

## THE EFFECT OF THE DISJUNCTION FEATURES ON ACADEMIC PRODUCT (DEPT. OF ARCHITECTURE, UOD AS A CASE STUDY)

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### ABSTRACT

In the context of architectural design, disjunction is considered a strategy for defining and distinguishing between inside and outside architectural forms. This study focuses on the role of disjunction in architectural education, and the motivation behind this choice is the observation the academic literature has not defined a precise and clear measure for evaluating the degree of disjunction between inside and outside architectural forms and how it affects academic outcomes. The goal of this research is to determine the path of disjunction for architectural engineering students at Duhok University, the types used, and to achieve this, a combination of quantitative and qualitative methods were used, supplemented by computer software as a tool for measuring the degree of disjunction. The research results reveal a descending path in how students deal with disjunction. This path begins in the second stage of their academic journey achieving the highest level of disjunction and gradually declining as they progress. An interesting finding is the direct relationship between the degree of disjunction and its types.

**KEYWORDS:** Disjunction, Academic Product, Inside and Outside Form, Types of Disjunctions.

### 1. INTRODUCTION

The concept of disjunction is incompatible with the static, autonomous, structural view of architecture. But it is not anti-autonomy or anti-structure; it simply implies constant, mechanical operations that systematically produce dissociation in space and time, where an architectural element only functions by colliding with a programmatic element, with the movement of bodies, or whatever. In this manner, disjunction becomes a systematic and theoretical tool for the making of architecture (Tschumi, 1996).

Bernard Tschumi's concept of disjunction, or disruption, is a new architectural approach that challenges the traditional focus on unity and harmony in Western post-modern culture. Tschumi's strategies involve deconstructing traditional components of architecture, such as superimposition and repetition, to create a new kind. His themes are developed at the boundaries of other fields, such as literature, philosophy, and film theory, and are adapted as architectural design tools (Porter, 2004).

Venturi even resorts to disjunction as it is used in logic, when he uses the operator "or" or "in the inclusive sense of "both... and "as an explanation for the ambiguities of architectural

signification (Ebert, 2003). (such as double-functioning building elements) and contradiction (such as the disjunction between interior and exterior), as well as contrast, tension and paradox. Such a multiplicity of meaning and content in a building can involve both the real and the abstract (Porter, 2004).

According to the researcher's analysis of the aforementioned studies, it is evident that the understanding of disjunction as a concept can vary depending on the context. In this particular research, disjunction is viewed as an academic design strategy aimed at establishing a difference between the inside and outside form through shifting building block, surface, or by adding an element.

#### 1.1 Research Problem

In the academic stages, students are interested in obtaining a great final product, while academics focus on how to obtain it. Education without a future outlook on the type of product leads to chaos. The Research Problem What is the Impact of Disjunction features on Academic Product?

#### 1.2 Research Aims and Objectives

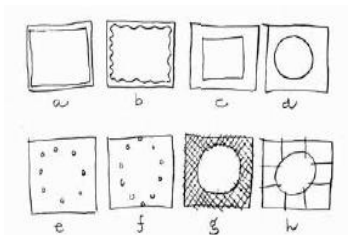
The aims of the research are providing a theoretical framework for disjunction relation between inside to outside and the extent of its

linked to the academic product. Meanwhile, the objectives of the research are:

- Exploring the Role of Disjunction in Shaping the Architectural Student's Development.
- What Types Does a Student Address in the Context of Inside-outside Disjunction?

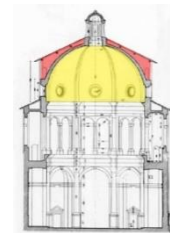
## 2.DEGREE AND TYPES OF DISJUNCTIONS

Venturi explored the interplay between inside and outside spaces by emphasizing the notions of disjunction and unity. Among the methods of creating disjunction, he highlighted the employment of linings, specifically in an unattached lining which produces an additional space between the lining and the exterior wall.

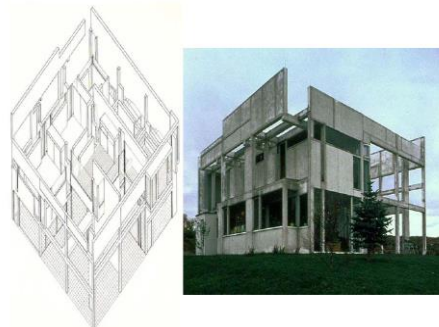


**Fig. (2.1):** Illustrate Layers Between Inside Space and Outside, Contrasting in Shape, Position, Pattern, And Size. (Venturi, 1977)

Plan diagrams (2.3) illustrate that such layers between the inside space and the outside space can be more or less contrasting in shape, position, pattern, and size. Figure (2.1) illustrates the simplest kind which is analogous and attached. At the Church of S. Maria in Cane Panova in Pavia Figure (2.2), there is a noticeable disjunction between the interior and exterior design of the dome. This disjunction is achieved by employing two distinct shapes for the dome, and the layered dome's impact is more apparent on the exterior rather than the interior (Venturi, 1977). **The study reveals that** the building consists of linings that disjunction the interior from the exterior with varying details, resulting in contradiction and the degree of disjunction is determined by how much the outer walls displacement from the inner structure.



