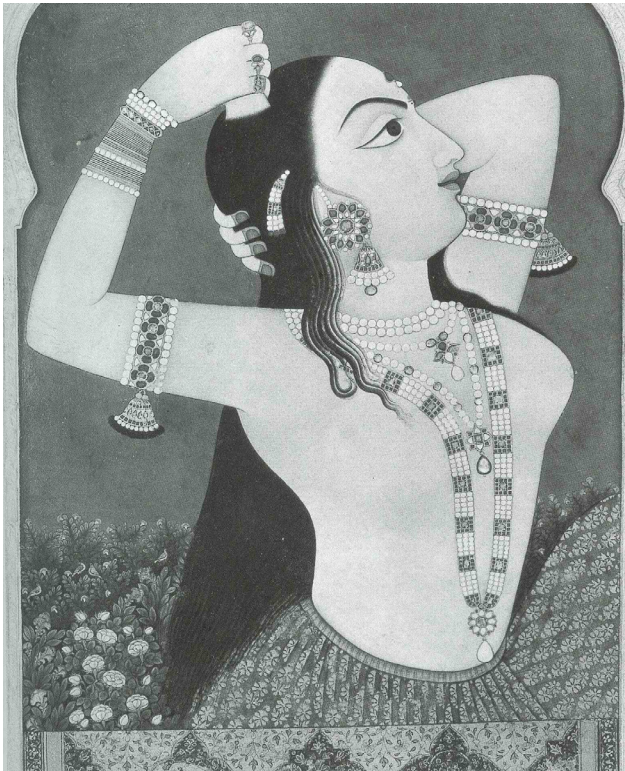


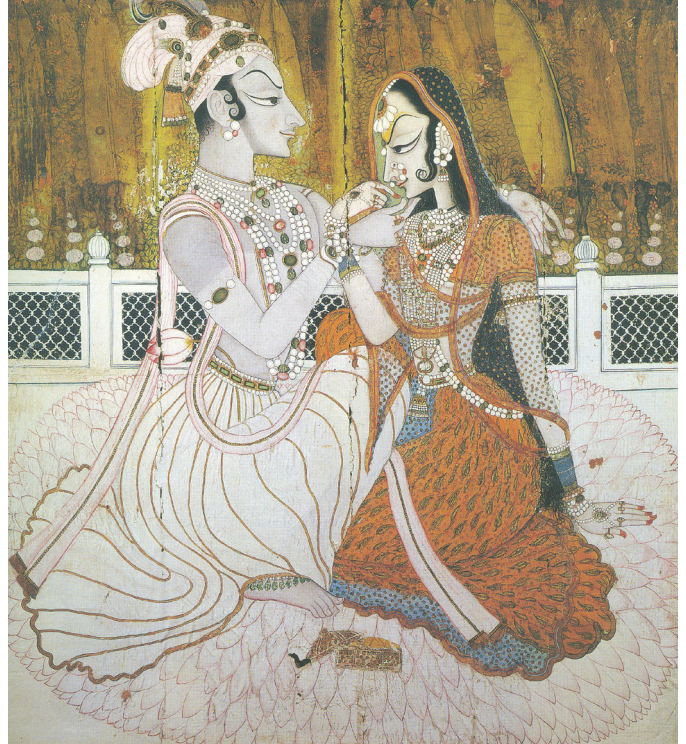














Kindly find below the summary of provisional figures of Export of gems & jewellery items during April-November 11 as compared to same period last year.

Annex I

NET EXPORTS OF GEMS & JEWELLERY

ITEMS	April-November '11		April-November '10		% Growth / decline	
	(Provisional)		(Same ports as current year)		over previous Year	
	Rs. In Crores	US \$ in Million	Rs. In Crores	US \$ in Million	Rs.	US \$
Cut & Pol Diamonds (Quantity in Lakh Carats)	75971.03 374.78	16447.95	75192.70 405.90	16426.16	1.04	0.13
Gold Jewellery - D. T. A.	7146.56	1538.42	6090.95	1335.41	17.33	15.20
SEZ / EPZ (included Gold Jewellery & Gold Medallions and coins)	43281.39	9276.09	28704.22	6283.93	50.78	47.62
Total	50427.95	10814.51	34795.18	7619.34	44.93	41.93
Coloured Gemstones	1006.89	216.39	815.26	177.76	23.51	21.73
Silver Jewellery	2115.35	452.54	1532.86	336.13	38	34.63
Others *	90.04	19.44	46.43	10.17	93.92	91.15
Net Exports	129611.26	27950.83	112382.43	24569.56	15.33	13.76
Exports of Rgh-Diam (Quantity in Lakh Carats)	5293.37 217.44	1138.49	2907.19 205.21	635.33	82.08	79.20
Others	311.41	65.65	152.38	33.06		
Total Exports	135216.05	29154.97	115442.00	25237.95	17.13	15.52

- 1) * Data of Cut & Pol Diamonds include export of CPD (Bonded W.H) also. (As per RBI average exchange rate)
2. Figures in bracket shows quantity in lakh carats.
3. Figures for April - November 2011 are provisional and subject to revision.
- I) Data for November 2011 does not include figures from Cochin Air Cargo & Mumbai FPO
4. Above figures does not include data for Costume/ Fashion Jewellery, and Sales to foreign tourists.

NET EXPORTS OF GEMS & JEWELLERY

ITEMS	April-December- 09		April-December- 08		% Growth / decline	
	(Provisional)		(Same ports as current year)		over previous Year	
	Rs. In Crores	US \$ in Million	Rs. In Crores	US \$ in Million	Rs.	US \$
Cut & Pol Diamonds *	57759.03	12063.94	50948.19	11535.89	13.37	4.58
(Quantity in Lakh Carats)	411.75		349.61		17.77	
Gold Jewellery - D. T. A.	7148.01	1492.70	6238.67	1402.33	14.58	6.44
SEZ / EPZ	24356.91	5077.61	23338.22	5194.26	4.36	-2.25
Total	31504.92	6570.31	29576.89	6596.59	6.52	-0.40
Coloured Gemstones	979.98	204.19	842.71	190.44	16.29	7.22
Others	1139.77	238.81	811.29	182.65	40.49	30.75
Net Exports	91383.71	19077.25	82179.07	18505.57	11.20	3.09
Exports of Rough Diamonds (Quantity in Lakh Carats)	2515.97 157.09	524.68	2715.43 249.05	615.28	-7.35	-14.73
Total Exports	93899.68	19601.93	84894.50	19120.85	10.61	2.52

NOTE :-

Exchange rate 1 US\$

46.63 Dec. 2009

48.64 Dec. 2008

- 1) * Data of Cut & Pol Diamonds include export of CPD (Bonded W.H) also. (As per RBI average exchange rate)
2. i) Data for November & December 2009 does not include figures from Chennai MEPZ & FPO, Cochin SEZ and data from Hyderabad for December 2009
- ii) Data for April to December 2009 does not include figures from Vizakhapatnam SEZ.
3. Above figures does not include data for Costume/ Fashion Jewellery, and Sales to foreign tourists.

Kindly find below the summary of provisional figures of Export of gems & jewellery items during April 08-March 09 as compared to same period last year.

Annex I

NET EXPORTS OF GEMS & JEWELLERY

ITEMS	April 08-Mar 09		April 07 -Mar 08		% Growth / decline	
	(Provisional)		(Same ports as current year)		over previous Year	
	Rs. In Crores	US \$ in Million	Rs. In Crores	US \$ in Million	Rs.	US \$
Cut & Pol Diamonds *	58649.45	13024.53	57117.17	14194.13	2.68	-8.24
(Quantity in Lakh Carats)	402.05		430.70			
Gold Jewellery - D. T. A.	9406.49	2088.94	11637.12	2891.93	-19.17	-27.77
SEZ / EPZ	21469.99	4767.93	10678.57	2653.72	101.06	79.67
Total	30876.48	6856.87	22315.70	5545.65	38.36	23.64
Coloured Gemstones	1197.55	265.95	1111.05	276.11	7.79	-3.68
Others	894.05	198.54	941.24	233.90	-5.01	-15.12
Net Exports	91617.53	20345.89	81485.16	20249.79	12.43	0.47
Exports of Rough Diamonds	3474.93	771.69	2280.32	566.68	52.39	36.18
(Quantity in Lakh Carats)	306.36		287.01		6.74	
Total Exports	95092.46	21117.58	83765.48	20816.47	13.52	1.45

NOTE :-

Exchange Rate

1) * Data of Cut & Pol Diamonds include export of CPD (Bonded W.H) also.

Apr 08-Mar 09 1 US\$ = Rs. 45.03

2. Figures for April 08 / March '2009 are provisional and subject to revision.

Apr 07-Mar 08 1 US\$ = Rs. 40.24

1) Data from Chennai MEPZ has not been received March 2009

3. Above figures for 2008-09 include data for Costume/ Fashion Jewellery, and Sales to foreign tourists, as the information is awaited from members..

NET EXPORTS OF GEMS & JEWELLERY

ITEMS	January-December- 08		January-December- 07		% Growth / decline	
	(Provisional)		(Same ports as current year)		over previous Year	
	Rs. In Crores	US \$ in Million	Rs. In Crores	US \$ in Million	Rs.	US \$
Cut & Pol Diamonds *	61579.16	14496.04	54819.31	13231.79	12.33	9.55
(Quantity in Lakh Carats)	426.62		411.17		3.76	
Gold Jewellery - D. T. A.	17348.51	4083.92	18510.54	4467.91	-6.28	-8.59
SEZ/ EPZ	5586.14	1315.01	4044.08	976.12	38.13	34.72
Total	22934.66	5398.93	22554.62	5444.03	1.68	-0.83
Coloured Gemstones	1256.54	295.80	1109.96	267.91	13.21	10.41
Others	923.97	217.50	912.39	220.23	1.27	-1.24
Net Exports	86694.32	20408.27	79396.28	19163.96	9.19	6.49
Exports of Rough Diamonds	3363.62	791.81	2377.41	573.84	41.48	37.98
(Quantity in Lakh Carats)	349.64		282.60		23.72	
Total Exports	90057.94	21200.08	81773.70	19737.80	10.13	7.41

NOTE :-

Exchange Rate

1) * Data of Cut & Pol Diamonds include export of CPD (Bonded W.H) also.

Jan-Dec 2008 1 US\$ = Rs. 42.48

2. Figures for January / December '2008 are provisional and subject to revision.

Jan-Dec 2007 1 US\$ = Rs. 41.43

3. Above figures does not include data for Costume/ Fashion Jewellery, and Sales to foreign tourists.

Appendix II

Following table summarizes various articles, papers and material available according to the title, author and year of publication. For ease of understanding and help in future research it elucidates their contribution and keywords.

Sr. No.	Title of paper/article	Author	Year	Contribution	Keywords
Alloy and Gold Material					
1	Heat Treatment of Gold Alloys, The Mechanism of Disorder-Order Hardening	J C Chaston Johnson Matthey & Co. Limited, London	1971	The article deals with the properties of certain gold alloys which can be modified to give hardness and mechanical strength.	Work Hardening, Mechanical Properties, Heat Treatment
2	Gold-Copper-Zinc Alloys with Shape Memory	G B Brook & R F Iles Fulmer Research Institute, Stoke Poges, England	1975	Shape-memory occurs in a wide range of compositions in which there is flexibility to optimize other important properties such as hot workability, mechanical strength and ductility.	Shape Memory Property, Composition, Mechanical Properties

Sr. No.	Title of paper/ article	Author	Year	Contribution	Keywords
3	The Alloying Behavior of Gold	Professor G V Raynor Department of Physical Metallurgy and Science of Materials, University, University of Birmingham, England	1976	The formation of solid structure and the factors affecting the formation of compound of gold with other metals are discussed.	Alloy Characteristic, Solid Formation in Gold
4	Improvement of 18 Carat White Gold Alloys	Grahame P O'Connor Bnf Metals Technology Centre, Wantage, England	1978	The article reviews the details of one line of approach which resulted in an interesting 18 carat alloy.	White Gold Alloys, Mechanism, Decorative
5	Surface Enrichment in Alloys Techniques, Theory and Practical Implications	Robert Bouwman Koninklijke/ Shell-Laboratorium, Amsterdam, Netherland	1979	The segregation of one component of an alloy solid solution at its surface is studied.	Bond-Breaking Theory, Lattice Strain Theory, Practical Implication, Decoration
6	The Color Characteristics of Gold Alloys	Errol F I Roberts & Keith M Clarke Department of Metallurgy & Materials, City of London Polytechnic, London	1979	The article describes the systematic determination of the color of alloys in the gold-silver-copper system.	Aesthetics, Color, Metallurgy of Ternary System
7	An Improved 9 Carat Yellow Gold Casting Alloy	Richard S Jackson Department of Metallurgy & Materials, The University of Aston in Birmingham, England	1979	Article deals with the new processes to be adapted to existing materials or should new materials be developed in order to take full advantage.	Gold Casting, Physical Aesthetics, Mechanical Properties
8	Deformation & Recrystallization of a Jewellery White Gold Alloy	Mario Rosa Pinasco & Enrica Stagno Laboratorio di Metallurgia e Metallografia, Università degli Studi di Genova, Genoa in association with Gori & Zucci, S.p.A., Arezzo, Italy	1979	The article shows how basic metallurgical principles may be applied for a specific alloy which will yield structures suitable for cold-working.	Metallurgical Principle, White Gold, Cold-Working

Sr. No.	Title of paper/ article	Author	Year	Contribution	Keywords
9	18 Carat White Gold Jewellery Alloys Some Aspects of Their Metallurgy	Christian P Susz & Michel H Linker, U.G.D.O. – Usine Genevoise de Degrossissage d'Or, Geneva, Switzerland	1980	The article illustrates the practical advantages of considering both nickel and palladium white gold's as based on the gold-silver-palladium system.	Metal-lurgical Properties, White Gold Jewellery, Color
10	The Abrasive Wear of Gold Jewellery Alloys	H Heidsiek & M Clasing Degussa AG., Metals Research Department, Hanau, Federal Republic of Germany	1983	The article deals with the damage of jewellery which leads to frequent cause of premature repair or replacement.	Mechanisms of Wear, Metal-lurgical Treatment, Abrasive Wear
11	Surface Enrichment of Low Gold Alloys	Gunnar Hultquist Department of Physical Chemistry, The Royal Institute of Technology, Stockholm, Sweden	1985	The article deals with the aesthetic enhancement of inferior carat gold.	Decoration, Low Gold Alloys, Aesthetics
12	The Metallurgy of The Coloured Carat Gold Alloys	William S Rapson	1990	Article discusses the new alloys with special reference to its potential for use by goldsmiths and manufacturers.	Color, Carat Gold Alloys, Physical Properties, Metallurgical Properties
13	Gold Alloy Data		1991	The data sheet in this article is intended as a supplement to the valuable information about carat gold alloys.	Carat Gold Alloy, Age Hardening, Work Hardening
14	White Golds: A Review of Commercial Material Characteristics & Alloy Design Alternatives	Greg Normandeau Imperial Smelting & Refining Co. of Canada Ltd., Markham, Ontario, Canada	1992	The article reviews the status of white gold alloy technology today and the efforts that have been made to improve the properties of these materials.	White Gold Alloys, Diamond Jewellery, Mechanical Properties

Sr. No.	Title of paper/article	Author	Year	Contribution	Keywords
15	Intermetallic Compounds of Gold	W S Rapson Consultant, 43 7th Street, Houghton 2198, South Africa	1996	The attributes and applications of inter-metallic compounds are discussed.	Gold Amalgam, Gold Copper, Gold Aluminium Alloys, Color
16	Stable Strengthening of 990-Gold	David M Jacobson, Martin R Harrison & Satti P S Sangha GEC Marconi Materials Technology Ltd, Borehamwood, UK	1996	The article tells about the addition of 1wt% titanium to gold to substantially harden the precious metal and enhance its wear resistance.	Thermo-Mechanical Treatment, Age Hardening, Strengthening Mechanism
17	A 23 Carat Alloy with a Colourful Sparkle	F C Levey, M B Cortie Mintek, Private Bag X3015, Randburg 2125, South Africa & L A Cornish University of the Witwatersrand, Private Bag 3, WITS 2050, South Africa	1998	The article reviews the play of color produced from the diffraction from arrays of very regular lamellae.	Alloy Composition, Color, Aesthetics
18	A New Method for Strengthening Gold	Alan Russell, Kai Xu, Scott Chumbley, James Parks & Joel Harringa Ames Laboratory of Iowa State University, Ames, IA 50011, USA	1998	Article reports on the first gold matrix metal-metal composite which had ultimate tensile strength.	Physical Properties, Gold Matrix, Metal-Metal Composites
19	Coloured Gold Alloys	Cristian Cretu & Elma van der Lingen Mintek, Private Bag X3015, Randburg 2125, South Africa	1999	The article describes the CIELAB system, which has gained acceptance as an effective way to assess color, with emphasis on the relationship between their metallurgy and their color.	Color, Decoration, Intermetallic Compounds

Sr. No.	Title of paper/ article	Author	Year	Contribution	Keywords
20	The Density of Gold-Silver-Copper Alloys & its Calculation from the Chemical Composition	J C Kraut & W B Stern Geochemical Laboratory, Institute of Mineralogy & Petrography, Bernoulistrasse 30, CH-4056 Basel, Switzerland	2000	The effects of ordering and disordering in the alloys are described in this article.	Chemical Composition, Ternary System, Binary System
21	The Development of a Novel Gold Alloy with 995 Fineness & Increased Hardness	Madeleine du Toit Department of Materials Science & Metallurgical Engineering, University of Pretoria, South Africa Elma van der Lingen, Lizelle Glaner & Rainer Süss Physical Metallurgy Division, Mintek, Private Bag X3015	2002	Article discusses the mechanical properties and processing of a newly developed ternary alloy.	Mechanical Properties, Ternary Alloy, Hardening Mechanism
22	18 Carat Yellow Gold Alloys with Increased Hardness	Rainer Süss, Elma van der Lingen & Lizelle Glaner Physical Metallurgy Division, Mintek, Private Bag X3015, Randburg 2125, South Africa. Madeleine du Toit Department of Materials Science & Metallurgical Engineering, University of Pretoria, South Africa.	2004	The article provides chemical formulae for yellow 18 carat gold alloys that have hardnesses which are higher than the hardnesses of the corresponding conventional 18 carat alloys.	Carat Gold Alloys, Chemical Properties, Hardening
23	White Gold Alloys: Color Measurement and Grading	Steven Henderson Metallurgical Department, Cookson Precious Metals Ltd, Birmingham B1 3NZ, England Dippal Manchanda Birmingham Assay Office, Birmingham B3 1SB, England	2005	The article is dealing with the grading system established for white gold to measure the amount of yellowness in them.	Composition, Color, White Gold Alloys

Sr. No.	Title of paper/ article	Author	Year	Contribution	Keywords
24	Gold with a Martensitic Transformation: Which Opportunities?	Stefano Besseghini ¹ , Francesca Passaretti ¹ , Elena Villa ¹ , Paolo Fabbro ² , Franca Ricciardi ² ¹ CNR-IENI Dept. of Lecco, Lecco, 23900, Italy Corso Promessi Sposi, 23900 Lecco ² UNOAERRE spa, Arezzo, 52100, Italy	2007	The article will overview of the precious alloys that could be of interest due to the inherent properties of the thermo elastic martensitic transformation.	Thermo Elastic Transformation, Investment Casting, Conventional Shape Memory
25	Gold & Gold Alloy foams	John Banhart	2008	The possibilities to manufacture gold-based foams are explored. Gold powder and various powdered alloying elements are mixed and triggered for foam formation.	Foamed Gold, Foam Formation, Spongy
26	The Aluminium-Copper-Gold Ternary System	V K Bhatia ¹ , F C Levey ² , C S Kealley ¹ , A Dowd ¹ & M B Cortie ¹ ¹ Institute for Nanoscale Technology, University of Technology Sydney, PO Box 123, Broadway NSW 2007, Australia ² 2600 Natta Blvd., Bellmore, NY 11710, USA	2009	The article review what is known, and consider the prospects for technological exploitation of some of the ternary compositions.	Composition, Microstructure, Crystal Structure, Shape Memory Alloys
Analysis					
27	Analysis for Gold, A Review of Methods	Roland S Young Consultant, Victoria, B.C., Canada	1980	The article deals with modern assay technique versus fire assay of gold.	Chemical Analysis, Blister Copper, Assay For Determining Gold

Sr. No.	Title of paper/ article	Author	Year	Contribution	Keywords
28	Analysis of Gold Jewellery Artifacts, Characterization of Ancient Gold Solders by Pixe	G Demortier L.A.R.N., Faculties Universitaires de Namur, B-5000 Namur, Belgium	1984	The article deals with the soldering or brazing of parts in gold jewellery, such solders or brazes were cadmium free.	Soldering, Cadmium, Forgery, Ancient Soldering
29	The Diamond Industry As A Virtual Organization: Past Success & Challenging Future	Isaac Mostovicz, ¹ Nada K. Kakabadse ^{2*} & Andrew P. Kakabadse ³ ¹ Janus Thinking Ltd, Antwerp, Belgium ² Northampton Business School, UK ³ Cranfield School of Management, UK	2007	This paper seeks to explain De Beers' behaviour and the reaction of the industry in terms of paradox management and identifies the requirement for a new form of leadership to replace the previous monopoly situation and guide the diamond industry into a better future.	Diamond Industry, Distribution Industry
30	Adams Jewelry	Nile Khanfar, Nova Southeastern University David Loudon, Samford University	2008	This paper deals with the operational philosophy and actions of a small retail jewelry store.	Retail Jewelry Store, Diamond Market, Promotion Strategies
31	Creativity & Space: The Opportunity Of An Urban Creative Jewellery Cluster	Lisa De Propris University of Birmingham Ping Wei Bournemouth University	2009	The objective of the article is to explore the relative determinants of firms' performance in the Birmingham Jewellery Quarter (BJQ) considering creativity and innovation; firms' access to the market and networking.	Jewellery Industry, Creative Cluster, Birmingham Urban, Regeneration

Sr. No.	Title of paper/ article	Author	Year	Contribution	Keywords
32	Straumann: Are Dental Implants Really as Economically Sensitive as Handbags, Jewelry & Cars?	Jack Scannell, Ph.D. Lisa Bedell Alex Blanckley	2009	The article talks about the correlation between GDP growth and dental implant procedure volumes.	Dental implant, Jewellery Correlation
33	Watches & Jewelry — A Difficult Time to Fight “Hard Luxury” Giants	Bernstein Research	2009	Article compares jewelry with luxury watches and other comparable products.	Jewelry, Watch Industry, Luxury Brands
Investment Casting					
34	Investment Casting of Gold Jewellery, Gas Pressure in Moulds During Casting: Their Measurement & Their Effects	Dieter Ott & Christoph J Raub, Forschungsinstitut Für Edelmetalle & Metallchemie , Schwäbisch Gmünd, Federal Republic of Germany	1985	The article describes the methods and observations made on the gas pressure in moulds during casting.	Investing Procedure, Gold Casting, Casting Technique
35	Investment Casting of Gold Jewellery, The Surface Properties of Castings: Effects of Casting Atmospheres & other Factors	Dieter Ott & Christoph J Raub, Forschungsinstitut Für Edelmetalle & Metallchemie , Schwäbisch Gmünd, Federal Republic of Germany	1985	Article reviews the factors which affect the quality of castings are sensitive to surface and interfacial energies during the pouring of the melt.	Decoration, Reaction Between Materials, Physical Properties

Sr. No.	Title of paper/ article	Author	Year	Contribution	Keywords
36	Investment Casting of Gold Jewellery, Porosity in Castings, its Causes & Prevention	Dieter Ott & Christoph J Raub, Forschungsinstitut Für Edelmetalle & Metallchemie , Schwäbisch Gmünd, Federal Republic of Germany William S Rapson (in part) Consultant, International Gold Corpotion, Johannesburg, Republic of South Africa	1985	The article reviews available information on shrinkage porosity in dental gold alloy.	Porosity, Dental Gold Alloy, Physical Prevention
37	Investment Casting of Gold Jewellery, Factors Affecting the Filling of Moulds	Dieter Ott & Christoph J Raub Forschungsinstitut Für Edelmetalle & Metallchemie , Schwäbisch Gmünd, Federal Republic of Germany	1986	The factors which affects are briefly discussed and the results of experiments are presented.	Investment Casting, Casting Methods Different
38	Investment Casting of Gold Jewellery, Temperature Changes Occurring in the Metal & the Investment: Their Measurement & Importance	Dieter Ott & Christoph J Raub, Forchungsinstitut Fur Edelmetalle & Metallchemie, Schwabisch Gmund, Federal Republic of Germany	1986	Article creates an understanding some changes is important for optimum casting practice.	Thermal Conductivity, Casting of Materials, Physical Changes
39	Chaos in Casting: An Approach to Shrinkage Porosity	Dieter Ott, Fem, Schwabisch, Germany	1997	Interaction between the effects of different factors are illustrated and discussed in this article.	Casting Method, Alloys, Properties of Alloy, Physical
40	Properties of Melt & Thermal Processes During Solidification in Jewellery Casting*	Dieter Ott Forschungsinstitut Für Edelmetalle & Metallchemie (FEM), Schwäbisch Gmünd, Germany	2000	In this article volume/ surface area ratio, superheat and solidification temperature are discussed.	Thermal Process, Physical Properties, Modeling, Solidification
Electrodeposition					

