A sketch of the 'conversion funnel' Can Cognitive Engineering assist in its design?

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Author's note
This paper is primarily aimed at students of information architecture and cognitive engineering, to illustrate concepts used in commercial design practice

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1. Abstract

The 'white heat' of commercial web design is increasingly centred around a business' 'conversion funnel'. Conversion funnels are the means by which a business delivers services to its customers, and such funnels are critical to the performance of the digital channel. In this paper, a sketch of commercial conversion funnel design practice is offered.

A complex relationship is described, where web analytics increasingly helps the business measure performance. Dowell and Long's conception (1998)[2] of the cognitive engineering design problem, is then used to suggest how the conversion funnel design process can be better structured, in a manner suited to 'design for performance', and to address a business context of user experience 'engineering' that is at present largely ignored in commercial web site design.

2. Introduction

Business services are delivered by 'channels', and channels are maintained by businesses for the purpose of contact and communication with consumers. Door-to-door sales representatives, direct mail catalogues, a branch network of shops, call centres, and digital (web sites) are all channels for managed contact with consumers. Channels all come with associated financial expenses to the business, at minimum, for maintenance of the channel.

Sales and Marketing functions within businesses drive product sales to consumers across all relevant channels, via techniques such as advertising campaigns. While it has always been hard to measure the impact of a budgeted television commercial on sales within a particular channel, in the case of digital marketing this has been proven easy. While a television advert rarely mentions a particular store, to the detriment of the product or brand being advertised, in the case of the digital channel, a banner advert can drive the prospective customer directly to a retail ecommerce site, and onwards into a purchasing journey.

One consequence of the directness of this relationship, between digital advertising and digital purchasing, is that all budgets can be measured within the business, and the expense of a banner advertising or email campaign, combined with the expenses of designing, building and maintaining a retail web site for the digital channel, can be weighed against the direct contribution to sales that the digital channel makes. Business expenses can be measured end-to-end, and incremental sales from the digital channel, and therefore

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2 Dowell, J & Long, J. B. 1998. Conception of the cognitive engineering design problem. *Ergonomics* 41 (2), 126-139.

profits, are known. The digital channel has a bright future because of this accountability between the marketing expense of the channel, and the channel's marginal contribution to product sales.

Given that the design of 'effective' digital web sites has a bright future; this paper looks at how design for the digital channel might be structured within this context. In the first part of this paper, commercial practice is examined, in terms of the analysis tools available to the information architect who will design the core goal-oriented journeys (education, consideration & fulfilment) and interactive experiences, such as navigation, that the web site needs to support. The concept of the 'Conversion Funnel' will be outlined in sketch form due to the size of the actual area of interest.

In the second part of the paper, an attempt will be made to understand the sketched space in terms of a design problem of 'cognitive engineering' where 'performance' is the beginning and end of a design cycle; and the hypothesis testing of website analytics should be replaced with efforts to optimise web site performance through a more rigorous approach to the prescription of informed design specifications. The information architect will thereby become a cognitive engineer.

3. A Sketch of the conversion funnel

The concept of the conversion funnel has arisen from web site analytics, and speaks of a user's journey across web pages that lead to a business service goal being achieved, such as the completion of a sale, a sample request, a document download, appointment booked, or the generation of a quotation. In these instances, such as clicking on a 'Checkout' button (in a retail context); the user is normally guided through a step-wise process, to buy the product.

This process normally involves steps, such as 'Personal Details' (needed for shipping and logistics), Financial Details (needed for billing and finance), accept 'Terms and Conditions' (needed by legal), 'Opt-in' to future product marketing updates and offers, and so forth. Each of these sub-sets of customer data is mandated by the business, for service delivery in the digital channel.

A statistical phenomena of such step-wise journeys, is that you can't have more users at step 3 than were at step 1. Through the conversion funnel you can only lose users, and subsequent service opportunities. Web site analytics enable each page on the user's journey to receive a unique 'tag' that enables user clicks to be tracked. All buttons and controls on all pages can be tagged, so where there is more than one way to the next step, individual buttons on the page can be assessed for success, at guiding the user's journey. Web analytics' claim is that this tagging and analysis process informs web site 'optimisation', by generating statistical aggregations of user behaviour over a set of tagged pages.