**Fig. (2.2):** Church of S. Maria in Cane Panova (Venturi, 1977) yellow color (inside) red color (outside) (Researcher)



**Fig. (2.3):** House II, (Ibrahim, 2019)

Peter Eisenman's architecture focuses on drawing out potential power from the architectural configuration itself, aiming to unlink the function that architecture represents from the appearance of the same object. Eisenman emphasizes the struggle between form and function, stating that without function, there is no architecture. His works distinguish him from other architects by using displacement as the building blocks of his designs and thinking. Displacement is not free of value or meaning, but it explains relationships in an architectural object

and acts as a mediator between a physical object, a real building, and architecture's interiority (Ibrahim, 2019). Figure (2.3) It clarifies displacement the exterior away from the interior.) Researcher indicates that utilizing displacement is one of the tactics employed to disjunction form from function, ultimately leading to the attainment of the intended designs and in the second house, there is a horizontal and vertical displacement.

Gottfried Semper's ideas regarding surface architecture encompass the concepts of dressing

and enclosure. The term "dressing" signifies a separation between the surface and the underlying structure, introducing the notions of ornamentation and the representation of the surface. This notion of dressing gives rise to discussions about tectonics and materials. The tectonic aspect primarily deals with the interaction between the exterior cladding or skin and the structure in terms of both aesthetics and structural resolution. The material aspect is focused on how materials are treated and expressed within the surface covering. The combination of tectonics and materials sparks discussions about the interplay between appearance and construction, as well as between representation and technology. Conversely, "enclosure" offers an alternative approach to surface architecture, placing emphasis on the arrangement of surfaces and their interrelation with surface formation, spatial effects, and perceptions of the human body. Enclosure's impact is rooted in the configuration and exchange of spatial relationships, rather than mere visual appearance (Feng, 2009). The study above leads us to conclude that surface architecture is a collection of layers that separate the external surface from the internal surface with various concepts (dressing, enclosure), and each

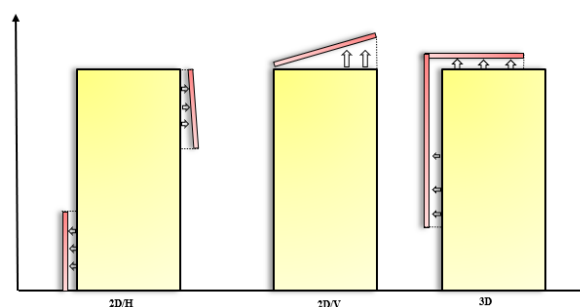
of them has a specific role, including spatial relations, appearance.

According to Venturi, Eisenman and Semper, the researcher inferred that the building consists of a set of surfaces and masses with varying degrees of disjunction. Therefore, it requires a measure to determine the degree of disjunction, as follows:

**Degree of Disjunction:** This metric quantifies the amount of displacement between the inside form (living space) and the outside form (non-living space), and its value is equal to or more than zero. There are two types of disjunctions:

1. **Surface Disjunction:** It is the displacement of the outside surface from the inside surface (whether vertical, horizontal, inclined, or otherwise) and there are three levels of surface disjunction:

- Horizontal Disjunction(2D/H): It involves the displacement occurring at the level of the building façade.
- vertical Disjunction(2D/V): It involves the displacement occurring at the level of the building's roof.
- Horizontal and vertical Disjunction(3D): This entails the displacement of the surface to both the roof and facade of the building, Figure 2.4. explain levels of surface disjunction.



**Fig. (2.4) Levels of Surface Disjunction**  
Inside(yellow), outside(red)(Researcher)

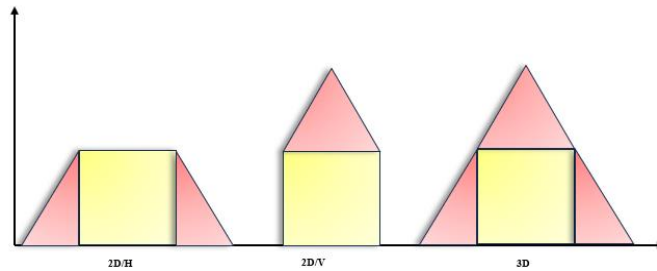
### 1. **Mass Disjunction:**

**This refers** to the displacement of the outside mass from the inside mass (whether vertical, horizontal, inclined, or otherwise) or adds an element and there are three types of mass disjunction:

- Horizontal Disjunction(2D/H): It involves adding mass to the building's facade.

- vertical Disjunction(2D/V): It involves adding mass to the building's roof.

- Horizontal and vertical Disjunction(3D): This entails the addition of mass to both the roof and facade of the building, figure 2.5 explains levels of mass disjunction.



**Fig. (2.5):** Levels of Mass Disjunction  
Inside(yellow), outside(red)(Researcher)

Mass and surface disjunction may include a portion of the building or the entire building. Some projects have more than one type of disjunction.

### 3.RESEARCH METHODOLOGY

The research methodology involves establishing a theoretical framework based on previous studies on degrees of disjunction, levels of disjunction, and inside and outside form. The framework is applied to the projects of the top ten students from the second to the fifth stage of the

Faculty of Engineering, Department of Architecture, University of Duhok, using three methods, referred to as "Qualitative and Quantitative approaches, and cloud compare program.