Sr. No.	Title of paper/ article	Author	Year	Contribution	Keywords
41	Stable Gold Alloy Electro-deposits	John K R Page & Vivian G Rivlin, Fulmer Research Institute, Stoke Poges, Buckinghamshire, England	1978	The article reviews the ensuring prolonged contact life from corrosion and diffusion.	Corrosion, Diffusion, Stable Gold Alloy
42	The Electro-forming of Gold & its Alloys	Anselm T Kuhn Faculty of Science & Technology, Harrow College, Harrow HA1 3TP, UK & Leslie V Lewis B.I.S Electro-forming Ltd., London NW6, UK	1988	Article focuses on development in both applications and techniques.	Electro formation, Gold Alloy, Development In Technique
Bonding, Joining and Soldering					
43	Soft Soldering Gold Coated Surfaces, Techniques for Making Reliable Joints	P A Ainsworth Tin Research Institute, Perivale, England	1971	The article reviews the factors influencing the mechanical properties of soldered joints between gold.	Mechanical Properties, Soft Soldering, Surface Technique
44	Gold Coatings for Fluxless Soldering	David M Jacobson & Giles Humpston Gec Hirst research Centre, Wembley, Middlesex, UK	1989	Article deals with the gold coatings play an important role in flux-free joining in a vacuum-a method widely used in electronics fabrication.	Flux Less Soldering, Decorative, Electronic Fabrication
45	Do 18 Carat Gold Solders Exist?	G Humpston & D M Jacobson, Hirst Research Centre Gec-marconi Ltd. Borehamwood, UK.	1994	Alternative joining technology, diffusion soldering for joining articles of 18 carat gold and its capabilities are described.	18 Carat Gold, Soldering, Joining Technology
46	Explosive Joining of Precious Metals	A Blatter & D A Peguiron PX Tech, Bd. des Eplatures 46, CH-2304 La Chaux-de-Fonds, Switzerland.	1998	The study explores the use of this technology for the joining of thin precious metal sheets with other metals.	Explosive Joining, Physical Treatment, Gold & Other Metals
Properties of Gold					

Sr. No.	Title of paper/ article	Author	Year	Contribution	Keywords
47	The Surface Structure of Gold, The Origin of Abnormalities in the Outer Atomic Layers	P J Dobson Physics Department, Imperial College, London	1974	The article reviews about the present knowledge of the single crystal surfaces of gold.	Surfaces Of Gold, Chemical Chemistry, Technical Fields
48	Wetting & Surface Tension Measurements on Gold Alloys	Enrica Ricci & Rada Novakovic, National Research Council (CNR) – Institute of Physical Chemistry of Materials, Via De Marini 6, I – 16149 Genoa (Italy)	2001	In this article the relationships between surface tension and density as a function of temperature are proposed.	Gold Alloys, Physical Function, Surface Tension
Miscellaneous					
49	Effective Marketing of Jewelry	Morton R Saren	1960	The article points out that constant changes in the style of modern life have tremendous repercussions on the jewelry industry.	Christmas-Gift Market, Bridal Market, Effective Marketing Of Jewelry
50	A New Bonding Process for Ceramics Reaction Welding with a Gold Filler	H J De Bruin the Flinders University of South Australia A F Moodie & C E Warble C.S.I.R.O., Division of Chemical Physics, Clayton, Victoria, Australia	1972	In this article the interface between ceramic oxide and gold form the strong and vacuum-tight joints.	Ceramic Oxide, Gold Filler, Welding
51	Gold the Chemical Unknown A Thing of Beauty in Need of Exploration	W D Mogerman	1972	Article reviews about the chemical durability of gold, on which the physical attractiveness dependent.	Aesthetics, Decorative, Gold Alloy
52	A New Gold Resistance Alloy, A Study of the Gold-Palladium-Vanadium System	Franz Sperner W C Heraeus GmbH, Hanau, West Germany	1973	The article describes the development of a gold-palladium-vanadium alloy that combines all these properties.	Binary System, Ternary System, Alloying Addition

Sr. No.	Title of paper/article	Author	Year	Contribution	Keywords
53	Applications for Gold-Base Brazing Alloys	M M Schwartz Rohr Industries, Chula Vista, California	1975	The advantageous properties of alloys have found a number of uses in the construction of aero-engines and space craft are discussed.	Brazing Alloys, Aircraft Engines, Nuclear Engineering
54	Inlay-Clad Gold Alloys The Wide Range of Properties of Properties Available	Robert J Russell Technical Materials Inc., Lincoln, Rhode Island, U.S.A	1976	The properties of gold alloys in inlay form are surveyed in making the most appropriate choice.	Gold Alloy Properties, Porosity, Ease Of Fabrication
55	The Malleability of Gold an Explanation of its Unique Mode of Deformation	Professor J Nutting & J L Nuttall, Department of Metallurgy, University of Leeds, England	1977	Article explains that gold can accommodate plastic deformation even when the thickness is less than the size of the sub grains formed.	Plastic Deformation, Metallographic Explanation, Grain Formation
56	The Electrodeposition of Gold by Pulse Plating Improvement in the Properties of Deposits	Ch. J Raub & A Knodler Forschungsinstitut Fur Edelmetalle und Metallchemie, Schwabisch Gmund, West Germany	1977	The replacement in the electrodeposition of gold has marked effect in improving the mechanical properties of the deposits and in reducing their internal stress.	Deposit Properties, Mechanical Properties, Electrodeposition
57	Electro-Discharge Machining of Gold Alloys A New Technique for Jewellery Manufacture	Ronald Stanton Diamond Design Limited, Eton, Berks., England	1979	The article deals with EDM machining of gold as a jewellery making process.	EDM Machining, Gold Alloy, Dielectric System
58	The Solid Phase Bonding of Gold to Metals Historical & More Fundamental Aspects	R F Tylecote Department of Metallurgy, University of Newcastle upon Tyne, England	1979	The article gives Information relating craftsmen in ancient times, and more recent applications in industry.	Solid Phase Bonding, Pressure Welding, Mechanical Deformation, Diffusion,

Sr. No.	Title of paper/ article	Author	Year	Contribution	Keywords
59	Low Melting Carat Gold Brazing Alloys for Jewellery Manufacture, A Study of Ag-Au-Ge-Si Alloys	G Zwingmann Degussa, Hanau, West Germany	1979	The article deals with phase diagrams of various gold alloys.	Soldering Studies, Working Temperature, Mechanical Workability Of Alloys,
60	Grain Size of Gold and Gold Alloys, A Review & Some Recent Developments	Dieter Ott & Christoph J Raub, Forschungsinstitut Für Edelmetalle & Metallchemie , Schwäbisch Gmünd, Federal Republic of Germany	1981	The article reviews the control of grain size in gold alloys include reference to recent findings regarding the use of cobalt in carat gold alloys.	Carat Gold Alloys, Grain Size, Solidification
61	Gold Casting Alloys, The Effect of Zinc Additions on Their Behaviour	Christoph J Raub & Dieter ott, Forschungsinstitut Für Edelmetalle und Metallchemie, Schwabisch Gmund, Federal Republic of Germany	1983	Article discusses the behavior of 14 and 18 carat gold alloys on addition of small amount of zinc.	Gold Casting, 14 And 18 Carat Gold Alloys, Porosity
62	Grain-Refined Recrystallized 14-Carat Gold Alloy, Effect of Small Additions of Elements in an Au – Ag – Cu – Zn Alloy	M Riabkina & L Gal-or Center for Noble Metals, Institute of Metals, Technion, Haifa, Israel, y Fishman, Dept. of Materials Engineering, Technion, Haifa, Israel G Iram, Dumax Corporation, Israel	1984	The article reveals the possible mechanisms by which grain refining during solidification and annealing is brought by addition of small amount of elements.	14 Carat Gold Alloy, Grain Refining, Solidification
63	Skin Contact With Gold & Gold Alloys Effects and Possible Causes of Black Dermographism & Metal Smudge	William S Rapson Consultant, International Gold Corporation, Johannesburg, South Africa	1984	The article reviews about the knowledge of the effects on contact of skin with gold.	Gold Alloy, Dermographism, Skin Properties

Sr. No.	Title of paper/article	Author	Year	Contribution	Keywords
64	Mechanism of 'in situ' Gold Crystallization	Michael Spiro Department of Chemistry, Imperial College of Science & Technology Logdon, SW7 2AY, United Kingdom	1987	The article deals with crystallization of gold in selective location.	Electroless Plating, Metallic Gold, Gold Crystallization
65	Solder Spread: a Criterion for Evaluation of Soldering	G Humpston & D M Jacobson Metallurgical Technology Group Gec Hirst Research Centre Wembley UK	1990	Article evaluates the penetration of solder at high temperature.	Soldering, Thin Gold Coatings, Solder Spread
66	History & Industry Location: The Case Of The Manufacturing Belt	paul krugman	1991	The paper illustrates path dependence in economic geography by describing a particular historical example.	Manufacturing Belt, Economic Geography, Costume Jewelry
67	Tarnish Resistance, Corrosion & Stress Corrosion Cracking of Gold Alloys	W S Rapson Johannesburg, South Africa	1996	The development in extraction, refining and fire assaying of gold are discussed.	Tarnish Resistance, Corrosion, Stress Corrosion Cracking
68	Investment Casting: Centrifugal or Static Vacuum Assist?	Dr. Valerio Faccenda Consultant, Aosta, Italy	1998	The article deals in the different methods of casting and also deals in the introduction to new equipments.	Investment Casting, Static Machines, Equipment Technical Evolution
69	Design Opportunities Through Production Technology	Prof. Dr. W Bohm Schmucktechnologisches Institut, Pforzheim, Germany	1998	The article reviews about the production technologies that offer increased design opportunities to cooperate between designers and technologists.	Laser, Electroforming, Metallurgy, Knitting
70	The Role of CAD/CAM in The Modern Jewellery Business	LC Molinari, MC Megazzini, E Bemporad	1998	The article explains how production techniques developed in fields of jewellery manufacture.	Cad, Cam, Gold Jewellery, Jewellery Manufacture

Sr. No.	Title of paper/article	Author	Year	Contribution	Keywords
71	The Surface Enrichment of Carat Gold Alloys–Depletion Gilding	M Grimwade Consultant, UK	1999	The article deals with the alternative processes to chemical bonding to be introduced to the manufacturers.	Carat Gold Alloys, Depletion Gilding, Coloring, Acid Pickling
72	A Plain Man's Guide To Alloy Phase Diagrams: Their Use In Jewellery Manufacture-Part 2	Mark Grimwade Consultant, Northwood, Middlesex, England	2000	The article describes the phase diagram for ternary alloy systems and the use of phase diagrams in jewellery manufacture.	Jewellery, Ternary Phase Diagram, Color Triangle
73	Designing A Virtual Gallery Of Contemporary Jewellery: The Realities Of The Virtual	Roderick Davies & Marie Jefsioutine Birmingham Institute of Art & Design, University of Central England, UK	2001	This paper records the development of the conceptual design of the gallery.	Design, Exhibition, Jewellery, Metaphor, Synergies
74	Gold(I) & Gold(III) Complexes with Anionic Oxygen Donor Ligands: Hydroxo, Oxo & Alkoxo Complexes	Maria Agostina Cinellu & Giovanni Minghetti Dipartimento di Chimica, Università di Sassari, via Vienna 2, 07100 Sassari, Italy	2002	The article deals with use of gold as chemical in organic materials.	Hydroxo, Oxo, Alkoxo Complexes
75	Optimising Gold Alloys for The Manufacturing Process Advantage & Disadvantage of Small Alloying Addition	Dieter Ott	2002	The article deals only with 14 and 18 carat yellow carat gold and how modifications must be made to improve their properties.	Yellow Carat Gold, Surface Enrichment, Silicon, Grain Refiners
76	Laser Applications in Gold Jewellery Manufacture	Santi Valenti Laservall Spa, Donnas, Italy	2002	The article deals with laser soldering and other processes.	Soldering, Laser Application, Gold Jewellery

Sr. No.	Title of paper/article	Author	Year	Contribution	Keywords
77	Rapid Prototyping & Tooling Technology in Jewelry CAD	Somlak Wannarumon Asian Institute of Technology & Erik L J Bohez Asian Institute of Technology	2004	This paper presents the investigation of computer-aided design and rapid prototyping technologies in jewelry design and manufacturing.	Computer-Aided Design (CAD), Rapid Prototyping (RP), Rapid Tooling, Stereo-lithography Apparatus (SLA), Jewelry Design, Jewelry Making.
78	Infrared Brazing of Ti50Ni50 Shape Memory Alloy Using Gold-based Braze Alloys	R H Shiue & S K Wu* Department of Materials Science & Engineering, National Taiwan University, Taipei 106, Taiwan *Corresponding author Prof. Shyi-Kaan Wu	2006	The article discusses the shape memory effect of brazed joint using Au filler is superior to that using Au-20Cu.	Infrared Brazing, Shape Memory, Mechanical Properties
79	A New Aesthetic Evolutionary Approach for Jewelry Design	Somlak Wannarumon & Erik L J Bohez Naresuan University, Thailand, Asian Institute of Technology, Thailand	2006	This paper presents a new evolutionary approach to create non-functional art forms for jewelry design.	Aesthetics, Evolutionary Algorithm, Fractal, Jewelry Design
80	A Study on the Analysis of the Jewelry Preference & Consumer's Lifestyle Elements	Chul-Min Lim	2008	The article deals with user preferences with reference to lifestyle.	Jewellery, Lifestyle, Decoration

Sr. No.	Title of paper/ article	Author	Year	Contribution	Keywords
81	Deformation Behavior & Dislocation Structure of CuAu Ordered Alloy	O V Antonova, B A Greenberg, A Yu Volkov Institute of Metal Physics, Ural Branch, Russian Academy of Sciences, 18 S. Kovalevskaya St., Ekaterinburg 620041, Russia	2008	The analysis reveals the presence of single dislocations, super dislocations and microtwins. Various models are discussed to account for the specific deformation behavior of alloys	Single Dislocation, Super Dislocation, Microtwins In Alloys
82	Quantification of the Abrasive Wear of a Gold Wedding Ring	Georg Steinhäuser Vienna University of Technology, Atominstitut der Österreichischen Universitäten, Stadionallee 2, 1020 Vienna, Austria	2008	The article discusses about the fact causes troubles in chemical analyses on abrasive wear of gold ring.	Gold Jewellery, Contamination, Abrasion, Corrosion, Neutron Activation Analysis.
83	Global Economic Shift Offers Investment Opportunities	David Hansen	2008	The article talks about the historical economical changes and the investment opportunity that comes as a result.	Investment Opportunity, Surplus Income, Gold, Protein Consumption
84	How Jewellery At Historic Homes Lets Guests Experience The Lives Of Others	Amy Detwiler	2009	The paper deals with the vintage and replica jewelry that embraces bygone eras.	Jewellery, Replica Jewellery, Powerful Symbolic Jewelry
85	Interactive Evolutionary 3D Fractal Modeling with Modified IFS	Wenjun Pang The Chinese University of Hong Kong & K C Hui The Chinese University of Hong Kong	2009	The article present a technique for the automatic generation of 3D art form, which allows designers to get access to large number of 3D shapes that can be altered interactively.	3d Fractal, IFS, Genetic Algorithm, Interactive Evolutionary Design.
86	Jewelry Sales That Shine On High	Magazine Review	2009	The article talks about various buyer profile and their choices.	18-Carat Gold, Gold Plated, Sterling Silver Pewter

Sr. No.	Title of paper/ article	Author	Year	Contribution	Keywords
87	Jewelry Is A Healthy Category For Hospital Shops	Marilyn Nason	2009	The article deals with the display techniques remains strong, unique by the year rounds.	Styling, Gift Shops, Jewelry Shops.
88	New Frontiers In Jewelry Retailing	Rob Bates	2009	The article deals with the computerized customization of jewelry shopping.	Jewelry Shopping, Computer-ized Shopping, Jewelry Design.
89	State Of The Jewelry Industry 2009	William George Shusthr	2009	The article describes the average annual sales volume, local economy, number of stores, and number of employees in a state.	Economy, Sales, Stores.
90	Zoo & Aquarium Section- Zoos Go Wild For Jewelry	Magazine Review	2009	The review talks about the jewelry being a good class for zoo souvenir shops.	Price Point, Costume Jewelry, Souvenir Jewelry
91	Zoo & Aquarium Section- Spotlight	Magazine Review	2009	The review talks about the zoo shops are an ideal showcase for children's jewelry.	Zoo Shop Display, Children's Jewelery
92	Facile Green Synthesis Of Gold Nanoparticles With Gum Arabic As A Stabilizing Agent & Reducing Agent	Chien-Chen Wu & Dong-Hwang Chen*	2010	The article deals that Highly stable Au have been successfully synthesized at room temperature to a slightly elevated temperature by using GA.	Gold Nanoplastic, Stabilizing Agent, Gum Arabic

Sr. No.	Title of paper/ article	Author	Year	Contribution	Keywords
93	Effects of Fabrication Technique upon, Material Properties & Permeation, Characteristics of Palladium-Gold Alloy Membranes for Hydrogen Separations	Sabina K Gadel, Kent E Coulter & J Douglas Way	2010	The article deals with use of palladium gold alloy as a material (chemical use).	Palladium Gold Alloy, Material Properties, Hydrogen Seperation
94	Room-Temperature Synthesis of Gold nanoparticles – Size-control by Slow Addition	Sankar K Sivaraman, Sanjeev Kumar & Venugopal Santham*	2010	The article deals with deposition of gold particles (potential for a manufacturing process).	Room Temperature Synthesis, Gold Nanoparticles, Effects Of Ph
95	Romancing The Jewelry Shopper	Jennifer Heebner & Paul Holewa	2010	The article deals about the jewelers know a lot about love.	Jewelry, Romancing The Customers, Jewelry As A Gift
96	Grain Coarsening Effects of Chromium & Iron in Au-Ag-Cu Alloys	D Ott & Ch. J Raub Forschungsinstitut Fur Edelmetalle und Metallchmie, Schwabisch Gmund, West Germany		The article reviews about the coarsening of microstructure of 18 carat au-ag-cu alloy on annealing	18 Carat Alloys, Gold Jewellery, Grain Coarse
97	Engineering Approach to Gold Jewellery Manufacture	Dr. Johnc. Wright, Consultant, Solibull, UK Dr. Christopher Corti, World Gold Council		The article demonstrates how alloy properties impact on some important processes used in the manufacture of gold jewellery.	Gold Jewellery, Engineering Approach, Alloy Properties, Mechanical Theory
98	Trends in the use of Gold in Current Industrial Applications	Dr Richard J Holliday & Christopher W Corti World Gold Council, London		Major current uses of gold in industrial applications are discussed in this article.	Industrial Application, Gold, Electronics, Dental

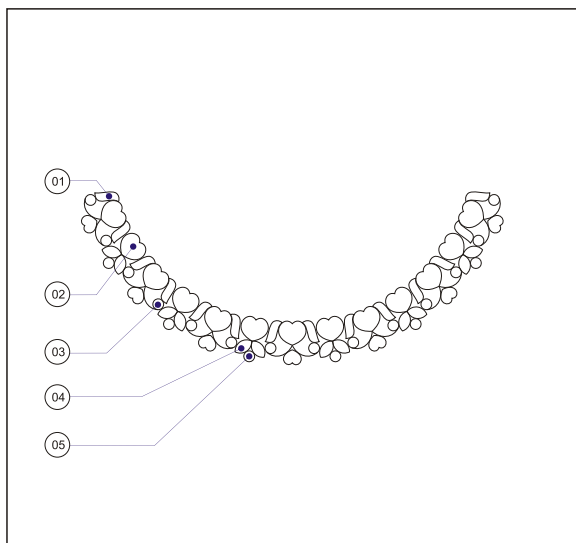
Sr. No.	Title of paper/article	Author	Year	Contribution	Keywords
99	Design Opportunities Through Innovative Materials	S Takahashi, N Uchiyama, A Nishio, Mitsubishi Materials Corporation, Sanda Plant, Sanda City, Hyogo, Japan Mitsubishi Materials Corporation, Precious Metals Department, Marunouchi, Tokyo, Japan		The article deals with the exciting gold products.	Diagold, HPG, Metal Clay
100	The 11th Santa Fe Symposium on Jewellery Manufacturing Technology	Mark Grimwade Consultant, UK		The article deals with an annual event in which introduction to precious metals and alloys metallurgy with 21 different papers with variety of topics was discussed.	Metals, Jewellery Manufacture, Platinum, Silver
101	The 12th Santa Fe Symposium on Jewellery Manufacturing Technology	Mark Grimwade Consultant, UK		In this event introduction to metallurgy, safety overview, and overview on casting technology was discussed.	Metallurgy, Alloys, Casting Technology, Jewellery Manufacture
102	The 13th Santa Fe Symposium on Jewellery Manufacturing Technology	Mark Grimwade Consultant, UK		In this annual meet introduction to metallurgy, safety review with respect to silica in investment powders, cyanides, cadmium, solvents and the repetitive strain injury were discussed.	Silica, Jewellery Manufacture, Metallurgy,
103	The 14th Santa Fe Symposium on Jewellery Manufacturing Technology	Mark Grimwade Consultant, UK		In this event twenty-one papers were discussed on subjects related to jewellery production.	Jewellery Production, Metallurgy, High-Carat Gold

Sr. No.	Title of paper/ article	Author	Year	Contribution	Keywords
104	The 15th Santa Fe Symposium on Jewellery Manufacturing Technology	Mark Grimwade Consultant, UK		In this event twenty-three papers were discussed, covering a wide range of topics related to jewellery manufacture.	Jewellery Manufacture, Investment Casting, Fusion, Alloys
105	A Plain Man's Guide To Alloy Phase Diagrams: Their Use In Jewellery Manufacture- Part 1	Mark grimwade Consultant, Northwood, Middlesex, England		The article deals in the selection of the best metal in terms of their cast ability, strength and hardness, workability, color, carat age and many more.	Phase Diagrams, Jewellery, Lever Rule, Binary Phase Diagram
106	Assaying of Gold Jewellery- Choice of Technique	Dr Christopher W Corti World Gold Council, London, England		The article reviews about the modern instrument technique for assaying gold jewellery have much to offer in terms of accuracy.	Jewellery, Assaying, Gold Alloy
107	Cause & Prevention of Defects in Wrought Alloys	Mark F Grimwade Consultant, Northwood, Middlesex, U.K.		The article deals on the defects that occur in jewellery manufacture which occur in lost wax casting.	Wax Casting, Wrought Alloys, Jewellery Manufacture

Appendix III

This part contains drawings and tabulations of semantic units used in one particular article of jewellery. This gave an insight into development of a visual tool for further research by providing a line art free from perspective and distortions. The number of times they were used in a design was also noted that revealed most frequently used units.

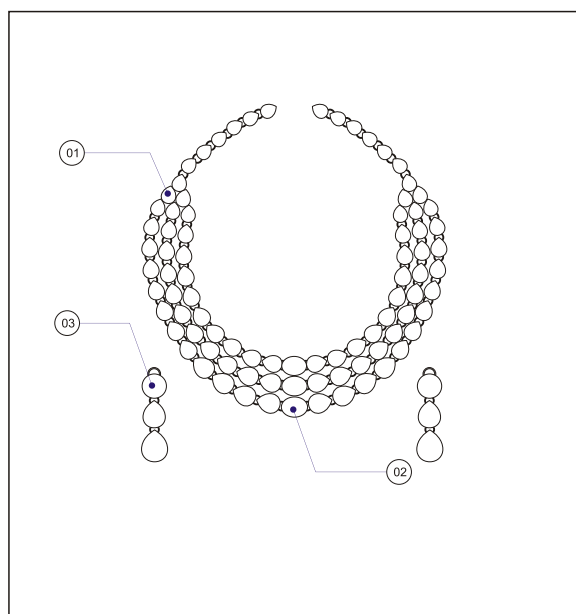
These can be of use in further research exploring formal aspects and form factors.



