

Demystifying the Dimensions and Roles of Metaverse Gaming Experience Value: A Multi-Study Investigation

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Introduction

Research Background



The metaverse gaming (MG) industry

- MG economy comprises **75%** of the global gaming revenue, and has an annual growth rate of **41.64%** (McKinsey & Company, 2022)
- Very low penetration rate (only **4.7%**) of players (Statistica 2024)
- Players suffer from **poor gaming experiences** (Statistica 2024)



In-depth research on MG experience value (MGEV)

MGEV: players' holistic evaluations of their MG experiences after gameplay (Molinillo et al., 2020)



The importance of MGEV

- Insights into metaverse game design
- Imperative for the wide diffusion and long-term success of the MG industry



Research Gaps

1. **Previous studies have rarely investigated the experience value in the MG context**
 - A context-specific understanding of its dimensionality has not yet been rigorously developed
2. **The body of literature predominantly relied on motivation-focused perspective, but overlooked the activeness-focused perspective**
 - Both the two perspectives are vital, and overlooking either perspective can lead to an incomplete portrayal of experience value in MG
3. **No tapping into nuanced subdimensions that reflect context-specific characteristics of experience value.**
 - difficult for researchers to operationalize the MGEV construct
 - Difficult for practitioners to design MG appropriate to users' needs for various MGEV dimensions

Research Goal

Identify the context-specific dimensions and subdimensions of MGEV and develop an MG-context-specific typology of MGEV by integrating the motivation-focused and activeness-focused perspectives

Research Gaps

1. A lack of a person-centered approach

- prior research on experience value in MG-related contexts has mainly adopted a variable-centered approach (Wu and LU, 2013)
- For different individuals, experience value dimensions can combine and be perceived in different ways (Gopal and Yang, 2015)
- A lack of such knowledge can hinder MG providers from attracting as many types of players as possible

Research Goal

Reveal player groups with different profiles of MGEV using a person-centered approach



How to approach the objective? **A multi-study investigation**

A two-axis typological framework for MGEV combining motivation- and activeness-focused perspectives

- Qualitative investigation (manual coding)
- Online textual reviews
- 6 dimensions + 21 subdimensions of MGEV

Study 1

- A deep learning classification model
- Aggregate the dataset into a balanced panel data
- Demonstrate MGEV validity

Study 2

- Person-centered approach
- Three player groups
- Different MGEV profiles and MG participation characteristics

Study 3

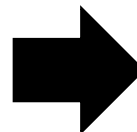


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Research Background and Literature Review

Experience value dimensions based on two orthogonal axes:

- Intrinsic vs. extrinsic value
- Active vs. reactive value



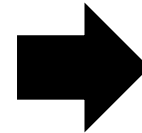
MGEV:

- no study has theorized the connotation and dimensionality of MGEV, providing a limited understanding of this important construct

Prior studies research content	Related research gaps
Over reliance on utilitarian and hedonic value (motivation-focused perspective)	• it largely overlooks the activeness-focused perspective (active versus reactive value) • These studies rely on general and nonspecific measurements, which cannot adequately capture the context-specific characteristics of the MG
Prior research employed a variable-centered approach (Kock and Lynn, 2012)	• experience value dimensions can be combined and experienced differently by different individuals (Centers and Bugental, 1966) • The underlying explanation for such differences remains unclear

Differences between MG and other virtual worlds:

- the integration or fusion of both realistic and unrealistic gaming environments (Dwivedi et al., 2022)
- advanced interactive devices (e.g., head-mounted displays)
- facilitate socialization among players (Statistica, 2024)

