Challenges for Universal Design in Vehicle Development

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Hitoshi Kanamori Vehicle Engineering Div. Kenji Misugi Toyota Design DIV.II TOYOTA MOTOR CORPORATION









Minimize negative impact of vehicles 0 (Zero-nize)

Maximize comfort and fun (Maxi-mize)







Toyota undertakes challenges for Universal Design as a part of "maxi-mize comfort/fun" activities.





1. Development of Universal Design Evaluation Indices

2. Spiral-up of Development Based on User Interaction

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Two Challenges for Universal Design



Our desire is to make various users enjoy their car life comfortably (ergonomics index) in various scenes (situational suitability).





1. Improvement of usability by considering different body sizes and physical capabilities Index I: Ergo-index

From the viewpoint of ergonomics (Functional ,physical aspect of people)

<u>2. Fulfillment of user needs toward cars (usage scenes/situations)</u>
 <u>Index II: Situational Suitability – Index (SSI)</u>
 From the viewpoint of dialog with users (Mental satisfaction aspect of people)</u>

Universal Design Evaluation Index I



1. Improvement of usability by considering different body sizes and physical capabilities

Index I: Ergo-index [Evaluation method]

- Set <u>180 evaluation items</u> that we should secure performance, through the analysis of human motion & behaviors in vehicle. These 180 items are evaluated by "<u>human characteristic base</u> <u>criteria</u>" and are given score.
- •The score of 180 items are summarized with <u>6 major axis</u> and used for target setting ,competitor analysis and so on.
- 1. Interior configuration
- 2. Ease of ingress and egress
- 3. Posture, comfort
- 4. Field of view, maneuverability
- 5. Visibility of Meter , indicators
- 6. Instrument panel, switches/buttons





<u>2. Ease of ingress and egress</u>

Front seat/rear seat

- · Legs: Ease of lifting, reaching and passing through
- · Waist: Ease of sitting down and standing up
- · Head/shoulders: Ease of ingress & egress, etc.



5. Visibility of meter, indicators, etc.

Reading meters, indicators, etc.

Easy to drop eye line onto meter, main indicators.
Ease of reading letters, indications and symbols, etc. (Considering various conditions ; direct sunlight, clear weather, twilight time, at night)



Calculation Method on Ergo-index





Calculation Method on Ergo-index





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Relationship between Seat Height and Burden on Muscles



Movement of "sitting down"



• The most appropriate height with little burden added is found.

12





Case: Ease of ingress and egress

... Evaluation of ease of shifting gravity point Relationship between hip point height and burden on muscles



Evaluation Based on Human Characteristics Study



Case: Visibility of indicators, etc.

... Evaluation of ease of reading letters/display Relationship between visual acuity and ages





Index I: Ergo-index

Quantitative evaluation of "how a wide range of users can enjoy driving easily and comfortably" from the viewpoint of ergonomics.

When the product attains the target "ease & comfort to drive" level, label the <u>Universal Design symbol</u> on the product.

In addition, indicate the achievement level by the number of the symbols.



1. Improvement of usability by considering different body sizes and physical capabilities Index I: Ergo-index From the viewpoint of ergonomics (Functional ,physical aspect of people)

2. Fulfillment of user needs toward cars (usage scenes/situations) Index II: Situational Suitability – Index (SSI) From the viewpoint of user needs in actual life scenes (Mental satisfaction aspect of people)

Universal Design Evaluation Index





Database Example of Usage Scenes/Situations



Categories	Scenes	Concrete situations for evaluating conformity level of the vehicle model		
Trip				
Shopping	Major scene categories: Trip Shopping			
Transfer	Driving to Driving,	to/from the office etc.		
Driving				

Universal Design Evaluation Index



Calculation method on Situational Suitability Index

Categories	Usage sc	ene	es correspondi	ng to user	needs	Conformity level
Shopping						:5 :4
Transfer						:5
Driving		:4				
						:5
Rankin	g criteria			102		
60 - 69			New RAUM			120
70 - 79			Suitability	85 points	Conversi	ion on a
80 & over			level		scale of 1 for the fu	19 19 19

RAUM: Evaluation Results



Index I	Interior configuration	Ease of ingress and egress	Posture, comfort	Field of view, maneuverability	Visibility of meter,indicators	Instrument panel, switches
index		YYYY				







Make the evaluation results public on the homepage.

20

Spiral-up of Development Based on User Interaction



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Flow of Customers' Voices (in the past)





Problems

- Little pre-evaluation with actual customers before the product launching.
- Little direct interaction between engineers/designers and customers



Summary



- 1. Incorporate the Universal Design performance in our vehicle development, by utilizing our original indices.
- 2. Continuously improve both our products and indices, by incorporating our customers' voices.
- 3. Make efforts to reflect our customers' voices on our activities, and create new value and new items.