Sr. No.	Description of motifs	Used qty.	Remarks
01	Koyali	14	01
02	Heart	14	01
03	Mindi dandi	14	01
04	Jo	12	02
05	Round	06	03
Total shape		60	



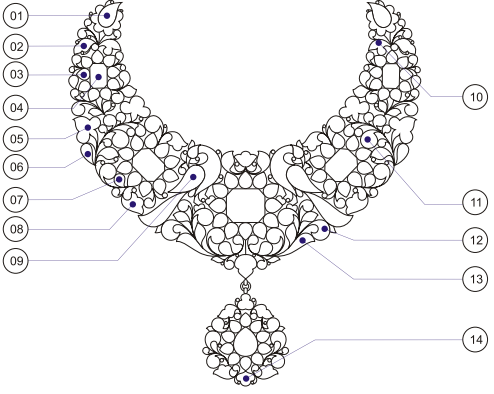
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DRG. No.: MWIN-008		DATE: XOXOXO	NOMINAL DIMENSION	
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ALL DIMENSION ARE IN M.M.		DO NOT MEASURE THE DRAWING		ISSUED ON: 01.08.08

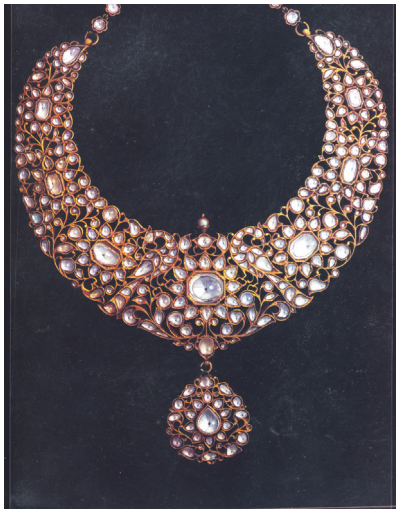


Sr. No.	Description of motifs	Used qty.	Remarks
01	Drops	88	01
02	Oval	03	02
03	Round	02	03
Total shape		93	

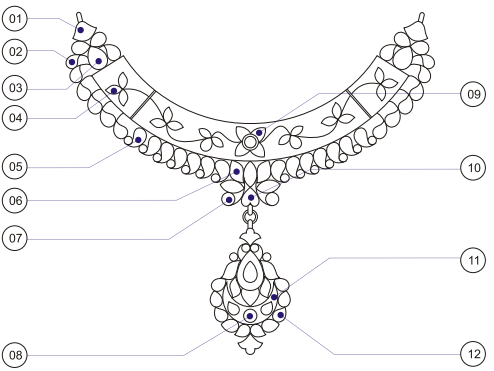


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DRG. No.: MWIN-002		DATE: XOXOXO	NOMINAL DIMENSION	
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ALL DIMENSION ARE IN M.M.		DO NOT MEASURE THE DRAWING		ISSUED ON: 01.08.08

			
Sr. No.	Description of motifs	Used qty.	Remarks
01	Kery Flower	02	08
02	Round Patti	04	08
03	Drop	61	08
04	Lumb chokey	05	08
05	Flower	04	08
06	Koyali	06	08
07	Kery Dandi	21	08
08	Mindi Patti	06	08
09	Peacock	02	08
10	Mindi Jo	02	08
11	Mindi dandi	60	08
12	Teda chand dandi	04	08
13	Patti	02	08
14	Pyala	04	08
Total shape		183	

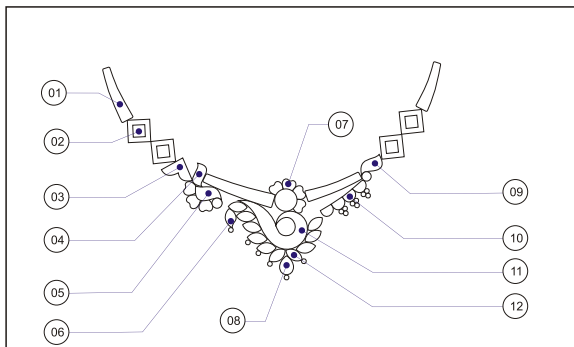


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DRG. No.: MWIN-003		DATE: XOXOXO	NOMINAL DIMENSION	
			XOXOXO	SHEET 01 OF 01
ALL DIMENSION ARE IN M.M.		DO NOT MEASURE THE DRAWING		ISSUED ON: 01.08.08

			
Sr. No.	Description of motifs	Used qty.	Remarks
01	Pyala	04	08
02	Kery dandi	14	08
03	Drop	14	08
04	Vell Patti	06	08
05	Kery Mindi	14	08
06	Koyali	07	08
07	Mindi dandi	21	08
08	Round	03	08
09	Tikha chofuliya	01	08
10	Tikha chand	01	08
11	Kery	06	08
Total shape		91	



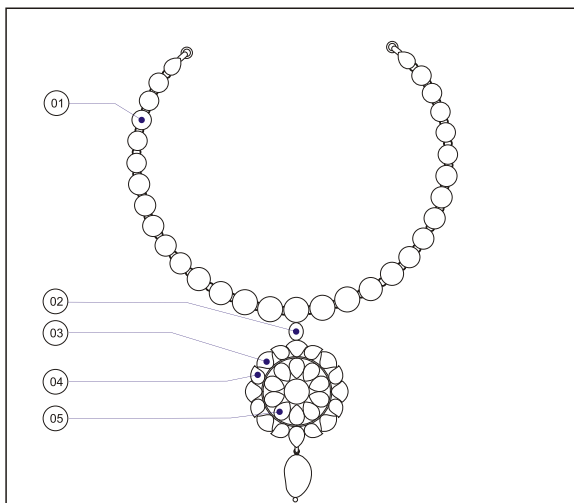
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			XOXOXO	SHEET 01 OF 01
ALL DIMENSION ARE IN M.M.		DO NOT MEASURE THE DRAWING		ISSUED ON: 01.08.08



Sr. No.	Description of motifs	Used qty.	Remarks
01	Chokey Boarder	04	08
02	Chokery	04	08
03	Pankha	01	08
04	Koyali	01	08
05	Koyali mindi flower	01	08
06	Koyali patti	01	08
07	Flower	01	08
08	Drop	01	08
09	Koyali mindi	01	08
10	Half round	04	08
11	Badi Koyali	01	08
12	Jo	10	08
Total shape		30	



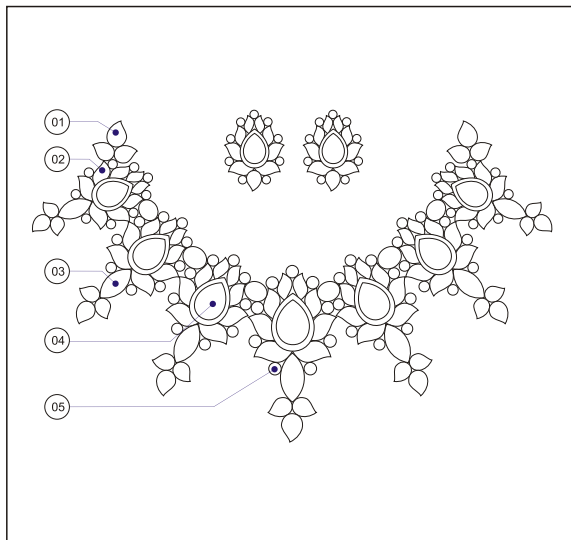
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Sr. No.	Description of motifs	Used qty.	Remarks
01	Round	30	01
02	Oval	01	01
03	Pyala	07	01
04	Kery	08	02
05	Drop	13	03
Total shape		57	



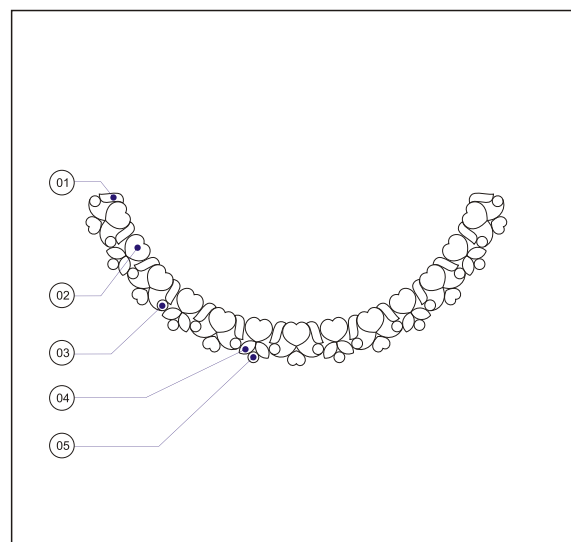
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APPROVED	PARAG VIYAS		DRG. NAME: DESIGN DETAILS	
DRG. No.: MWIN-006		DATE: XOXOXO	NOMINAL DIMENSION	
ALL DIMENSION ARE IN M.M.		DO NOT MEASURE THE DRAWING	XOXOXO	SHEET 01 OF 01
			ISSUED ON: 01.08.08	



Sr. No.	Description of motifs	Used qty.	Remarks
01	Kery	29	01
02	Koyali patti	72	01
03	Jo	07	01
04	Drop	09	02
05	Round	81	03
Total shape		198	



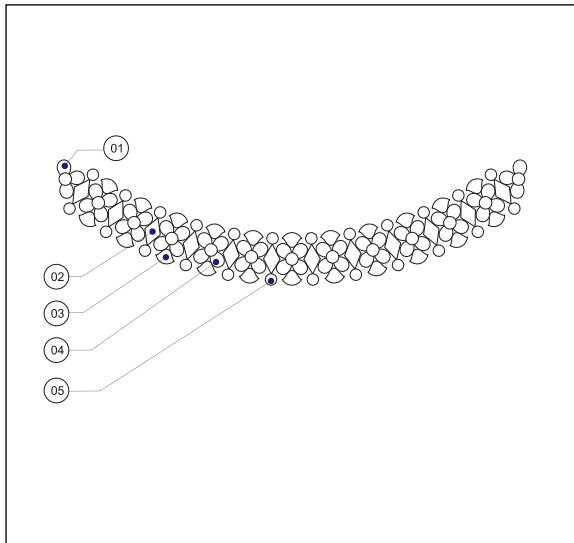
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DRG. No.: MWIN-003			DATE: XOXOXO	NOMINAL DIMENSION XOXOXO	SHEET 01 OF 01
ALL DIMENSION ARE IN M.M.			DO NOT MEASURE THE DRAWING		ISSUED ON: 01.06.08



Sr. No.	Description of motifs	Used qty.	Remarks
01	Koyali	14	01
02	Heart	14	01
03	Mindi dandi	14	01
04	Jo	12	02
05	Round	06	03
Total shape		60	



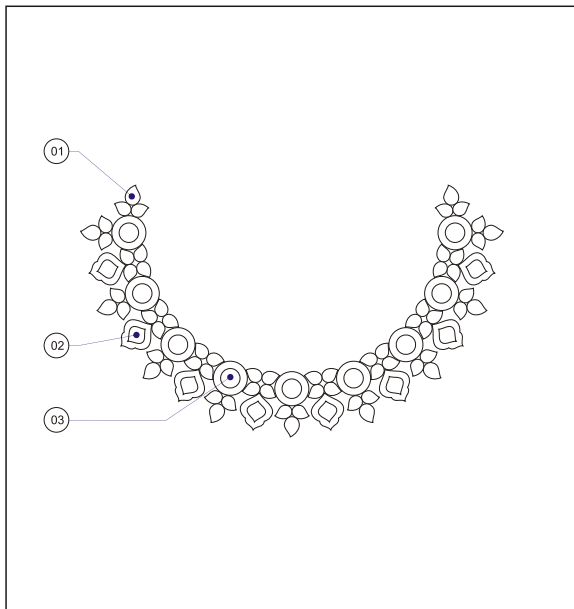
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DRG. No.: MWIN-008			DATE: XOXOXO	NOMINAL DIMENSION XOXOXO	SHEET 01 OF 01
ALL DIMENSION ARE IN M.M.			DO NOT MEASURE THE DRAWING		ISSUED ON: 01.06.08



Sr. No.	Description of motifs	Used qty.	Remarks
01	Tin patti flower	02	01
02	Chofulya flower	11	01
03	Shakkar para	12	01
04	Pyala	22	02
05	Round	24	03
Total shape		71	



DRAWN	VINAY SONI		XOXOXO PROJECT	
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APPROVED	PARAG VYAS		DRG. NAME: DESIGN DETAILS	
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ALL DIMENSION ARE IN M.M.		DO NOT MEASURE THE DRAWING		ISSUED ON: 01.08.08



Sr. No.	Description of motifs	Used qty.	Remarks
01	Kery	65	01
02	Shankhala	08	02
03	Round	09	03
Total shape		82	



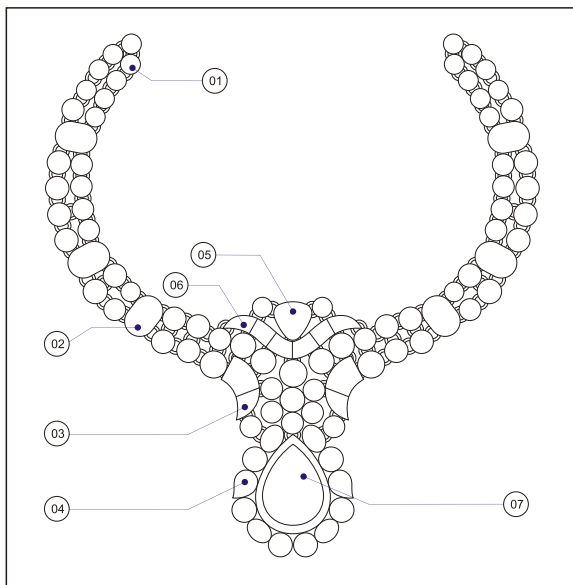
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Sr. No.	Description of motifs	Used qty.	Remarks
01	Kery dandi	04	01
02	Flower to drops	11	02
03	Drops	114	03
Total shape		129	



DRAWN	VINAY SONI		XOXOXO PROJECT	
DESIGNED	MANU PANCHAL		CLIENT : XOXOXOXOXOXOXO	
APPROVED	PARAG VIAS		DRG. NAME: DESIGN DETAILS	
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ALL DIMENSION ARE IN M.M.		DO NOT MEASURE THE DRAWING		ISSUED ON: 01.06.08



Sr. No.	Description of motifs	Used qty.	Remarks
01	Round	71	
02	Oval	10	
03	Koyali	02	
04	Kery	02	
05	Trio	01	
06	Lambi koyali	01	
07	Drope	01	
08			
Total shape		88	



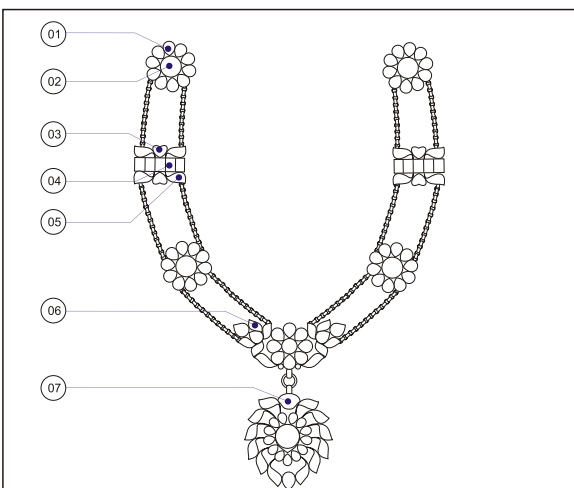
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DESIGNED	MANU PANCHAL		CLIENT : XOXOXOXOXOXOXO	
APPROVED	PARAG VIAS		DRG. NAME: DESIGN DETAILS	
DRG. No.: MWIN-013		DATE: XOXOXO	NOMINAL DIMENSION	
			XOXOXO	SHEET 01 OF 01
ALL DIMENSION ARE IN M.M.		DO NOT MEASURE THE DRAWING		ISSUED ON: 01.06.08



Sr. No.	Description of motifs	Used qty.	Remarks
01	Kery dandi	04	
02	Round	02	
03	Baguette	22	
04	Oval	164	
05	Kery	06	
06	Lotus pandadi	13	
07	Koyali	14	
08	Drope	16	
09	Cup	19	
Total shape		260	



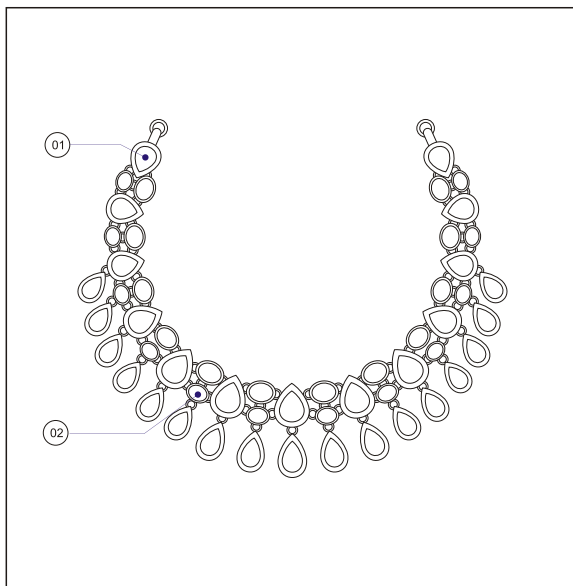
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DESIGNED	MANU PANCHAL		CLIENT: XOXOXOXOXOXOXO	
APPROVED	PARAG VIYAS		DRG. NAME: DESIGN DETAILS	
DRG. No.: MWIN-013		DATE: XOXOXO	NOMINAL DIMENSION	
			XOXOXO	SHEET 01 OF 01
ALL DIMENSION ARE IN M.M.		DO NOT MEASURE THE DRAWING		ISSUED ON: 01.08.06



Sr. No.	Description of motifs	Used qty.	Remarks
01	Drop	60	
02	Round	06	
03	Heart	04	
04	Baguet	10	
05	Koyali dandi	20	
06	Koyali	10	
07	Cup	01	
Total shape		111	



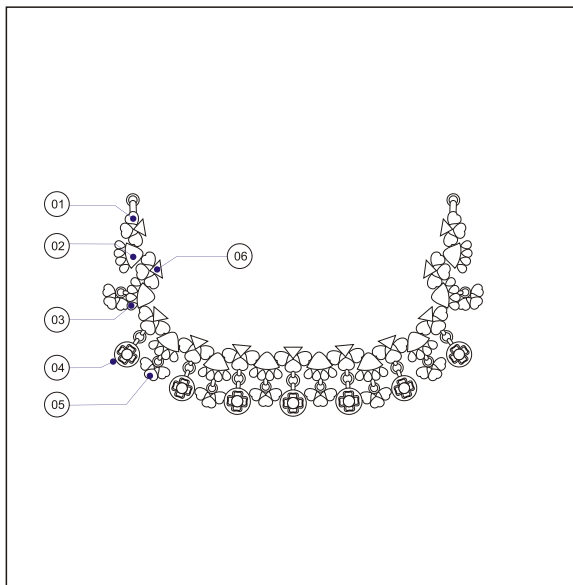
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DESIGNED	MANU PANCHAL		CLIENT: XOXOXOXOXOXOXO	
APPROVED	PARAG VIYAS		DRG. NAME: DESIGN DETAILS	
DRG. No.: MWIN-0036		DATE: XOXOXO	NOMINAL DIMENSION	
			XOXOXO	SHEET 01 OF 01
ALL DIMENSION ARE IN M.M.		DO NOT MEASURE THE DRAWING		ISSUED ON: 01.08.06



Sr. No.	Description of motifs	Used qty.	Remarks
01	Drope	30	
02	Oval	24	
	Total shape	54	



DRAWN	VINAY SONI		XOXOXO PROJECT		
DESIGNED	MANU PANCHAL		CLIENT : XOXOXOXOXOXOXO		
APPROVED	PARAG VIAS		DRG. NAME: DESIGN DETAILS		
DRG. No.: MWIN-015			DATE: XOXOXO	NOMINAL DIMENSION XOXOXO	SHEET 01 OF 01
ALL DIMENSION ARE IN M.M.			DO NOT MEASURE THE DRAWING		ISSUED ON: 01.08.08



Sr. No.	Description of motifs	Used qty.	Remarks
01	Dandi pandadi	38	
02	Cup	10	
03	Drope	40	
04	Flower with Enamling	07	
05	Heart	19	
06	Triangle	11	
07			
08			
	Total shape	126	



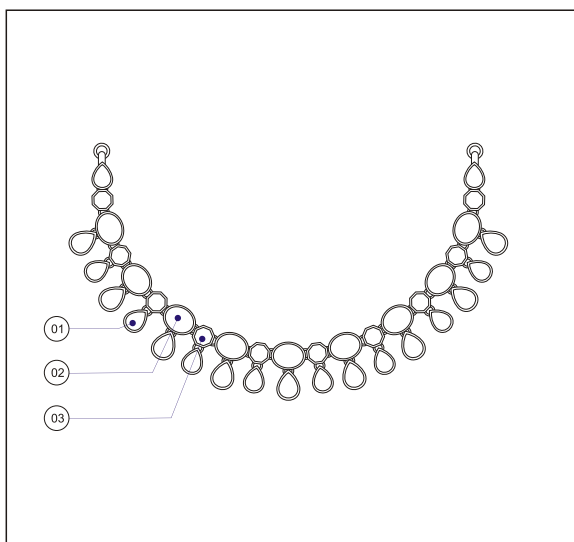
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DESIGNED	MANU PANCHAL		CLIENT : XOXOXOXOXOXOXO		
APPROVED	PARAG VIAS		DRG. NAME: DESIGN DETAILS		
DRG. No.: MWIN-016			DATE: XOXOXO	NOMINAL DIMENSION XOXOXO	SHEET 01 OF 01
ALL DIMENSION ARE IN M.M.			DO NOT MEASURE THE DRAWING		ISSUED ON: 01.08.08



Sr. No.	Description of motifs	Used qty.	Remarks
01	Drope	106	
02	Cup	04	
03	Koyali dandi	04	
04	Kery dandi	04	
05	Oval	03	
06	Round	02	
07			
08			
Total shape		123	



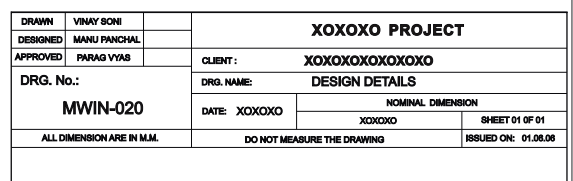
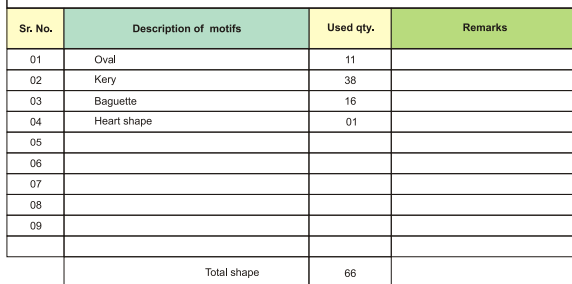
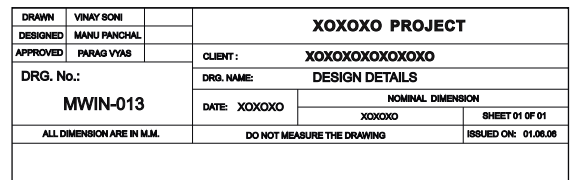
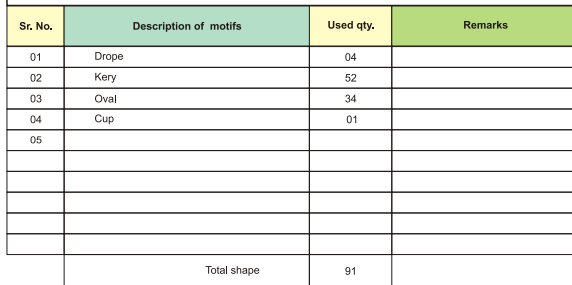
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DESIGNED	MANU PANCHAL			
APPROVED	PARAG VIYAS		CLIENT :	XOXOXOXOXOXOXO
DRG. No.:		DRG. NAME: DESIGN DETAILS		
		DATE: XOXOXO	NOMINAL DIMENSION	
MWIN-013			XOXOXO	SHEET 01 OF 01
ALL DIMENSION ARE IN M.M.		DO NOT MEASURE THE DRAWING		ISSUED ON: 01.08.08



Sr. No.	Description of motifs	Used qty.	Remarks
01	Drope	19	
02	Oval	09	
03	Aust Pail	10	
04			
05			
06			
07			
08			
09			
Total shape		38	



DRAWN	VINAY SONI		XOXOXO PROJECT	
DESIGNED	MANU PANCHAL			
APPROVED	PARAG VIYAS		CLIENT :	XOXOXOXOXOXOXO
DRG. No.:		DRG. NAME: DESIGN DETAILS		
		DATE: XOXOXO	NOMINAL DIMENSION	
MWIN-018			XOXOXO	SHEET 01 OF 01
ALL DIMENSION ARE IN M.M.		DO NOT MEASURE THE DRAWING		ISSUED ON: 01.08.08

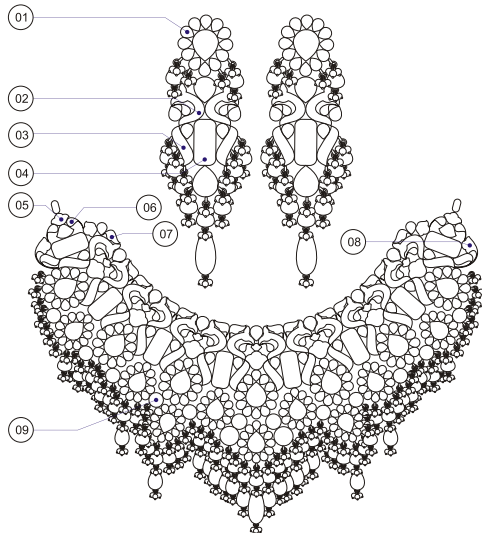




Sr. No.	Description of motifs	Used qty.	Remarks
01	Koyali patti	04	
02	Drope	63	
03	Kery	30	
04	Cup	31	
05			
06			
07			
08			
Total shape		128	



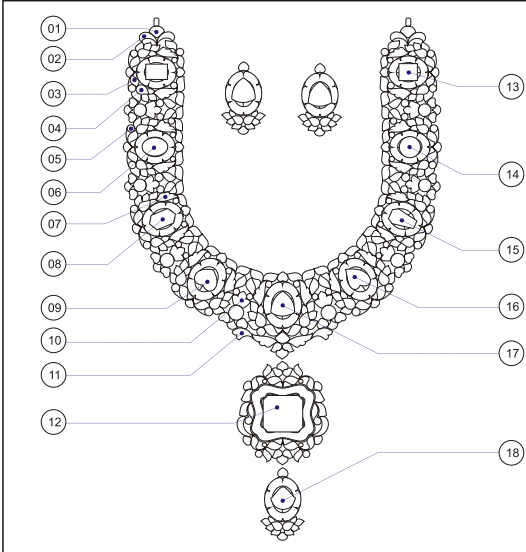
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DESIGNED	MANU PANCHAL		CLIENT : XOXOXOXOXOXOXO	
APPROVED	PARAG VYAS		DRG. NAME: DESIGN DETAILS	
DRG. No.: MWIN-021		DATE: XOXOXO	NOMINAL DIMENSION	
			XOXOXO	SHEET 01 OF 01
ALL DIMENSION ARE IN M.M.		DO NOT MEASURE THE DRAWING		ISSUED ON: 01.08.08



Sr. No.	Description of motifs	Used qty.	Remarks
01	Drope	267	
02	Snake	18	
03	Koyali	20	
04	Lumb choras	10	
05	Cup	34	
06	Kery dandi	22	
07	Pyala patti	14	
08	Dandi patti	02	
09	Round	14	
Total shape		401	



