

# DESIGN FOR INTERNATIONAL DIALOGUE

## ELECTRIC ASSISTED KICK-SCOOTER DESIGN

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### 1. RATIONAL AND OVERVIEW

In early 2015, five international universities registered their interest in participating in a competition that would focus on solutions exploring electric assisted kick-scooters with a focus on an adult customer. The desire to speed up walking with a simple device that can be instantly and safely operated by just about anybody and without any training led to the challenge of upgrading the basic kick-scooter with power assist - somewhat similar to the electric e-bike and its enormous popularity. If small enough and minimal in every respect, such a scooter could go where bicycles are impractical or prohibited, becoming especially useful for the so-called 'first and last mile' of urban or rural commutes. By folding down (as simply as an umbrella), it could be carried along instead of needing to be parked and once compacted, would take practically no space in the trunk of a car. Being a 'scooter' this device would be propelled by kicking, thus providing physical exercise. Yet combined with the convenience of electric assist (e.g. in uphill terrain), its use would be simplified and greatly broadened.

Overcoming the stigma of such product -that it is a child's toy- was one of the biggest challenges of the project since adults don't want to appear childish, even though backpacks carried over business attire or sneakers worn with suits and dresses prove that cultural norms can be successfully challenged. Many others have thought about how such a product might gain popularity, and many comparable designs have lately emerged on the market. The idea of creating an ideal answer to this challenge has been explored for nearly a decade at universities around the globe (Kostrzewska, Macikowski, 2017), (Markovic, et al, 2010). These explorations led to test-runs -first in the context of short workshops at a university in Taiwan and subsequently at a university in the U.S.- concluding that the concept of an electrified kick-scooter is still an original idea worthy of further exploration.

In an effort to explore different approaches to the same problem the founder of this project reached out to his large global network of universities and designers. A total of five international industrial design programs participated exploring the west and east European market, Asia, and the Midwest USA. Each participating design school had at least one instructor in charge of the project. Some of the schools recruited specifically for this project and running special topics courses, whereas others implemented it in existing curricula. The unifying factor was that all schools were given the same design brief with the goal to start and finish the project during the first half of 2016.

Participating universities were from:

Berlin and Darmstadt/Germany, Budapest/Hungary, Taipei/Taiwan, Ames, IA/USA

### 2. PROCESS

Competition coordinators distributed a set of objectives and guidelines for the development of product concepts (rather than finished designs, ready for mass-manufacturing) so that ideas that contribute to the ongoing discussion of the issue of personal mobility could be compared. Due to the different starting points of each semester at the various universities the project began around winter or late spring of 2016. This paper is structured to provide an overview of the student work from the five participating design programs. Each school is introduced by the instructor in charge of the project, explaining the specific interpretation of the assignment and justifying any deviation -if applicable- from the strict set of original

objectives and requirements as below. Straying from those was allowed to maintain the students' belief in the project's relevance, in spite of the various scooters already known and available. Another reason was the need to relate the project as closely as possible to the course's educational objectives and emphases, not to mention any specifics stemming from the widely varying international cultural and market conditions.

## **2.1. DESIGN CRITERIA**

All five design program participants were constrained by the following requirements (not ranked in order of importance):

- Must relate to emerging lifestyles of the target users (m and f, ages 15-50+)
- Must be 'cool' with the potential to attain cult status (like iProducts, sneakers, etc.)
- Should look somewhat original (but still reminiscent of an in-line basic kick-scooter)
- Should promote kicking as primary propelling force (max. electric range <10 miles)
- Must be legally operable on paved sidewalks (electric assisted speed up to 10 mph)
- Must be energy efficient and versatile (quick recharge, energy recovery?)
- Must be extremely lightweight, plus foldable and conveniently portable (<25 lb.)
- Should signify special emphases (advanced materials, semantics, ecology, etc.)
- Should be totally intuitive (in terms of operation, maintenance, etc.)
- Must consider human factors (to accommodate 5–95 percentile users, up to 220 lb.)
- Should be customizable (with lights, kickstand, hooks, baskets, etc.)
- Must be safe and secure (if used as intended and licensed)
- Must be affordable (from \$500.- MSRP and up, depending on features)

