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Five Dimensions in the Communication of Design Intent.

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ABSTRACT.

Industries which utilize Computer Aided Design, (CAD), are in a similar situation to the film industry, where the use of Computer Graphics, (CG), has reached such a level of reality that audiences often do not spot where CG has been used. This has resulted in a general attitude among critics of:

“CG is what you expect in a film, but what we often lack is a decent plot”.

Over a similar period, CAD software has become a powerful tool with proficient users, whilst the marketplace for such services now takes such facilities for granted. The ‘wow factor’ has faded. The special effects used in films has contributed to this dulling of presentation impact, which leads us to question where we stand in relation to a competitive edge, with the realization that:

“CAD is what you expect from a firm, but what we often lack is clear intent.”

The questioning of competitive edge draws us into some complex issues, concerning the reduction of compromise for design intent, where priorities fight for first place. There is no disputing the importance of time to market, yet the time compression technologies may no longer be providing a sufficient cutting edge. Even if new technologies facilitate even shorter lead-times we will always face the threat of a time management trap and potential loss of design quality. As a high-risk strategy for competitive advantage, contractual agreements for specified short lead-time deliveries, in some cases with penalty clauses written in, have established an expectation among the client base. Such a strategy leads us to effectively burn our bridges, in sacrificing margins for schedule

slippage and error compensation, leaving us nowhere to go but back. With such a lean approach to product development we have to improve our focus on the plot and its intent for design quality. The more investment we make at the front end, to enable the decision making process, the more likely we are to avoid pain at the back-end.

Presently, decisions are made on a resource of available quality and quantity of data, using a perspective which is based on the experience, tacit knowledge and intuition of those involved. Whilst intuition is a good starting point or fall-back, as with tacit knowledge, it often proves difficult to substantiate. Background experience is the most valuable asset here but proves ineffectual when faced with low quality data, either through ambiguity, error or lack of substance. The improvement of quality standards require that we look closely at the production and presentation of data in the context of decision making and establish a process by which quality decisions can be made quickly and efficiently.

This paper focuses on the process of communication between designers and their colleagues and clients, concerning the presentation of CAD models, from a cognitive perspective. It first establishes a context for individual differences in the management of auditory and visual information for decision making. This is followed by a discussion of five approaches to the communication of design intent and concludes with a checklist, to aid selection of an effective approach to communication.

THE CONTEXT FOR APPROPRIATE COMMUNICATION.

Time-Compression technologies and the whole approach to concurrent engineering have brought about an acceleration of change, where competition in the marketplace has become the accelerant. As James Gleick commented in his book *'Faster'*....

‘....the wish of every business to speed past its competitors without suffering speed’s harrying consequences. In reality, of course, we speed up, and they speed up, and competition continues, faster.’

Gleick (1999)

If we take this to be suggesting that the desired competitive edge is unlikely to keep coming from time compression technologies for much longer, then a competitive approach to design management has to encourage....

‘Clearer Communication for Design Quality’.

This form of competition is not about generating more information, but concerns the management of information for effective decision making. I see this as the next logical step in our Industrial Evolution.

‘Communication is key to the design process in that it acts as a facilitator for the creative act. It is assumed that effective decision making is intrinsic to an effective design process. However, if a design ‘thought’ is inappropriately communicated, then design decisions may be made to the detriment of the future development of that design. The management of the media is therefore critical – as the inappropriate use of media can cause problems whether communicating internally within the design team or externally to clients.’

Warburton (1996)

In order to improve our chances of quality design decision making, regardless of a desire for speed, we must surely gain a better understanding of what influences our information

management and reasoning powers. This approach is referred to as ‘Metacognition’, understanding understanding. (Nickerson, 1994.)

METACOGNITION.