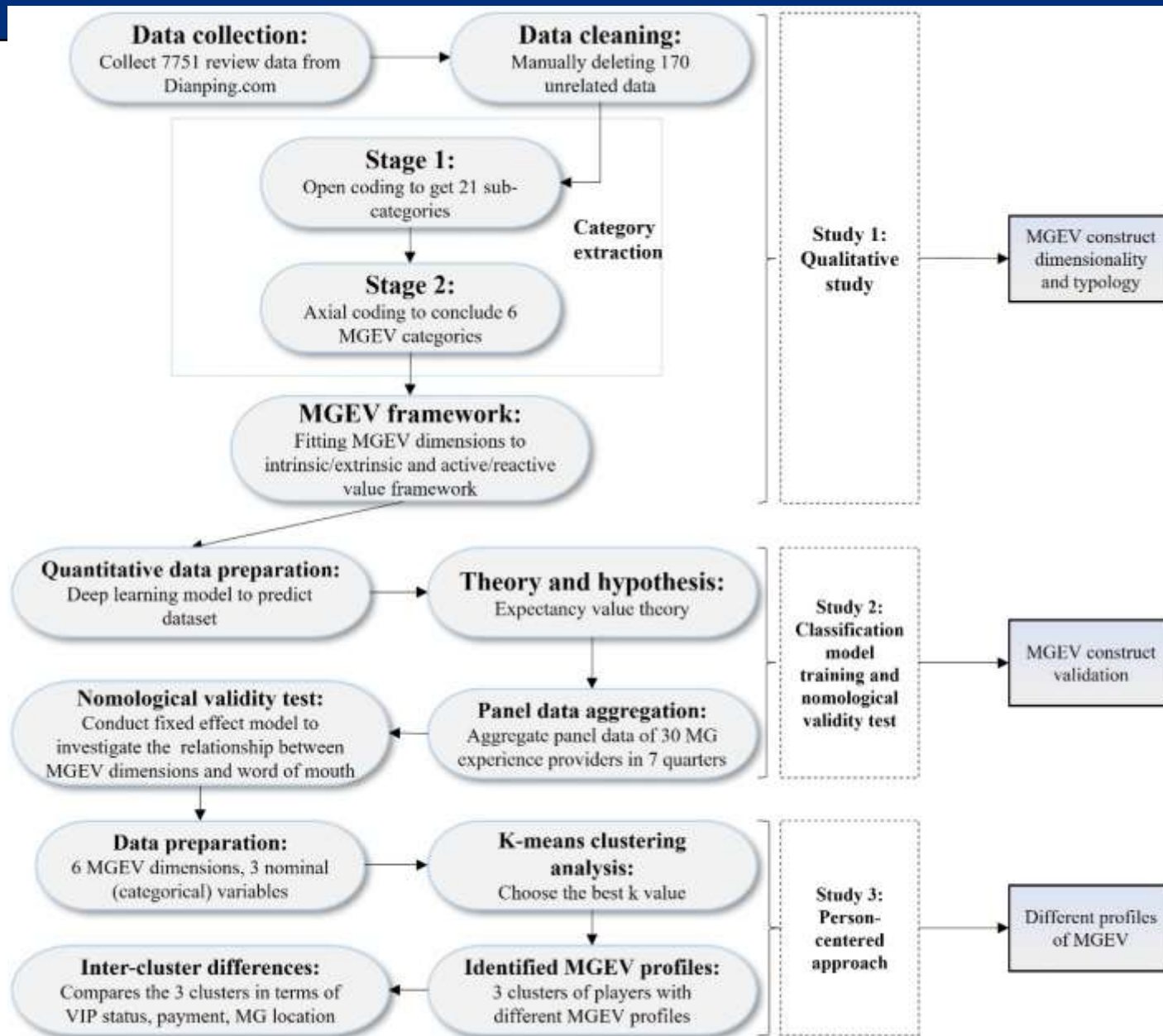


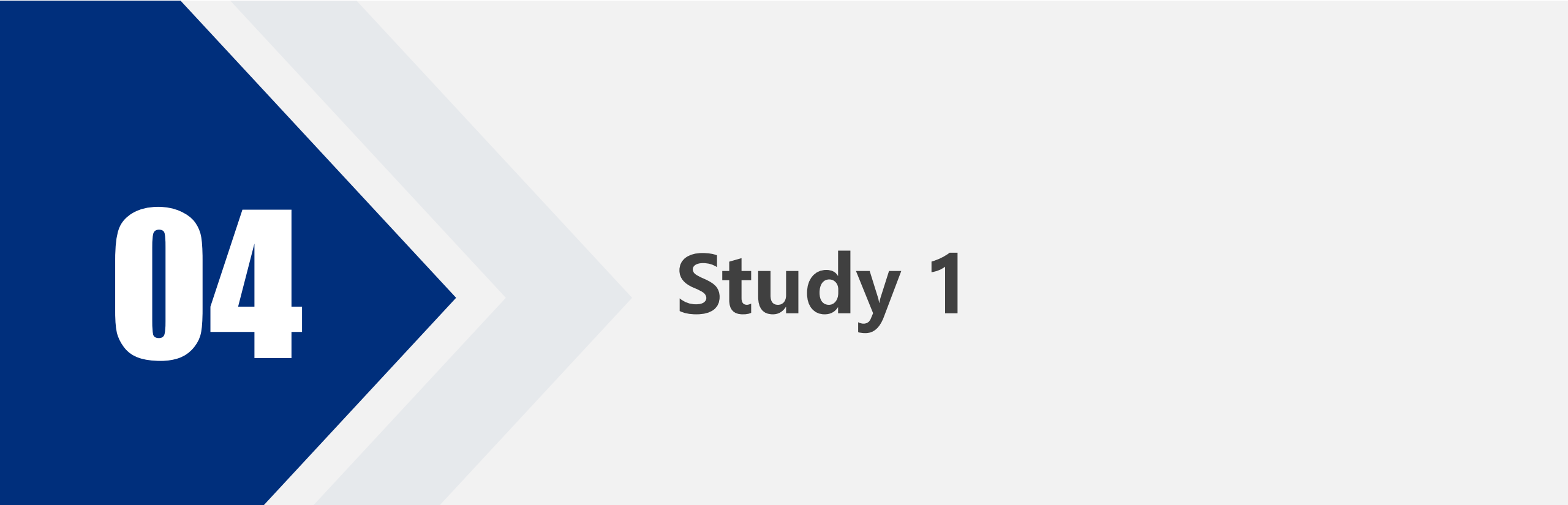
MG is an amalgamation that integrates intrinsic and extrinsic as well as active and reactive elements



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Research Methodology

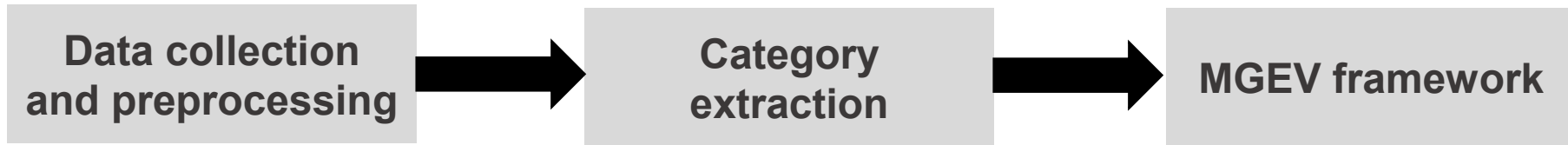




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Study 1

Study 1: Qualitative Data Analysis



Public online reviews of MG experiences from players in a metropolis in China from a popular Chinese word-of-mouth website (dianping.com) over a span of seven years (January 1, 2016, to December 31, 2022)