## **3. CONTRIBUTIONS OF FIVE INTERNATIONAL UNIVERSITIES**

Each university followed its own approach and emphasis on research and development. The class sizes varied from 2 students to more than twenty, as did the time that was spent on each phase. Access to existing kick-scooters was limited for some due to their respective locations. The overall goal of this project was to establish a network of international collaboration, compare the different outcomes, and to pilot a project of such global extent. The approaches to research and synthesis varied, as did the final deliverables. The five industrial design programs developed a total of 25 different design concepts; ranging from full-scale models to detailed computer renderings. Nine concepts were developed by individual students and resulted in 3D computer renderings. 14 were developed by teams and included a full-scale model in addition to 3D detailed renderings. The following is an overview of the process of each university accompanied by select research outcomes and final concepts.

### **3.1 HOCHSCHULE FÜR TECHNIK UND WIRTSCHAFT BERLIN (GERMANY)**

The project started in early April, with the first interim presentation mid May, second interim presentation early June, final presentation third week of July and concluding with an internal exhibition end of July.

Each student was tasked to prepare a presentation for one of the following research topics:

Market Overview Kick Scooter, Electric Motors and Drive Concepts, Batteries and Energy Management, Modern Production Technologies and, Generative Manufacturing Processes, Safety Aspects, Laws and, Regulations, Weight Management, Ergonomics and Settings, Public Transport and Multimodal Mobility, Suspension Technologies, Lightweight Construction and Innovative Materials, Wheels and Tires, Brake Technology. The above information was researched at the beginning of the project. Among others, students visited specialized e-scooter shops and intensively tested, reviewed and rated many different micro e-mobility products. In addition, potential users and buyers of these products were interviewed.