Bearing in mind that ‘communication’ is our input to and output from the ‘decision-making process’ and that the old adage of ‘garbage in-garbage out’ still holds true, we cannot afford to let this part of the process fall to force-of-habit responses. A substantial amount of decision making can be based on tacit knowledge and a ‘Feeling of Knowing’ (Nickerson, 1994), which influences the level of confidence in dealing with unknown factors. However, we can improve upon the level of implicit and explicit information, (Dorfman *et al*, 1996), which we work with, by a reasonably straight forward approach to preparation for communication. (See Appendix: Presentation Preparation.)

Designers and their clients take cues from all levels of communication. Tomes *et al* (1998) described the development of the designer-client relationship and how a verbal and visual dictionary is developed and added to, providing for mutual understanding of design intent.

Ullman (2000) discussed the cues involved in object recognition and highlighted the following sources of difficulty for consideration in communication:

1. Viewing Position.
2. Photometric Effects.
3. Object Setting.
4. Changing Shape.

Effective communication of design intent would suggest the need to abandon any preferred single approach, in favor of developing a second nature process of assessing individual presentation requirements.

‘It seems to me that there is no single best scheme that is appropriate for all cases.’

Ullman (2000)

So, in terms of audio/visual media communication, each presentation should carry their cues as an agenda of bullet-points to the discussion. The intent of each point is to provide an appropriate platform for shared understanding of the principles involved in the concept and its development methodology in order to determine whether the design intent is still in keeping with the brief.

The work of Gregorc (1982) suggests that we need to take into account the *individuality* of cognition, to allow for, and cater for, visual, auditory and kinesthetic learning styles. This could be achieved, in part, by a flexible approach to the use of media, and the matching to task, of the appropriate 1D-5D communication categories.

CLIENT BRIEF.

The analysis of a brief should start with the deconstruction, but end up with the reconstruction of the content. By breaking down a brief it allows us to go some way towards determining what the client believes they want, but more importantly to identify what the client actually needs. Briefs can often be ambiguous when the client attempts to describe what they may *feel* the issues are.

There are often three types of content within a brief:

Key Elements, which frame important points positively or negatively.

Situational Elements, which are of secondary importance but, nevertheless help set the context for the key elements.

Distractive Elements, which serve only to distract from the key elements.

The distractive elements must be identified quickly and set aside in order to clarify the intent of the brief and to identify the key elements. Once these are determined, the brief needs to be reconstructed with a clear context, described by using the situational elements to set the scene for the key elements to be understood.

FIVE DIMENSIONS OF COMMUNICATION.

1D.

In comparison to the meanings we may hold for 2D and 3D communication, 1D communication as a reference presently has little meaning outside of this paper. I propose that 1D has merit as a reference here, though it may suggest a lack of substance and depth, by referring in the main to sound and situation. By this I mean a number of cues which would include: the sound of materials and features, the presentation environment, and in addition to the verbal, the non-verbal communication techniques used.

Whilst it may be argued that sound, especially in stereo, could be considered to be spatial in nature, it is intended that these 1D to 5D category references should be viewed as being a co-supportive collection of communication categories. By this approach we then see that appropriate 1D elements can add clarity in support of the 2D to 5D categories of communication.

Whilst speech is often delivered face to face we find ourselves more aware of it when lacking visual references, such as during phone calls, where it may be compared to operating in the dark. The focus of attention upon any sensory cue will increase when the availability of information from the other senses reduces or ceases. In such a case as a phone conversation we may become aware that the quality of the communication relies not only on what is said, but how it is said. Argyle (1975) and Adair (1997) discuss the verbal and the non-verbal issues of communication.

Non-verbal communication in the form of gestures and postures serve to reinforce or contradict what is being said. Our posture may also influence our tone of voice, for instance we may sound different sitting down talking than standing and talking. Gestures are so deeply seated for some of us that we gesture whilst carrying out a phone conversation, subconsciously making an attempt to add value to the communication.

Whilst we can increase our awareness of these 1D factors, this category is probably the most difficult to control because many of the factors are deeply embedded in habit. Nevertheless, the value of consideration and control of these factors is unquestionable.

