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OVERCOMING THE COMPLEXITY OF TEACHING FORM AND DETAIL AESTHETICS IN PRODUCT DESIGN EDUCATION

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ABSTRACT
Student ability to design and capture complex product shapes is frequently limited by technical ability and understanding of aesthetic forms and details. Ability is also regularly influenced and often compromised by the complexity of capturing or designing product concepts in 3D CAD software packages.
This paper discusses recently trialled methodologies to reduce instances of design compromise within the conceptual design process and thus endeavour to improve skills in form giving and understanding design aesthetics. Two didactic methods were trialled to teach product styling aesthetics: evaluation and identification of broader semiotic elements and iterative sketching techniques.
It was found that students following historical semiotic threads had tangible aesthetic points of reference that were easily communicated between tutor and students. Positive aspects of this were an increase in sketch iteration and an increase of aesthetically pleasing products across the student cohort.
This paper considers the teaching of styling aesthetics by appropriating semiotic elements of complex historical forms as well as how students design form, communicate complex shapes, gain ownership over appropriated semantic elements and avoid concept compromise when moving into the 3D software environment.

Keywords: Semantics, Drawing, Sketching, Car styling, Shape Grammar

1 INTRODUCTION
Understanding styling aesthetics, sketching forms and communicating concepts in 3D CAD systems can prove challenging for student designers. This paper introduces the challenges then gives context to problems and solutions based on changes made in the Unit Industrial Graphics 5 at the University of Western Sydney over a three-year period. Improvements in preceding Units meant greater 3D CAD surface modelling and form design challenges were required to extend students ability to demonstrate skill. After reviewing the new requirements and potential product areas, an automotive styling and surface modelling project was selected. The complexities of designing such a product brought up challenges that were addressed in the second year the automotive project was run. Discussed are the issues and trialled methods to improve student outcomes.

2 SKETCHING
Declining hand-sketching ability among new students is a universal theme in product design schools and has been widely discussed in journals for many years now. Jonson

discusses in the context of digital image manipulation ‘free hand drawing is no longer a core activity in design education and practice’.[1] Sketching is however, even if marginalised by new technologies, a skill that goes far beyond the concept development process. From a pedagogical point of view, building student’s tacit understanding of form and it’s manipulation through hand sketch ideation builds skills that far outreach just visual communication of concept. Working on design problems using the hand sketching process has a further supporting effect: immediate feedback.[2] As well as building students’ 3D spatial understanding, it allows studio instructors to quickly intervene where needed helping student learning and reducing instances of compiling design issues. These issues may not be discovered as quickly if a CAD ideation process is used.

3 CONCEPT COMPROMISE IN THE 3D CAD ENVIRONMENT

It has been noted by the Author and supported by the work of Coyne that in design ‘The computer seems to promote different ways of working’ and further to this, ‘inexperience seems to limit design possibilities.’ [3] Styling may be compromised or influenced by CAD software in terms of certain forms being easier to attain, and therefore selected to increase the ease of modelling. Surface modelling software such as Rhino 4 can produce surfaced forms of most types; the ease and speed however of producing different forms can vary dramatically. Time poor students frequently opt for the easier to 3D model option in the absence of strong initial 2D documentation of their concept. Concept development using 3D software may not produce lesser results in a professional design studio, however within the context of undergraduate design teaching programs, 2nd and 3rd year students may produce concepts with similarity of forms dictated by 3D software surfacing tools.

4 HISTORICAL BRAND SEMANTICS

Product design as a term covers many forms of designing including the fuzzy area of styling. ‘In the context of aesthetic design, the difficulties to formalise knowledge are mainly related to the knowledge characterising the styling process itself’’ [4] Styling, being easy to define as a process, however difficult to quantify, produces pedagogic challenges in the design studio. Easily definable, tangible feedback for students about their learning is essential, not only for studio tutor critique, but for self-reflective evaluation. Therefore, a product language in the form of shape grammar or semantics was required to facilitate discussions.