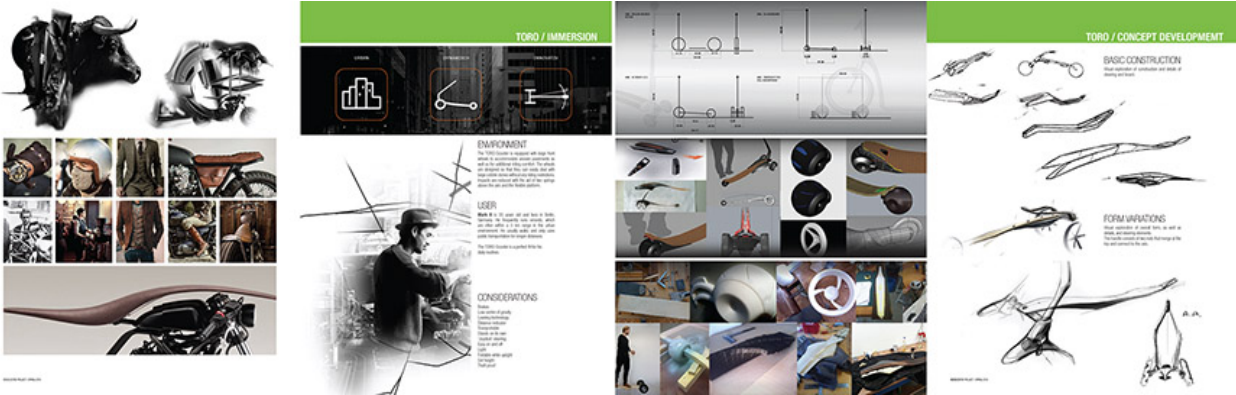


Figure 1: Research, Inspiration, Concept Development: TORO

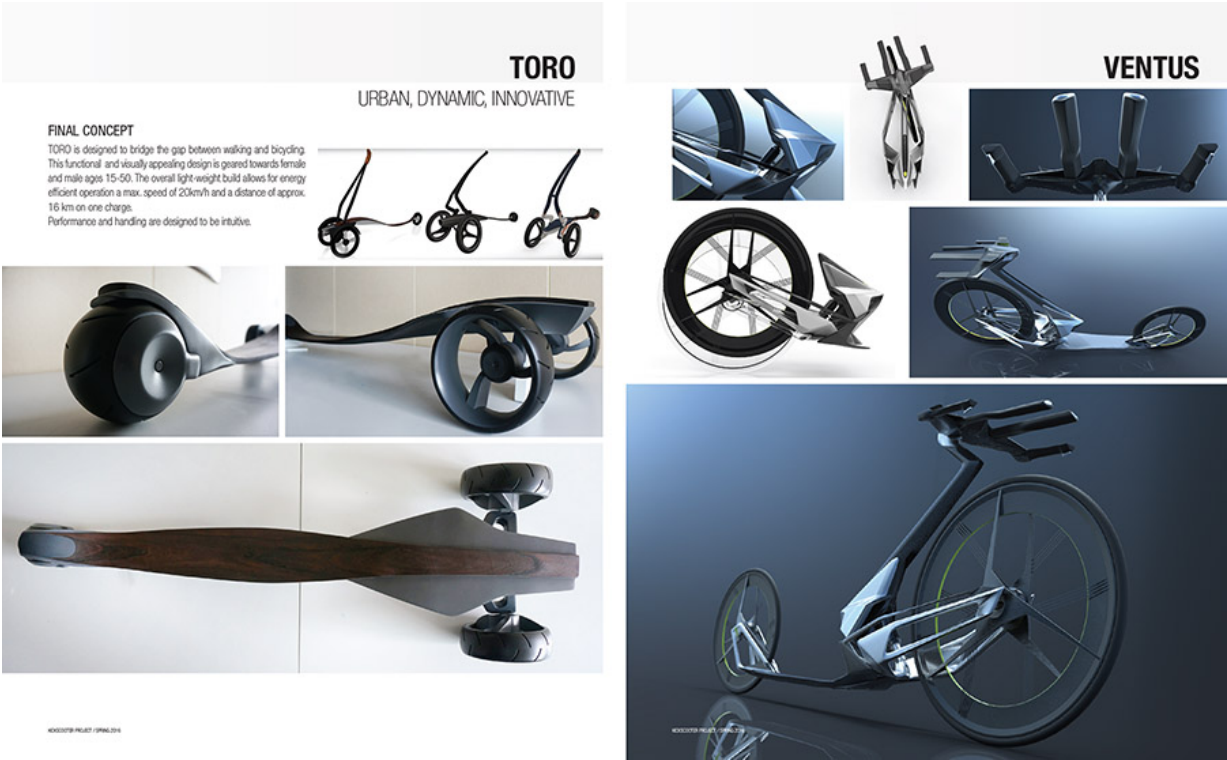


Figure 2: Form development, final full-scale model and rendering 'TORO'

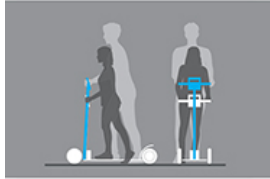
**3.2 UNIVERSITY OF APPLIED SCIENCES (DARMSTADT, GERMANY)**

The scooter project was integrated in the course „technical design“, which is part of the curriculum of the diploma degree Industrial- Design. 25 students were divided into 4/5 teams led by two faculty. In the first phase of the project, the focus was on the collecting and visualization of context information. The resulting framework served as a guideline with the requirement of a mobile function model. The first concept studies were tested on a 1:1 scale using technical drawings and simple cardboard/wood models. In the second phase, the individual team members were able to formulate their own ideas, which were subsequently evaluated in the team and integrated into the overall concept. In the second half of the project the students focused on the technical feasibility and possible solutions. Details were further elaborated, presented in weekly meetings and further deepened in a joint discourse. In the last phase of the project, the mobile models were created and the final designs and key pictures were visualized.