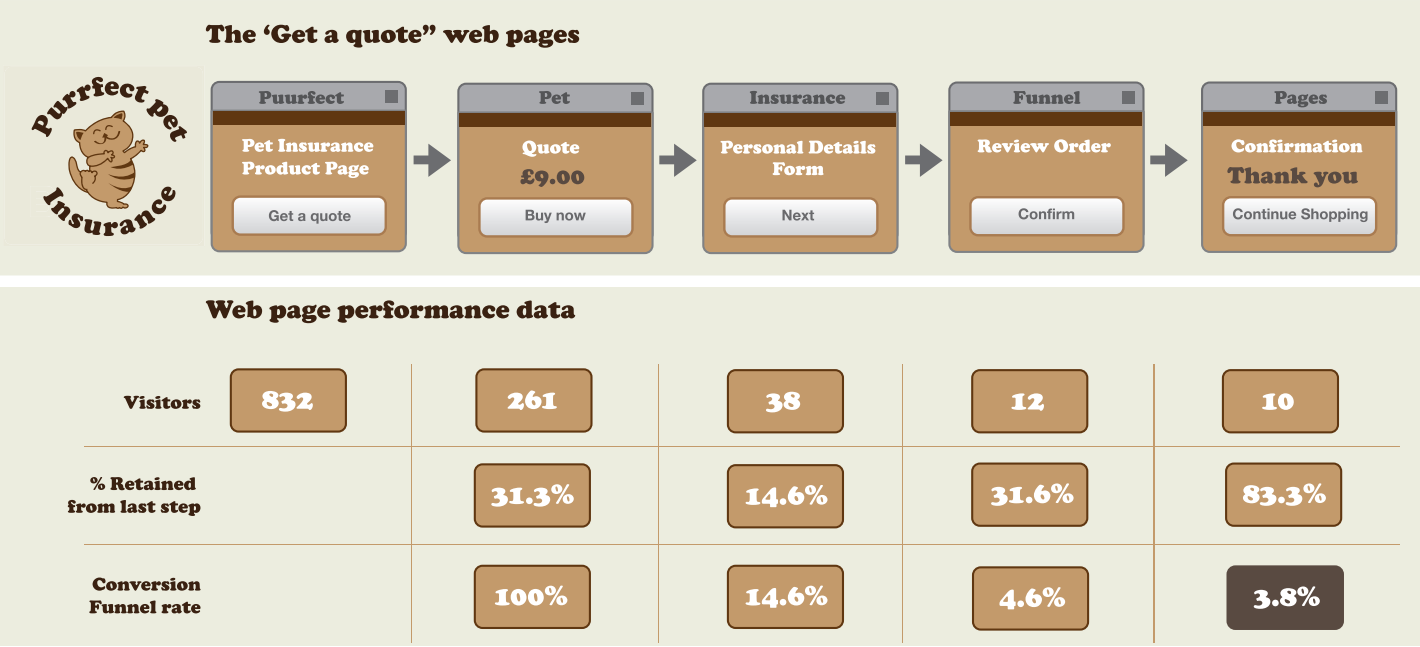

Figure 1: Illustrative conversion funnel data

If we take an example, Figure 1 shows illustrative conversion funnel data for a 'quote and buy' service, offered by 'Purrfect Pet Insurance'in the digital channel. A five page journey is of interest, and while all pages are tagged, a conversion funnel has been set-up for a user journey from offering a quotation, to purchase confirmation – the last four pages of the journey.

Figure 1 tells the following story. All details are fictitious and for the purposes of illustration.

On the Purrfect Pet Insurance website (www.purrfectpetinsurance.com), a Pet Insurance product is described, and offered for purchase in the digital channel. Product information is displayed to the user on a single page, the 'Pet Insurance Product Page', illustrated in Figure 1 (top left). Analytics data reveals that on a single day, this product page had 832 unique visitors. The page holds an important primary Call to Action, 'Get a quote'.

