# A Taxonomy for Analyzing Dashboard Design in XR **based Content and Data Visualization Tool**

### Hyoji Ha

#### Hyerim Joung

### Sanghun Park

Graduate School of Metaverse, Sogang University hjha0508@sogang.ac.kr

Lifemedia Interdisciplinary Program, Ajou University hlj1014@ajou.ac.kr

Graduate School of Metaverse, Sogang University mshpark@sogang.ac.kr



This work was supported by the National Research Foundation of Korea(NRF) and the ITRC(Information Technology Research Center) support program supervised by the IITP(Institute for Information & Communications Technology Planning & Evaluation) grant funded by the Korea government(MSIT) (RS-2023-00251681, RS-2023-00259099, RS-2022-00156318)

Main category	Sub category level 1	Sub category level 2	Clinic Immersives	Index2018 Holofit	Insight Heart Enscape VR	MXN22 JMP21	WIIG ITIS VN LJJ21 MAM23	VR Resorts	Arkio VK Gravity Sketch Holotable	DataView SSAS22 KGM18	UXDA	JAR18 KMT18	JDR18 NiwViw	JABT20	HAR18 NAJ20 JCL19	WMK23 XR Content (COUNT)	XR-based DataVis Tool		Check the start proposed and pull it Back towards to be compared to a start of the start of the start of the start of the start of the start of the start of the start of the start of the start of passes the start of the start			CR Coc Bol Criticon C	rdial Infarction Arterial Hypertension Artial Fibrillat
		Business														2	1				The Part		O Part
Type of Data		Finance														9	6					Ancaster Hos Anneal X	
Type of Data	Categories of Data	Architecture														7	7		Clinic Immersive	Index2018	Holofit	Euzor VP	InsightHeart
(Covered Field)		Educational														11	11			INCENZOTO			
		Medical														2	1		Sotting			Sereenhols	CORRECTORY OF LINE ANALYSIS EXCEPTION OF LINE ANALYSIS E
Audience	Types of Audiences in	Public														2	5						COMING BOALLS
	terms of Utilization	Organization														0	1		Outlines	Sunshine: Temperature: 36.64" x Humidity Co.44			B17 ARRAYEE
	(group)	Individual														8	7		0 11:00 12:00 13:00 14:00 15:00				
	Intermediation in	VR														6	12			place 7 3		Coversited	Common Description of the second seco
	Dashboards	AR														6	2			basil to o			
Dashboard	Dasilobalus	MR														3	2						
Implement		Joystick														5	4		Escape VR	MXN22	JMP21	Wild iris VR	LIJ21
	Interaction Device	Controller														4	8						
		Hand														6	4		Hi Filippo! Welcome back! How can I help	Contraction Artic			
		Showing Directional														3	4		C C C				HOLO Table Sun Position
	Strategic Dashboard	Representing Temporal Data	a													3	7			Phylicet Marriott Net Associates			≠ 110°
Purpose of Dashboard		Evaluating														11	5			Restormed and a constraint of the constraint of	Raph of the second s		* • • • • •
		Monitoring														12	11	is ]					THE