Shape grammars produce precise generating rules, which in turn, can be used to produce a language of shapes. [5] Shape grammars although useful for formalising aesthetic styles rely on computational rules rather than inherent understanding of form. Semantics on the other hand rely on less rigidly formalised languages that more loosely define character such as aggressive, sleek or slow in form and features. Understanding form in the context of semantic language is something that humans do very well from the moment of birth: semantic learning and assessment is essential to human survival in society. It is this inherent ability to assess the semantic language of form that is so intrinsically linked with styling and aesthetics responses, and therefore an important component of formalising the aesthetics of styling.

5 WHY AUTOMOTIVE TRANSPORT

University of Western Sydney does not have a history of transportation styling, and as the Australian automotive industry is small, the question might be, why run a transportation styling exercise? Transportation styling or more specifically automotive styling according to Tovey, Porter and Norman ‘is a specialized activity because of the particularities of the product form, and because of the high level of demarcation in the design and development process in the industry.’ [6] Due to this, particular focus can be placed on styling rather than whole product development as with standard industrial design projects. Complexities of styling then capturing the subtlety of automotive forms provided an environment for students to focus on complex 3D CAD surface capture, without the usual design constraints afforded by products designed in Design Studio Units. More focus could be placed on semantics and aesthetics of the styled automotive form, therefore the topic selection was aimed at producing sketch concepts more likely to demonstrate student’s 3D surface modelling ability in the 3D CAD environment.

6 THE UNIT DISCUSSED

Discussed, are changes to pedagogical methods used in the Unit Industrial Graphics 5. The unit was developed as a capstone Unit for the Industrial Graphics sub major allowing students to demonstrate their Industrial Graphics skills in the area of sketching, styling, and 3D CAD surface modelling. The Unit has matured from designing and documenting basic product concepts in 3D CAD solid modelling, to now documenting intensely styled complex forms in 3D CAD surface modelling.

Prior to 2006, the Unit focused on designing children’s tricycles. Full part design and documentation was required. All components of the design intent were captured down to the screws that bolted the seat onto the frame. Concept outcomes were presented in an A3 document set using Rhino for capturing 3D surfaces, it was then rendered in Flamingo and brought together in Adobe Photoshop or Illustrator for the final presentation graphics. On reflection, the difference between ability demonstrated by students came down to the amount of time spent on documenting and presenting the components. The project did not test the students’ 3D surface modelling ability, but rather their commitment of hours dedicated to the Unit.

In 2006, the automotive styling project was trialled. Some minor assessment requirements were also modified including the requirement to produce a brochure of the final concept that included detail renderings and designed layout rather than just concept documentation.

Initially outcomes seemed in line with previous cohorts, with some students at the top end producing results beyond our expectations. We had an even spread of grades from top to bottom without areas of grade clustering, indicating the project achieved the new outcome of extending 3D CAD surfacing skills. On further review of the final assignment, some students had produced a large quantity of detailed work in a very glossy professional output, similar to when students documented all the components in the tricycle design project the previous year. A large proportion of students had styled the automobiles in a naïve way but included significant detail, therefore maintaining a higher grade. Student modelling skills were moderately extended compared to previous years. However, final concepts in the middle to lower grade range had a tendency to be modelled with simple or easily defined geometry. This corresponds with Coynes’ view on computers influencing concept.[3] An example of software-influenced work with simple surface geometry can be seen in figure 1.

Figure 1, 2006 Software influenced work with simple geometry

7 UNDERSTANDING AUTOMOTIVE DESIGN

In 2006 when the project was first run the automotive styling assignment was managed like any other industrial design project. Assignment requirements focus on; environmental factors, ergonomics and technological aspects. Student work was discussed in terms or proportion, scale, shape and use. Consequently, it was found, that focusing on these terms and requirements, students tended to design rather than style. As stated by Tovey, car stylists are specialised industrial designers.[7] It was found that students struggled to produce more than basic automotive concepts. Wright and Curtis discuss how ‘Unlike specialists in other fields, designers and design critics are obliged to work without an objective yardstick for evaluating aesthetic content.’ [8] Student output demonstrated that without automotive specialist knowledge or techniques, students struggled to come to terms with this styling activity and further changes to the Unit were required.

8 HISTORICAL BRAND SEMANTIC APPLIED

As part of the project, automotive research material was collected by students and covered; new technologies, styles of cars, how people use transport, and company product lines. This in 2006 proved to be inadequate without specialised automotive styling knowledge to produce meaningful concepts. A process of evaluation was required to produce a tangible language of how brand is communicated in automotive styling.