Excluded 170 unrelated reviews (e.g., reviews about prize claws and search notices for missing items during gameplay)

Remaining review: 7,581

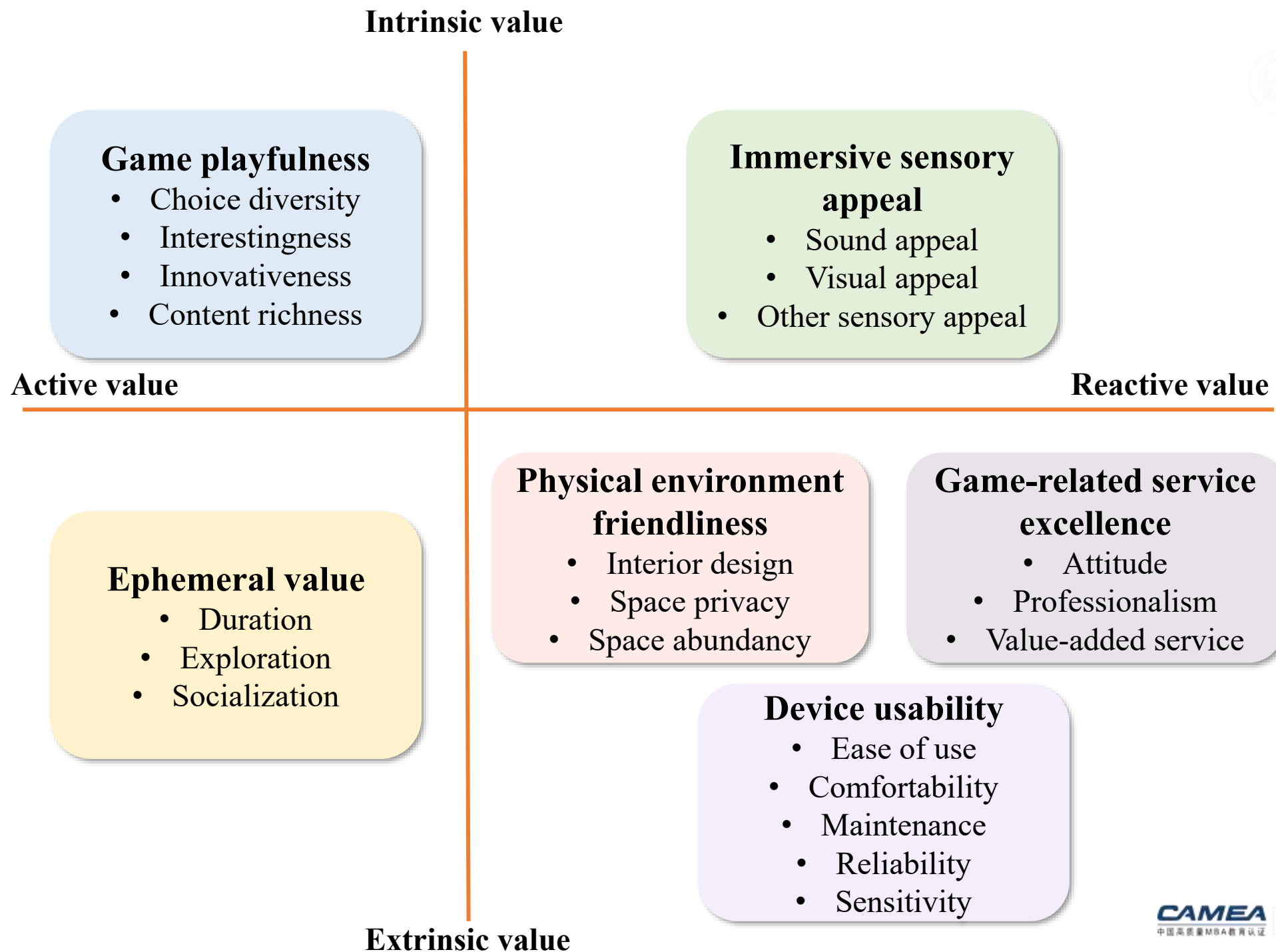
Open coding: identify specific labels and subdimensions