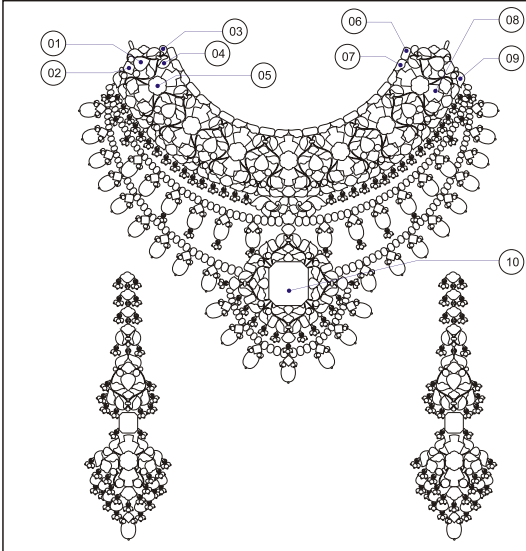
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DESIGNED	MANU PANCHAL		CLIENT : XOXOXOXOXOXOXO	
APPROVED	PARAG VYAS		DRG. NAME: DESIGN DETAILS	
DRG. No.: MWIN-022		DATE: XOXOXO	NOMINAL DIMENSION	
			XOXOXO	SHEET 01 OF 01
ALL DIMENSION ARE IN M.M.		DO NOT MEASURE THE DRAWING		ISSUED ON: 01.08.08



Sr. No.	Description of motifs	Used qty.	Sr. No.	Description of motifs	Used qty.	Remarks
01	Cup	29	10	Pyala	08	
02	Chand	06	11	Patti	02	
03	Koyali	86	12	Aust pail flower	01	
04	Kery	110	13	Square stone flower	01	
05	Mindi dandi	20	14	Round stone flower	01	
06	Oval Flower	01	15	Baguet flower	01	
07	Patti	26	16	Daudi pan flower	01	
08	Six pail stone flower	01	17	Trio flower	03	
09	Heart shape flower	01	18	Cup flower	01	
Total shape		280	Total shape		19	All Total : 299



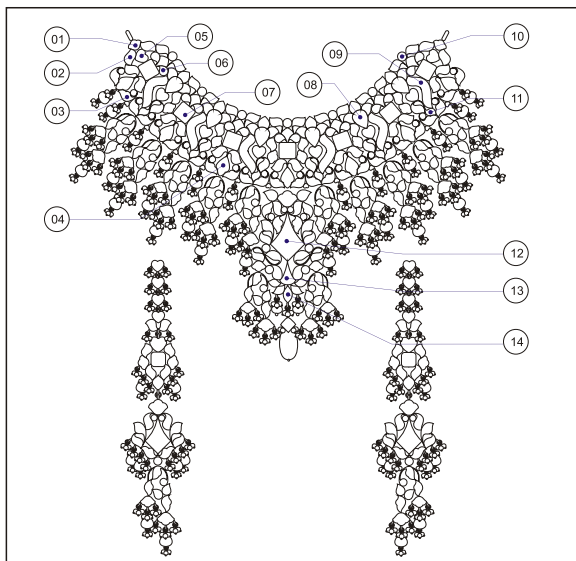
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DESIGNED	MANU PANCHAL		CLIENT : XOXOXOXOXOXOXO		
APPROVED	PARAG VIAS		DRG. NAME: DESIGN DETAILS		
DRG. No.: MWIN-023			DATE: XOXOXO		
ALL DIMENSION ARE IN M.M.			NOMINAL DIMENSION		SHEET 01 OF 01
			XOXOXO		ISSUED ON: 01.06.06
			DO NOT MEASURE THE DRAWING		



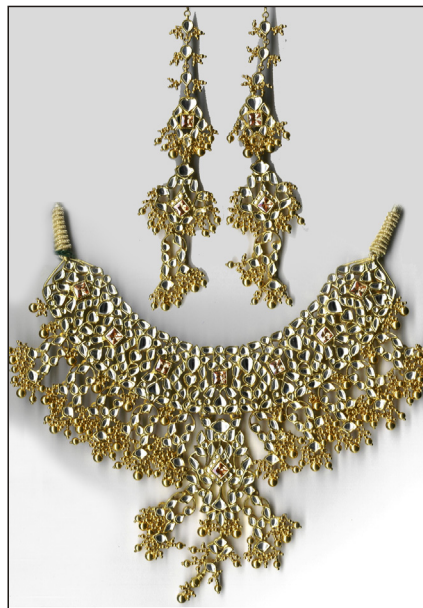
Sr. No.	Description of motifs	Used qty.	Sr. No.	Description of motifs	Used qty.	Remarks
01	Drope	34	10	Emerald cut	03	
02	Pyala	64	11			
03	Kery	12	12			
04	Koyali	32	13			
05	Six pail flower	09	14			
06	Baguet	08	15			
07	Pyala Patti	50	16			
08	Uneven Shape	18	17			
09	Bell patti mindi	50	18			
Total shape		275	Total shape		03	All Total : 278



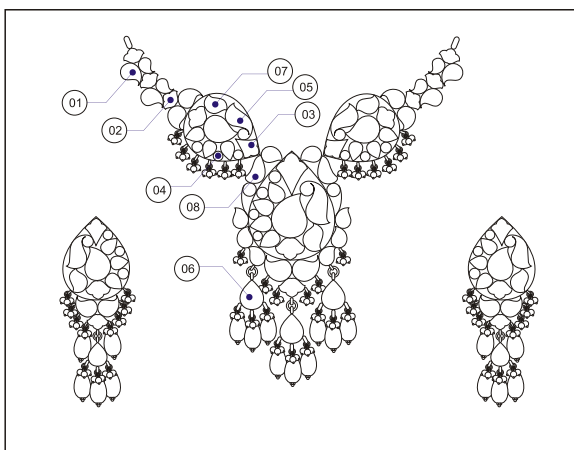
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DESIGNED	MANU PANCHAL		CLIENT : XOXOXOXOXOXOXO		
APPROVED	PARAG VIAS		DRG. NAME: DESIGN DETAILS		
DRG. No.: MWIN-024			DATE: XOXOXO		
ALL DIMENSION ARE IN M.M.			NOMINAL DIMENSION		SHEET 01 OF 01
			XOXOXO		ISSUED ON: 01.06.06
			DO NOT MEASURE THE DRAWING		



Sr. No.	Description of motifs	Used qty.	Sr. No.	Description of motifs	Used qty.	Remarks
01	Cup	39	10	Round	12	
02	Koyali	18	11	Koyali Dandi	98	
03	Bell patti mindi	48	12	Patang	03	
04	Lamba Cup	07	13	Trio	01	
05	Heart	30	14	Marques	01	
06	Kery	62	15			
07	Princess cut	10	16			
08	Drope	06	17			
09	Tady Koyali	06	18			
Total shape		226	Total shape		115	All Total : 341



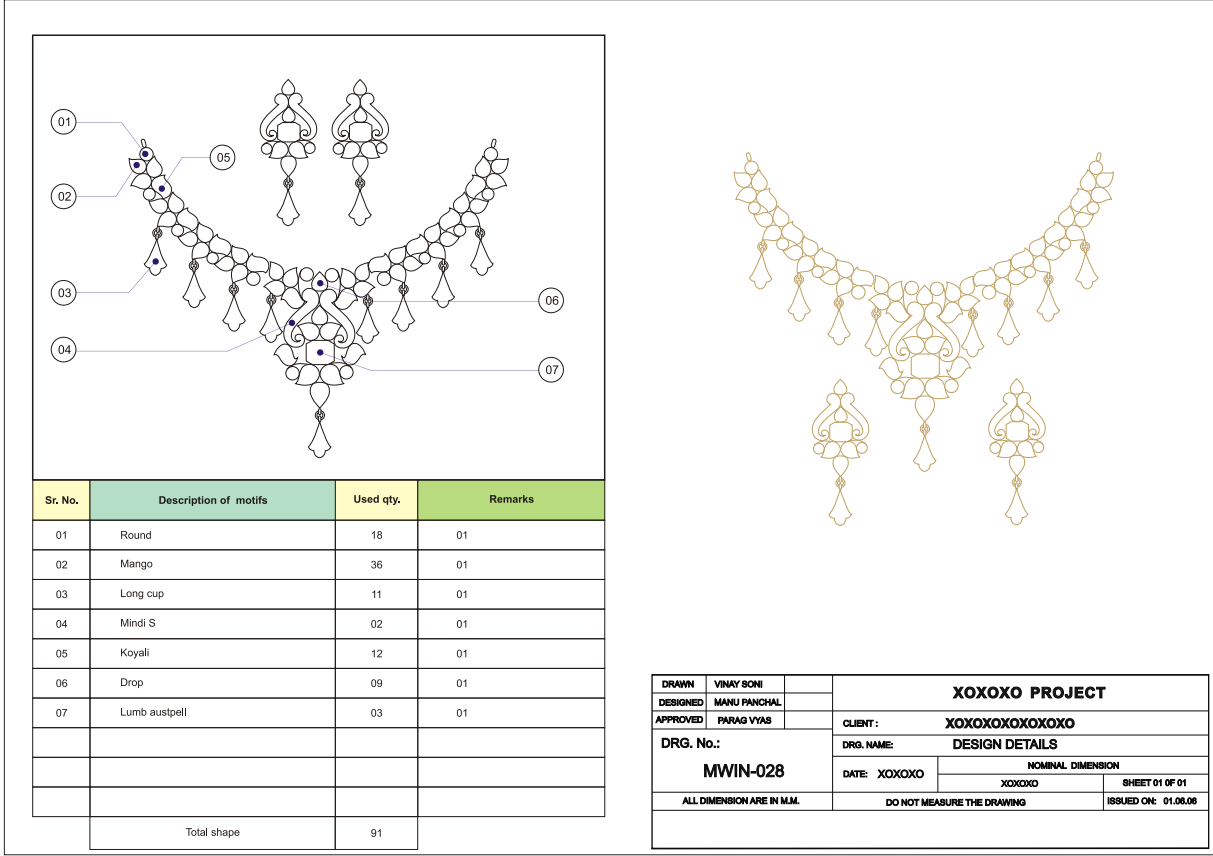
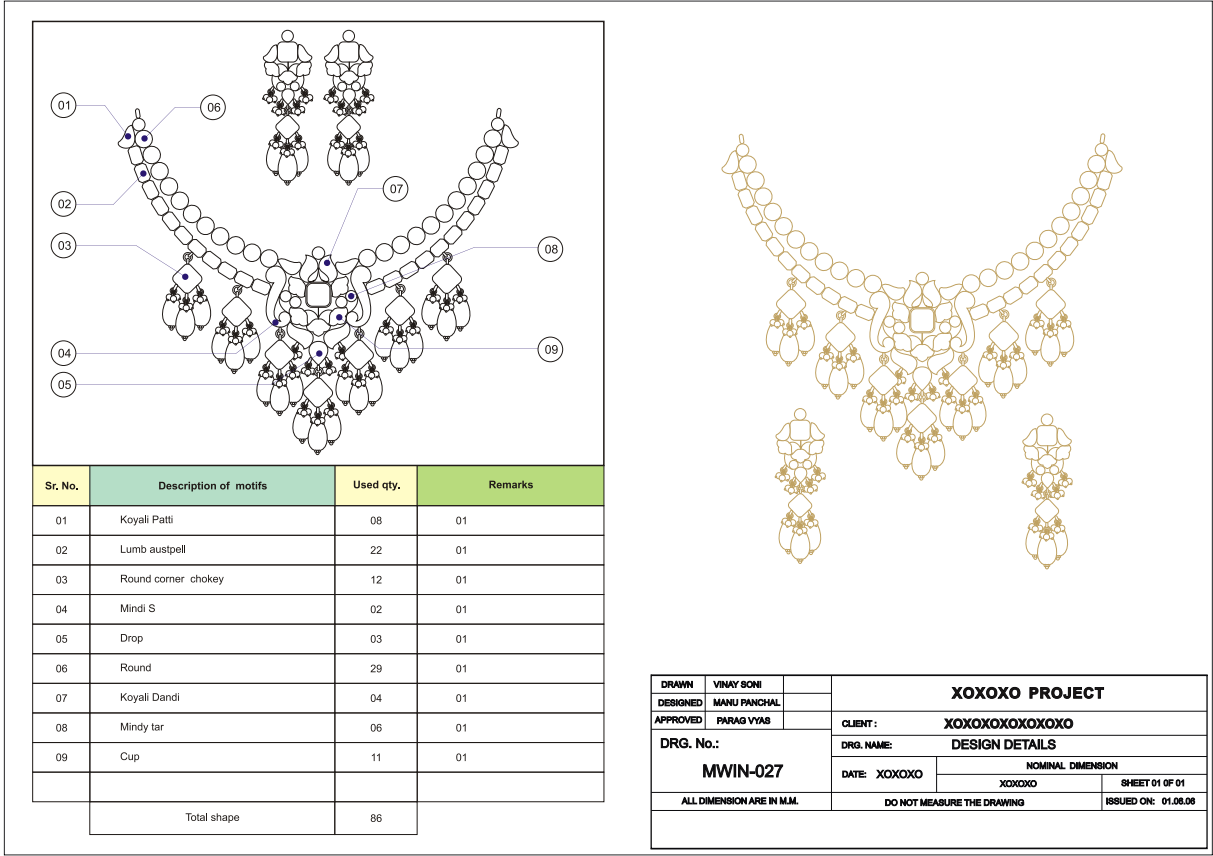
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DESIGNED	MANU PANCHAL		CLIENT : XOXOXOXOXOXOXO	
APPROVED	PARAG VIYAS		DRG. NAME: DESIGN DETAILS	
DRG. No.: MWIN-025		DATE: XOXOXO	NOMINAL DIMENSION	
			XOXOXO	SHEET 01 OF 01
ALL DIMENSION ARE IN M.M.		DO NOT MEASURE THE DRAWING		ISSUED ON: 01.08.08

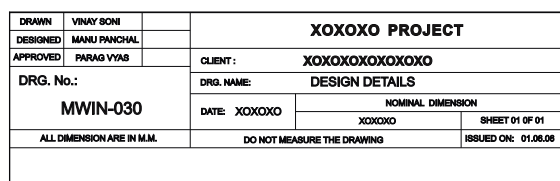
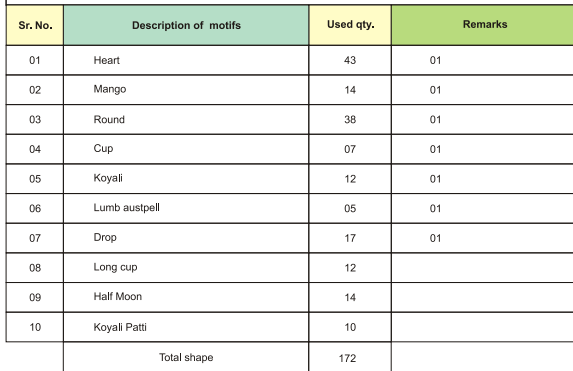
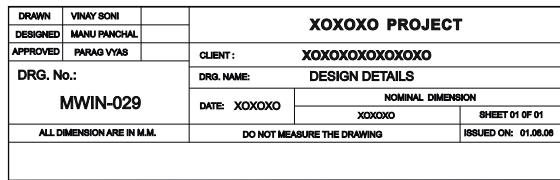
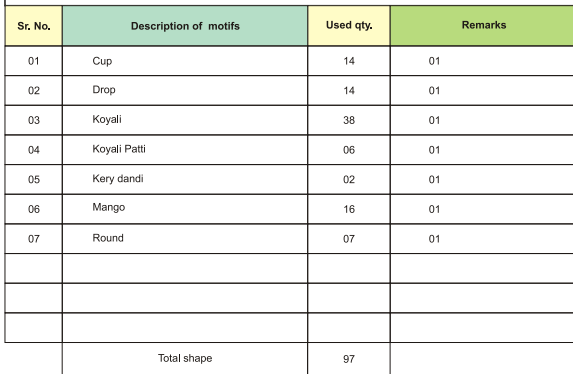


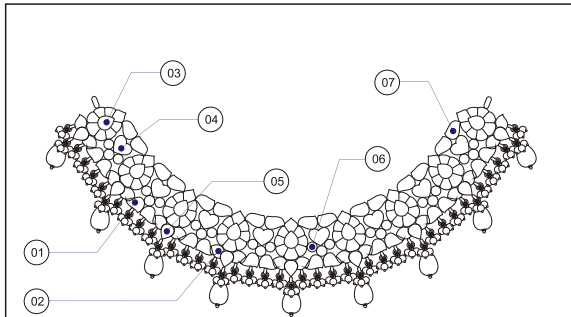
Sr. No.	Description of motifs	Used qty.	Remarks
01	Mango	31	01
02	Cup	12	01
03	Long cup	05	01
04	Round	16	01
05	Koylia Mindi	05	01
06	Drops	26	01
07	Koyali	05	02
08	Koyali Patti	02	03
Total shape		102	



DRAWN	VINAY SONI		XOXOXO PROJECT	
DESIGNED	MANU PANCHAL		CLIENT : XOXOXOXOXOXOXO	
APPROVED	PARAG VIYAS		DRG. NAME: DESIGN DETAILS	
DRG. No.: MWIN-026		DATE: XOXOXO	NOMINAL DIMENSION	
			XOXOXO	SHEET 01 OF 01
ALL DIMENSION ARE IN M.M.		DO NOT MEASURE THE DRAWING		ISSUED ON: 01.08.08



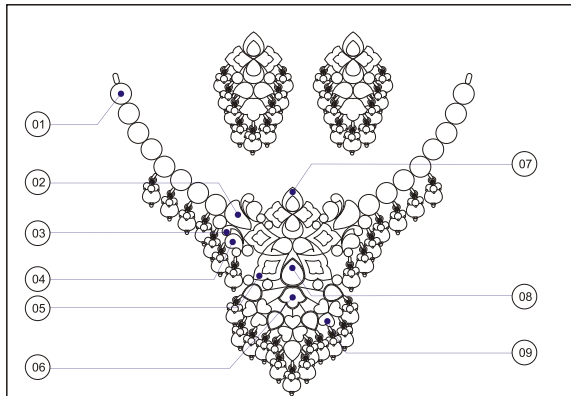




Sr. No.	Description of motifs	Used qty.	Remarks
01	Koyali Patti	16	01
02	Koyali Patti (mango type)	18	01
03	Drop with patti	09	01
04	Heart	08	01
05	Drop	09	01
06	Round	24	01
07	Koyali	16	01
	Total shape	100	



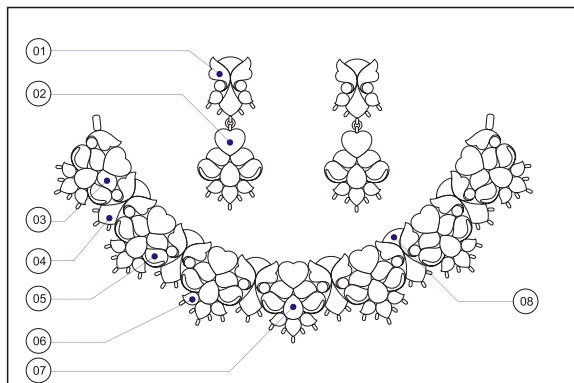
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DESIGNED	MANU PANCHAL		CLIENT : XOXOXOXOXOXOXO		
APPROVED	PARAG VIAS		DRG. NAME: DESIGN DETAILS		
DRG. No.: MWIN-031			DATE: XOXOXO	NOMINAL DIMENSION XOXOXO	SHEET 01 OF 01
ALL DIMENSION ARE IN M.M.			DO NOT MEASURE THE DRAWING		ISSUED ON: 01.06.06



Sr. No.	Description of motifs	Used qty.	Remarks
01	Round	30	01
02	Koyali Patti	02	01
03	Kery dandi	04	01
04	Mango	06	01
05	Long Cup	08	01
06	Cup	03	01
07	Pan Patti	03	01
08	Drop	06	
09	Heart	09	
09	Kery Mindy	04	
	Total shape	75	



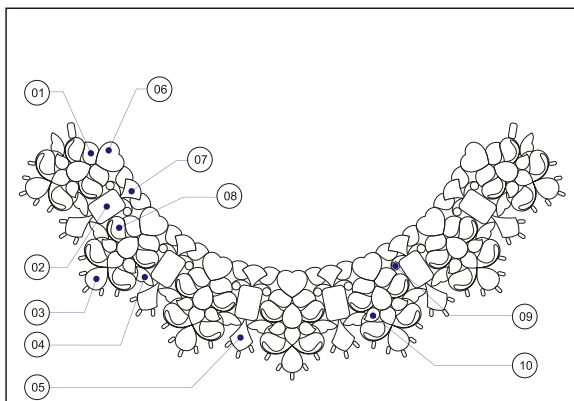
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DESIGNED	MANU PANCHAL		CLIENT : XOXOXOXOXOXOXO		
APPROVED	PARAG VIAS		DRG. NAME: DESIGN DETAILS		
DRG. No.: MWIN-032			DATE: XOXOXO	NOMINAL DIMENSION XOXOXO	SHEET 01 OF 01
ALL DIMENSION ARE IN M.M.			DO NOT MEASURE THE DRAWING		ISSUED ON: 01.06.06



Sr. No.	Description of motifs	Used qty.	Remarks
01	Pan Mindy	18	01
02	Heart	09	01
03	Koyali Patti	18	01
04	Long Cup	08	01
05	Koyali dandi	18	01
06	Mango	16	01
07	Drop	18	01
08	Jo tryangel	08	
	Total shape	113	



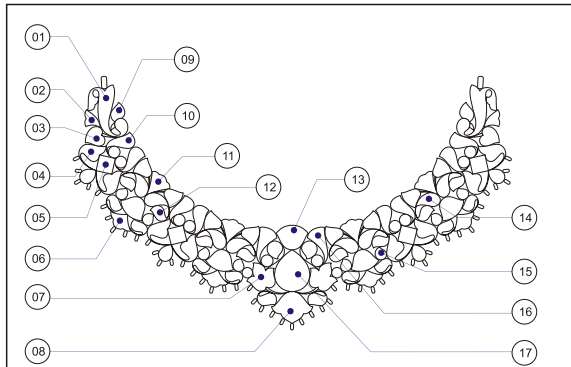
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DESIGNED	MANU PANCHAL			
APPROVED	PARAG VYAS		CLIENT :	XOXOXOXOXOXOXO
DRG. No.:			DRG. NAME:	DESIGN DETAILS
MWIN-033			DATE: XOXOXO	NOMINAL DIMENSION
				XOXOXO SHEET 01 OF 01
ALL DIMENSION ARE IN M.M.			DO NOT MEASURE THE DRAWING	ISSUED ON: 01.08.08



Sr. No.	Description of motifs	Used qty.	Remarks
01	Koyali Patti	26	01
02	Lumb chokey	06	01
03	Drop	21	01
04	Patti	14	01
05	Patang	06	01
06	Heart	07	01
07	Jo tryangel	06	01
08	Koyali Dandi	28	
09	Kery Dandi	12	
10	Mango	14	
	Total shape	142	



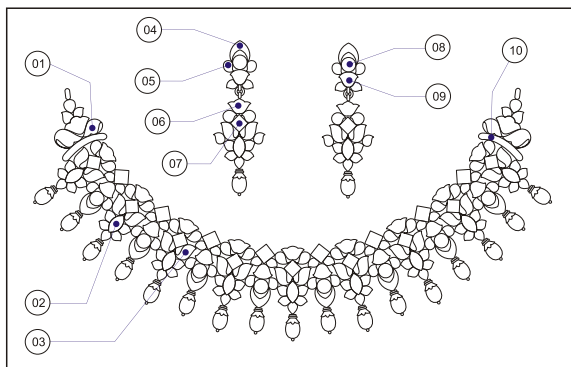
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DESIGNED	MANU PANCHAL			
APPROVED	PARAG VYAS		CLIENT :	XOXOXOXOXOXOXO
DRG. No.:			DRG. NAME:	DESIGN DETAILS
MWIN-034			DATE: XOXOXO	NOMINAL DIMENSION
				XOXOXO SHEET 01 OF 01
ALL DIMENSION ARE IN M.M.			DO NOT MEASURE THE DRAWING	ISSUED ON: 01.08.08



Sr. No.	Description of motifs	Used qty.	Remarks
01	Full Kelly	02	
02	Patti	02	
03	Tikha Pan	02	
04	Vell Patti	08	
05	Chokey	04	
06	Cup	06	
07	Tikha cup	02	
08	Cup	01	
09	Koyali	02	
10	Koyali Mindy	08	
11	Lumb Cup	04	
12	Koyali Dandi	18	
13	Round Cup	13	
14	Lumby Kary	08	
15		10	
16	Jo mindy	02	
17	Drop	05	
Total shape		99	



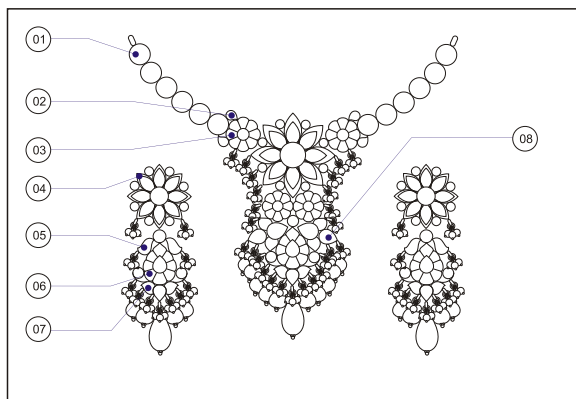
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DESIGNED	MANU PANCHAL		CLIENT : XOXOXOXOXOXOXO	
APPROVED	PARAG VYAS		DRG. NAME: DESIGN DETAILS	
DRG. No.: MWIN-035		DATE: XOXOXO	NOMINAL DIMENSION XOXOXO SHEET 01 OF 01	
ALL DIMENSION ARE IN M.M.		DO NOT MEASURE THE DRAWING		ISSUED ON: 01.08.08



Sr. No.	Description of motifs	Used qty.	Remarks
01	Vell Patti	04	01
02	Jo Koyali Patti flower	11	01
03	Koyali	22	01
04	Tikha Chand	10	01
05	Mango	70	01
06	Cup	13	01
07	Chokey	11	01
08	Round	10	01
09	Cup	10	
10	Border patti	02	
11	Drop	02	
Total shape		165	