2D.

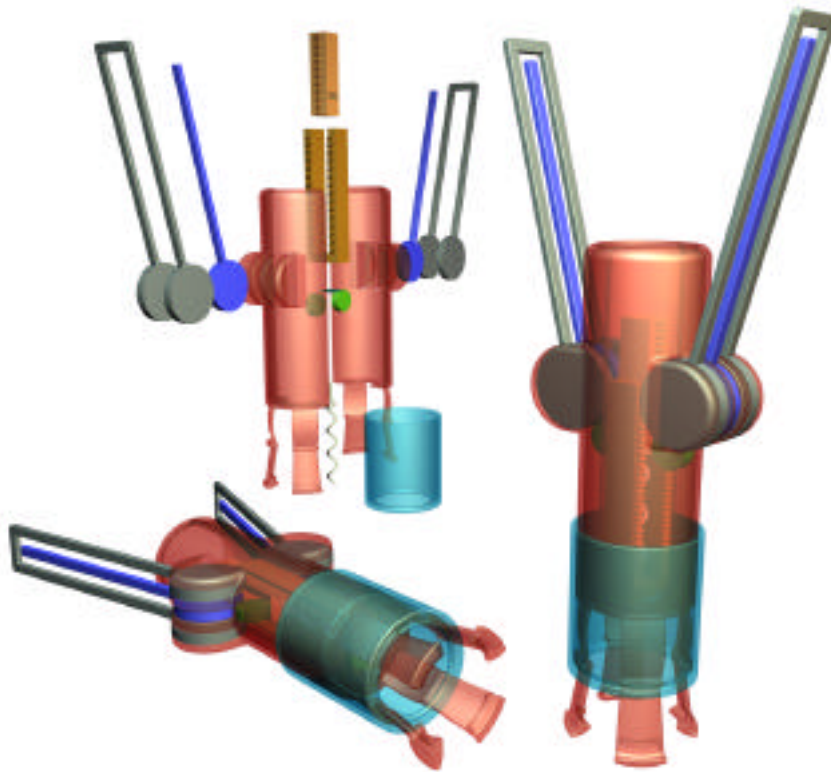


Fig.1.A Concept Development Presentation of Winemaster.

There a number of questions to be asked in preparation for a presentation, see Appendix: Presentation Preparation (A Checklist). However, a major quality and cue issue concerns ‘Truth to Position’ within the design process. A *concept*, fig.1, should not be confused with a *design*, Fig.2, or vice versa.

So the screen images or prints can be used to describe design intent to various levels of realism, presenting the concept or design via dimensioned drawings or texture-mapped

models, alone or in situ. Beyond possible need for shading, casting shadows or the use of reflections, be aware of other cues that the eye subconsciously picks up on, such as depth of scene from heavier tones and warmer colours for foreground and lighter tones and cooler colours for background. Some of this can be achieved through the colour of the lighting used in the virtual studio. Tinting lights differently e.g. one warm tint spotlight with a cool tint spotlight in an opposed position of 45-180 degrees casting shadow, can aid our reading of otherwise difficult to present pale or white products. Such studios can be set up as template defaults.



Fig.2. A Design Development Presentation of Winemaster.

3D.



Fig.3. A QTVR Object Reference Image.

We can take the 2D presentation principles into 3D by outputting a series of images, fig.3, which are then constructed into a QuickTime Virtual Reality (QTVR) file, fig.4. With QTVR files, or similar, we only need a single file to look at all the views of a concept or design. (This method may also be used with photographs of real product, possibly as an optional aid to discussion context.) The important thing here though is that *virtual realization* does not equate with *virtual finalization*. The ‘realization’ is just a 3D statement of where the project has progressed. So it might be *virtual concept*, as in Fig.4, displaying a soft model for developmental discussions, or it might be a *virtual design* showing a full detailed 3D model that may explode and un-explode interactively, possibly to be used for presales purposes.