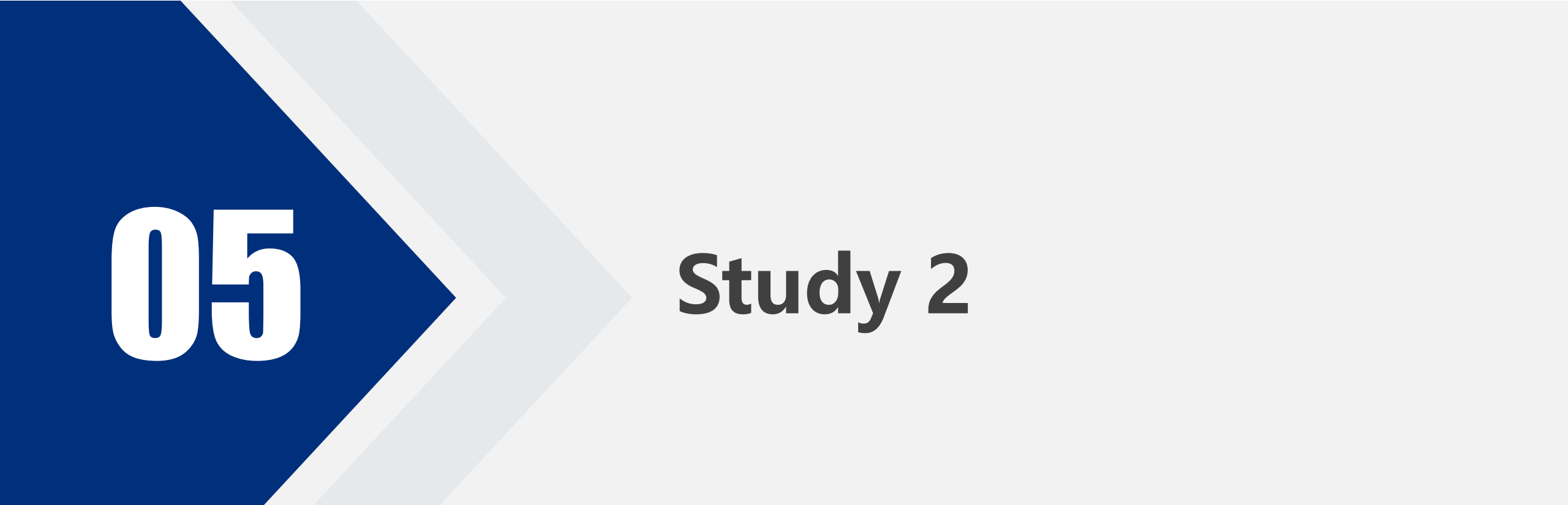
Axial coding: extracted broader dimensions

The development of a four-quadrant MGEV framework

Original statements*	Labels	Subdimensions
The interior design (a4) is also stunning, I bet it's the most technological style (a6) I've ever seen. Because it is my first time playing, the boss is very patient (b1), and he's also a very professional (b5) player; he has recommended (b8) numerous (e1) playful games and gave instructions (b9) to us when we had no idea what to do.	A4 Interior design	interior design
	a6 style	
	b1 patient	attitude
	b5 professional	professionalism
	b8 recommend	
	b9 instructions	
	e1 numerous	choice diversity

Dimensions	Subdimensions generated from open coding
Physical environment friendliness	interior design, space privacy, space abundance
Game-related service excellence	attitude, professionalism, value-added service
Device usability	ease of use, comfortability, maintenance, reliability, sensitivity
Immersive sensory appeal	sound appeal, visual appeal, other sensory appeal
Game playfulness	choice diversity, interestingness, innovativeness, content richness
Ephemeral value	duration, exploration, socialization





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Study 2

Study 2: MGEV Nomological Validity Validation

Expectancy value theory:

Individual behavioral outcomes can be explained by the values embedded in a behavior or object (Verhagen et al., 2011)

Outcome variable:

word of mouth

Quantitative data preparation through deep learning model

- Split data into 100, 100, 400, 400 reviews
- the coders independently coded one 100-review subsample (first two rounds)



- In the final round, each coder independently coded one of the two 400-review sub-samples



- Remove duplicates, stop words, and special characters
- Jieba: Chinese word segmentation



- convolutional neural network (CNN)

Table 3 Values of hyperparameters

Hyperparameter	Value
filter region size	(3, 4, 5)
feature maps	100
activation function	ReLU
pooling	1-max pooling
dropout rate	0.5
l2 norm constraint	3

Table 4 Micro-F1 of other multi-label text classifiers

Source	Model	Micro-F1
Dhal & Azad [9]	Lightweight Term-weighting FS (LwTwFS)	0.988
Rajabi et al. [50]	Convolutional Neural Network (CNN)	0.899
Lu et al. [39]	CNN-BiLSTM-Attention classifier	0.875
Peng et al. [47]	Hierarchical taxonomy-aware and Attentional Graph↓ Capsule Recurrent CNN (HE-AGCRCNN)	0.778
Liao et al. [34]	Seq2Seq-based multi-label classifier	0.715
Tran & Kavuluru [62]	Recurrent neural networks with hierarchical attention (ReHAN)	0.619

Study 2: MGEV Nomological Validity Validation

Measurement of Variables

- the CNN model trained in Section 5.2 to extract the label (0 or 1) for each subdimension within the six MGEV dimensions



- summed up the value of all the subdimensions corresponding to the dimension (dimension measurement)



- Word of mouth (crawled from dianping.com)
- ratings equal to 5 as 1 and ratings below 5 as 0

Panel data aggregation

- Numpy and pandas to aggregate the raw data by MG experience providers and players' experience time (on a quarterly basis) based on mean values



- Concentrate on the last seven quarters (quarter 2, 2021, to quarter 4, 2022)
- 30 MG providers



- Utilized the average value of the variable for the same MG experience provider across the entire seven-quarter time window