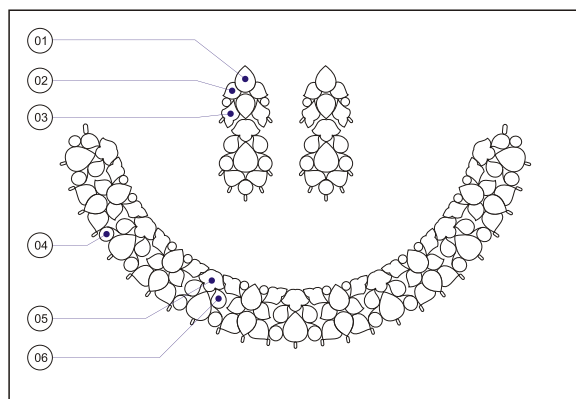
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DESIGNED	MANU PANCHAL		CLIENT : XOXOXOXOXOXOXO	
APPROVED	PARAG VYAS		DRG. NAME: DESIGN DETAILS	
DRG. No.: MWIN-036		DATE: XOXOXO	NOMINAL DIMENSION XOXOXO SHEET 01 OF 01	
ALL DIMENSION ARE IN M.M.		DO NOT MEASURE THE DRAWING		ISSUED ON: 01.08.08



Sr. No.	Description of motifs	Used qty.	Remarks
01	Round	45	01
02	Mango	04	01
03	Aust pail flower	04	01
04	Tikha chand	24	01
05	Koyali	04	01
06	Aust pail drop flower	03	01
07	Koyali patti	10	01
08	Drop	05	01
	Total shape	99	



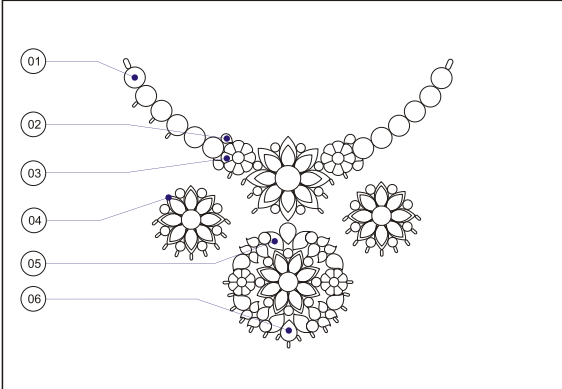
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DESIGNED	MANU PANCHAL		CLIENT : XOXOXOXOXOXOXO	
APPROVED	PARAG VIYAS		DRG. NAME: DESIGN DETAILS	
DRG. No.: MWIN-037		DATE: XOXOXO	NOMINAL DIMENSION	
			XOXOXO	SHEET 01 OF 01
ALL DIMENSION ARE IN M.M.		DO NOT MEASURE THE DRAWING		ISSUED ON: 01.06.06



Sr. No.	Description of motifs	Used qty.	Remarks
01	Drop	25	01
02	Koyali patti	32	01
03	Pyala patti	16	01
04	Round	38	01
05	Cup	09	01
06	Mango	18	01
07			01
08			01
09			
10			
11			
	Total shape	138	

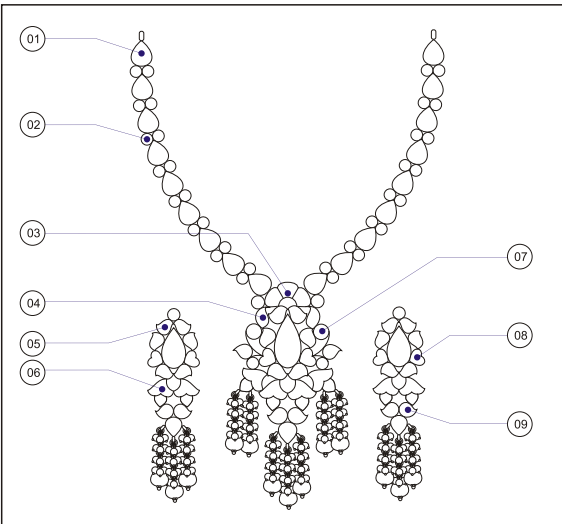


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DESIGNED	MANU PANCHAL		CLIENT : XOXOXOXOXOXOXO	
APPROVED	PARAG VIYAS		DRG. NAME: DESIGN DETAILS	
DRG. No.: MWIN-038		DATE: XOXOXO	NOMINAL DIMENSION	
			XOXOXO	SHEET 01 OF 01
ALL DIMENSION ARE IN M.M.		DO NOT MEASURE THE DRAWING		ISSUED ON: 01.06.06

			
Sr. No.	Description of motifs	Used qty.	Remarks
01	Round	44	01
02	Mango	24	01
03	Aust pail flower	04	01
04	Tikha chand	32	01
05	Koyal Mindi	04	01
06	Drop	02	01
	Total shape	110	

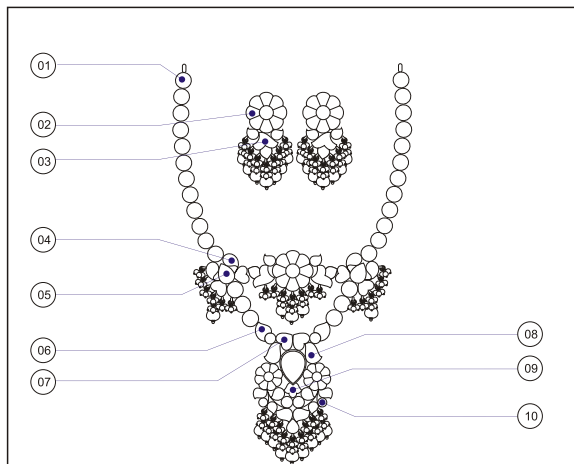


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DESIGNED	MANU PANCHAL		CLIENT : XOXOXOXOXOXOXO	
APPROVED	PARAG VIAS		DRG. NAME: DESIGN DETAILS	
DRG. No.: MWIN-039		DATE: XOXOXO	NOMINAL DIMENSION	
			XOXOXO	SHEET 01 OF 01
ALL DIMENSION ARE IN M.M.		DO NOT MEASURE THE DRAWING		ISSUED ON: 01.08.08

			
Sr. No.	Description of motifs	Used qty.	Remarks
01	Drop	44	01
02	Round	44	01
03	Tin patti Flower	44	01
04	Koali	44	01
05	Koyali patti	44	01
06	Round patti	44	01
07	Kery dandi	44	01
08	Heart	44	01
09	Mango	44	01
	Total shape	93	



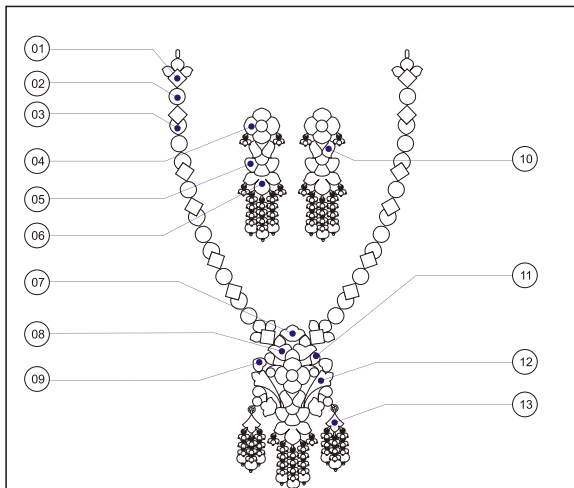
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DESIGNED	MANU PANCHAL		CLIENT : XOXOXOXOXOXOXO	
APPROVED	PARAG VIAS		DRG. NAME: DESIGN DETAILS	
DRG. No.: MWIN-040		DATE: XOXOXO	NOMINAL DIMENSION	
			XOXOXO	SHEET 01 OF 01
ALL DIMENSION ARE IN M.M.		DO NOT MEASURE THE DRAWING		ISSUED ON: 01.08.08



Sr. No.	Description of motifs	Used qty.	Remarks
01	Round	30	01
02	Aust pail Flower	05	01
03	Pyala patti	04	01
04	Mango	14	01
05	Drop	04	01
06	Kery Mindi	02	01
07	Heart	04	01
08	Koyali	06	01
09	Cup	01	01
10	Kery Mindi	04	
Total shape		74	



DRAWN	VINAY SONI		XOXOXO PROJECT	
DESIGNED	MANU PANCHAL		CLIENT : XOXOXOXOXOXOXO	
APPROVED	PARAG VYAS		DRG. NAME: DESIGN DETAILS	
DRG. No.: MWIN-041		DATE: XOXOXO	NOMINAL DIMENSION	
			XOXOXO	SHEET 01 OF 01
ALL DIMENSION ARE IN M.M.		DO NOT MEASURE THE DRAWING		ISSUED ON: 01.08.08



Sr. No.	Description of motifs	Used qty.	Remarks
01	Chokey Flower	04	
02	Round	12	
03	Patti	10	
04	Char Patti Flower	03	
05	Tin patti Flower	03	
06	Tin Patti Flower	03	
07	Cup	02	
08	Pyala patti	02	
09	Heart	02	
10	Koyali	04	
11	Kery Dandi	04	
12	Lumba cup	02	
13	Pyala	02	
Total shape		53	



DRAWN	VINAY SONI		XOXOXO PROJECT	
DESIGNED	MANU PANCHAL		CLIENT : XOXOXOXOXOXOXO	
APPROVED	PARAG VYAS		DRG. NAME: DESIGN DETAILS	
DRG. No.: MWIN-042		DATE: XOXOXO	NOMINAL DIMENSION	
			XOXOXO	SHEET 01 OF 01
ALL DIMENSION ARE IN M.M.		DO NOT MEASURE THE DRAWING		ISSUED ON: 01.08.08

			
Sr. No.	Description of motifs	Used qty.	Remarks
01	Patti	14	
02	Cup	18	
03	Drop	16	
04	Kery Mindi	06	
05	Heart	03	
06	Tin patti flower	02	
07	Koyali	10	
08	Kery dandi	02	
09	Round	02	
10	Mindi dandi	20	
Total shape		93	



DRAWN	VINAY SONI	XOXOXO PROJECT	
DESIGNED	MANU PANCHAL		
APPROVED	PARAG VIAS	CLIENT :	XOXOXOXOXOXOXO
DRG. No.: MWIN-043		DRG. NAME:	DESIGN DETAILS
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ALL DIMENSION ARE IN M.M.		DO NOT MEASURE THE DRAWING	
		ISSUED ON: 01.08.08	

			
Sr. No.	Description of motifs	Used qty.	Remarks
01	Heart	19	
02	Mango	32	
03	Drop	18	
04	Kalgi	02	
05	Kery Midi	02	
06	Kery dadi	02	
07	Cup	05	
08	Tin patti flower	06	
09	Koyali	06	
10	Pyali patti	02	
Total shape		94	



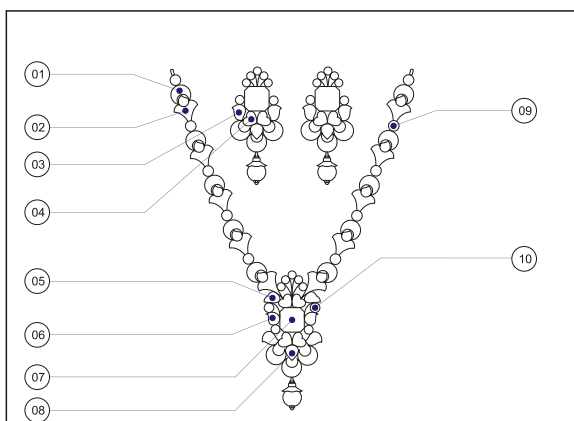
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APPROVED	PARAG VIAS	CLIENT :	XOXOXOXOXOXOXO
DRG. No.: MWIN-044		DRG. NAME:	DESIGN DETAILS
		DATE: XOXOXO	NOMINAL DIMENSION XOXOXO SHEET 01 OF 01
ALL DIMENSION ARE IN M.M.		DO NOT MEASURE THE DRAWING	
		ISSUED ON: 01.08.08	



Sr. No.	Description of motifs	Used qty.	Remarks
01	Heart	20	
02	Lumb chokey	08	
03	Chokey	10	
04	Cup	05	
05	Mango	08	
06	Oval	03	
07	Koyali dandi	10	
08	Tin patti flower	02	
09	Mindi Dandi	10	
10	Round	03	
11	Parrot	06	
Total shape		85	



DRAWN	VINAY SONI		XOXOXO PROJECT	
DESIGNED	MANU PANCHAL		CLIENT : XOXOXOXOXOXOXO	
APPROVED	PARAG VIYAS		DRG. NAME: DESIGN DETAILS	
DRG. No.: MWIN-045		DATE: XOXOXO	NOMINAL DIMENSION	
			XOXOXO	SHEET 01 OF 01
ALL DIMENSION ARE IN M.M.		DO NOT MEASURE THE DRAWING		ISSUED ON: 01.08.08



Sr. No.	Description of motifs	Used qty.	Remarks
01	Moon	19	
02	Pyala patti with kery	10	
03	Koyali	06	
04	Heart	08	
05	Pyala	02	
06	Mango	02	
07	Aust pail	03	
08	Drop	03	
09	Round	15	
10	Mindi Dandi	14	
Total shape		82	

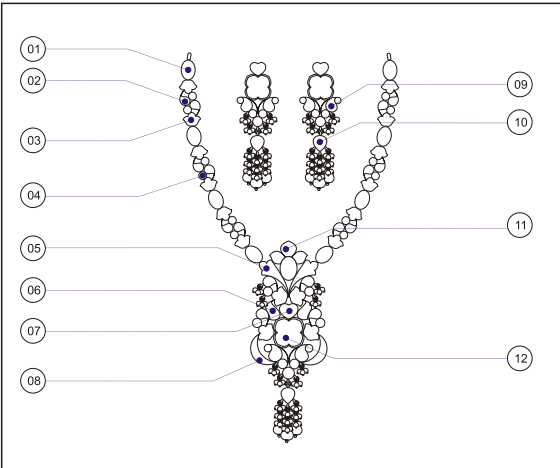


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APPROVED	PARAG VIYAS		DRG. NAME: DESIGN DETAILS	
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			XOXOXO	SHEET 01 OF 01
ALL DIMENSION ARE IN M.M.		DO NOT MEASURE THE DRAWING		ISSUED ON: 01.08.08

			
Sr. No.	Description of motifs	Used qty.	Remarks
01	Cup	18	
02	Pankha	14	
03	Mango	26	
04	Round	09	
05	Koyali	16	
06	Baguet Border	01	
07	Drop	01	
08	Tin patti Flower	04	
09	Pyala patti	02	
10	Daudi Pan	06	
11	Heart	04	
12	Mindi Dandi	04	
Total shape		105	

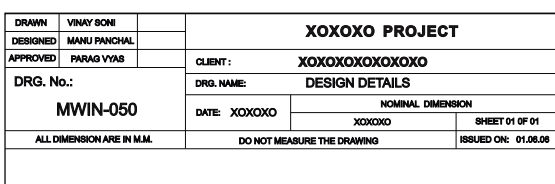
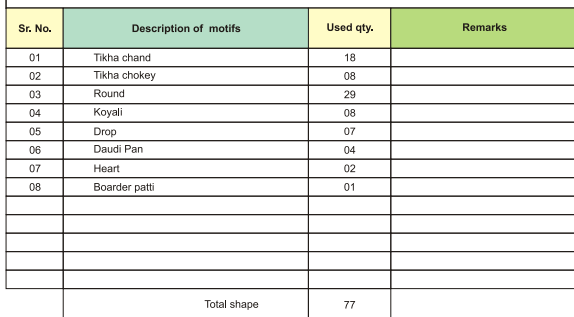
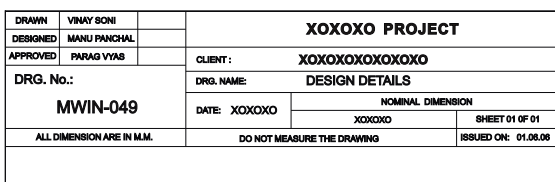
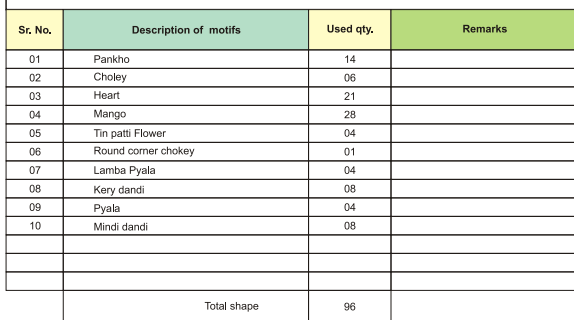


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DESIGNED	MANU PANCHAL		
APPROVED	PARAG VIAS	CLIENT :	XOXOXOXOXOXO
DRG. No.: MWIN-047		DRG. NAME:	DESIGN DETAILS
		DATE: XOXOXO	NOMINAL DIMENSION XOXOXO SHEET 01 OF 01
ALL DIMENSION ARE IN M.M.		DO NOT MEASURE THE DRAWING ISSUED ON: 01.08.08	

			
Sr. No.	Description of motifs	Used qty.	Remarks
01	Oval	09	
02	Kery Dandi	16	
03	Cup	16	
04	Round	19	
05	Lumba Pyala	02	
06	Koyali	02	
07	Heart	03	
08	Tikha chand	02	
09	Kery Mindi	06	
10	Drop	03	
11	Teen patti Flower	01	
12	Chotuliya	03	
Total shape		82	



DRAWN	VINAY SONI	XOXOXO PROJECT	
DESIGNED	MANU PANCHAL		
APPROVED	PARAG VIAS	CLIENT :	XOXOXOXOXOXO
DRG. No.: MWIN-048		DRG. NAME:	DESIGN DETAILS
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ALL DIMENSION ARE IN M.M.		DO NOT MEASURE THE DRAWING ISSUED ON: 01.08.08	



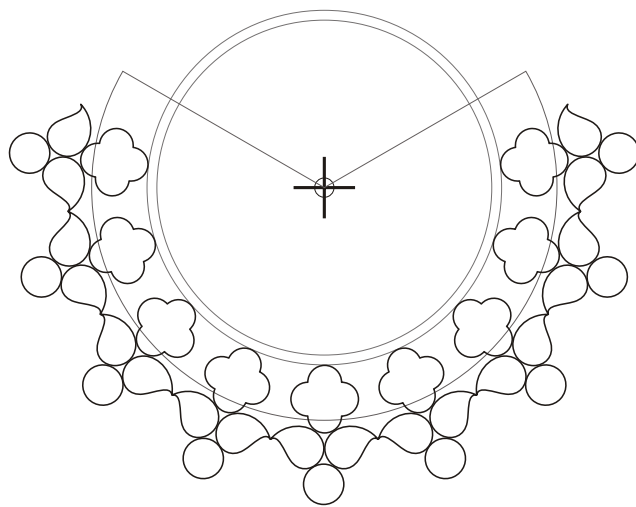
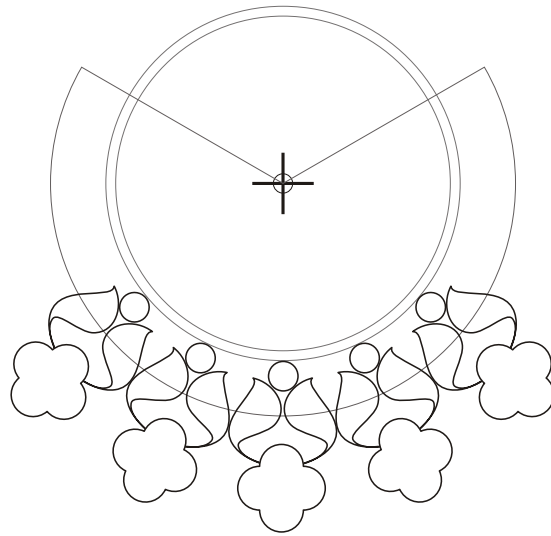
Appendix IV

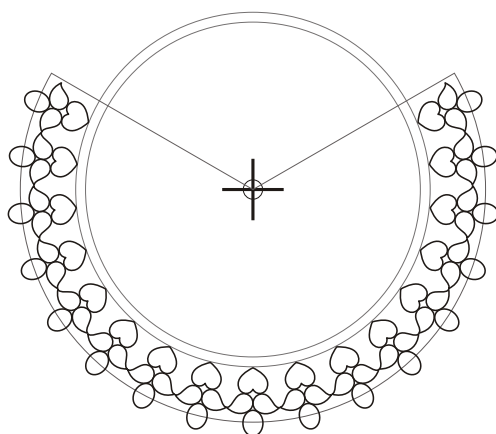
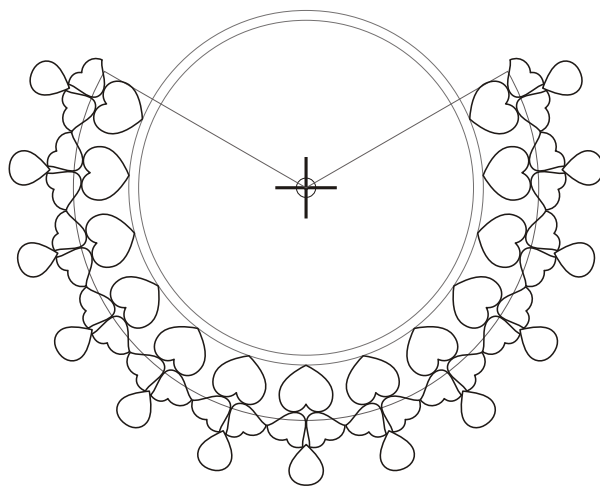
This section of appendices contains core body of work in form of 125 designs. These designs were created by kundansaaz by first making form clusters using a predetermined number of Smallest semantic units.

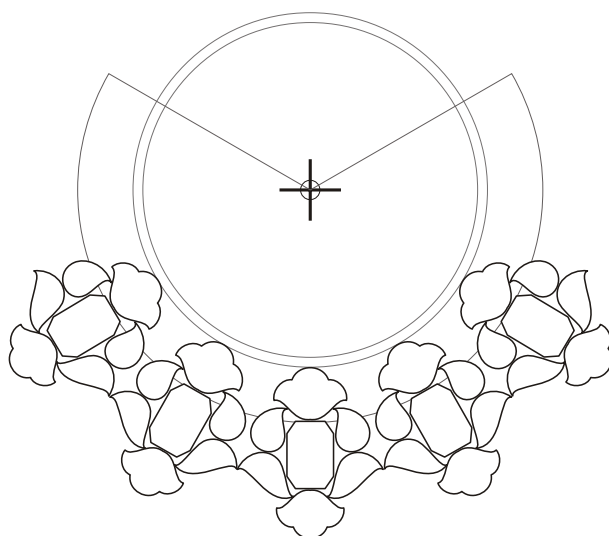
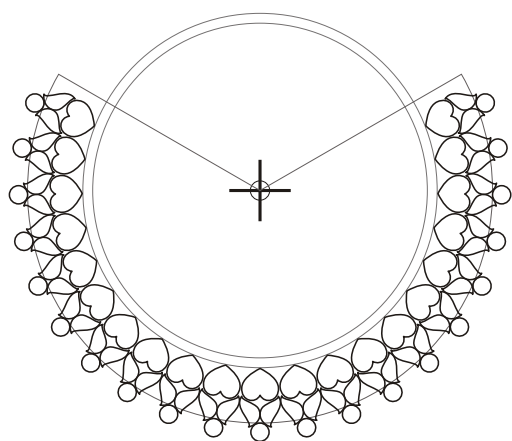
These were then arranged around principle circle to achieve an overall form. Cluster pitch was varied as the number of form cluster increased.

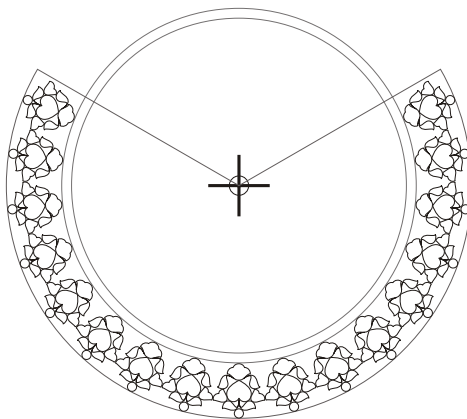
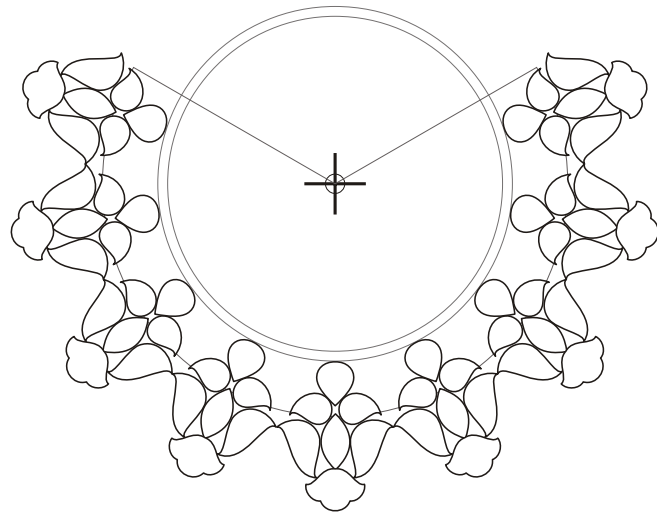
In later part of this appendix five sectional plates are reproduced that gives more details of cluster pitch specific to that particular design.