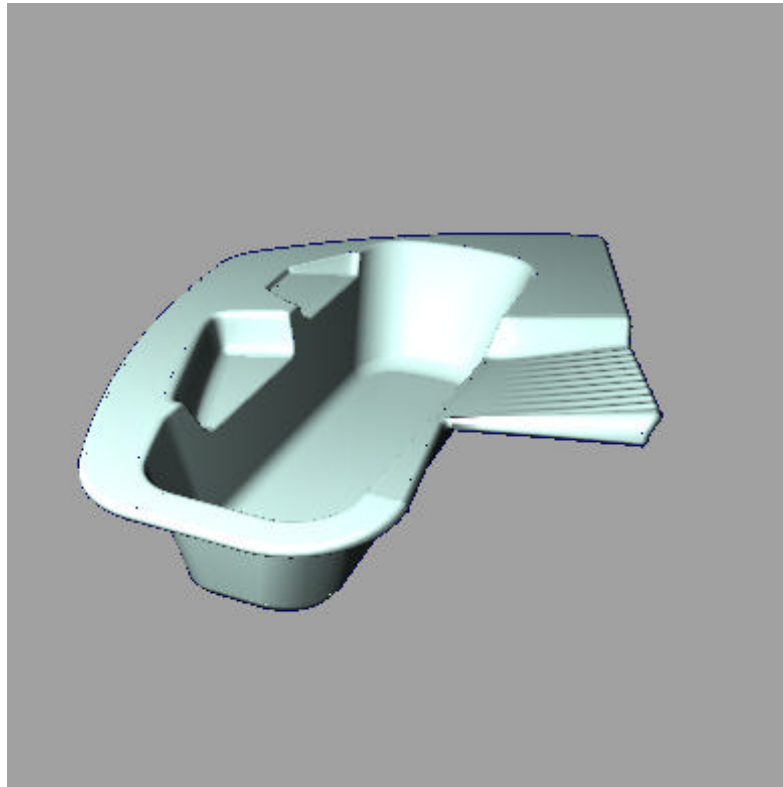


Fig.4. A Single QTVR Image.

4D.

Some elements of design intent cannot be described adequately by 2D or 3D communication, so the fourth dimension of *time*, fig.5, can be used to communicate quality cues that would otherwise be passed over or left to assumption. To one degree or another our quality judgements may be influenced by the projection of anthropomorphic or zoomorphic character onto product.

From sound and motion cues we can read in characteristics about objects in our surroundings, affecting our likes and dislikes, and therefore our decision-making. For instance, the way that a piece of toast may pop up from a toaster, the sound of closing

door, the way a bulb illuminates a room or the way liquid pours from a vessel. These characteristics may be appropriate for one situation yet not for another. These cues may infer aggression, care, effort, fun and many more expectations. Though we know the possession of intent on the part of the product to be untrue, of even an animate object, we might nevertheless prefer an aggressive response from, for instance, a security light rather than a 40 watt soft response.