Observation=210 (30 cases by 7 time series)						
Variables		Subdimensions	Mean	Standard deviation	Min	Max
Word of mouth		--	0.5328	0.3227	0	1
MGEV	PEF	Interior design	0.3362	0.2608	0	1.5
		Space privacy				
		Space abundance				
	GRSE	Attitude	1.1853	0.5263	0	3
		Professionalism				
		Value-added service				
	DU	Ease of use	0.8827	0.4661	0	3
		Comfortability				
		Maintenance				
		Reliability				
		Sensitivity				
	ISA	Sound appeal	0.4958	0.5309	0	3
		Visual appeal				
		Other sensory appeal				
	GP	Choice diversity	1.1201	0.4792	0	3
		Interestingness				
		Innovativeness				
		Content richness				
	EV	Duration	1.0768	0.5099	0	3
		Exploration				
		Socialization				

VIF test

	Word of mouth	PEF	GRSE	DU	ISA	GP	EV	VIF
Word of mouth	1.0000							--
PEF	0.1447	1.0000						1.05
GRSE	0.2200	0.0733	1.0000					1.07
DU	-0.0332	-0.0700	0.1829	1.0000				1.20
ISA	0.1062	-0.0795	-0.0356	0.2851	1.0000			1.19
GP	0.2301	0.1405	0.1055	0.0667	0.2028	1.0000		1.10
EV	-0.2706	-0.0886	0.1464	0.2206	-0.0874	0.1070	1.0000	1.12

Nomological validity test

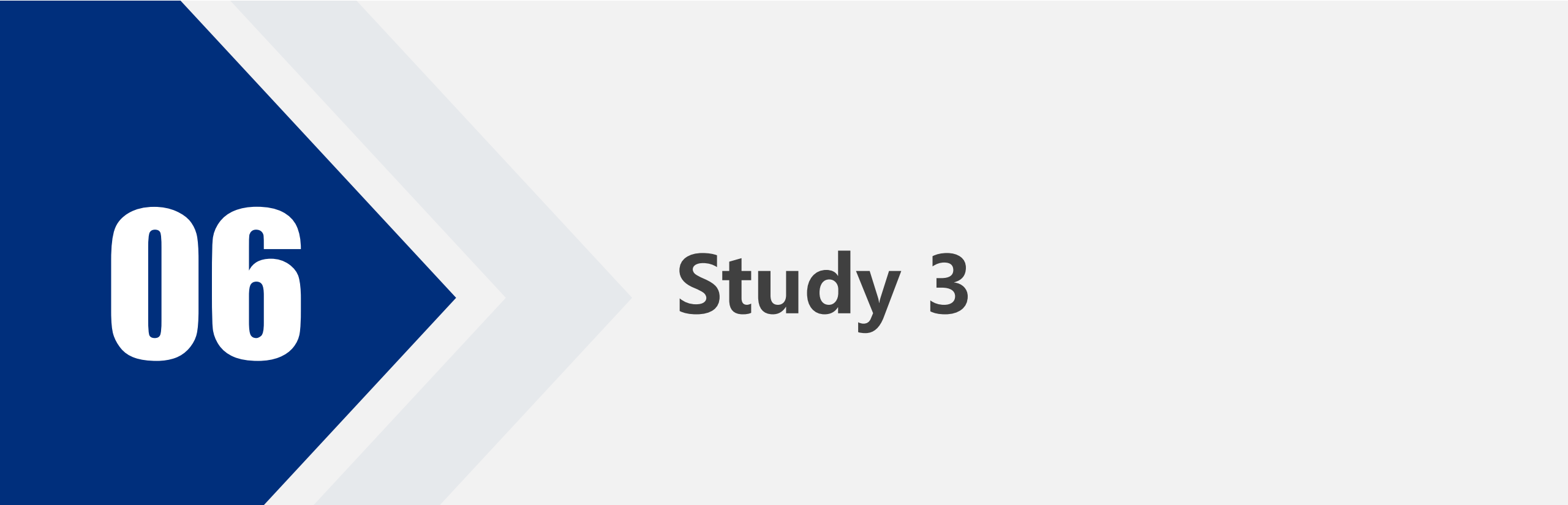
- Fixed effect panel data analysis in Stata 16
- Control variable: review length (numerical), attached pictures (numerical), received likes (numerical), received responses (numerical), anonymity (0 or 1), VIP status (0 or 1), pay for free (0 or 1), pay by cost (0 or 1), review count in a focal quarter (numerical), and accumulated review count as of the focal quarter (numerical)
- Hausman test: fixed effect model is more suitable

R-square:		Within=0.3301	Number of observations	210
		Between=0.2094	Number of groups	30
		Overall=0.2529	F-value	0.0000
Word of mouth		Coefficient	Standard Error	p-value
PEF		0.085	0.064	0.183
GRSE		0.072	0.039	0.072*
DU		0.009	0.042	0.829
ISA		0.222	0.049	0.000***
GP		0.145	0.037	0.000***
EV		-0.014	0.040	0.728
Time				
2021Q3		-0.041	0.051	0.414
2021Q4		0.021	0.052	0.685
2022Q1		-0.009	0.055	0.873
2022Q2		0.016	0.058	0.778
2022Q3		-0.003	0.060	0.959
2022Q4		-0.029	0.063	0.645

Control Variables

Review length	-0.001	0.0004	0.112
Attached pictures	0.053	0.019	0.006**
Received likes	0.003	0.007	0.647
Received responses	-0.233	0.087	0.008**
Anonymity	-0.152	0.105	0.150
VIP status	-0.222	0.088	0.012*
Pay for free	-0.120	0.146	0.411
Pay by cost	0.189	0.095	0.047*
Review count	-0.0002	0.001	0.852
Accumulated review count	0.0002	0.0005	0.738
Constant	0.150	0.117	0.201