	Analytical Dashboard	Providing Context														3	7	iter aV			Lunston a	+	and the second sec
		Determine Cause and Effect	t					$\downarrow$								3	9	Con Dat					
	Operational Dashboard	Verify Result and Quick Response														7	2	: XR C ased [	MAM23	VR Resorts		Corravity Sketch	Holotable
		View Real-Time Event														8	5					Areas of struggle	
		Providing Details														6	5	– <mark>,2</mark> ×				(5 min) 2x + 3x = 10 5 + 2x = 10 (5 - 2x + 3x = 10) (5 - 3x + 3x + 3x = 10) (5 - 3x + 3x	Vivi,21300 Note (2010) and (2010) Second Harrison (2010)
	Layout	Hierarchical														1	4	אר	Henry - Corport			-3 (c) > 0 Skill: Twide both sides by the variable coeff. 34% <b>3</b> (c) <b>3</b> (	
		Categorical														7	6	Pii	Compand 2			SX = 2 - 3 (c i read op) Other common errors	Georgia Liera Tarchina za Antonia Liera Antonia Tarchina za Antonia Antonia Antonia
		Grouped														12	7					<ul> <li>4(5 + x) = 40</li> <li>20 + x = 40 + x</li> <li>(2 main m)</li> </ul>	
		Schematic														0	2			Pagar Danad Mada		201 20 00	
	Graphic and Metric	Graph														8	10		Nanome	DataView	SSAS22	KGM18	UXDA
		Image														8	5		A) 2002, 6) 2009, C) 2011, B) 2014,				
		Icon and Pictogram														12	7		Which was highly, the mean energy constant/the hardware 1997 and 2001     (whaten) of break 2001 (which was highly and 2001     A) 1997-2001, (i) 2004-2001     Or the strangery ind service sectors, which experimented the largest     of the strangery ind service sectors, which experimented the largest     of the strangery indication of the sectors.			Ander a	AlbertaWar
		Text														12	11		A menugers is journed 6. Which dataconsponded the most energy access all 4 sectors, 1997-2006 (inclusion) a 2007-2016 (inclusive)? A) 1997-2006, B) 2007-2016				Car US
Dashboard Design		Direction Controllers														0	1		Energy Consumption in the UK since 1997	5	Manager and Andrew and Andre		
		Table/List														5	7				The state of the s		
	Color	Distinguishing Data Encodings														9	11						
		Differentiating Colors for Different Users														2	0		VRIA	JAR18	KMT18	JDR18	NiwViw
		Theme														4	3			Margan a			
	Dynamic Media	Video														2	1		January February March April	Ben de la factoria	Lingsage Breakup Isean 87 % 2		B3 B5
		Flash														2	3		May Jane		weets: 3193		B4
	Behavioral Design	Gesture-driven Dashboard Output/Movement														1	5		August Coner Coner	The standard and and and and and and and and and an	n8 45 05 25 13 19 0		
		Single Laver														12	5						- Mary
Spatial Design	Dashboard Layer	Multi-laver														3	10		AL AT AT AT AT AT AT AT	an a		DAGEN - DAGEN	4
	D 11 151	Target Centered Lock														11	12						
	Dashboard Placement	Controller Centered Lock														3	3		JABT20	HAR18	NAJ20	JCL19	WMK23