**3.1. The qualitative method** is an interpretive, naturalistic approach used to study objects in their natural settings(Fossey et al., 2002). It employs disjunction to enhance understanding of variables. A structured analysis sheet is developed, breaking down steps into sub-variables for potential values. This information is displaced in Table 3.1

**Table (3.1):** Qualitative analyzing sheet

The Effect of The Disjunction Feature on Academic Product/ Analyzing Sheet			
Code:	Architect:	Year:	Type of project:
Project Name:		Place:	
Concept:		Project image:	
Project plans	Inside Form	Inside +Outside Form	
			Ground. Fl
			First.fl
			Section
			Section(inside+outside)
<b>Step 1: Degrees of Disjunction:</b> Project image analysis		<b>Step 2: Types of Disjunctions</b>	
Mass	2D/H	A	
		P	
	2D/V	A	
		P	
	3D	A	
		P	
Surface	2D/H	A	
		P	
	2D/V	A	
		P	
	3D	A	
		P	

Every individual case study will be assessed using this sheet, guided by the indicators present in the displayed Table (3.2)

**Table (3.2): Assessing Indications of the Qualitative Approach (Author).**

Empty cell	The indicator is not available in the case study
Full filled circle	The indicator is available in the case study ●

**3.2. The quantitative method** aims to obtain precise, reliable measurements for statistical examination (Queirós et al., 2017) transitioning from qualitative to quantitative analysis in case

studies, assigning numeric values to the qualitative indicators within the theoretical framework table (3.3)

**Table (3.3) Transforming Qualitative Information into Quantitative Data (Authors).**

Empty cell	0
Full filled circle ●	1

**3.3. Cloud Compare** is a 2003-created 3D point cloud editing software for direct comparison between dense clouds, utilizing an octree structure for large point clouds and triangular meshes(Girardeau-Montaut, 2015).

**3.3.1. Program application** Case studies were created in 3D Max and AutoCAD and exported to Cloud Compare (STL). This format is used for rapid prototyping and printing 3D Geometry Surface Dimensioning (STL) and Computer Aided Manufacturing(Grimm, 2004). Files are stored after analysis and measurement operations in the Cloud Compare program, which converts them into a flat grid element and a number.

The research involved 250,000 points for external and internal geometries in each case study, with the inside marked as the reference and the outside as a comparison. Determine the degree of disjunction by gauging the distance between two cloud instances. In this comparison of two models, the root mean square (RMS) value is utilized as a measure, representing the extent of disparity, denoted as degree of disjunction (D1).

Degree of disjunction(D1) :The value obtained from a program.

The program operates on modeling objects in their entirety by considering their respective bases. In order to achieve a real degree of disjunction, the subtraction of the base area (D2). As in the equation below

$D2(\text{Degree of disjunction for 3D Project}) = \text{total area} / (\text{total area-inner surface area}) * D1$

To obtain degree of disjunction at the elevation level, for 2D project. use this equation:

$\text{Elevation Disjunction}(D3) = [\text{Wall Area} / (\text{Wall Area-Ceiling Area})] * D1$

As the degree of disjunction approaches zero, the convergence and similarity between them increase. Conversely, as the degree of disjunction increases and moves away from zero, the contrast and difference between them escalate.

**3.4 THE RESEARCH HYPOTHESIS** assumes that the disjunction strategy appears strongly in their initial stages and gradually decreases.

**4. CASE STUDIES AND RESULTS**

**4.1 Case Studies for Second Stage:** the University of Duhok's Department of Architecture's second phase in the 2019 academic year involved designing various institutes encompassing music, filmmaking, novels, and literature, Project images and analysis can be seen in Appendix A.

**4.1.1. Results for the second stage:** The results for the second stage are evident in charts 4.1,4.2 while Detailed data about individual variables is within appendix B.

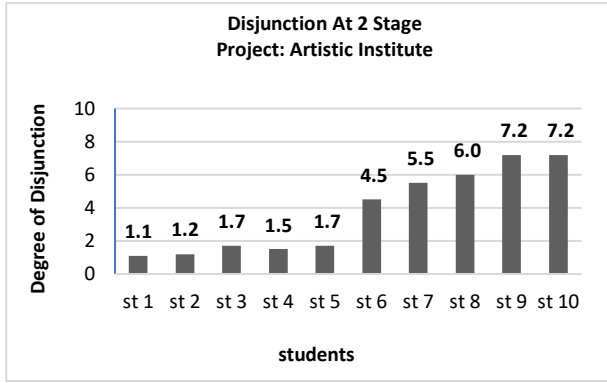


Chart4.1 Explain Degree of Disjunction for Second

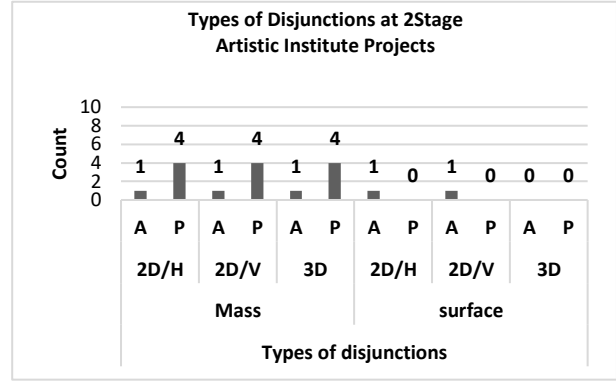


Chart4. 2 Explain Types and levels of Disjunction for Second Stage

4

1.2. Discussion of second stage Results

The results obtained from the analysis of ten case studies in the second stage, focusing on the design of diverse institutes (music, filmmaking, novel, and literature), have revealed notable findings. A chart representation of the data indicated that five students exhibited a lower degree of disjunction, with values of the disjunction variable less than two (indicating a low level of disjunction). Conversely, the remaining five students demonstrated a higher degree of disjunction, with values of the disjunction variable exceeding 4.5 (indicating a high level of disjunction) as shown in chart (4.1). The reason for this goes back to using more than one level of separation in the same project, especially for the entire building, and also the type of project that requires achieving a design concept to reach the desired form.