Single-tail t-test: ***p<0.001; **p<0.01; *p<0.1



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Study 3

Study 3: A Person-Centered Approach to Identifying MGEV Profiles

Data preparation

- The value of each of the six MGEV dimensions: aggregate their respective subdimensions
- Value range of MGEV dimensions: zero to the total number of subdimensions within that specific MGEV dimension
- Encode three nominal variables representing MG participation characteristics (**VIP status, payment, MG location**)

Nominal variable description

- VIP status: whether a player is a VIP member on dianping.com (1) or not (0)
- Payment: whether the player was a paid MG participant and had three values: 0 (unknown), 1 (no payment), and 2 (payment)
- the reviewed MG experience provider was situated in a suburban (1), semi-central or semi-suburban (2), or central urban (3) area

Data description of Study 3

Categories	Names	Types	Encoding Rules	Levels/Categories and Distribution
MGEV Dimensions	PEF (Physical Environment Friendliness)	Ordinal	SUM (interior design, space privacy, space abundance)	4 Levels: 0 (69.16%), 1 (25.96%), 2 (4.34%), 3 (0.54%)
	GSE (Game-related Service Excellence)	Ordinal	SUM (attitude, professionalism, value-added service)	4 Levels: 0 (34.71%), 1 (21.37%), 2 (41.08%), 3 (2.85%)
	DU (Device Usability)	Ordinal	SUM (ease of use, comfortability, maintenance, reliability, sensitivity)	6 Levels: 0 (39.68%), 1 (39.01%), 2 (17.32%), 3 (3.55%), 4 (0.42%), 5 (0.03%)
	ISA (Immersive Sensory Appeal)	Ordinal	SUM (sound appeal, visual appeal, other sensory appeal)	4 Levels: 0 (63.88%), 1 (22.07%), 2 (7.57%), 3 (6.48%)
	GP (Game Playfulness)	Ordinal	SUM (choice diversity, interestingness, innovativeness, content Richness)	5 Levels: 0 (24.61%), 1 (40.02%), 2 (26.96%), 3 (7.49%), 4 (0.91%)
	EV (Ephemeral Value)	Ordinal	SUM (duration, exploration, socialization)	4 Levels: 0 (31.42%), 1 (45.96%), 2 (31.42%), 3 (3.09%)
Clustering Results	Cluster	Nominal	K-Means clustering results	3 Categories: 1 (13.77%), 2 (39.43%), 3 (46.80%)
MG Participation Characteristics	VIP Status	Nominal	Whether the player is a VIP of dianping.com	2 Levels: 0 (80.16%), 1 (19.84%)
	Payment	Nominal	Unknown = 0, free to play = 1, pay to play = 2	3 Levels: 0 (46.04%), 1 (15.75%), 2 (38.21%)
	MG Location	Nominal	suburb = 1, semi-central and semi-suburban area = 2, central city = 3	3 Levels: 1 (6.23%), 2 (11.05%), 3 (82.72%)