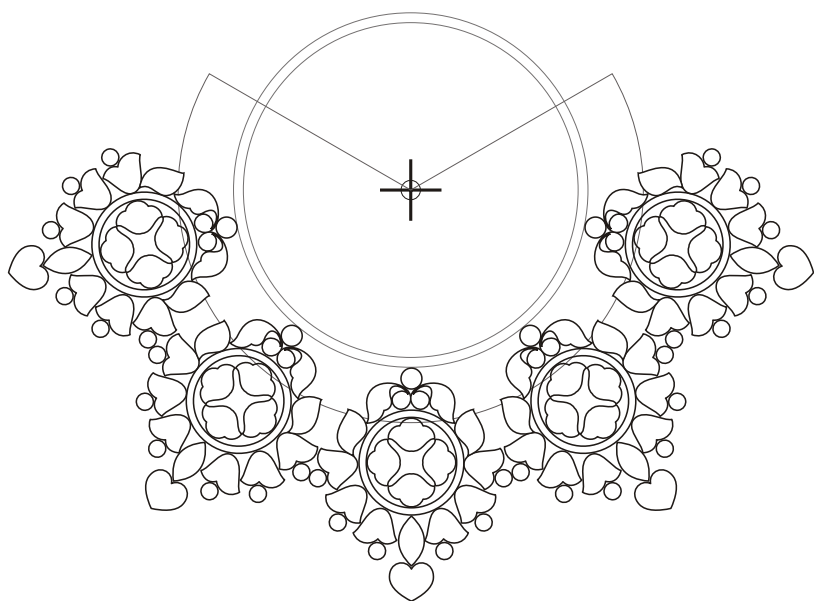
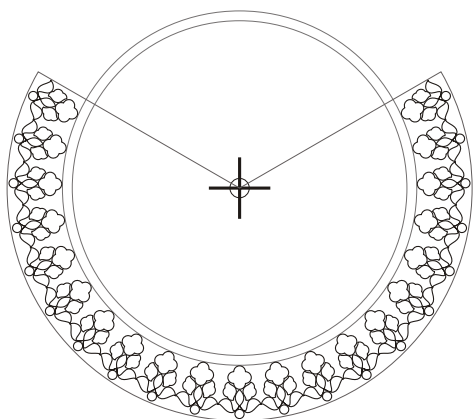
A mathematical interpretation of a subjective aspect thus becomes more objective as an mathematical interpretation is now possible not only in terms of 'less' or 'more' but also becomes quantifiable as to 'how much more' or 'how much less', which so far was a subjective judgement.

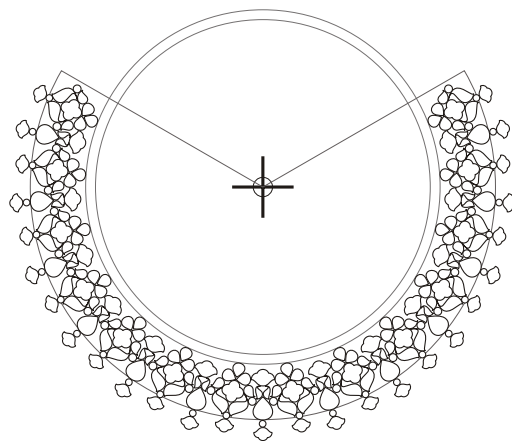
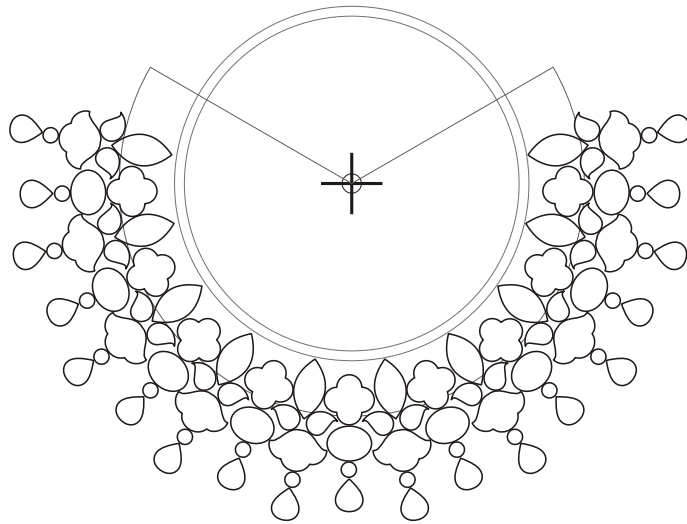


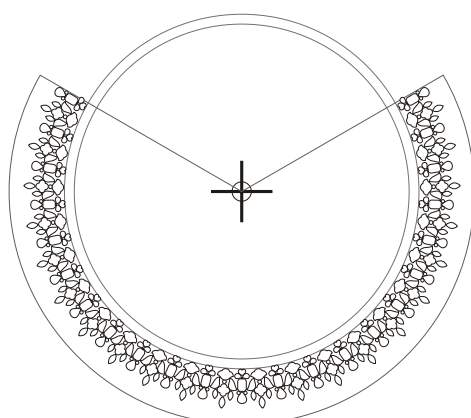
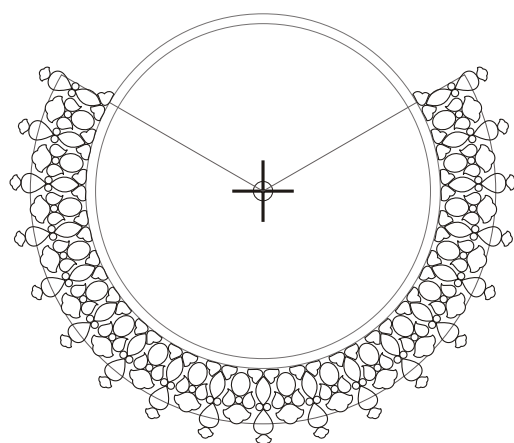


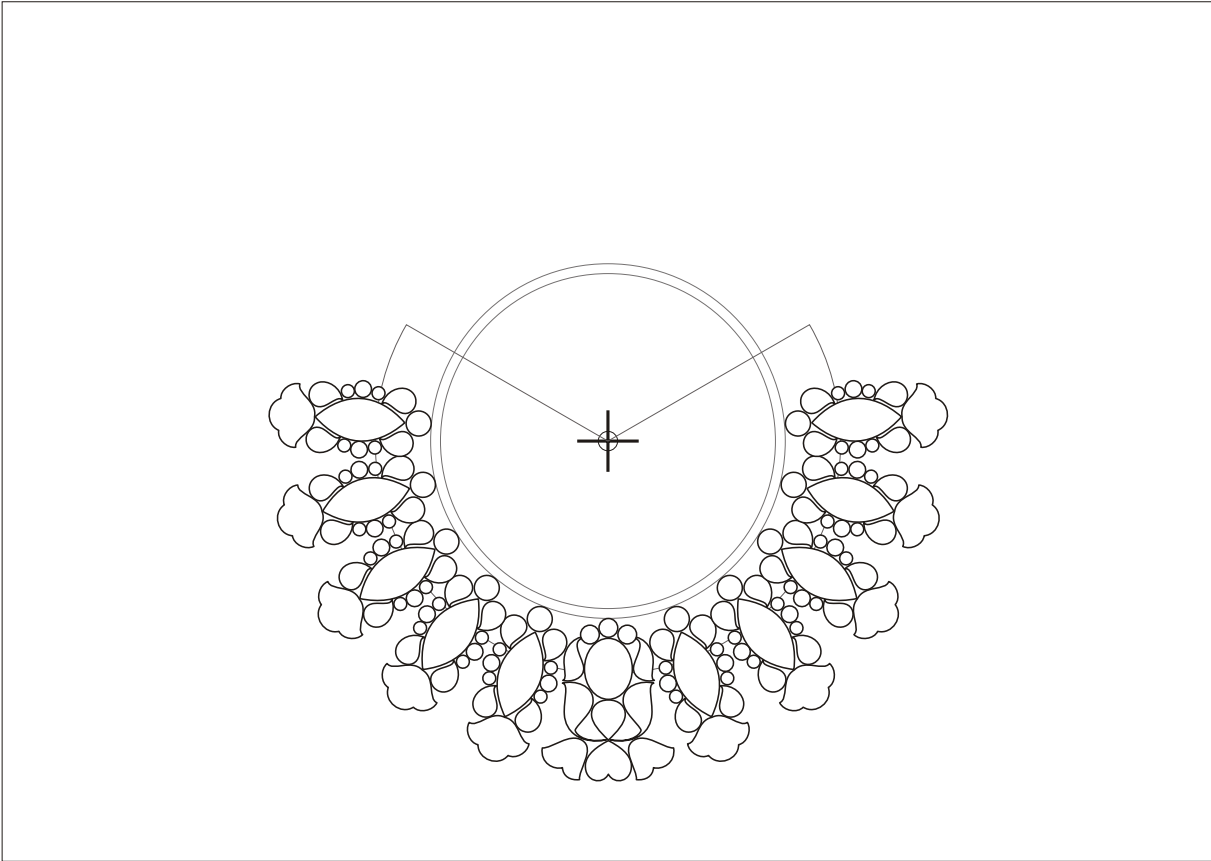
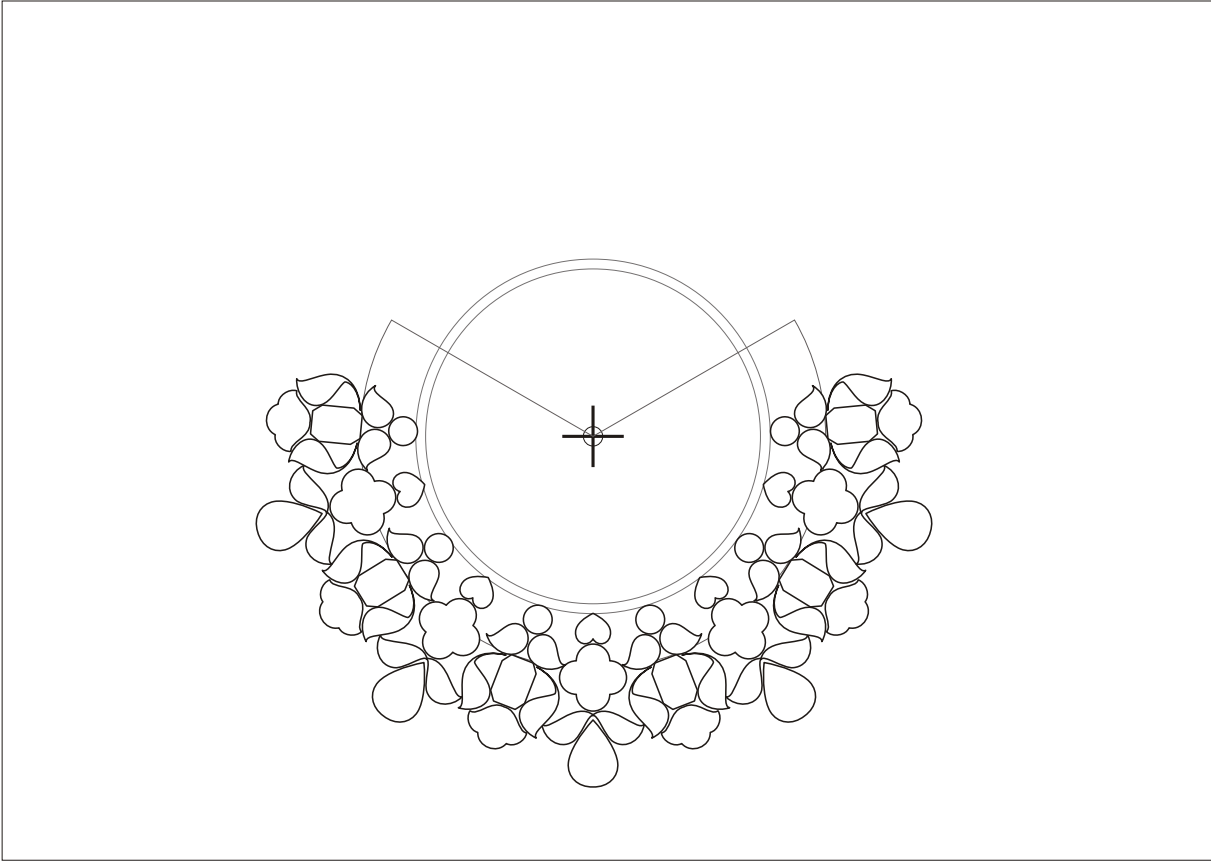


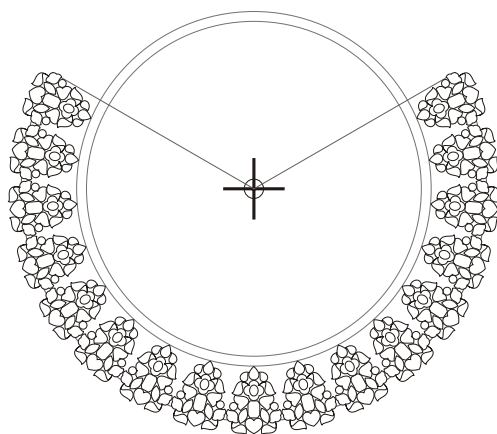
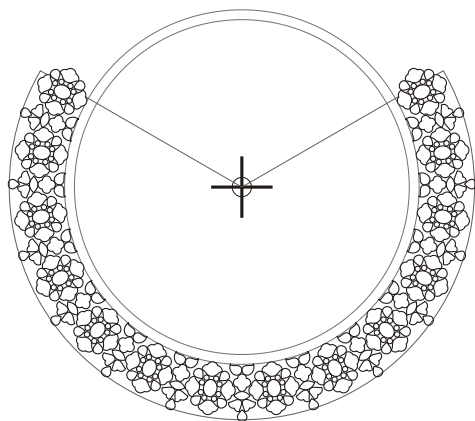


