

Featured Articles I

Hitachi's Core Concept for Elevator and Escalator Products and Services, and Concept Model

—Core Concept for Hitachi Elevators and Escalators that Aims to Supply Systems that Proactively Anticipate Unconscious Human Behavior—

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OVERVIEW: What people are looking for from the elevators and escalators that serve as essential transportation infrastructure in buildings is smooth and safe mobility and comfortable utilization. To satisfy these latent needs and unspoken customer requirements, Hitachi has drawn on the knowledge of external designers to formulate its new core concept for all of its elevator and escalator products and services with the aim of supplying systems that proactively anticipate unconscious human behavior. Hitachi's elevators and escalators are designed to provide safe and comfortable mobility. Along with its future plans for these elevators and escalators, this article describes a concept model that Hitachi built to serve as an example of what it is trying to achieve by supplying products and services that proactively anticipate unconscious human behavior so that everyone can move more safely and comfortably.

INTRODUCTION

HITACHI has designed its elevators in the past based on the concepts of “neutral modern” (meaning they are able to blend in with a wide variety of building designs) and “universal design” (meaning they are designed to be accessible to everyone)⁽¹⁾. However, together with security enhancements and more complex movement patterns resulting from urban redevelopment, changes in society and attitudes toward safety and security have raised new obstacles to the free movement of people by breaking up their movement patterns. What is needed is to get away from the focus of past development practices on improving the functionality of the elevators and escalators themselves and instead provide customers with new value by supplying the market with products and services that are even more easy to use for users and that enable free movement.

Accordingly, Hitachi Building Systems Co., Ltd. has collaborated with the Global Center for Social Innovation – Tokyo of Hitachi Ltd.'s Research & Development Group, to bring in external know-how by working with Naoto Fukasawa Design Ltd., the international product design business represented by Naoto Fukasawa⁽²⁾.

CHANGES IN THE SOCIAL ENVIRONMENT AND THE DEVELOPMENT OF NEW CONCEPTS

Enhancing the Experience of Vertical Urban Transportation

Along with the horizontal mobility provided by cars and trains, urban transportation also extends vertically in facilities such as building complexes that house



Fig. 1—Concept of Vertical Transportation in Urban Environments.

Along with facilities such as building complexes that house both offices and hotels, there are also numerous examples of buildings that are closely tied to their neighborhoods and communities, such as office buildings and shopping complexes that are linked to railway stations. In those spaces, it is elevators and escalators that underpin movement in the vertical direction.

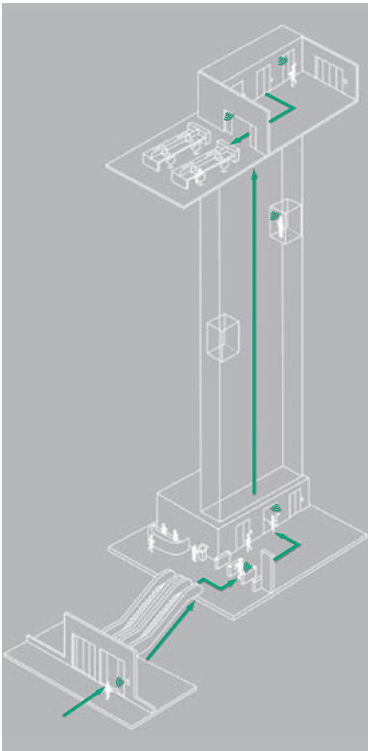


Fig. 2—Concept for Streamlining Increasingly Complex Movement Patterns.

Together with the security enhancements and more complex movement patterns resulting from urban redevelopment, changes in society and attitudes toward safety and security are raising new obstacles to the free movement of people by breaking up their movement patterns. Hitachi makes places more attractive by streamlining these movement patterns.

both offices and hotels. Recent years have also seen numerous examples of buildings that are closely tied to their neighborhoods and communities, such as office buildings and shopping complexes linked to metro stations and subways (see Fig. 1).