When it comes to the types of disjunctions, mass disjunction with its levels is more prevalent

than surface disjunction. Mass disjunction involves four projects and two for surface disjunction. Mass disjunction has three levels (2D/H, 2D/V, 3D), with a value of 4 for each in a section of the building and 1 for each in the entire building. Surface disjunction levels use a (2D/H, 2D/V) level with a value of 1 for each in both cases and for the entire building. as shown in chart 4. 2

4.2. Case Studies for Third Stage: During the academic year of 2020, the Department of Architecture at the University of Duhok undertook the design of a shopping mall project, Project images and analysis can be seen in Appendix A.

4.2.1. Results for Third Stage: The outcomes of the third stage can be observed in charts 4.3, and 4.4, while comprehensive information regarding specific variables can be found in Appendix B.

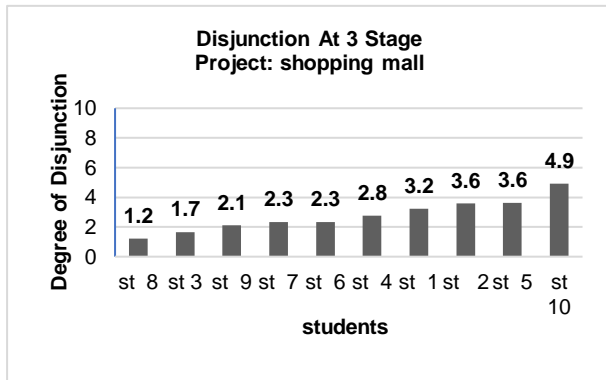


Chart4.3 Explain Degree of Disjunction for Third

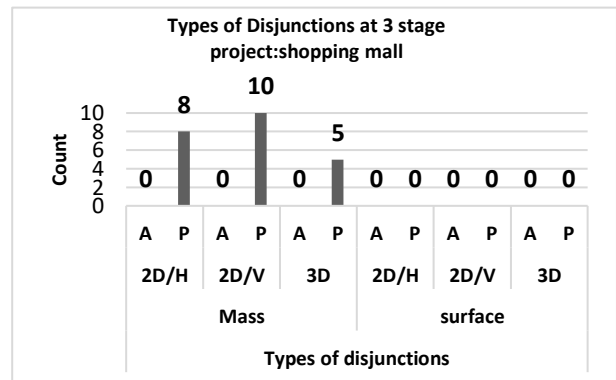


Chart4.4 Explain Types and levels of Disjunction for Third Stage

**4.2.2. Discussion of Third stage Results**

In the third stage of analyzing shopping mall design, significant findings have emerged regarding the extent of disjunction. A visual representation of the data has illustrated that the disjunction degree varies from 1.2 to 4.9. St 8 attained the lowest disjunction degree at 1.2, while St 10 reached the highest disjunction degree at 4.9.

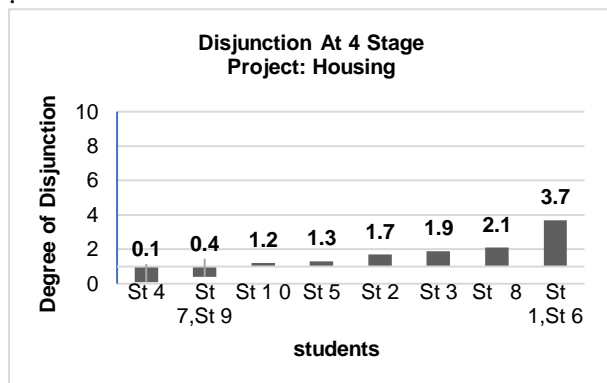
Furthermore, several students, specifically st 3, st 9, and st 8 achieved disjunction degree below 2, indicating a similarity between the inside and outside configurations. In contrast, st 1, st 2, and st 5 obtained comparatively higher disjunction degrees, suggesting a contrast between the inside and outside forms. It is noteworthy that both st 6 and st 7 achieved an identical disjunction degree of 2.3.

The third stage ranks second in terms of the highest degree of disjunction across stages, and the reason for this can be attributed to the use of massing disjunction in all projects. This is achieved by adding an external mass(3D) To 5 projects as it plays a significant role in achieving

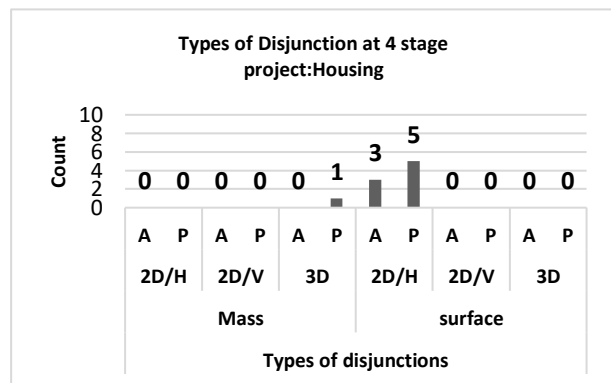
the desired form without providing tangible functionality. Similarly, the design of a grand entrance is used to attract visitors through the use of horizontal massing disjunction (8 projects/P). As for vertical disjunction (10 projects/P), it is commonly employed in the final floors to create grandeur for the project without utilizing this height for living functions.

**4.3 Case Studies for Fourth Stage:** In the academic year 2021, the fourth-year students in the Department of Architecture at Duhok University undertook a major architectural project (residential complex). During this project, each pair of students collaborated as a design team with the task of creating a residential complex. When evaluating the project, they chose to analyze just one building from each complex, without considering the accompanying landscaping, Project images and analysis can be seen in Appendix A.