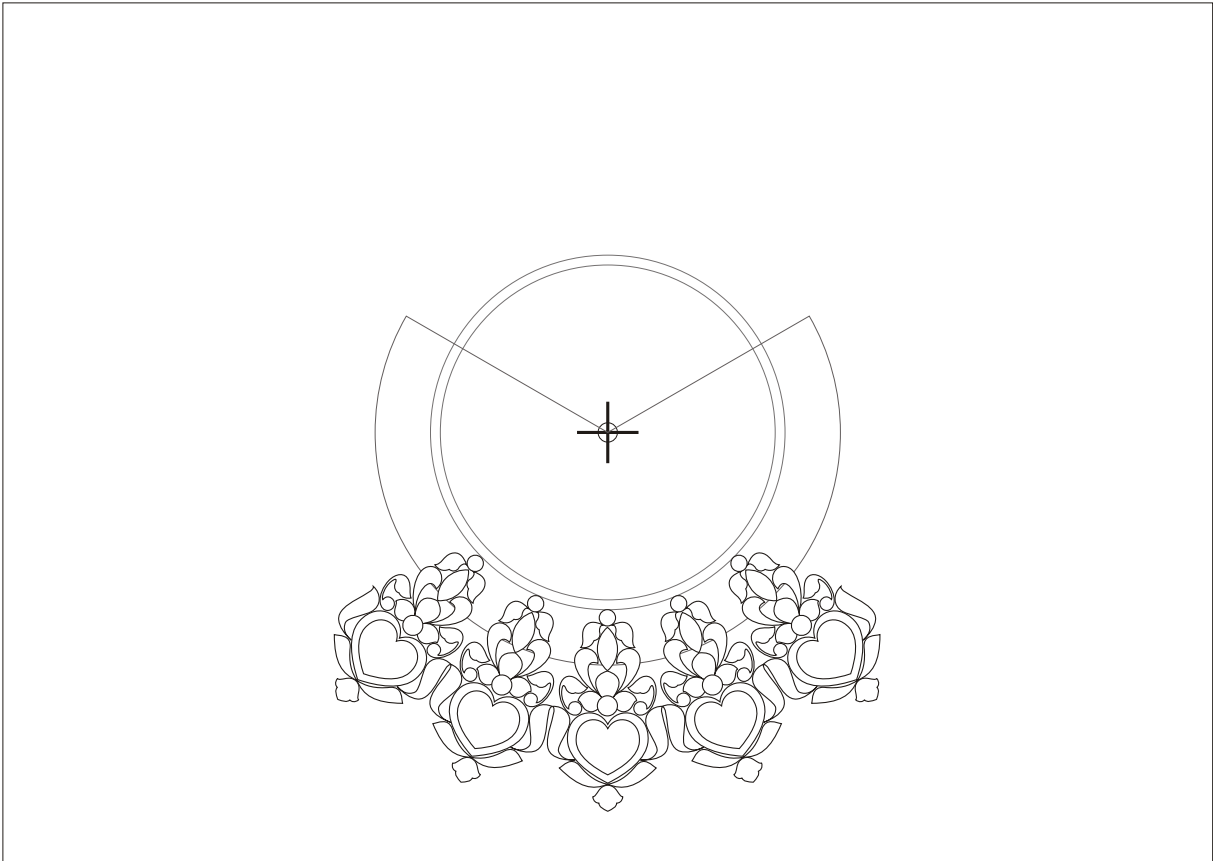




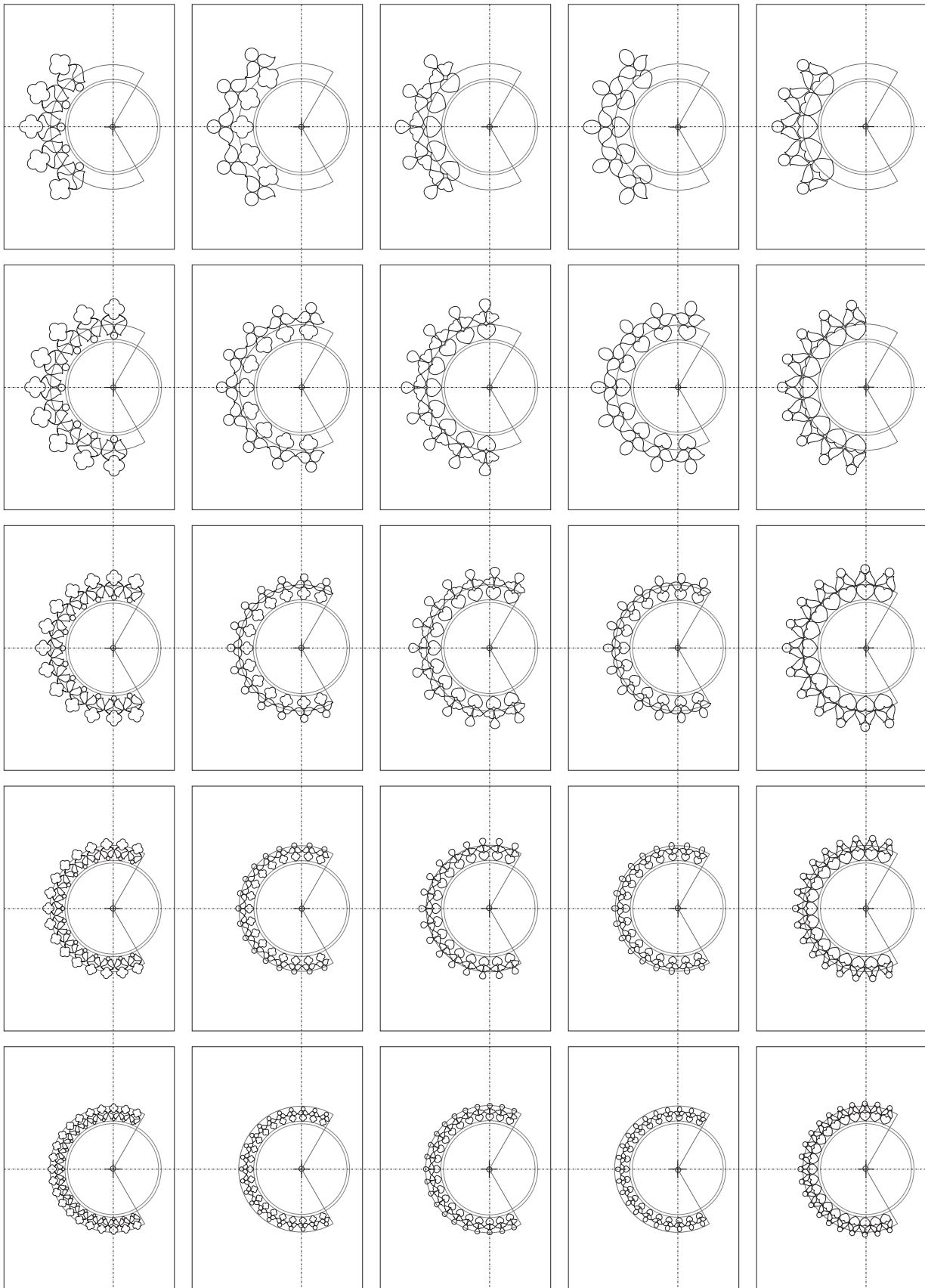




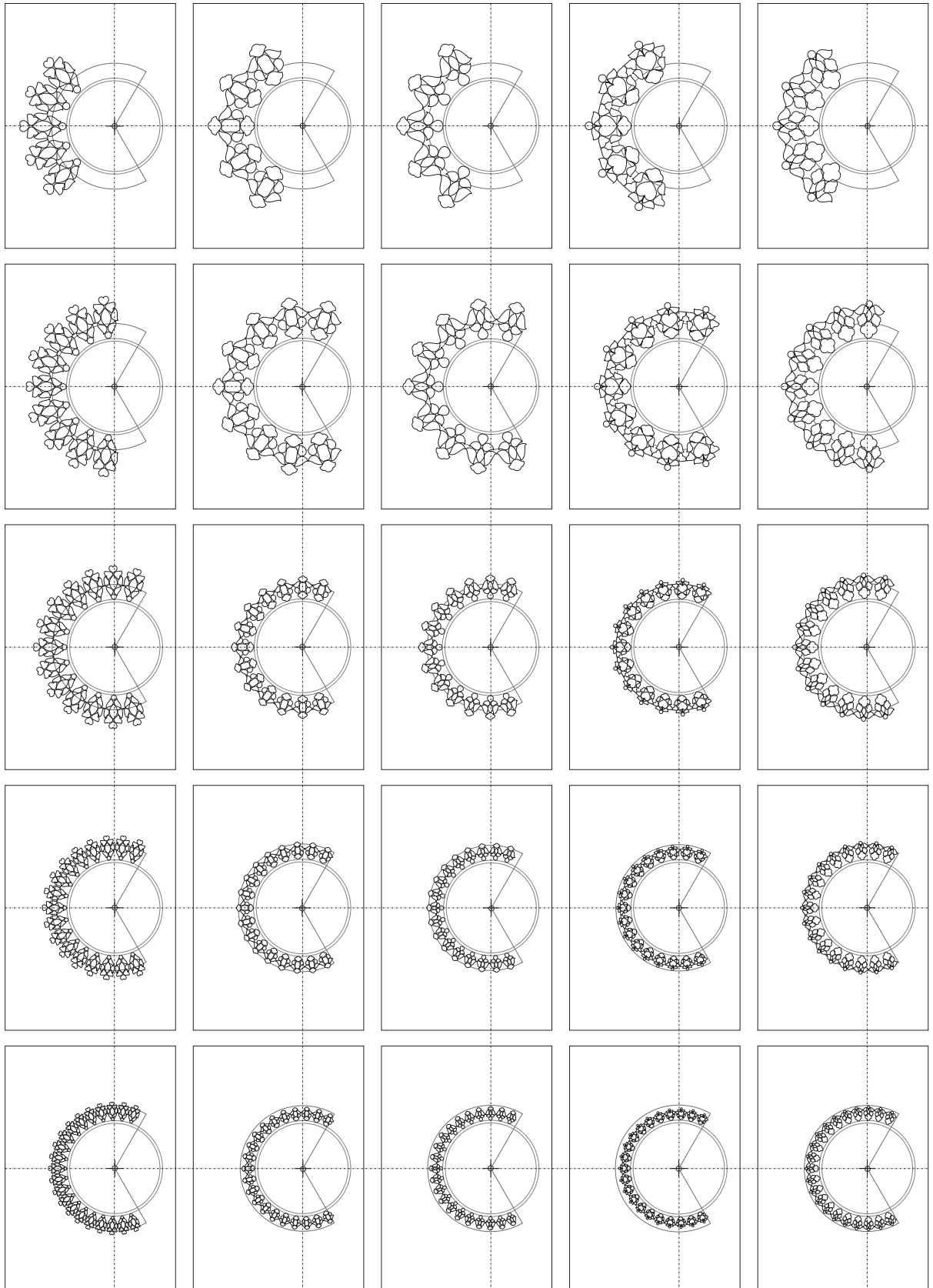




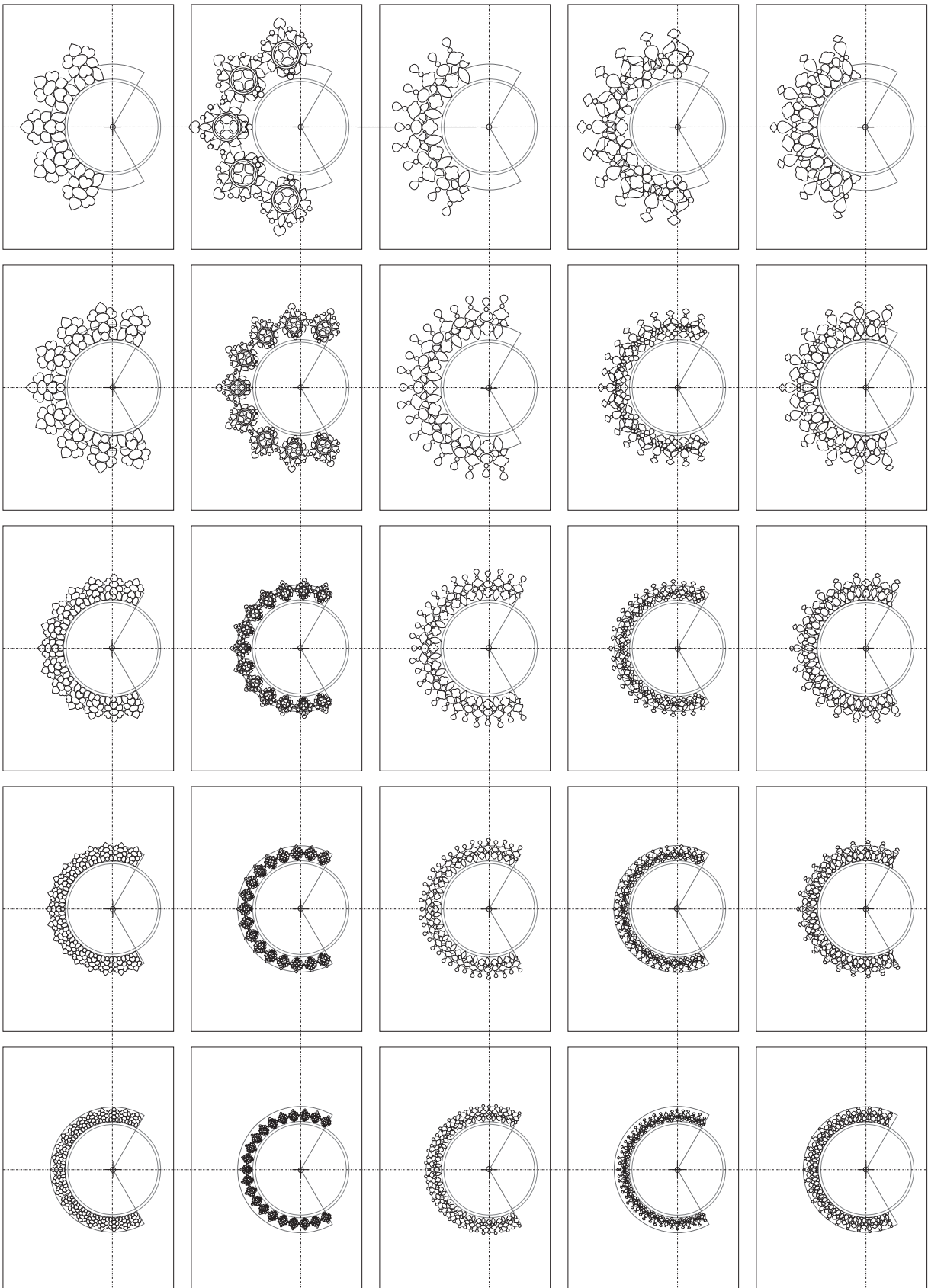
3 SSU_5 Design Variation



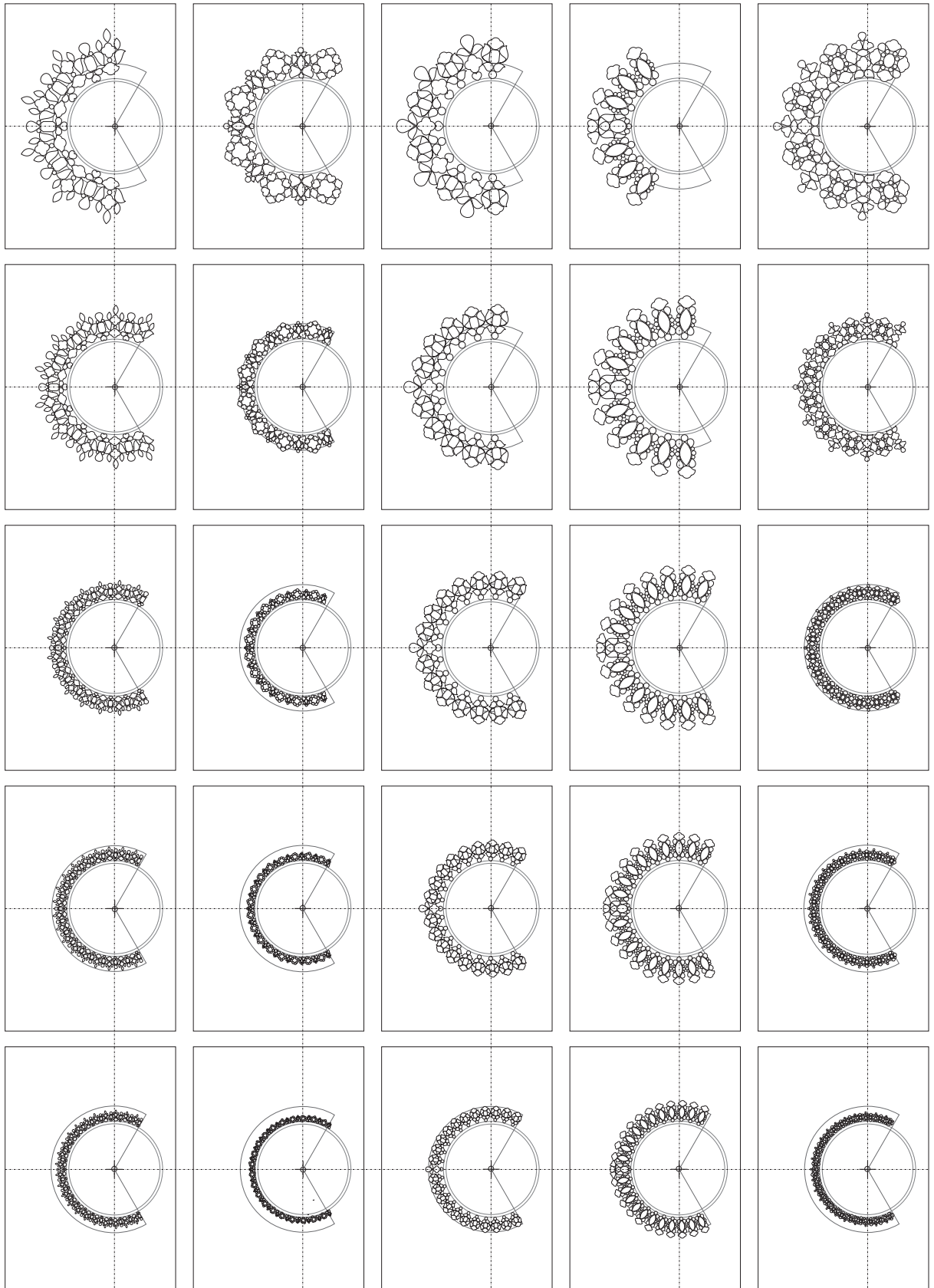
5 SSU_5 Design Variation



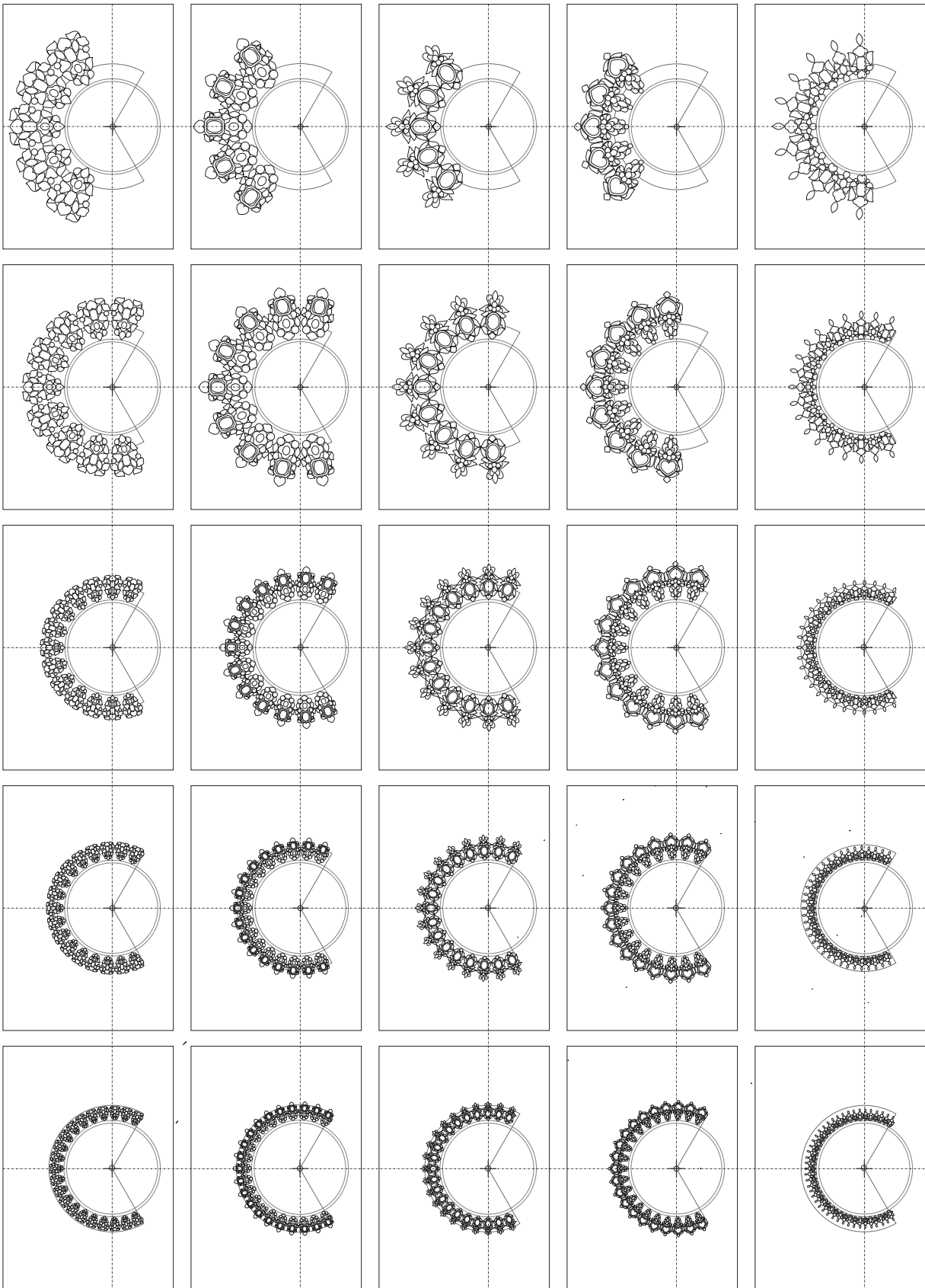
7 SSU_5 Design Variation



9 SSU_5 Design Variation



11 SSU_5 Design Variation



Data format

Basic information

Subject number	Date	Place	Starting time	Finishing time

Subject

Name	Gender	Marital Status	Age	Occupation	Contact

First Selection (12 articles, noted in ascending order) *no hierarchy of preference

Article number (as on backside)												
------------------------------------	--	--	--	--	--	--	--	--	--	--	--	--

Second Selection (6 articles, noted in ascending order) *no hierarchy of preference

Article number (as on backside)						
------------------------------------	--	--	--	--	--	--

Third Selection (2 articles, noted in ascending order) *no hierarchy of preference

Article number (as on backside)		
------------------------------------	--	--

Final Selection (1 articles) if possible and keywords if they can affix one

Article number (as on backside)	
------------------------------------	--

Additional Information

Keywords used to describe the articles (often used words, phrases, adjectives)	Any peculiarity during interview	Social status High, High -Middle, Middle

Appendix V

Re-Testing

1. Introduction

In continuation to experiment investigating likeness of *kundan* articles, this interim report is a summary of an experiment conducted to test validity. This experiment was conducted by taking five select articles and modifying them in a particular way. A set of these modified articles was used as plates for presentation to subjects.

A set of twenty five such plates were presented, for selection of two, among five for purpose of testing. Thirty subjects were approached for experiment (so far, experiment is in its conclusive stage at the time of report writing). Two experts were interviewed, in depth, for reflection on findings and their opinion was taken in account.

2. Preferred Designs

Preferred designs have a few threads running common through them, they have cluster pitches ranging between 12 to 18 millimeters and compactness to their construction (known on Shop floor as *Gathila* or tightly packed). They also do not have sharp points coming close to the neck side, for example a point of heart, marquis or tear drop pointing towards neck.

For testing these are modified by changing orientation of the central piece, central piece itself to some other , within same group of smallest semantic units or by a different configuration following a different proximity of particular semantic units (Fig.1.).

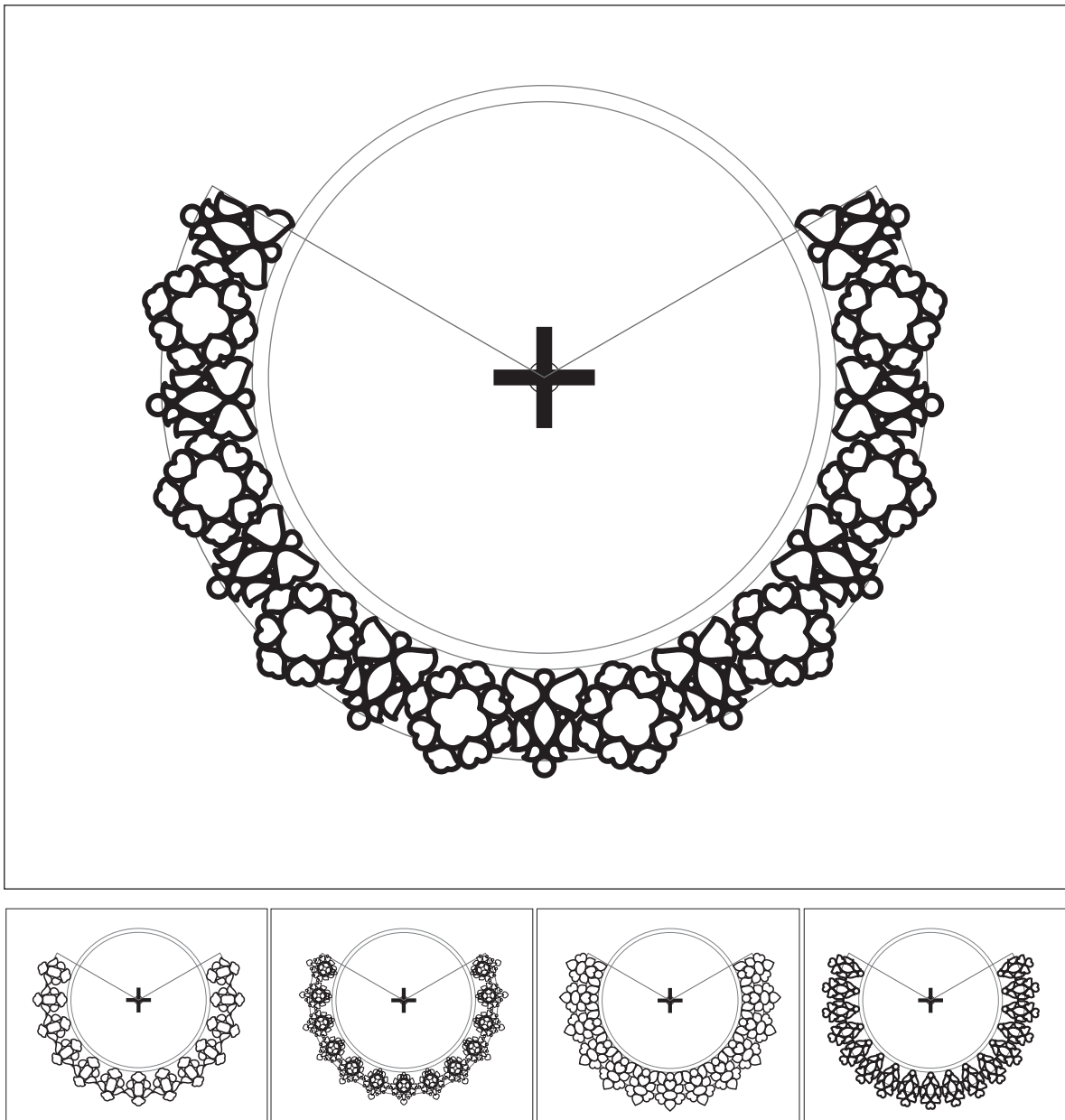


Fig.1. Designs for retesting.

3. Validation of Findings by Changing *Gothavni*

An experiment is conducted along with in depth interviews with experts in the fields and subjects with ability to articulate. Design of experiment is as follows(Fig.2.).

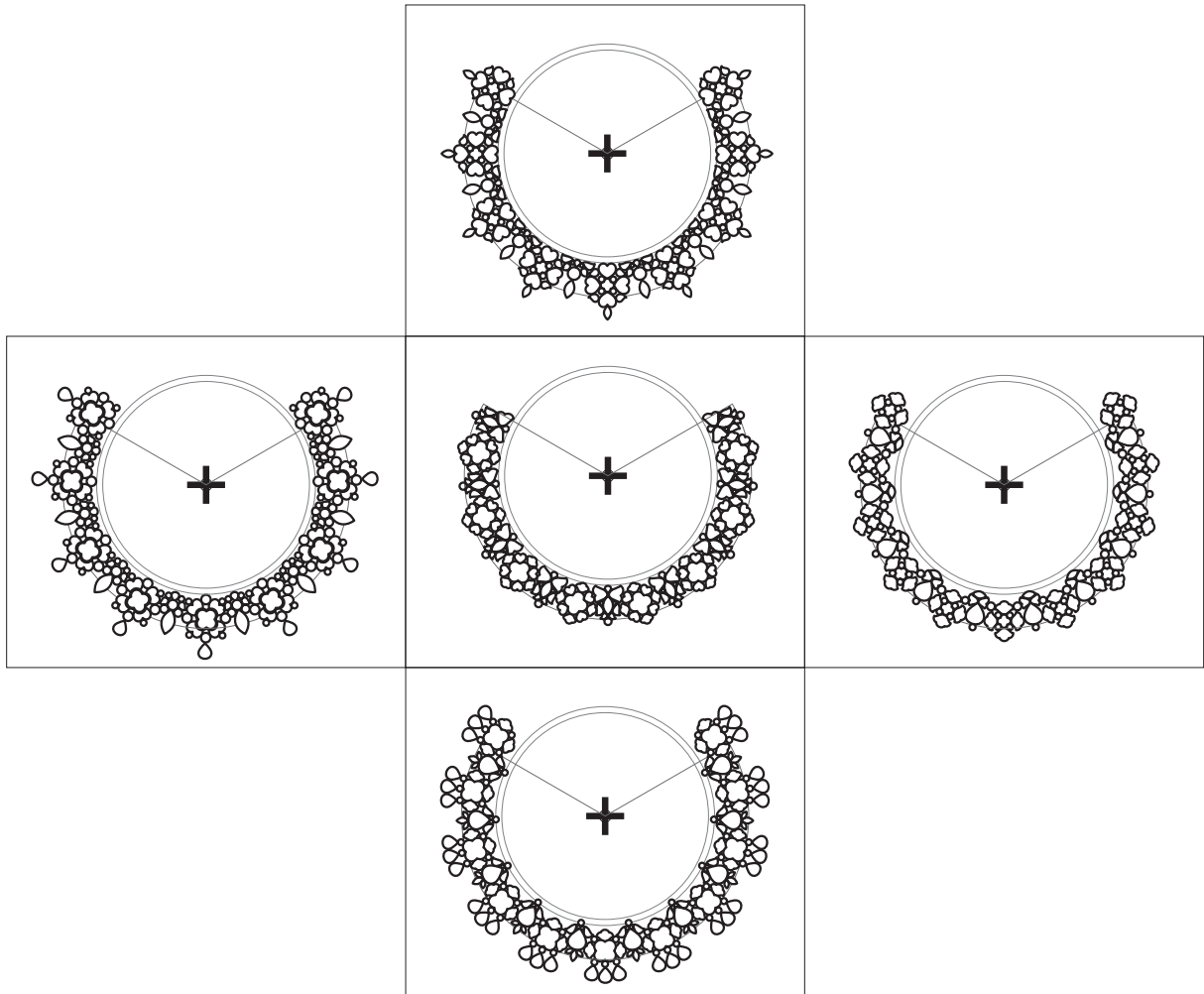


Fig.2. Design of experiment.

4. Design of Experiment

This experiment is designed to test out if likeness of preferred semantic units when compared to other possible combinations by using same number of semantic units in a different configuration. By changing orientation and proximity of few top runners, few variations were created. A two dimensional construct was used (Shajahan S, 2004 ref1).for testing. Five of these designs were picked up for testing as a central member of a two dimensional construct. Objective is to “nudge” designs, slightly left and right and check out if a particular design is still preferred. Fig.3.

Experimental Dimensionality

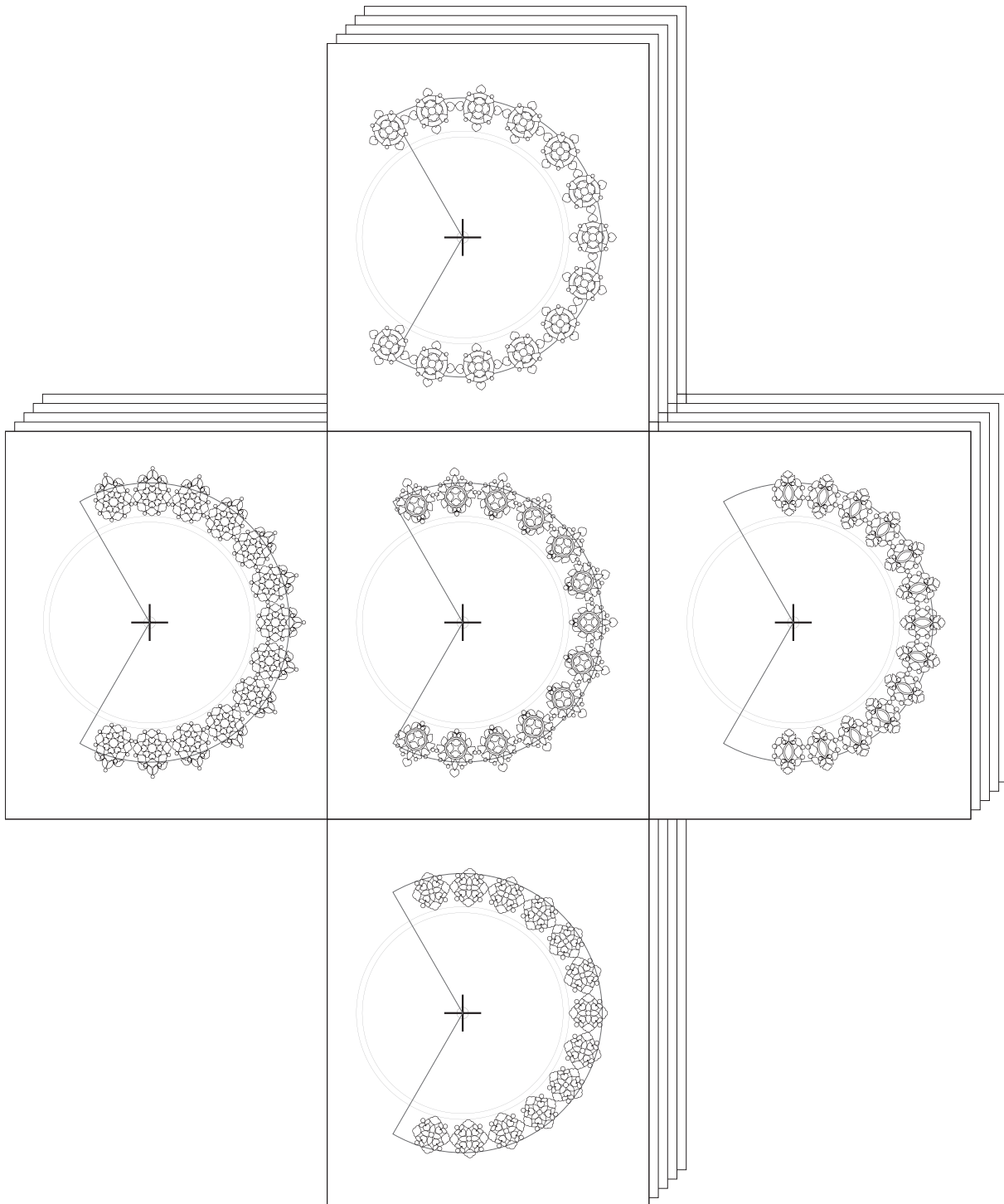


Fig.3. Presentation to subjects.

Two variants were created to left and right of the central member and two were created to top and bottom, making a set of five presentation plates. One plate was created by deliberately breaking rules of grammar of *kundan*, flouting mirror symmetry, replaced by rotational symmetry. These pieces upon casual observation appeared like regular *kundan* but axis of symmetry be replaced by rotational placement of a smallest semantic unit Fig.4.

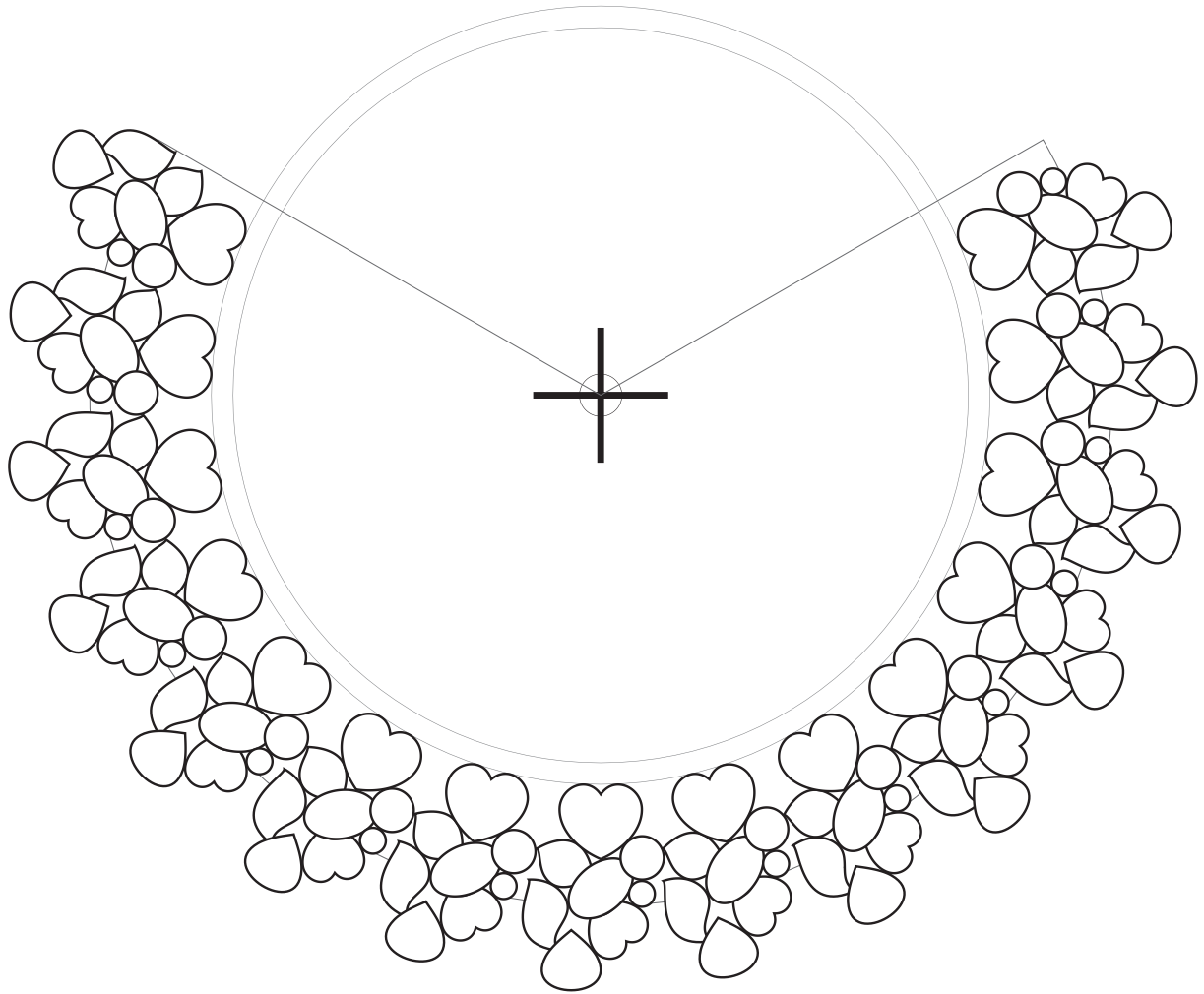


Fig.4. Mirror symmetry, replaced by rotational symmetry.