In the past, the focus has been placed on improving the functionality of the elevators and escalators that provide this vertical mobility, including their speed and safety. However, if richer urban environments are to be provided in the future, there is a need to go beyond the “safer and faster” objectives of the past by also proactively anticipating unconscious human behavior, given that their movement patterns are becoming more complex or are being broken up by tighter security (see Fig. 2). Having concern for people and ensuring their comfort can make moving around more pleasant. In other words, it can enhance the experience of mobility.

“Without Thought” and a New Core Concept

Elevators and escalators are classic examples of products that people use without thinking. Being

something that the general public encounters or uses without giving it any particular attention, this transportation infrastructure needs to proactively anticipate unconscious human behavior.

Drawing on its concepts of universal design and neutral modern, Hitachi has sought to develop elevators and escalators that everyone finds easy to use. For example, the design of Hitachi’s standard elevator has a mirror on the rear wall to allow wheelchair users to back out when they reach the destination floor. Similarly, the destination floor buttons on the operation panels in the elevator car or hall are labeled with raised digits. These high-contrast buttons featuring raised black text on a white background are provided to help people with impaired sight who cannot read braille. Other typical examples of Hitachi’s use of universal design include such functions as flashing the light when the elevator approaches the destination floor. Hitachi also treats elevators as architectural features, so rather than adopting bright color schemes, its practice has been to aim instead for simple neutral designs that blend in with the various other building features.

While these practices were adopted to overcome the challenges that have arisen and to help provide users with a safe and comfortable ride, Hitachi’s aim for the future is to build upon these two existing design concepts by providing unobtrusive forms of mobility that are so easy to use that people don’t even notice they are using them. Achieving this means identifying and resolving issues before they arise.

To do so, Hitachi has adopted a user conceptual model (UCM) based on Naoto Fukasawa’s design philosophy of “without thought”⁽³⁾.

The philosophy of without thought is all about having people interact with their surroundings in a natural way, without conscious thought. Coming to grips with this unconscious behavior requires an understanding of users and their relationships with particular environments. In terms of that behavior, it is necessary to extract the concepts (a UCM) of what users commonly feel and perceive. By doing so, it is possible to resolve issues before they arise by taking a fresh look at what people do or think unconsciously when riding in an elevator, and then conducting in-house testing from a variety of perspectives.

Based on this approach, Hitachi developed a core concept for all of its elevator and escalator products and services with the aim of supplying systems that proactively anticipate unconscious human behavior using a combination of design and interface technology (see Fig. 3).

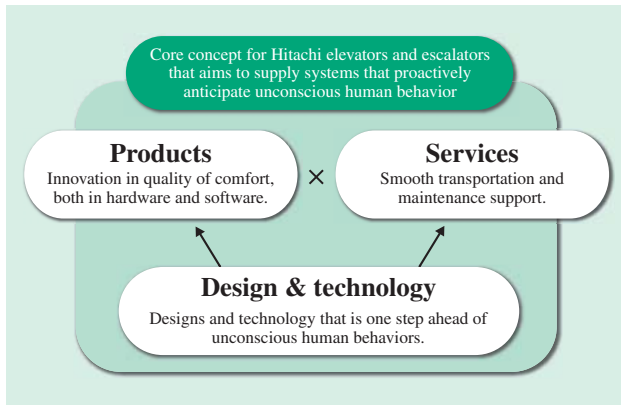


Fig. 3—Diagram of Core Concept of Supplying Systems that Proactively Anticipate Unconscious Human Behavior. Hitachi developed its core concept for all of its elevator and escalator products and services with the aim of supplying systems that proactively anticipate unconscious human behavior by using a combination of design and interface technology.

ANNOUNCEMENT OF CONCEPT MODEL AND SHARING VALUE WITH CUSTOMERS

Hitachi built an elevator concept model as an example to encourage a better understanding of what its core concept of supplying systems that proactively anticipate unconscious human behavior means in practice. Naoto Fukasawa designed the new concept model and also oversaw its development.