**4.3.1. Results for Fourth Stage:** The outcomes of the fourth stage can be observed in charts 4.5,4. 6, while comprehensive information regarding specific variables can be found in Appendix B



**Chart4.5** Explain Degree of Disjunction for fourth Stage



**Chart4. 6** Explain Types and levels of Disjunction for fourth Stage

**4.3.2. Discussion of fourth stage Results:**

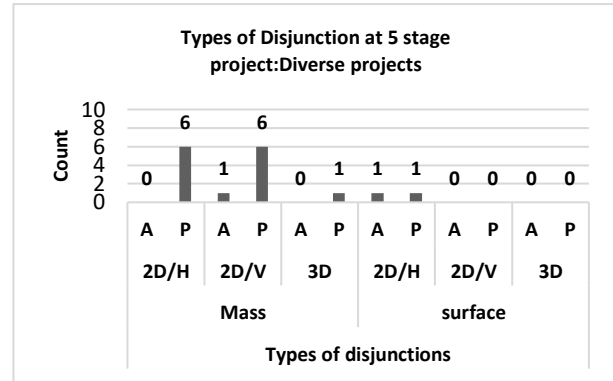
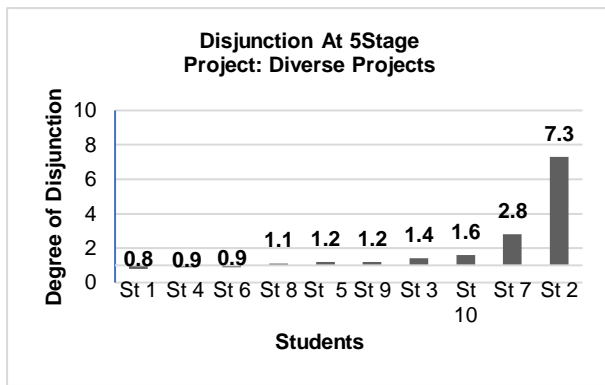
Based on the chart provided above, the scientific findings can be employed to the degree of disjunction in the fourth phase of the housing project spans from 0.1 to 3.7, with the majority of values falling below 2. Generally, this is seen as an indication of a minimal degree of disjunction, except for one project that registered a score of 3.7. This can be attributed to their utilization of hanging gardens, which were viewed as an outside form.

In terms of disjunction types, horizontal surface disjunction had the highest occurrence, observed in 8 projects, followed by mass disjunction(3D/P) in 1 project. This is due, to the housing being a functional project and is perceived to exhibit surface disjunction

through the use of curtain walls and the integration of elements and symbols that align with the project's concept.

**4.4. Case Studies for Fifth Stage:** In the 2022 academic year, students in their fifth year from the Department of Architecture at the University of Dohuk were involved in designing various projects, encompassing both residential and educational complexes. For this category of projects, one building was selected for the assessment of variables, Project images and analysis can be seen in Appendix A.

**4.4.1. Results for the Fifth Stage:** You can observe the outcomes of the fifth phase in charts 4.7 and 4.8, while comprehensive information regarding specific variables can be found in Appendix B.



**Chart4.7** Explain Degree of Disjunction for Fifth Stage **Chart4.8** Explain Types and Levels of Disjunction for Fifth Stage

**4.4.2. Discussion of Fifth Stage Results:**

From the provided blueprints (4.7-4.8) researchers deduce that the extent of disjunction at the fifth stage has been categorized into three distinct groups:

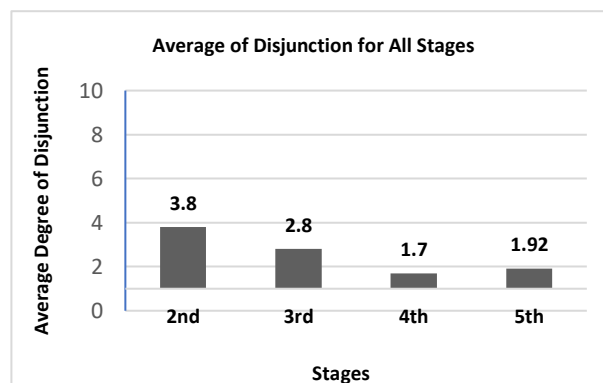
1. The initial category comprises three projects exhibiting a disjunction degree of less than one.
2. The subsequent category encompasses five projects with a disjunction degree of less than 2.
3. The final group features a sole project with a remarkably elevated disjunction degree, reaching 7.3.

The notable variance in the extent of disjunction is attributed to the diversity among the graduation projects, which can be classified into five categories: residential structures (comprising tourist-oriented, residential, and hotel buildings), educational facilities (totaling three), cultural establishments (such as a water-based animal park and the genocide center), a healthcare facility, and, lastly, a carpet manufacturing laboratory. Generally, the degree of disjunction is low, except for cultural centers, where emphasis

is placed on conveying the design concept through the external appearance.

Regarding the types of disjunctions, horizontal and vertical levels of mass disjunction recorded the highest degree, using (0A,6P) for the horizontal level and (1A,6p) for the vertical level, while surface disjunction was utilized the least frequently. Use (1A.1P) for vertical level. Some projects incorporated multiple levels of disjunction, driven by the desire for design freedom to achieve forms that effectively communicate the design concept.