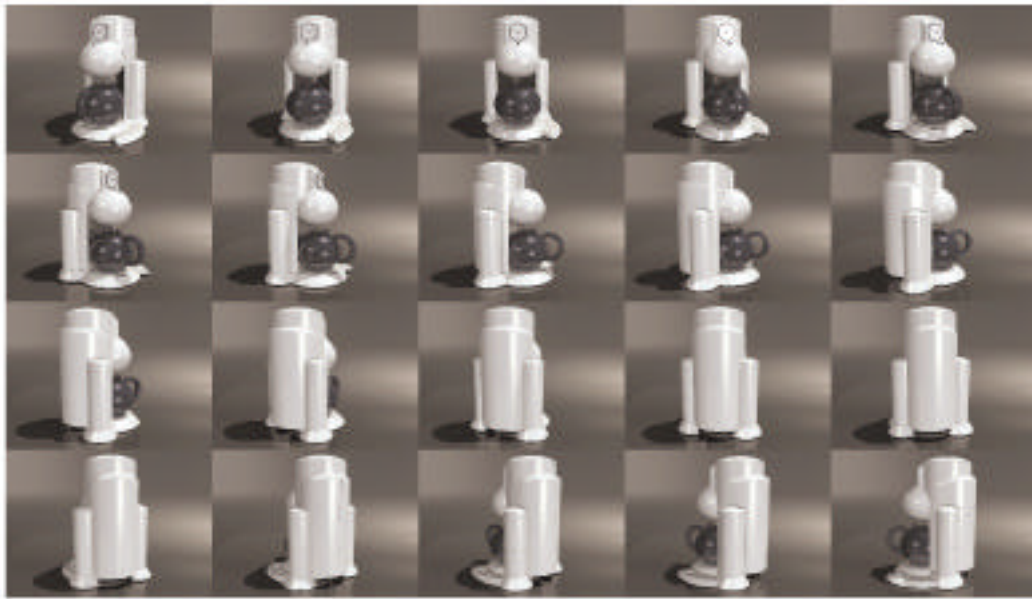


Fig.5. A Series of Animation Cells.

Whether we are aware of these judgements or not, as consumers it can affect initial and return purchases, and as users our level of interaction. In the absence of actual product or even adequate prototypes, animation is often the most important presentation aid. (It is

suggested that beyond the communication issue, designers could gain from accessing the experience of character animators, to develop appropriate character in product).

5D.

This category concerns the communication of alternative *realities* where an infinite number of alternatives lie in time. For instance a designer may be working to a specific colour scheme, but ‘*What if* other colour choices are investigated?’ If a corporate ID product colour scheme is set, the designers might still suggest ‘*What if* the layout was different?’ How do these changes alter the way the potential consumer will read the product?

However, this is just scratching the surface of the 5D category. It is simple enough to ask ‘*What if* it was made out of different materials?’, but deeper still we could be asking ‘*What if* it was a different shape?’ Animation software often provides morphing tools, which can allow the observer to see the infinite stages between two forms and at some point, and not necessarily midway, interest might be sparked. See fig.6.

‘The designer can specify the number of keyframes to go in-between, and then the computer takes the extremes to produce as many in-betweens. It is very likely that the designer can apply such interpolation as in-between functions to effectively explore and analyse shapes, which he might not even think of.’

Wang. (1995)

Whilst the ‘*What if?*’ 5D card can carry higher media production costs, used appropriately it can catch and question areas of design intent and opportunity which might otherwise be lost revenue.