Selection of Key Ideas

The UCM was developed first, before starting the actual design, and was used as a basis for considering key ideas and for redeploying products that were already in commercial use. The following three ideas in particular express the core concept of supplying systems that proactively anticipate unconscious human behavior.

(1) Rounded edges are gentler on people

When moving around, people tend to shy away from sharp edges. This is something people do without thinking through a form of muscle memory. It is important that elevators that are routinely used by large numbers of people present themselves as spaces that people see as inviting and physically non-threatening.

(2) Intuitive interfaces

Elevator displays show a floor indicator and an arrow to show the elevator car's current location. These displays need to be formatted in such a way that users can intuitively see where they are in the building and which way they are going.

(3) Adjustment of lighting to match biological rhythms

The color of the lighting in an elevator car has a major influence on its appearance. Cooler white light

conveys a crisp sense of early morning, while warmer colors of light provide a calmer feeling, like in the evening, or a sense of warmth. Along with conveying a particular impression, light also has an influence on human health and intellectual productivity, being closely linked with circadian rhythms (biological rhythms synchronized to the light of the sun)^{(4), (5)}.

By changing lighting in the elevator car in the morning and in the evening, the aim is to help people keep in step with the proper biological rhythms that are innate in people.

Features of the Elevator Concept Model

Hitachi developed the concept model with the three key ideas listed above as axes to give users a sense of being enveloped in an inviting space and to provide intuitive operation⁽⁶⁾.

To enhance the user experience and provide ease of mobility, the concept model features a non-claustrophobic rounded design throughout the interior of the elevator car and down to the individual parts, combining this with a vertical liquid crystal display (LCD) that features improved visibility.

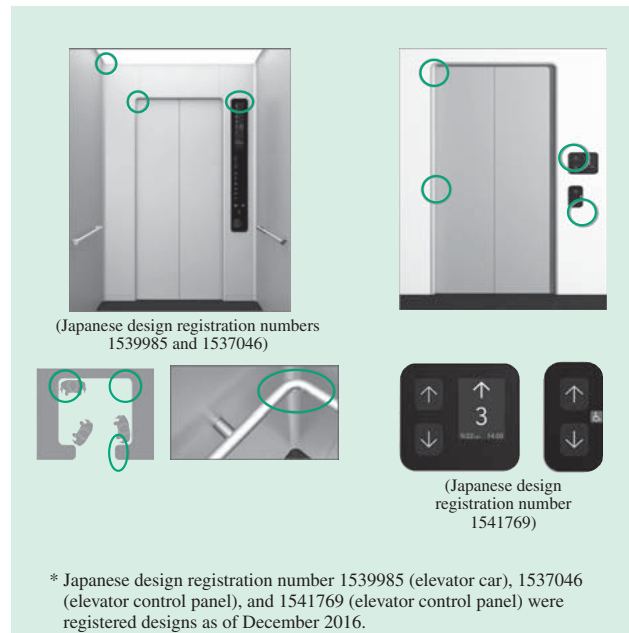


Fig. 4—Elevator Concept Model.

The top-left photo shows the design of the elevator interior, the top-right photo shows the hall, and the bottom-left photo shows the entrance. The rounded edges of the entrance design provide subliminal guidance that facilitates the smooth movement of people in and out of the elevator. The large hall elevator button shown in the bottom-right photo was designed to allow people to press it using their elbow when their hands are full.