**4.5. Result of Average of Disjunction for all Stages:** From 2019 to 2022, students at the College of Architecture, Duhok University, undertook the design of a variety of projects that varied across different stages Therefore, the researcher resorted to making a comparison of the disjunction degree average between the stages to understand the trajectory of student movement during this period. As shown in chart (4.9) and Appendix B contains tables detailing the average degree of disjunction for each stage



**Chart4.9** Explain average for stages

The above graph illustrates the students' interaction with the disjunction rate throughout their academic stages. It shows that the second stage recorded the highest degree, followed by the third stage, then the fourth stage. The fifth stage recorded a slight increase over the fourth stage. This trajectory moves from top to bottom, excluding the fifth stage, which involves diverse project designs at the stage level.

#### 4.5.1. Discussion of Average of Disjunction for All Stages:

The trajectory indicates that disjunction is a strategy in academic work. The highest average in the second stage is attributed to students' focus on designing architectural forms to capture the desired concept at the expense of function and structural considerations. Additionally, the project type played a significant role in their pronounced disjunction. Following this, in the third stage, disjunction decreases by one degree as students aim for a balance between form and function in their project design.

The fourth stage is considered crucial in the design process, with students working on projects closely aligned with reality, showing attention to every design detail. As for the fifth stage, its diverse projects contributed to a higher disjunction compared to the preceding stages.

## 5. CONCLUSIONS

- The disjunction appeared as a working strategy utilized by students of various types, and it was present alongside students' efforts at different stages with varying percentages, as a formal or environmental mechanism.
- The path of student movement towards disjunction was gradual, emerging strongly in the initial stages and decreased in the intermediate and final stages.
- The researcher concludes that there is a direct relationship between the degree of disjunction and its types, where the degree of disjunction increases as...
  - Prioritize the utilization of mass disjunction over surface disjunction.
  - Incorporating multiple types of disjunctions within a single project.

➤ Employ disjunction on the scale of the entire building, as it is stronger than disjunction at the part types.

- The extent of disjunction is influenced by the project type, with 3D projects exhibiting a higher degree of disjunction compared to 2D projects.
- In academic projects, mass disjunction is a more prevalent approach compared to surface disjunction. Formal projects tend to employ mass disjunction, while functional projects typically make use of surface disjunction.
- In academic projects, it is more common to implement disjunction on a partial section of the project rather than applying it to the project as a whole.

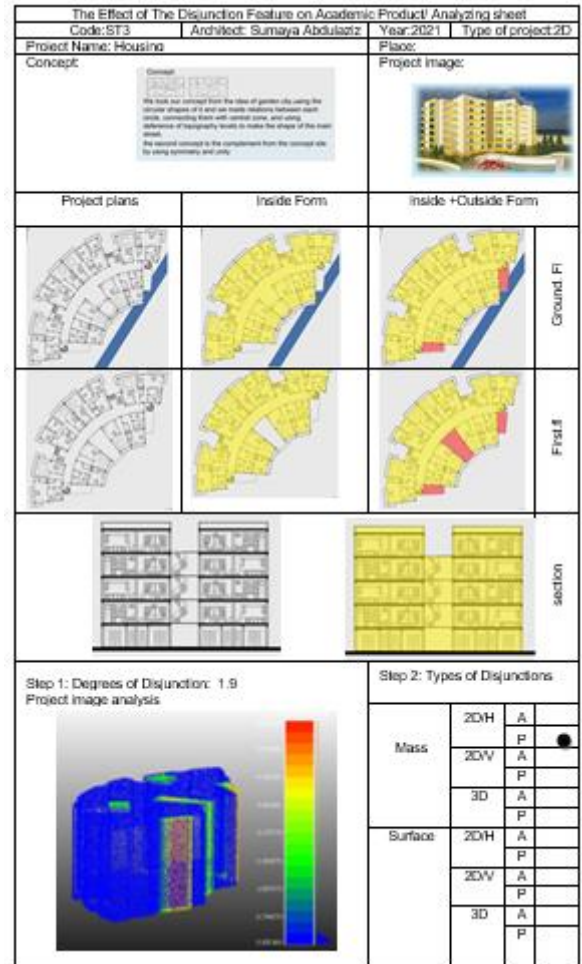
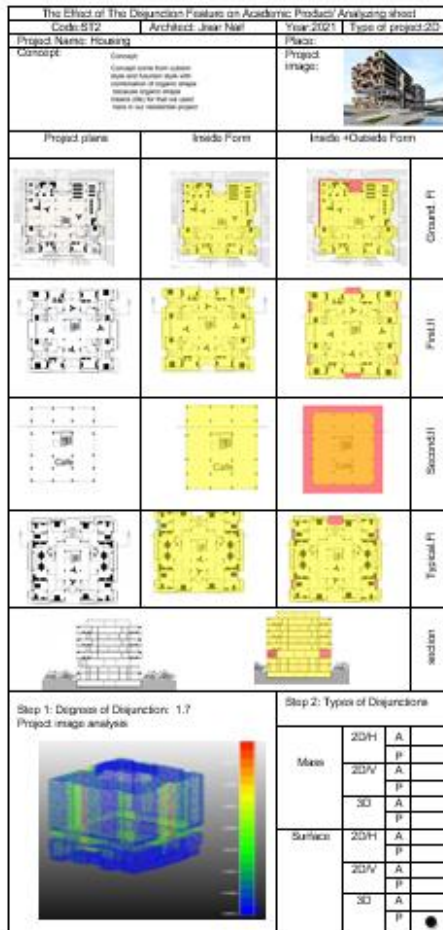
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APPENDIX A