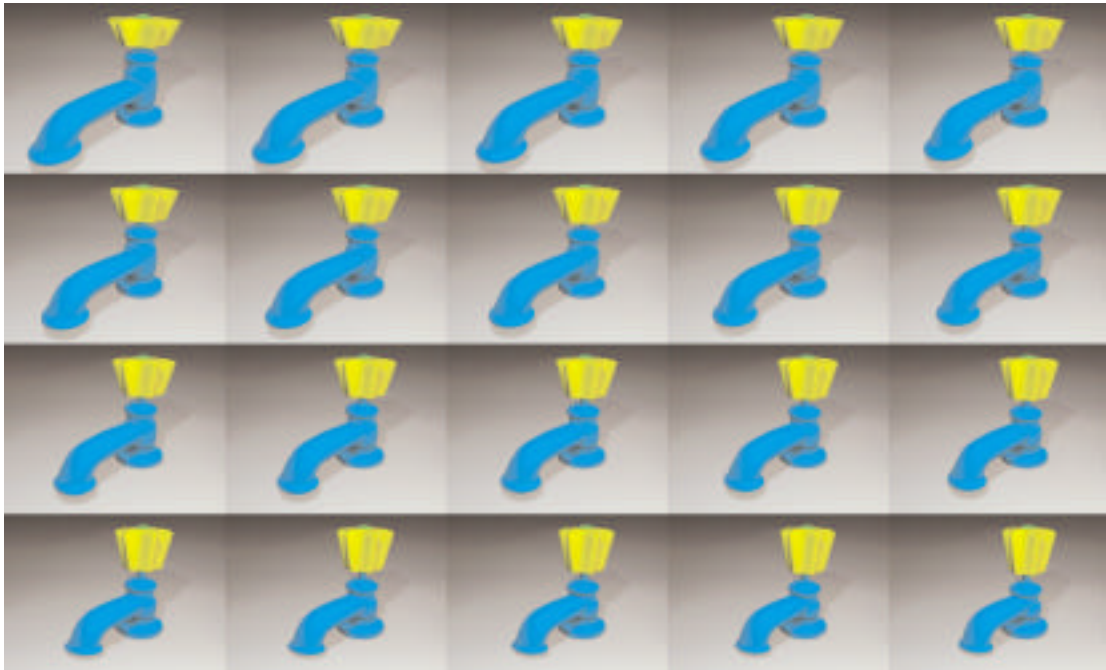


Fig.6. Animation Cells Describing the Morphing of Form.

CONCLUSION.

Via the five option categories for communicating design intent, this paper has mainly been concerned with a ‘*Where we are at*’ presentation mode. However, it is sometimes appropriate to communicate with a *future-forecast* intent, to indicate confidently ‘*Where we believe we are going.*’ This may be for discussion around predicted changes in product trend, or may be in order to secure further stages of development funding, which

may need an in situ, degree of reality, approach to be taken with the concept in order to maintain focus through clarity of communication. So we cannot discount the value of what Loosschilder (1997) refers to as 'Concept Testing' where customer feedback is gained from the production and pre-sales usage of photorealistic renderings of concept models. The five dimensions of communication are still applicable in this instance, but with a fundamentally different intent.

However, a pre-sales, future-forecast, approach accounts for only a small part of communication within the design process. Therefore the intent of this paper has been to encourage the consideration of appropriate vehicles of communication. Also, it has looked to discourage the formation of any rigid single structure for communication management, and whilst the discussion has centered around CAD or CG media it should be kept in mind that sketching and model-making will always serve a need for communicating parts of the design process.

Finally I would like to take this opportunity to suggest the possibility of a 6D category. For some years the idea of a sixth dimension has represented, to me, a step beyond the *realities* covered by the 5D communication category. Where these 5D alternative *realities* might be considered as sharing some degree of similar nature, suggesting that they are all relatively understandable, we could use 6D as an opportunity to represent alternative *rules*. Addressing alternative *rules* may require some profound changes in perception and reasoning to understand. So, could 6D communication refer to the presentation of original innovation, as opposed to incremental innovation? The 'Thoughts outside the box'? New

ways of doing things with product? If so, the best form of communication of such intent might require that the 6D category covers the use of *metaphor*. See fig.7.