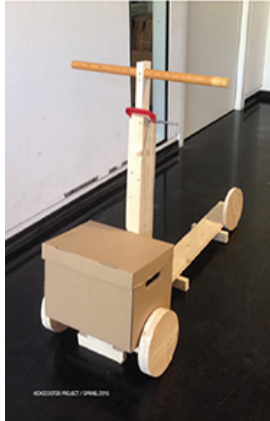
Figure 3: Full-scale test and feasibility mock ups


**TEAM 04**  
THE SHOPPER



**INSPIRATION AND CONCEPT**

"The Shopper" is an all-round scooter for different people, but especially for those living in urban areas who commute daily between home and work. They often stop at supermarkets or weekly markets to purchase groceries for their households. Others run errands to ship packages or to buy something in the city. For all these situations our team created a comfortable, eco-friendly and compact-sized vehicle for easy transportation of cargo, such as groceries or other items of varying sizes.








Figure 4: Full-scale functional model and 3D rendering: 'The Shopper'

### 3.3 MOHOLY-NAGY UNIVERSITY OF ART AND DESIGN (BUDAPEST, HUNGARY)

Students started working on this project during their third semester of study in September 2016 and they finished it close to December of that year. This was a short design project in accordance with the

university's educational concept with duration of three months. The design process was divided into three stages: Research, design, final design. After the first meeting, the research has begun in two groups. This process ended with two summaries and it addressed opportunities, current trends, safety, storage, and functional needs that students can encounter in their daily life.

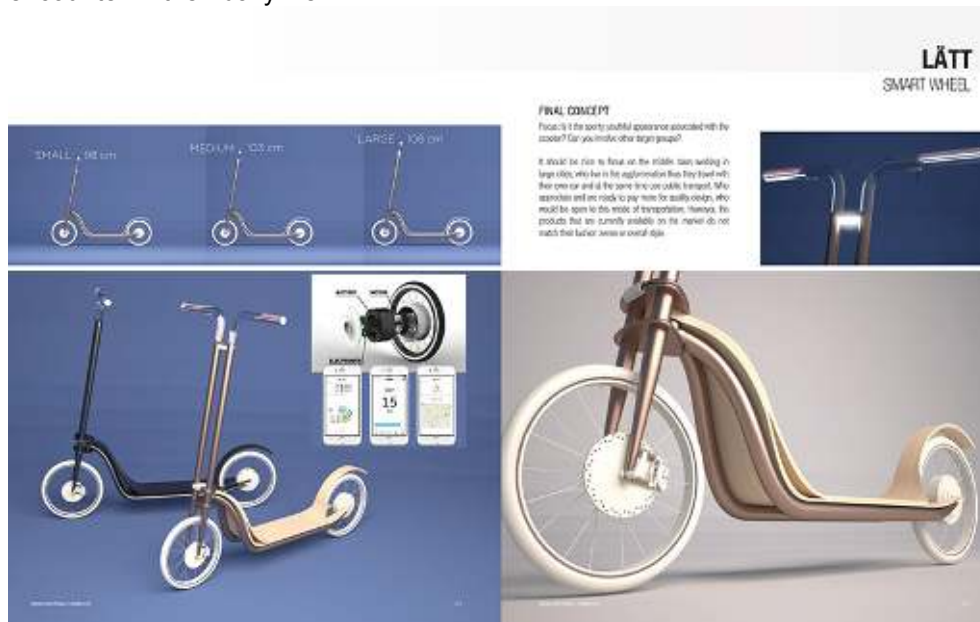


Figure 5: Final concept: 'Lätt'



Figure 6: Final concept: scooter as 'Cult Object'

During the design phase, the students took into account the possibilities that are difficult to realize, but which can be exciting due to their formatting or novel approach. In the finalization stage, the ideas developed by the students took into account the realities and the technical possibilities.

With the creation of ergonomic models, the students tested and justified their ideas. External experts helped to define the technical possibilities providing objective feedback. More attention was paid on

developing innovations that can be forward-looking to the future. The design process concluded with 3D models, renderings and mockups.

**3.4 SHIH-CHIEN UNIVERSITY (TAIPEI, TAIWAN)**

The design objective of the project was to use existing technology to redefine what an electric kick-scooter should be. As the design should be compact and mobile, facilitating short distance commutes. During the research phase, the designers focusws on the urban environment, where population has been growing exponentially and projected to expand even wider to the outskirts of the urban area.