The Effect of The Disjunction Feature on Academic Product/ Analyzing sheet																			
Code:ST1	Architect: Thekra Ziyad	Year:2019	Type of project:3D																
Project Name: Movie Institute		Place:																	
Concept: The Maze Runner Movie		Project Image:																	
Project plans	Inside Form	Inside +Outside Form																	
			Ground. Fl																
			First Fl																
			Section																
			Section (inside +outside)																
The Effect of The Disjunction Feature on Academic Product/ Analyzing sheet																			
Code:ST4	Architect: Srouf Bahram	Year:2020	Type of project:3D																
Project Name: shopping mall		Place:																	
Concept: did not mention		Project image:																	
Project plans	inside Form	Inside +Outside Form																	
			Ground. Fl																
			First Fl																
			Second Fl																
			section																
			Section(inside +outside)																
Step 1: Degrees of Disjunction: 2.8 Project image analysis		Step 2: Types of Disjunctions																	
		<table border="1"> <tr> <th rowspan="3">Mass</th> <th rowspan="3">2D/H</th> <th>A</th> <th></th> </tr> <tr> <th>P</th> <th></th> </tr> <tr> <th></th> <th></th> </tr> <tr> <th rowspan="3">Surface</th> <th rowspan="3">2D/H</th> <th>A</th> <th></th> </tr> <tr> <th>P</th> <th></th> </tr> <tr> <th></th> <th></th> </tr> </table>		Mass	2D/H	A		P				Surface	2D/H	A		P			
Mass	2D/H	A																	
		P																	
Surface	2D/H	A																	
		P																	

The Effect of The Disjunction Feature on Academic Product/ Analyzing sheet																			
Code:ST2	Architect: Jsar Naif	Year:2018	Type of project:3D																
Project Name: Movie institute		Place:																	
Concept: Coco Movie		Project image:																	
Project plans	Inside Form	Project plans																	
			Ground. Fl																
			First Fl																
			Second. Fl																
			section																
			Section(inside +outside)																
Step 1: Degrees of Disjunction: 1.2 Project image analysis		Step 2: Types of Disjunctions																	
		<table border="1"> <tr> <th rowspan="3">Mass</th> <th rowspan="3">2D/H</th> <th>A</th> <th></th> </tr> <tr> <th>P</th> <th></th> </tr> <tr> <th></th> <th></th> </tr> <tr> <th rowspan="3">Surface</th> <th rowspan="3">2D/H</th> <th>A</th> <th></th> </tr> <tr> <th>P</th> <th></th> </tr> <tr> <th></th> <th></th> </tr> </table>		Mass	2D/H	A		P				Surface	2D/H	A		P			
Mass	2D/H	A																	
		P																	
Surface	2D/H	A																	
		P																	
Step 1: Degrees of Disjunction: 1.7 Project image analysis		Step 2: Types of Disjunctions																	
		<table border="1"> <tr> <th rowspan="3">Mass</th> <th rowspan="3">2D/H</th> <th>A</th> <th></th> </tr> <tr> <th>P</th> <th></th> </tr> <tr> <th></th> <th></th> </tr> <tr> <th rowspan="3">Surface</th> <th rowspan="3">2D/H</th> <th>A</th> <th></th> </tr> <tr> <th>P</th> <th></th> </tr> <tr> <th></th> <th></th> </tr> </table>		Mass	2D/H	A		P				Surface	2D/H	A		P			
Mass	2D/H	A																	
		P																	
Surface	2D/H	A																	
		P																	



**Appendix B****Project: Artistic Institute****Stage: 2<sup>nd</sup>****Step1: Degree of Disjunction**

Students Code	Degree Of Disjunction(D1)	Total Surface Area	Inner Surface Area	Degree Of Disjunction2(D2)	Type Of Project	Ceilin g Area	Wall Area	Elevation Disjunction(D3)
ST 1	0.8	11,041	3,286.00	1.1	3D			
ST 2	0.9	6,112	1,593.59	1.2	3D			
ST 3	1.4	7,672	279.32	1.5	2D	890	7,393	1.7
ST 4	1.2	13,587	2,721.04	1.5	3D			
ST 5	1.4	20,260	3,469.64	1.7	3D			
ST 6	4.5	7,078	54.11	4.5	3D			
ST 7	4.8	6,338	814.87	5.5	3D			
ST 8	4.6	10,860	2,541.02	6.0	3D			
ST 9	6.5	16,372	1,552.79	7.2	3D			
ST 10	5.7	10,799	2,254.38	7.2	3D			
<b>Mean:3.8</b>								
<b>St. d :2.4</b>								

**Project: shopping mall****Stage: 3<sup>rd</sup>****Step1: Degree of Disjunction**

Students Code	Degree Of Disjunction(D1)	Total Surface Area	Inner Surface Area	Degree Of Disjunction2(D2)	Type Of Project
ST 1	1.54	8224.28	4292	3.2	3D
ST 2	2.9	30200.80	5783	3.6	3D
ST 3	1.39	8224.28	1353	1.7	3D
ST 4	2.1	73236.10	17914	2.8	3D
ST 5	2.4	31018.30	10439	3.6	3D
ST 6	1.95	9198.16	1493	2.3	3D
ST 7	1.8	16584.10	3694	2.3	3D
ST 8	0.9	9090.73	2032.02	1.2	3D
ST 9	1.9	16318.00	1599	2.1	3D
ST 10	3.4	20689.30	6386	4.9	3D
<b>Mean:2.8</b>					
<b>St. d :1</b>					