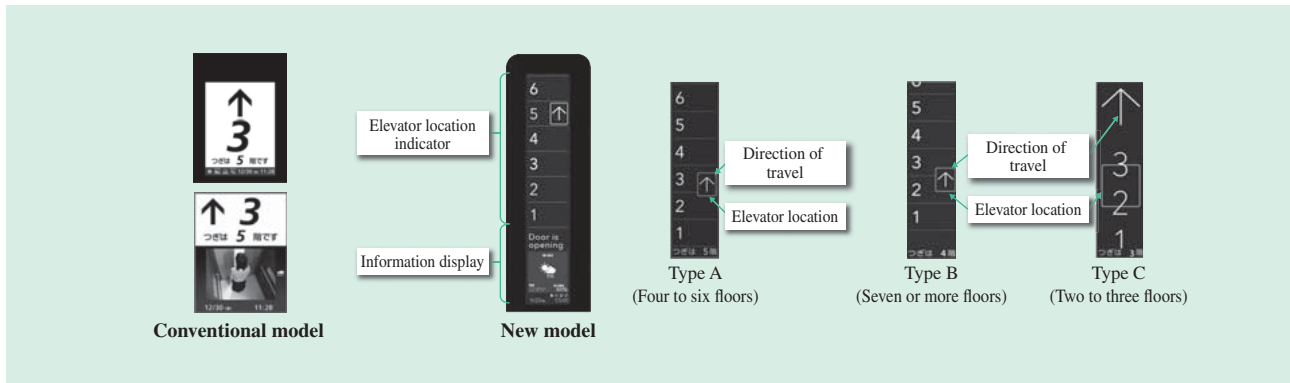


Fig. 5—Comparison of Conventional and New Elevator Car Location Indicators (Left) and Elevator Car Location Indicator Patterns (Right).

The large, portrait-oriented LCD provided in the elevator car to display its current location can also be used for the simultaneous display of things like emergency operations or camera images from inside the car. Three intuitive elevator location indicator patterns are provided, with consistency between visual and bodily sensation being maintained by providing a more detailed indication of elevator location.

Design of Elevator Car and Hall

Working from the key idea of rounded edges being gentler on people, a visually inviting design was adopted for the elevator car and entrance. The elevator car was given a rounded layout that eliminated any sharp edges, included rounded edges for the ceiling, skirting, built-in handrails, and other internal corners. Rounded edges were also used for the entrance to facilitate ease of movement (see Fig. 4).

Elevator Car LCD

A large vertical LCD was provided in the elevator car to display its current location. It can be used for the simultaneous display of things like emergency operations or camera images from inside the car. Moreover, the display's more detailed information on elevator location maintains consistency between visual and bodily sensation (see Fig. 5).

The elevator location display is available in three different formats. Type A provides an intuitive indication of the user's current location in the building and the direction of travel by moving the indicator for these up and down alongside the static building floor numbers. In the case of types B and C, which are intended for high-rise and low-rise buildings, the direction of travel and elevator location are displayed at static locations and the floor number display moves vertically.

Ceiling Lighting with Variable Color Temperature

The ceiling lighting automatically adjusts the lighting (color temperature) to suit the time of day. The lighting tone in the elevator car is adjusted to convey impressions such as crispness or warmth, for example, using a white light of 5,000 K during the day, and

changing to a color temperature of 3,000 K (similar to a light bulb) during the night (see Fig. 6).

In this way, along with the safety, security, and comfort functions incorporated into past elevators, through the development of a UCM, the concept model was designed to give users a gentle and friendly impression when they lean against the side, with non-claustrophobic curved design throughout the interior

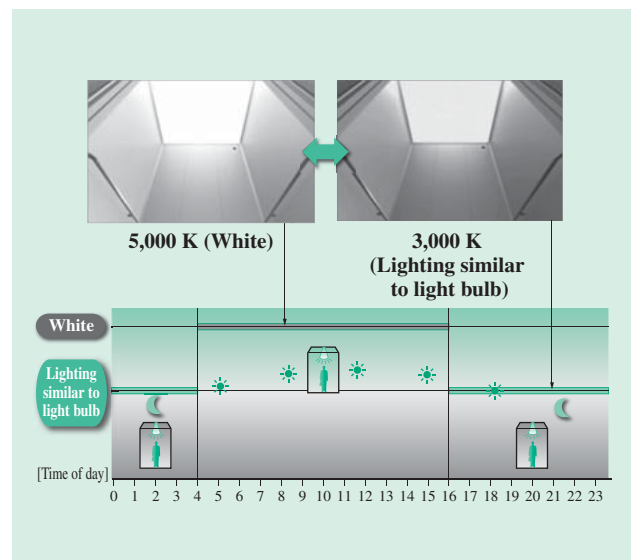


Fig. 6—Example Use of Function for Adjusting Lighting Automatically.