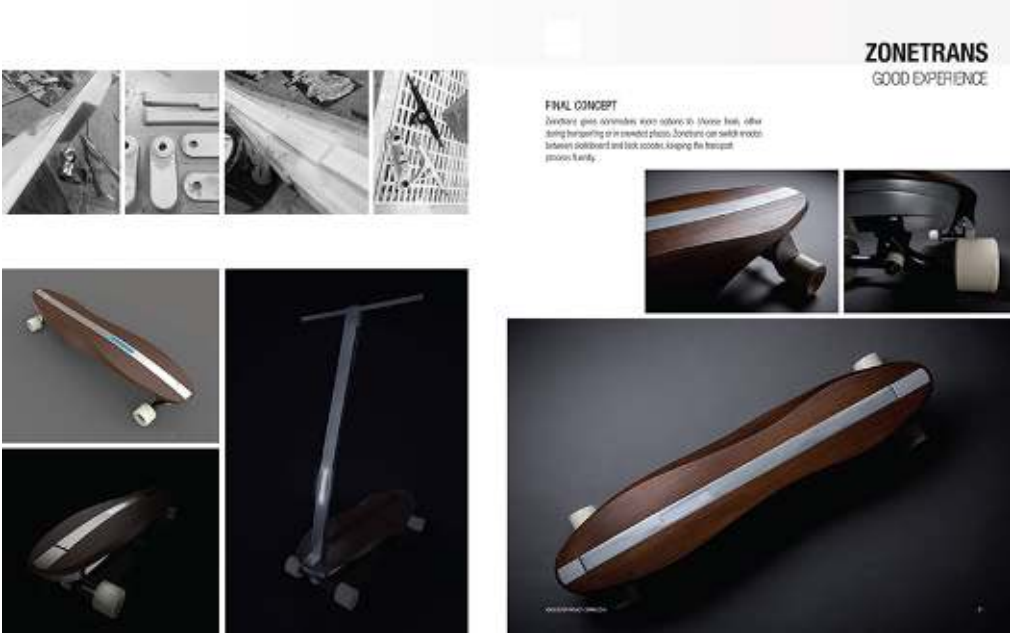


Figure 7: Final concept: 'Zonetrans'

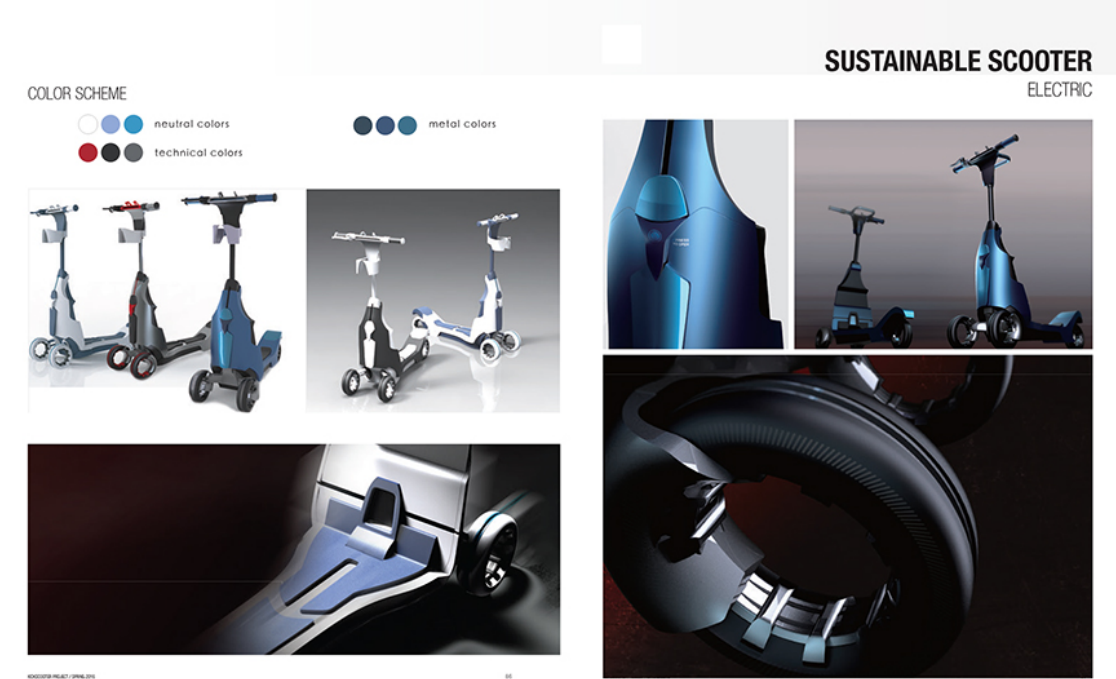


Figure 8: Final concept: 'Sustainable Scooter'