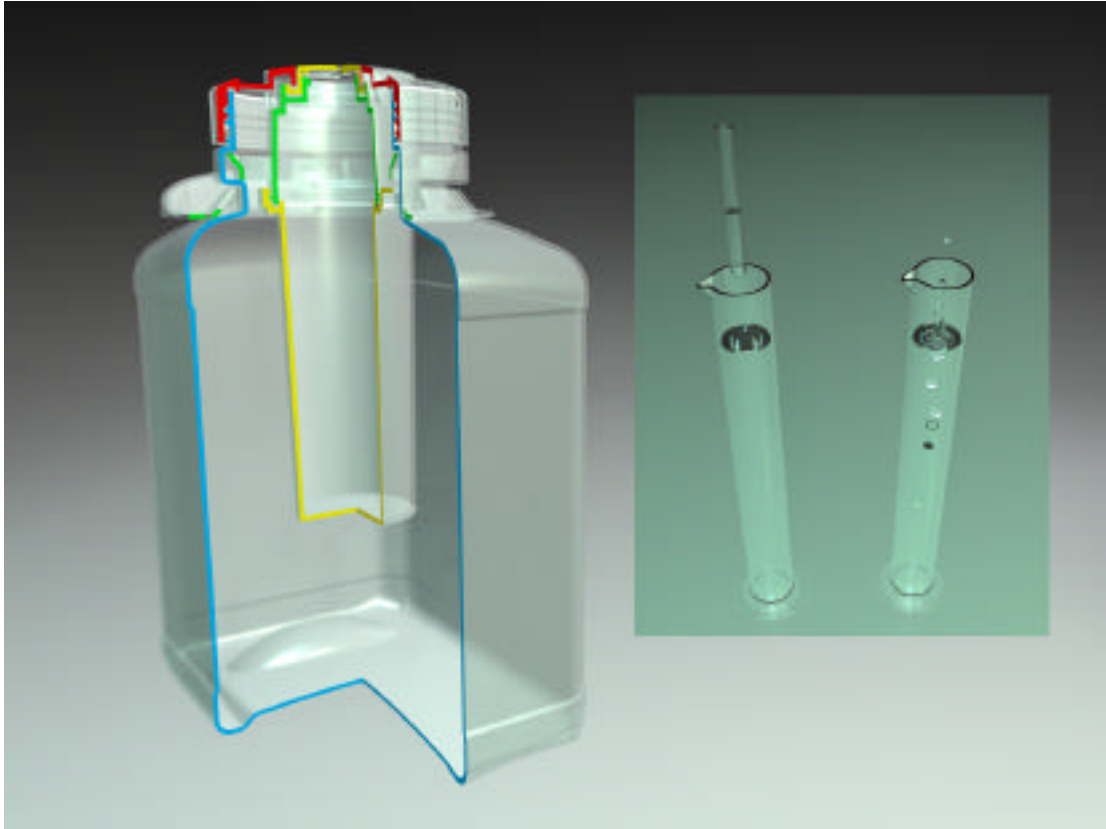


Fig.7. A Sectioned Container Design, with a Function Metaphor Inset.

Whether 6D adds an additional category or not, the important point raised in this paper is that we, as a group of related professions, must now determine ways toward competing more on *design quality* and continue to question the appropriateness of our communications.

APPENDIX: PRESENTATION PREPARATION. (A CHECKLIST)

1. What is the level of the clients design awareness?

Aim to communicate on the clients level. If you do not know the client well enough, do not get caught up in too much time consuming detail and realism, but *never* dumb-down, not only might you miss out important elements, presentations should also be seen as a valuable education opportunity for clients and designers.

2. What is the client actually expecting to see?

If you know what your client needs from prior discussion, not assumption, ask yourself the most effective ways of accomplishing this format of communication. If there is time to provide a little extra benefit then aim to wow the client, but beware of then creating unrealistic expectations for future work.

3. What key design intent areas do you need to present?

Is it clear which elements need to be shown in the presentation, or do you need to write a list or story board first? For example do you need to provide exploded views, transparent or cut-away casings? How many images do you need? Would animation say it better?

4. What stage of the process does this communication relate to?

Are you presenting concept or design? Beware of presenting all work to a photorealistic quality, because for some clients this can sell concept as design and lead to complications in the conclusion of a project, which the client may then think is near completion.

5. Is scale an issue?

Whether the image of a product is on screen or on a printout, scale can be misleading. The use of an appropriate prop not only sets a sense of scale it also acts to ground the product.

6. How long will it take?

How long will it take to generate the 2D data for decals and textures? How will the 3D data be originated and will there be any transfer issues? Once you have a handle on the timescale, be sure that the client understands all the issues. The quote to clients should outline, in appropriate detail, what the service is providing. Clients can be lost at the quote stage because they do not understand the investment and perceive that they are *only* getting some images or *just* an animation.

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