The ceiling lighting automatically adjusts the lighting (color temperature) to suit the time of day. The lighting tone in the elevator car is adjusted to convey impressions such as crispness or warmth, for example, using a white light of 5,000 K during the day, changing to a color temperature of 3,000 K (similar to a light bulb) during the night.

that extends down to the smallest detail. It also uses LCDs with a portrait orientation for ease of viewing to display information in a way that makes it easier for passengers to visualize the movement of the elevator to their destination floor by giving an intuitive indication of the current location. The concept model also features a design in which even the smallest details have been chosen to create a pleasant environment, including changing the tone of the lighting to suit the time of day and using appealing sign tones.

In October 2015, the elevator won a Good Design Gold Award (Minister for Economy, Trade and Industry's Award) at the Good Design Awards of the Japan Institute of Design Promotion, where the elevator was chosen from among 3,658 entries and praised for its innovative design, which conveys a sleek image of vertical mobility in future Tokyo, with well-thought-out features that extend to things like ceiling height and lighting⁽⁷⁾.

The concept model is a harbinger of Hitachi elevators and escalators that are designed to provide products and services that users find appealing. This work on using a concept model to realize the ideas behind the concept has been well received by customers who are dealing with the same issues.

CONCLUSIONS

In the future, Hitachi intends to continue to work with all of its staff together as one to supply products and services based on the core concept of supplying systems that proactively anticipate unconscious human behavior, and as a way of reiterating its stance of making further enhancements to user-oriented technologies.

Following the announcement of its concept model, in February 2016, Hitachi also launched a group control elevator in Japan with a new destination floor reservation system that facilitates smooth mobility.

Another instance of the core concept approach to supplying systems that proactively anticipate unconscious human behavior is a maintenance service that provides 24-hour/365-day monitoring of elevators and escalators. To use maintenance services as a way of providing greater reassurance, Hitachi is also introducing maintenance services that watch over elevator users, including shortening the time it takes for the remote rescue of users in the event they become trapped in an elevator, and support services that provide video and audio links between elevator cars and a monitoring center.

Hitachi also intends to extend the core concept of supplying systems that proactively anticipate unconscious human behavior to countries around the world where Hitachi elevators and escalators are used, providing safety, security, and comfort, the three major strengths of Japanese brands, in ways that are visible to users in those countries.

REFERENCES

- (1) N. Konno ed., "Social Innovation Design –Hitachi Design Challenge–," (Dec. 2007) in Japanese.
- (2) N. Fukasawa, NAOTO FUKASAWA, Phaidon Press (2007)
- (3) T. Goto et al., "The Ecological Approach to Design," Tokyo Shoseki Co., Ltd., Tokyo (2004) in Japanese.
- (4) M. Okawa, "Chapter 3 Light that Contributes to a Healthy Lifestyle, 2 Therapeutic Applications of Light –Regulating Circadian Biorhythm with Light–," Report of the Subdivision on Resources, the Council for Science and Technology, Ministry of Education, Culture, Sports, Science and Technology, Japan (Sep. 2007), http://www.mext.go.jp/b_menu/shingi/gijyutu/gijyutu3/toushin/attach/1333542.htm in Japanese.
- (5) K. Honma, "Human Circadian Rhythms and Light Environment," *Ergonomics* 37 Supplement, https://www.jstage.jst.go.jp/article/jje1965/37/Supplement/37_Supplement_44/_pdf in Japanese.
- (6) K. Sakurai et al., "Hitachi's Core Concept for Elevators and Escalators that Proactively Anticipate Unconscious Human Behavior," *Elevator Journal* 9, Japan Elevator Association (Apr. 2016), http://www.n-elekyo.or.jp/about/elevatorjournal/pdf/Journal9_07.pdf in Japanese.
- (7) Good Design Gold Award 2015 (Minister for Economy, Trade and Industry's Award), <https://www.g-mark.org/award/describe/42630?locale=en>

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