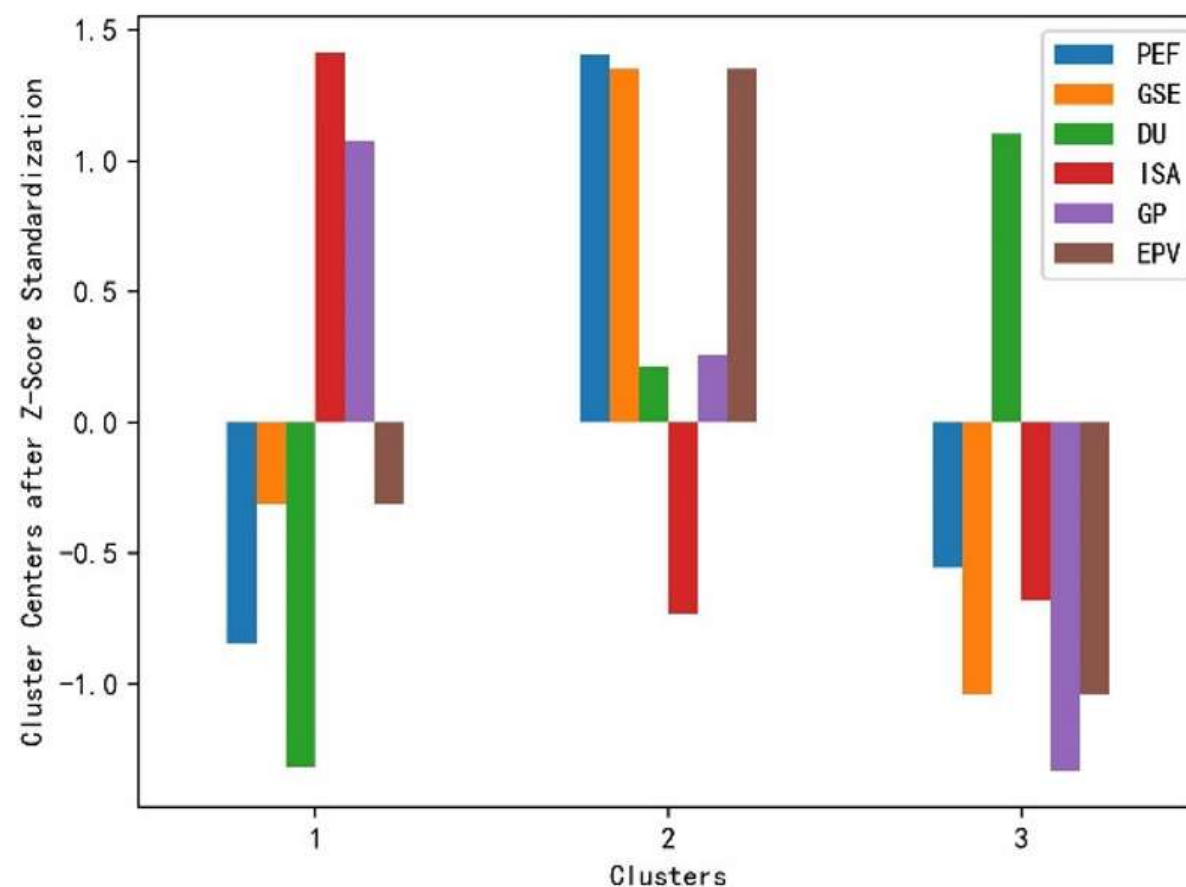
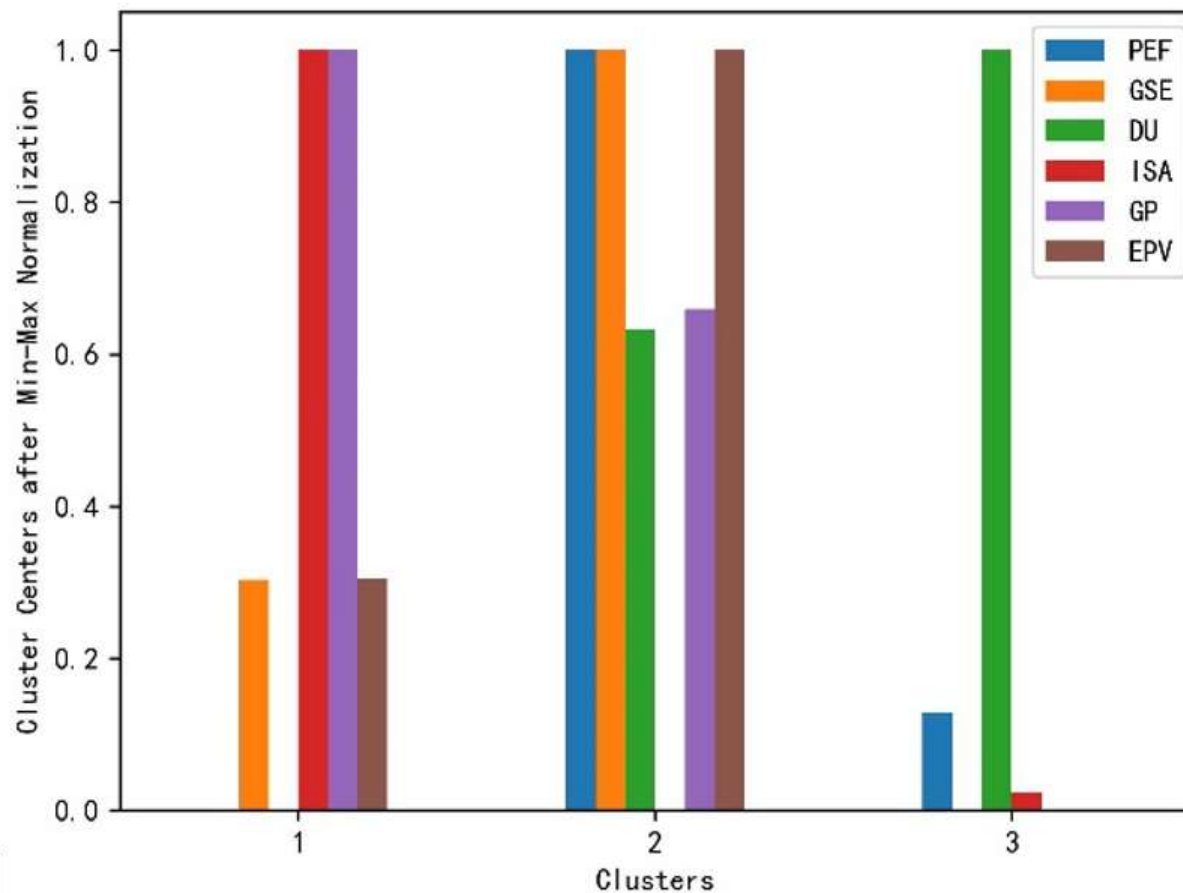
K-means clustering and optimal clusters

- k-means algorithm for cluster analysis
- Centroid initialization → Distance calculation → Grouping into clusters → Centroids calculation → Iterating until convergence [26]
- we chose $k=3$ as the target number of clusters

Cluster Centers

Cluster	Sample Size	PEF	GSE	DU	ISA	GP	EPV
1 (Intrinsic value dominated)	1044	0.2672	0.8994	0.8190	2.5498	1.2864	0.9377
2 (Intrinsic value dominated)	2989	0.4781	2.0605	0.8559	0.2340	1.2384	0.9649
3 (Mixed)	3548	0.2933	0.3931	0.8779	0.2862	1.1435	0.9258