**Project: Diverse projects**  
**Stage:5<sup>th</sup>**  
**Step1: Degree of Disjunction**

Students Code	Degree Of Disjunction(D1)	Total Surface Area	Inner Surface Area	Degree Of Disjunction2(D2)	Type Of Project	Ceiling Area	Wall Area	Elevation Disjunction(D3)
St 1	0.7	21,854.10	1,707.54	0.8	2D	832.3849	20,146.56	0.8
St 2	5.9	34,569.50	6,639.08	7.3	3D			
St 3	1.06	39,968.30	8,965.56	1.4	3D			
St 4	0.7	19,719.20	5,179.71	0.9	3D			
St 5	0.9	30,405.80	7,551.65	1.2	3D			
St 6	0.8	48,134.40	7,380.38	0.9	3D			
St 7	2.5	53,716.10	6,002.71	2.8	3D			
St 8	0.7	2,772.10	496.86	0.8	2D	589.8	2,275.24	1.1
St 9	1.0	43,796.60	8,171.31	1.2	3D			
St 10	1.25	44,625.40	6,181.45	1.5	2D	2562.983	38,443.95	1.6
<b>Mean:1.92</b>								
<b>St. d :1.9</b>								

**Project: Housing**  
**Stage:4<sup>th</sup>**  
**Step1: Degree of Disjunction**

Students Code	Degree Of Disjunction(D1)	Total Surface Area	Inner Surface Area	Degree Of Disjunction2(D2)	Type Of Project	Ceiling Area	Wall Area	Elevation Disjunction(D3)
St 1, St 6	2.5	9468.88	2210	3.3	2D	903.0	7258.9	3.7
ST 2	1.22	23149.1	2803	1.4	2D	3687.0	20346.1	1.7
ST 3	1.2	25732.7	4381	1.4	2D	4973.0	21351.7	1.9
ST 4	0.1	9311.9	186	0.1	2D	2230.0	9125.9	0.1
ST 5	0.9	12292.8	1616	1.0	2D	1840.0	10676.8	1.3
St 7, St 9	0.3	10241	832	0.3	2D	1565.0	9408.9	0.4
ST 8	1.77			2.1	3D			2.1
ST 10	0.776	13551.8	2221	0.9	2D	2509.0	11330.8	1.2
<b>Mean:1.7</b>								
<b>St. d :1.2</b>								

**Project: Diverse projects**  
**Stage:5<sup>th</sup>**  
**Step1: Degree of Disjunction**

Students Code	Degree Of Disjunction(D1)	Total Area	Surface Area	Inner Surface Area	Degree Of Disjunction2(D2)	Type Of Project	Ceiling Area	Wall Area	Elevation Disjunction(D3)
St 1	0.7	21,854.10		1,707.54	0.8	2D	832.3849	20,146.56	0.8
St 2	5.9	34,569.50		6,639.08	7.3	3D			
St 3	1.06	39,968.30		8,965.56	1.4	3D			
St 4	0.7	19,719.20		5,179.71	0.9	3D			
St 5	0.9	30,405.80		7,551.65	1.2	3D			
St 6	0.8	48,134.40		7,380.38	0.9	3D			
St 7	2.5	53,716.10		6,002.71	2.8	3D			
St 8	0.7	2,772.10		496.86	0.8	2D	589.8	2,275.24	1.1
St 9	1.0	43,796.60		8,171.31	1.2	3D			
St 10	1.25	44,625.40		6,181.45	1.5	2D	2562.983	38,443.95	1.6
Mean:1.92 St. d :1.9									

**Project: Artistic Institute**  
**Stage:2<sup>nd</sup>**  
**Step2: Types of Disjunctions**

Code	types of Disjunctions											
	Mass						Surface					
	2D/H		2D/V		3D		2D/H		2D/V		3D	
	A	P	A	P	A	P	A	P	A	P	A	P
St1												1
St2			1		1							
St3										1		
St4		1		1								
St5		1										
St6					1							
St7	1		1			1						
St8		1					1					
St9				1		1						
St10		1		1								
count	1	4	1	4	1	4	1	0	1	0	0	0

**Project: shopping mall**  
**Stage: 3<sup>rd</sup>**  
**Step2: Types of Disjunctions**

Code	types of Disjunctions											
	Mass						Surface					
	2D/H		2D/V		3D		2D/H		2D/V		3D	
	A	P	A	P	A	P	A	P	A	P	A	P
St1					1					1		
St2		1					1					
St3		1					1					
St4		1		1					1			
St5		1		1					1			
St6		1				1						
St7		1		1					1			
St8		1					1					
St9		1				1						
St10							1			1		
count	0	8	0	0	10	0	5	0	0	0	0	0

**Project: Housing**  
**Stage:4<sup>th</sup>**  
**Step2: Types of Disjunctions**

Code	types of Disjunctions											
	Mass						Surface					
	2D/H		2D/V		3D		2D/H		2D/V		3D	
	A	P	A	P	A	P	A	P	A	P	A	P
ST 1, St6												1
ST 2												1
ST 3												1
ST 4												1
ST 5												1
ST 7, St9												1
ST 8					1	1						
ST 10												1

**Project: Diverse projects**  
**Stage:5<sup>th</sup>**  
**Step2: Types of Disjunctions**

Code	types of Disjunctions											
	Mass						Surface					
	2D/H		2D/V		3D		2D/H		2D/V		3D	
	A	P	A	P	A	P	A	P	A	P	A	P
St1		1										
St2				1								
St3						1						
St4										1		
St5		1		1								
St6		1		1								
St7		1		1				1				
St8											1	
St9		1		1								
St10		1		1								
count	0	6	1	6	0	1	1	1	0	0	0	0