Since a majority of people lives in the urban city area, public transportation would exceed its capacity. As for people moving further away from the city where public transportation is not as accessible, a personal mobile transportation is an ideal way to help people to get to the stations. This design opportunity is centered on people who need a mobility vehicle for short distance commutes to easily take on public transportation or inside buildings. The first design targets the younger active generation and combines skateboard with kick-scooter. When it's in skateboard mode, it steers by shifting balance just like traditional skateboard. To switch to kick-scooter mode, just simply unfold the handle bar that's integrated in the main body. The dual mode gives the rider the options to switch from electric skateboard to casual scooter riding. The second design offers daily storage convenience that's not available in the current designs. Daily commuters often have to carry personal belongings or groceries. The front panel above the front wheels can be unfold like a front rack to carry bags. A cup holder is also incorporated into the design. It can also connect with personal mobile device so the rider can navigate through the city with ease.

### 3.5 IOWA STATE UNIVERSITY (AMES, IOWA, USA)

The Double Diamond Design Process as defined by the U.K. Design Council (Hunter, 2015), further described by Don Norman (Norman, 2013) provided guidelines for developing the structure of this project. As a result, three over arching phases were defined as follows:

- Finding the right problem: Primary and secondary research, Analysis and synthesis
- Finding the right solution: Ideation, concept exploration (2D/3D), testing through full-scale mock-ups.
- Detailing: Form development, material and manufacturing.

During phase 1, four student teams focused on a distinct area of immersive research during the first five weeks of the semester. The trends team researched technology, human propelled vehicles, automotive, transportation, living, wellness, fashion, etc. This included but was not limited to expert interviews, observations, secondary research, remote research and diverse media research. The culture-team explored ways to bridge the gap between bicycling and walking with the goal of building a broad acceptance of such a product.



Figure 9: Research Team: Culture, User and Environment

Market & materials determined emerging and viable materials for construction and gathered material samples. Investigated the current market and defined key components and capabilities. The user & environments team conducted in depth user research with a focus on different regions and current methods of personal and public transportation. The group established correlations between diverse user dynamics, vast environmental terrains and identified potential user obligations and behaviors. The teams were encouraged to create a “war wall” to visualize their research in an attempt to identify patterns and

connections and to include the entire group into their discoveries and findings. During the interpretation, analysis and synthesis of the data, students developed a set of guiding design criteria stemming from each research theme. This set of criteria and the original criteria from the design brief were packaged and made available as a set. The following design semantic themes emerged: Economy, High-End, Sport and Utility. Based on these themes, the students regrouped into new teams, each applying the same design guidelines for the next phase of finding the Right Solution.



Figure 10: High-End Kick-scooter, persona, full scale mock-ups, final full-scale model, and 3D renderings

#### 4. CONCLUSION AND OUTLOOK

It was to be expected that the results of the project would vary widely - and vary they did, from emphasis on research and process to full-scale modeling and testing - thus proving it wise to have called the endeavor 'challenge' rather than 'competition' with winners and losers. By valuing the variety of results, nearly every submission offered insights for further development of what originally was -and still could be- conceived as a second phase: the fabrication of fully functional prototypes, and even a third phase that includes the testing, evaluation and assessment of final design(s). Whether such optimism is realistic remains to be seen but is certainly encouraged. With an array of scooters already on the market, but none with overwhelming commercial success, it seems like the demand for such a product is limited. The reason that this is the case could, however, be that the optimal solution is yet to be discovered. Thus, the challenge still remains, and invites to be further pursuit.

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