A taxonomy for analyzing dashboard design in XR based content and data visualization tool and representative image of 30 cases

## **Research Introduction and Process**











#### **⊘unity** 🔿 Meta Quest

Since the growth of XR technologies, there has been a surge in the development of dashboards designed for immersive environments. These dashboards handle complex data visualization within XR, requiring unique design considerations.

However, applying traditional dashboard designs directly to XR environments can lead to cognitive overload. The need for customized design approaches in XR dashboards has become evident to enhance user experience and interaction.



To address this, we collaborated with experts to create a taxonomy that categorizes XR dashboard designs by factors like Type of Data, Audience Settings, Dashboard Implement, Purpose of Dashboard, Dashboard Design, Spatial Design.



Using this taxonomy, 30 XR dashboard cases were analyzed to identify common design elements. The findings were then used to propose an exploration system that allows users to navigate and apply these design insights in future XR dashboard projects.

## **Case Analysis Example**

Main category	Classification result of Kenneth Holstein et al. [3]	Representative image of Kenneth Holstein et al. [3]					
Type of Data (Covered Field)	Categories of Data: Educational	Les marters, high prester Les marters, high pre					
Audience	Types of Audiences in terms of Utilization: Organization, Individual	$\begin{array}{c} Current problem (non) \\ 3x + 3 = 24 \\ 0 & 3x = 24 \\ 0 & 3x = 24 \\ \end{array}$					
Dashboard Implement	Intermediation in Dashboards: <b>AR</b> Interaction Device: <b>Hand</b>						
Purpose of Dashboard	Strategic Dashboard: <b>Evaluating, Monitoring</b> Interaction Device: <b>Determine cause and effect</b>						
Dashboard Design	Layout: <b>Categorical</b> Graphic & Metric: <b>Graph, Icon and Pictogram, Text</b> Color: <b>Distinguishing Data Encodings</b>	ZZZ     Display     LaMarr     marr     Areas Of Struggio       LaMarr     Display     LaMarr     Marr     Marr     Marr       Display     Display     Display     Display     Marr     Marr       Display     Display     Display     Display     Display     Marr       Display     Display     Display     Display     Display     Display       Display     Display     Display     Display     Display     Display       Display     Display     Display     Display     Display     Display					
Spatial Design	Dashboard Layer: <b>Single Layer</b> Dashboard Placement: <b>Target Centered Lock</b>	How to matter some skills					

**Classification result of Kenneth Holstein et al. (See reference 3 in the abstract paper)** 

## **Future Research (Exploration System)**

Dashboard Vis							XR Dashboard Vis						
ype of Data (Covered Field)  gogries of Data usiness   Finance   Architecture ducation   Medical  udience  ss of Audience in terms of Utilization ubic   Organization   Individual						Audience	Type of Data (Covered Field)     Categories of Data     Business Finance Architecture     Education Medical      Audience     Types of Audience in terms of Utilization     Public Organization Individual						Audience Individual Organization Public 0 2 4 6 8 10 12 Dashboard Implement
ashboard Implement	Clinic Immersive	Index2018	Holofit	Fuzor VR	InsightHeart	Hand	Dashboard Implement	Fuzor VR	InsightHeart	NAJ20	JCL19	WMK23	Hand
ediation in Dashboards t	Stitups market 1 Had 1200 Had 1400 Store Backet of the second Escape VR Market of the second se	MXN22	JMP21	Wild iris VR	LU21	AR MR 0 2 4 5 8 10 12 14 15 Type of Data Madical Arbitecture	Intermediation in Dashboards A & XR A MR Intercation Device Joystick Controller Hand Purpose of Dashboard Strategic Dashboard Strategic Dashboard Representing Temporal Data E raviauring Monitoring Analytical Dashboard Providing context	Ranome	DataView				Neglicat educational Architecture Medicat
etermine cause and effect ational Dashboard effy Result and Quick Response ew Real-Time Event oviding Details ashboard Design	МАМ23	VR Resorts	Arkio VR	Gravity Sketch	Holotable	Finance Business 0 2 4 6 8 10 12 14 16 Purpose of Dashboard	Covernine, cuse and effect Operational Dashboard Verify Nexe Reasonse Verify Result and Quick Response Verify Real-Time Event Providing Details  Dashboard Design						Pressee 0 2 4 6 8 10 12 Purpose of Dashboard Providing Details
ut erarchical categorical ouped Schmatic hic and Metric aph Image on and Pictogram Text r stinguishing Data Encodings						View Acat Time Vient	Layout Herarchical Categorical Grouped Schmatic Graphic and Metric Graphic and Metric Graph Image foca and Pictogram Text Direction Controllers Table/List Color Distinguishing Data Encodings Differentiating Colors for Different Users						View Real-Time Event Vienty Result and Quick Reprime Determine cause and effect Providing context Monitoring Evaluating Evaluating Representing Temporal Data

#### (a) Overview

(b) Example of extracting dashboard cases based on a combination of taxonomy criteria

## **Case Frequency Report**







Architecture educational Individual Multi-laye LIJ21 Graph Image /erify Result and Quick Resp /iew Real-Time E (a) Overview

(R Dashboard Vi

(b) Example of extracting dashboard cases based on a combination of taxonomy criteria

**XR Content** 

#### **XR-based DataVisTool**

**Exploration system concept design 2: Data visualization-based mode**