In 2007, students were required to design for an existing automotive manufacturer with strong historical styling history. McCormack, Cagan and Vogel discuss the importance of presenting clear automotive brand identity.[9] Focus for this Unit was placed on European brands rather than American or Japanese. In general European brands tend to follow a style across their range from year to year whereas Japanese and American brands have greater difference between ranges and therefore more difficult to evaluate unless focusing on a particular model. McCormack, Cagan and Vogel present the process of capturing the Buick language using shape grammars.[9] Shape grammars may become cumbersome tools in the context of student styling new forms. Identifying the grammar and understanding it in terms of semantics elements helps build a tacit understanding of form evaluation and styling rather than relying on a rule system.

In previous Units, students had been trained in identifying and discussing product semantics and applying semantic language to everyday objects. In the context of cars, the complexities of the language were broken down into simpler elements. Students started with following a single semantic element through generational change. This gave students an understanding of where that element has come from and where it may possibly be going in the future. This element could be manipulated within boundaries,

boundaries of which students could easily identify and test through sketch iteration. The language defined and stabilised brand, allowing students to experiment with form and follow styling trends without loosing brand character traits. This is demonstrated in figure 2.

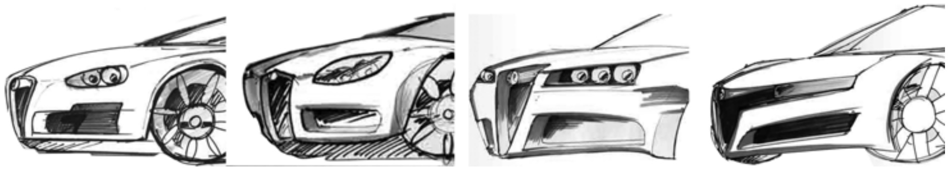

Figure 2 2007 Example of design exploration within a brand identity

Assessing an automotive brand through time from a semantic viewpoint had several positive outcomes;

- Styling for a particular brand gave the studio lecturer points of reference when discussing sketch concepts with students. These points of reference became apparent to students in the context of the historical semantics brand language.
- A further positive outcome was an increase in concept sketch iteration. Students were better able to self evaluate concepts and therefore more likely to re-sketch concepts without studio tutor intervention, increasing quantity and quality of concept sketching output.

9 REDUCING CONCEPT COMPROMISE IN THE 3D CAD ENVIRONMENT

Before entering the 3D CAD environment, concept design should be mostly resolved. Allowing students to restyle in the CAD software gives students the opportunity to select easier to model geometry. And therefore, a strong reference rendering with correlating orthographic views is essential before entering design data into software. Deviation from 2D renderings was reduced in the second year the project was run. This was due to;

- Students having better resolved concepts
- Stronger 2D reference renderings were required as part of assessment
- Better understanding of automotive styling and brand semantics and a desire to follow this through in the final CAD documentation
- Students could better self evaluate own work and therefore less likely to compromise design intent.

Figure 3 2007 Example of uncompromised geometry

10 SKETCHING IMPROVEMENTS

Engaging design students in an iterative sketching process can be difficult. Overcoming limited sketching ability or the desire to sketch is one issue; the lack of ability to self-critique due to intangible criteria of styling aesthetics is another. Students, if required to hand sketch, frequently disengage after capturing the initial intent, feeling the design is 'Done' they opt to resolve any further styling issues in 3D CAD systems. After linking understanding of brand semantics with the styling process students were better able to self critique and could better understand they weren't 'Done' and as a result engaged more with the sketch iteration process producing better styled, and aesthetic products.

11 CONCLUSION

Using an automotive styling project to challenge 3D CAD surface-modelling ability has comprehensively covered a range of 3D CAD surfacing tools and has challenged and extended student ability. Student work demonstrating design concept uncompromised by 3D CAD surface geometry can be seen in figure 3.

By understanding the aesthetics of a brand, and what constitutes the semantics elements within the brand, it is possible to follow through generational change, design character. It is also possible to predict to a certain extent the future of shape grammars within new trends. This increases student awareness and understanding of aesthetics and increases ability to self evaluate further motivates students to develop concepts and sketch iteratively.

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