These five designs were presented to subjects in five folios, randomly, and they were asked to select two out of five (one deliberately radical/ distorted member was also presented for references/cross checking).

Outcome may follow one of two probabilistic trends, one, it may gyrate towards initially preferred articles. Two, it may gyrate away from them. This can be represented visually as illustrated in Fig.5. & Fig.6.. (A central position given to preferred design is merely for the purpose of illustration and ease of understanding.)

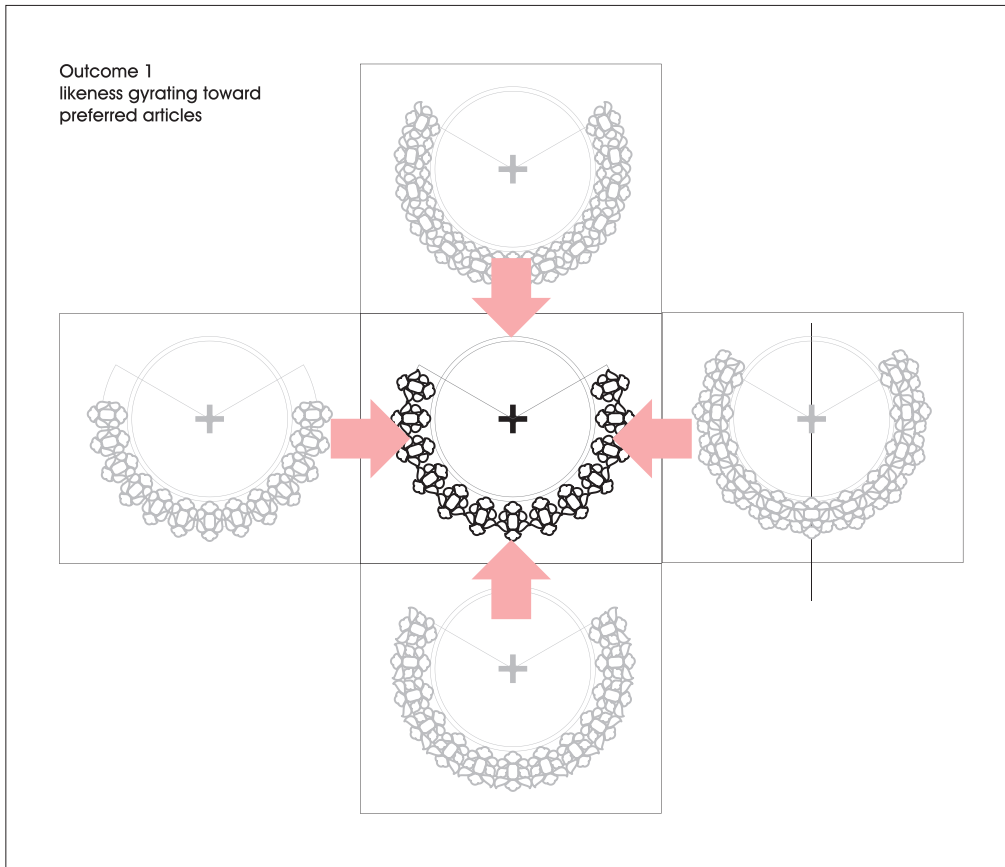


Fig.5. Likeness gyrating to center.

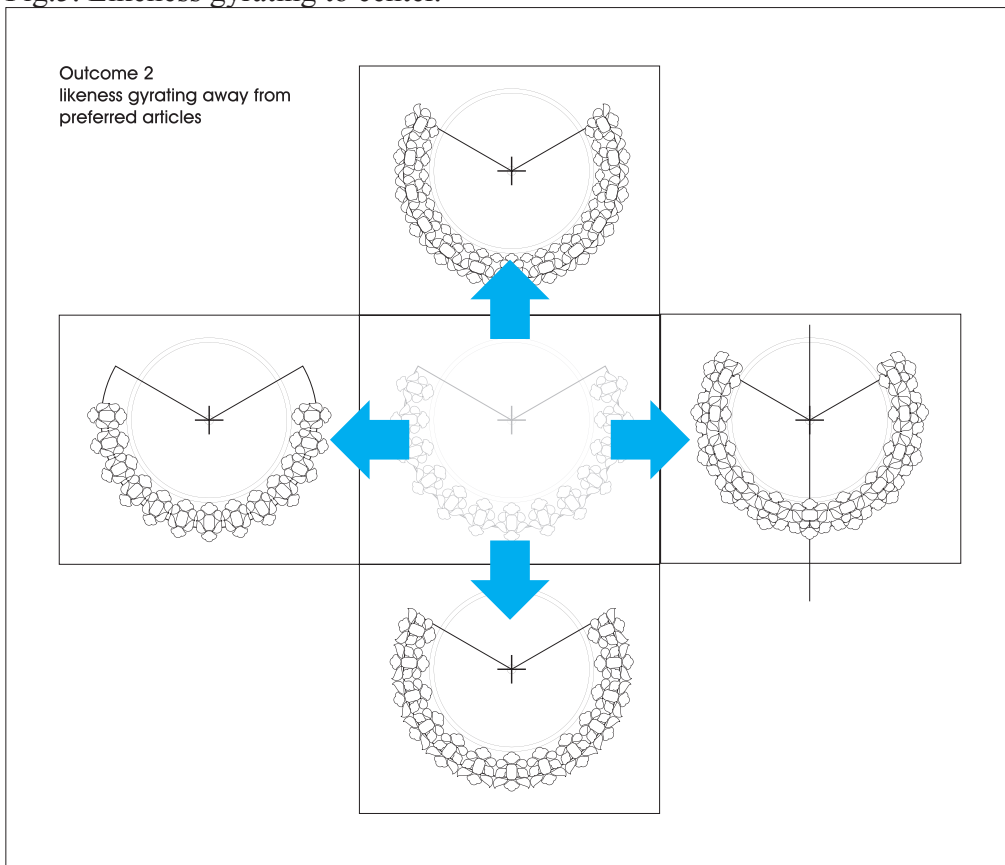


Fig.6. Likeness gyrating away.

If we superimpose likeness on illustrations by a dot, as an expression of likeness, data presented visually is expected to reveal one of these two broad trends. In case of a gyration towards preferred units, findings are reassured and confirmed. However, a divergence is also expected to reveal a few things.

5. Sampling Method

Sampling method used is snowball sampling, references from subjects led to more references and this was found to be useful in such type of work. A person of good network among circle of friends was particularly useful; presidents of ladies club, principle of school were first approached to start ball rolling. Subjects are from similar profile as main experiment and are from a section of overall population that has awareness about *kundan* and affluence as present or potential user. A large portion of sample comes from middle, upper middle and affluent class. Sample contained housewives as well as working women. A typical section is teachers, students in marriageable age, and working women along with housewives. Approaching a particular subject was judgement call of interviewer.

6. Experimental Setup

Experiment was conducted around a table in an amicable atmosphere either in subject's house or a similar setting where a free interaction away from routine distractions can take place. Often a preferred place is found around a coffee or dining table, Fig.7. Subjects were presented five designs each in five folios. Folios were to keep designs being compared together, however order was randomized. Subjects were asked to mark their preference by placing a card over that particular design. Thirty three subjects were covered in experiment for validation of results.



Fig.7. Experimental setup

7. Interview

Subjects were contacted and briefed about academic nature of study, to mitigate anxiety present in domain of jewellery and relevant questions. This is an essential measure to avoid normative answering by subjects, or high level of anxiety influencing selection. A prior appointment was sought for meeting and subjects were approached at time in an amicable atmosphere. A familiar setting like drawing room was found to be place of choice to conduct experiments. Often interviewer and subjects found it more convenient to use a dining table, after the meal-

Time, to observe presentation plates. By snowball sampling data was collected in a format as previous experiment. Beside routine information, they were asked to choose two from each folio of five.

Presentation plates were made of A3 size printouts on adequately thick paper that can be repeatedly used for several surveys in line and resists creasing or folding. The printouts were monochrome, presenting a single line vector artwork of *kundan* neck pieces for observation. Construct of the experiment is a centre around which modification is done to form cluster of semantic units constituting a neck piece. In an overview central plate has a plate to left and to right, to top and to bottom, making a grid of five presentation plates (figure 3). These five variations were presented, along with a sixth deliberately distorted one, for validation.

For experiment Subjects were briefed about *kundan* and asked to browse through folios. They were asked to select two out of five. They were asked to mark their likeness by placing a card over presentation plate, Fig.8. Identification marks were on backside of sheets for clear distinction, likeness was recorded by ticking off a rectangle by surveyor on a separate sheet of paper once experiment was over.



Fig.8. Card over presentation plate.

8. In depth Interview by Experts in Field

In depth interviews with experts in the field were conducted to reflect on findings. Their views were incorporated in study.

9. Summary

The preferential likeness was found to gyrate to the original pieces chosen for modification by deviation. It was found that rotational symmetry or out of symmetry modifications were not preferred. They are also not preferred if the axis of a form cluster is tilted out of true in one direction. Overall a symmetrical traditional approach is preferred, over radical experiments.

Appendix VI

To Look at Data

The bar charts are also one possible way to look at the data. They give an ordinal preference for each design that can be used for interpretation. However, a radar diagrams at a glance show the direction of inclination of preference.

A direction often is more useful than precise instructions; hence radar diagrams were used in body of thesis. Select bar charts are reproduced for reference. They also give insights into subject matter. One way to present data is illustrated in large format printout.

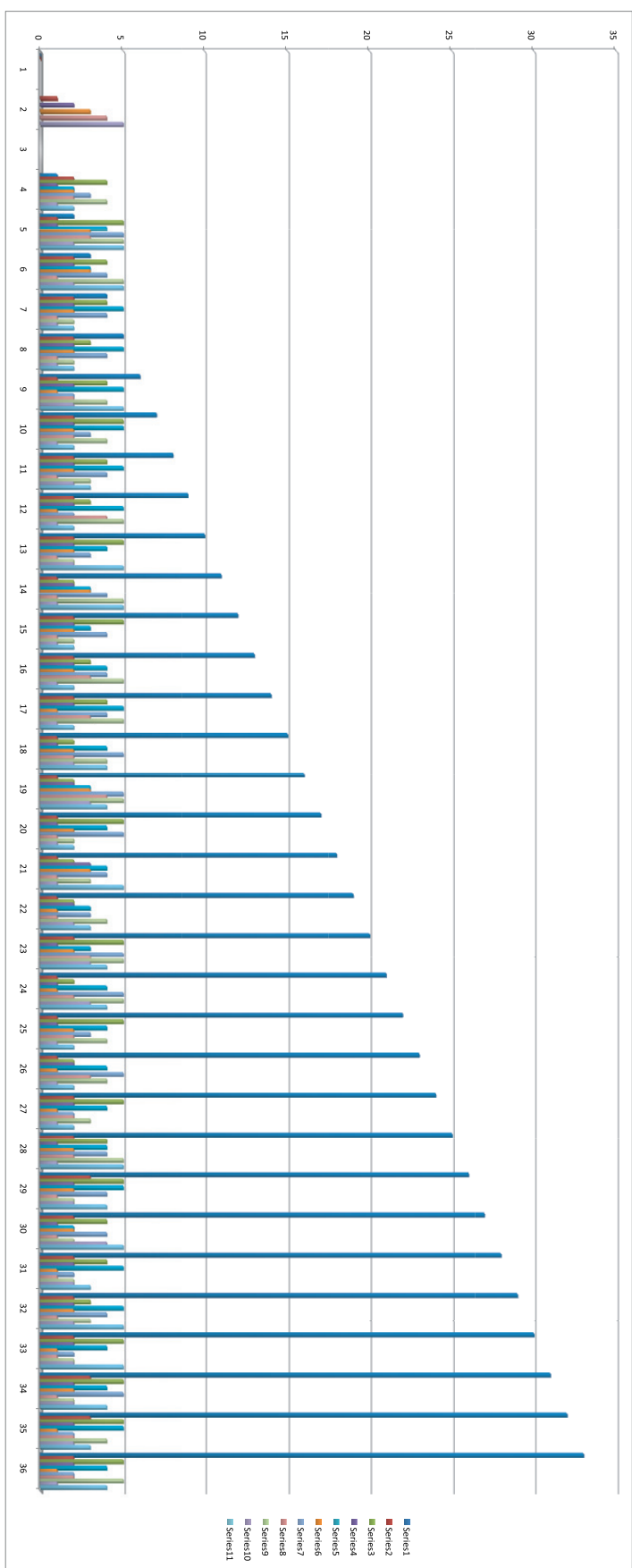


Fig.1. Bar charts Frequency distributions

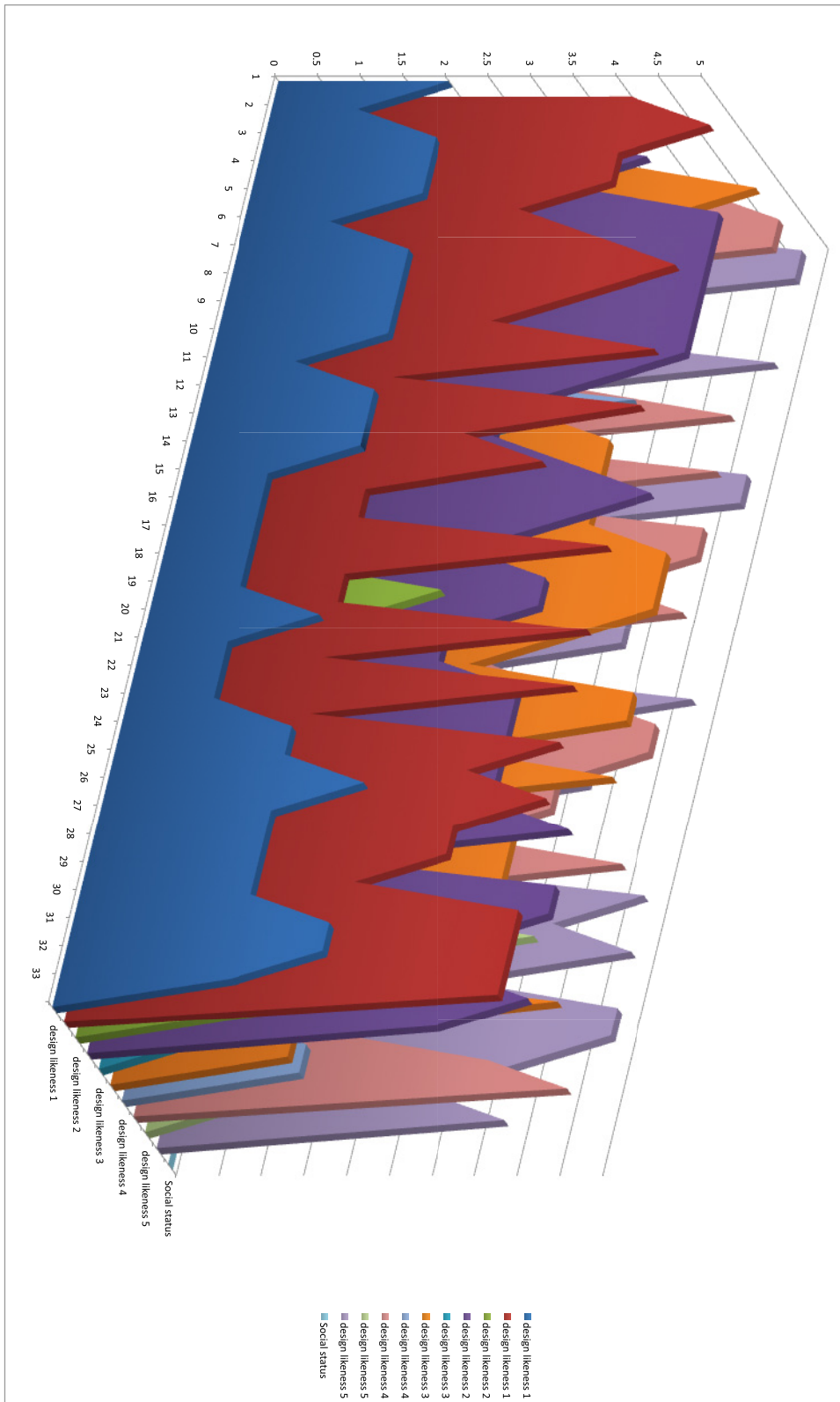


Fig.2. Level graphs.

Ordinal Plotting

The vertical columns separate four stages of selection from level 1 to 4. The illustration is one of the ways to look at research inferences by arranging the preferential likeness on a ordinal scale.

The highest preferred is placed at top and scrolling down we can look at the progressively less preferred designs at that level.

At next level we can see how the selection process is progressing revealing an upward or downward movement of an article. It four levels of selection can be observed at a glance in the illustration. They also can be traced backwards from fourth level to have an insight how did they rank in previous stages of selection. A large format printout is inserted to provide a holistic view.

Glossary of Terms

1. **Angoothi** - Finger ornament, a ring that can be worn on any of the fingers.
2. **Bharavdaar (Bhara-Bhara)** - U composition of many smallest semantic units in close proximity that gives densely packed appearance. Very little counter or no space between two adjoining units.
3. **Brilliant cuts**- Used in context of diamonds, refers to cuts with high (to very high) optical properties of total internal reflection in various shapes. (Round, oval, pillow, heart, teardrop etc)
4. **Bulgari** - Us an Italian jeweler and luxury goods retailer. The trademark is usually written “BVLGARP” in the classical Latin alphabet (where V = English U), and is derived from the surname of the company’s Greek founder. Although the company made a name for itself with jewelry, today it is a recognized luxury brand that markets several product lines including watches.
5. **Carat** - Used in context of diamonds, refers to the measure of weight 200 milligrams. Used in context of gold refers to alloy composition in parts of 24. (Example, 22 carat gold is an alloy that has 22 parts gold and two parts of any other alloy metal, usually silver or copper, per 24 parts of metal mixed weight by weight. They are abbreviated and referred to as ‘C’ and ‘k’ respectively in their individual contexts.
6. **Chaap** - An arc of a circle, a bow.
7. **Chidi** - A bird or bird like figure, also a club form as in playing cards.
8. **Dankh** - A burnished reflective foil applied on the underside of a gemstone to achieve high reflectivity; sometimes a colored tint is applied to enhance the base color.
9. **Daudi paan** - Stylized heart shape.
10. **Devdas** - A recent Hindi movie, remake of an old classical on same *storyline*.
11. **Dharma** - (That which upholds or supports) Means Law or Natural Law (as in the natural order of things) and is a concept of central importance in Indian philosophy and religion.
12. **Do chheh anni** - Two and three quarters.
13. **Do char anni** - Two and a half.
14. **Fire** - Used in context of diamonds, refers to the optical property of total internal refraction.
15. **Ghaat** - Framework of gold that is ready to receive gemstones, ready to be set with gemstones.
16. **Gothavani** - A specific way of arrangement of semantic units

17. **Grands Joailliers** - Literally “grand jewellers”
18. **Hrim** - A seed syllable, *beej* mantra. (see *beej* mantra)- *
19. **Jadai Kaam** - The work of *Jadai*. See *jadai*.
20. **Jadai** - The process of setting a gemstone in a seat of golden framework from which *Jadai* gets its name.
21. **Jadai** - Fine jewellery made by process of setting a gemstone, known as *jadai*. It is from the process of *jadai* jewellery gets its name.
22. **Jali, Jallikam** - *Kundan* work with lots of space in between smallest semantic units giving appearance of a *jali* or grill like appearance.
23. **Janchana** - To show a design and broad agreement on aesthetics. Literally, *janchana*- to agree or concur.
24. **Jau** - Literally barley, a shape resembling a grain of barley.
25. **Joban** - A foil of metal made by rolling an ingot or section in a rolling mill. Material is thinned out and surface becomes lustrous. Sometimes colored.
26. **Jodha Akbar** - A recent hindi movie, where the lead actress is shown wearing elaborate jewellery.
27. **Kamal** - Lotus flower
28. **Kangan** - A wrist ornament that is worn like a bangle, much more embellished.
29. **Kanthi** - A neck ornament, neck piece
30. **Karkhana** - A *Karkana* typically is a place where jewelers and specialty craftsmen engage in jewellery making and other peripheral activities such as repairing, stringing, and enameling. This place often is in proximity to *Sarafa*, traditional Indian jewellery market, not accessible to clientele directly.
31. **Kaustubha (alternatively Kaustubh)** - Is a divine jewel - the most valuable gemstone or “*Mani*” is in the possession of lord *Vishnu* who lives in the *Ksheer Sagar* - “the Ocean of milk”.
32. **Kautilya’s Aarthshastra** - A treatise on economics by learned scholar and politician *Kautilya*, also popularly known by name of *Chanakya*. He was also teacher and prime minister of *Chhandragupt Maurya*, *Magadh* Empire.
33. **Kery Chowfuliya** - A four petal flower made by rotation of a *kery* around a centre.
34. **Khila, khula-khulaa** - A design that has an open structure with a blossoming appearance.
35. **Koilee** - A typical shape made of two *sinusoidal* curves frequently used in *kundan* articles.

36. **Kundan** - *Kundan* is traditional South Asian gemstone jewellery, also a method of gem setting in a jewellery piece, consisting of inserting gold foil between the stones and its mount, usually used to create elaborate necklaces believed to have originated in the royal courts of *Rajasthan* and *Gujarat*. It is the oldest form of jewellery made and worn in India. The word *kundan* in Hindi means “Pure gold,” and is applied to a flush stone closed setting type commonly practiced in India in the ancient past and still in use today for both cabochon and faceted stones. It is also used to describe a person of strong disposition “purified by fire”, indicating high degree of refinement.
37. **Kundansaaaz** - A craftsman making/setting *kundan* articles, literally translating to embellishing (*saaaz*) by *kundan*. A Jeweler who makes *kundan* articles, especially setting stones flush. (Also called *Karighar*)
38. **Latkan** - An ear piece, typically a dangler.
39. **Machhli** - A fish motif.
40. **Mangteeka** - An ornament worn on forehead by married women, typically where hair are parted. This partition on either side, often in middle is called *maang*, as worn along this line its called *maangteeka*.
41. **Mina (or Meenakari)** - The process of enameling the gold surface adding a wide range of colors to the metal surface.
42. **Nageena** - A generic term for a gemstone, both precious and semi precious.
43. **PachchiKam** - A style of jewellery similar to *kundan* in use of motifs, but different in terms of use of presswork or “*Thalle ka kam*”, metal being pressed in between die and punch.
44. **Pachchikari** - Surface embellishment.
45. **Panchratna Haar** - A necklace made of five major gemstones namely diamond, ruby, emerald, sapphire and pearl. These may also be made of five varieties of semi precious gemstones alternatively.
46. **Pankh** - A feather.
47. **Phool** - A flower
48. **Phool kali** - A flower and a bud
49. **Pliny’s’ adamas** - Refers to diamond, literally translating to unconquerable, one which cannot be broken by anything else. It was believed to protect the wearer by imparting its virtues to the wearer.
50. **Polki or Vilandi** - Refers to minimally faceted chips of diamond used in *kundan* jewellery.

51. **Sanyuktakshar** - A ligature, a character made by conjoining of more than one *akshar*.
52. **Beejakshar (or beej mantra)** - An *akshar* that is a mantra. A seed syllable for example like ‘*aum*’ that encompasses a complete mantra in itself.
53. **Sarafa** - A traditional Indian jewellery market where jewellery, bullion metals, gemstone are sold/purchased/ traded. It also caters to peripheral activities like repair, stringing, metallurgy, assaying, hallmarking and valuation. It acts as trade and manufacturing hub for jewellery.
54. **Sawa do anni** - Two and a quarter.
55. **Sone ki Chidiya** - Literally translating to “the golden bird” was often used for referring to India. This was largely due to great amount of wealth the country held in form of gold held by population.
56. **Stone** - A generic term used as a short form in context of gemstones, usually diamond or a precious/semi precious stone.
57. **Surma** - A paste used to hold gemstone in place before setting, which is pressed out as the setting progresses.
58. **Vishnu** - Is the Supreme god in the *Vaishnavite* tradition of Hinduism. *Smarta* followers of *Adi Shankara*, among others, venerate *Vishnu* as one of the five primary forms of God.
59. **Vedic** - Pertaining to Veda’s that followed tradition of verbal transfer of knowledge and not written text.

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