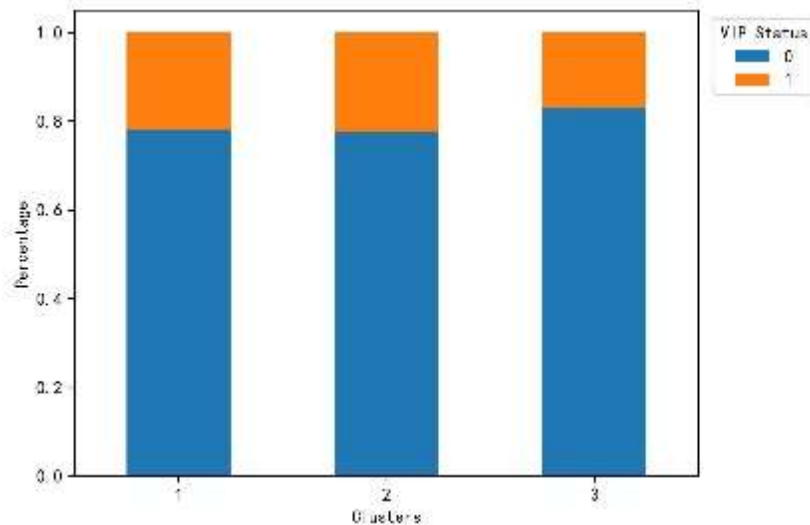
Cluster centers after min-max normalization or Z-score normalization



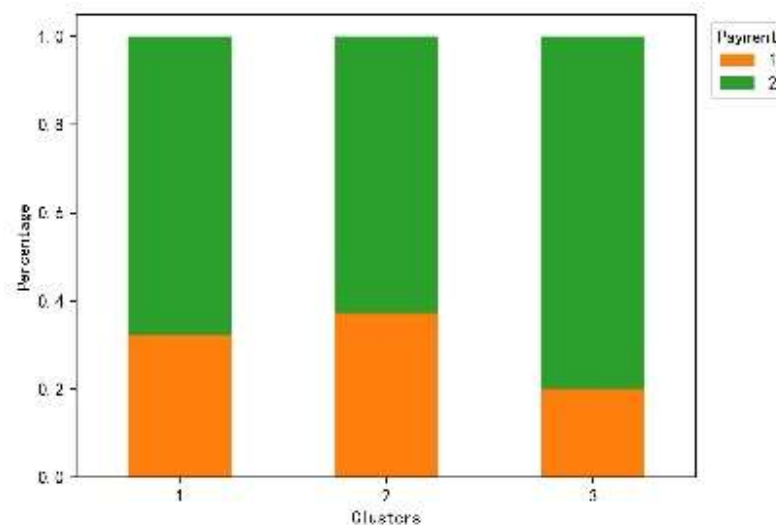
- Cluster 1: Intrinsic Value-Dominated Group
- Cluster 2: Extrinsic Value-Dominated Group
- Cluster 3: Mixed Group

Inter-Cluster Differences in MG Participation Characteristics

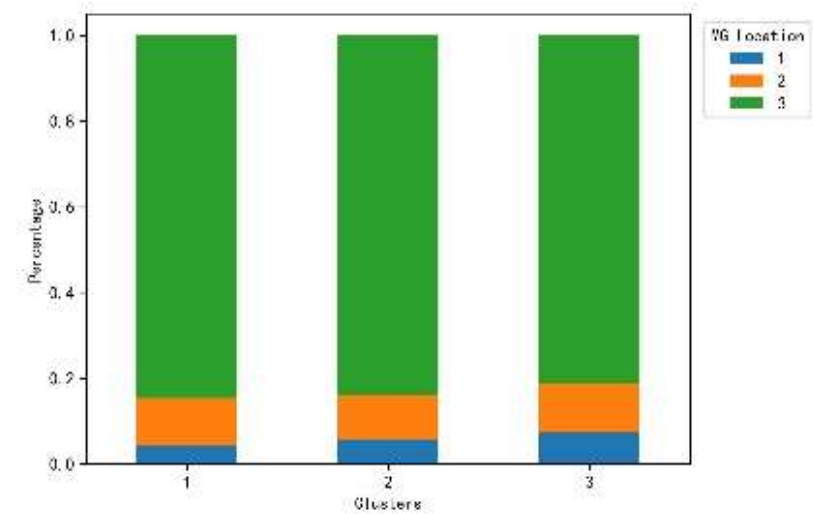
We compare the three clusters of MG players in terms of their MG participation characteristics, including VIP status, payment, and MG location, using stacked percentage bar charts to illustrate the inter-cluster differences



(a)



(b)



(c)

Percentage bar stacking chart for VIP status (a), payment (b), and MG location (c)

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Discussion and Conclusion

Theoretical implications

1. The six MGEV dimensions and their corresponding subdimensions identified in this study can serve as **a foundational basis for conceptualizing and operationalizing this important construct in future research endeavors**
2. Integrate the often-overlooked activeness-focused perspective (active versus reactive value) with the widely utilized motivation-focused perspective (intrinsic versus extrinsic value) to **formulate a four-quadrant typological framework**
3. Delve into and unveils **the presence of various MGEV player profiles**
4. **Expand the theoretical framework of online reviews** by concentrating on MG-related content, an area overlooked in existing literature

Practical implications

- assist practitioners in improving their MG designs and operations
- different MGEV dimensions have varying effects on word of mouth
- three player groups with distinct MGEV mindsets: intrinsic value-dominated, extrinsic value-dominated, and mixed (leverage these participation characteristics to attract specific player types)

Directions for future research

1. Replicate our study using MG services in other countries and with diverse player populations
2. Utilize alternative types and sources of data (such as data collected through large-scale surveys, experiments, and interviews) for replication and triangulation purposes

2024
TONG JISEM

Thanks