When the user clicks the 'Get a quote' button, on the product page, they are taken to a 'Quote' page. Accurate quotations require a number of pieces of information to be elicited from the prospective customer, so on the Quote page radio buttons and drop-down choice controls enable the pet (to be insured) to be described. A dynamic quote is thereby generated within the page, based on the user's actions. Here, a quote of £9.00 results, and once a well-formed quotation is generated and displayed, a 'Buy now' button is offered to the user. Analytics show that 261 users, of the 832 users who visited the product page, progressed to see the Quote page.

That is a 31.3% retention of interest in the product. 31% of visitors who read about the product, sought to get a quote. This group of 261 users, who obtained a quote, may be considered by the business to be a target group of 'warm prospects', users judged as having a genuine interest in the product, and are ready to act within the digital channel. Of the 571 visitors to the product page that didn't seek a quote, some may have been conducting research, and then progressed an order via a Call Centre channel, or approached a shop branch or broker channel. The digital channel may still be serving important user needs even when action within the channel is not evident.

If the prospective customer then clicks the 'Buy now' button on the Quote page, having considered the quote, they are taken to a 'Personal details' form, where contact and financial details are captured. A 'Next' button then progresses the user onto a 'Review Order' page, and a 'Confirm' button will generate an Order Confirmation page. In theory, everybody who sees the Order Confirmation page is a customer of the business, as they have bought the product via the digital channel. The Order Confirmation page is therefore the end of a transaction process, and cannot be found and visited via the navigation, or passed as a URL within an email.

Analytics data show, across these pages, a gradual drop-off in visitor numbers as prospective customers 'exit' out of this journey to purchase the product, maybe via bookmarks, or by closing the window. It can be seen that only 10 users saw the Confirmation page on the day in question, 10 prospective customers became actual customers of the business. Tabulated below the analytics data for page visits are percentage statistics that reflect the volume of visitors retained by the digital channel, from preceding step. Only 14.6% of people who sought a quote, elected to then 'Buy now', and of this elite group, two thirds were then lost during form filling.

Finally, a conversion funnel has been set up from the Quote page through to the Confirmation page. If the 261 visitors to the 'Quote' page are considered a target group for purchasing (the warm prospects), and only 10 of that group of prospective customers actually became customers (the ones that saw the Confirmation page), the business' digital channel has a 3.8% conversion rate for this product on the day in question.

4. Information architecture and the conversion funnel sketch

Now, information architects design the pages that are reflected in such statistical analyses of the web site, and web site analytics reflect a limited 'glimpse' of a web site design's 'performance'. Where a business has sales targets for the digital channel, it is possible that the current volume level of 10 product sales per day is insufficient to justify the expense of the channel, and uplift is needed to 20 sales per day, for the achievement of business benefit in offering the channel to prospective customers. In the case of Purrfect Pet Insurance, for the 261 visitors to the Quote page, changes need to be made to the digital channel's web site, sales process, or both; so that a 7.6% conversion rate is attained. Then 20 confirmation pages will be seen by 20 of the 261 'prospects' who saw the Quote page. This may be possible without changing the web-site significantly, for example, the user may be incentivised to purchase via a '5% off' offer. Alternatively, theories may be created about how the Quote page could be improved, to get more people through to click 'Buy now' and start filling the Personal Details Form. Instructional text may be insufficient to reassure the user how easy the process will be, or 'Buy now' buttons may be out of sight and require scrolling.

The business, in conjunction with the information architect, may thereby seek to redesign parts of the site to achieve improved conversion rates and sales volume uplift. Alternatively, the business, in conjunction with digital marketeers, may place an increasing number of banner adverts on partner sites, to drive twice the volume of users to the product page, and thereby mine the existing statistical patterns through the conversion funnel to reach the same end result, 20 target sales for the channel. This paper is concerned with the former; redesign to achieve improved conversion.

Drawing on conversion funnel data, the web site is thereby changed, maybe with clearer instructional text and two 'Buy now' buttons, one at the top and one at the bottom of the page. The changed site is then measured, in a similar manner to the first design, and over time a comparative conversion funnel is generated. Usability testing should be employed, before the new design is made live, to reduce the risk that new user problems were not introduced by any alterations, a form of 'proof test' (Vincenti, 1990)[3]. While a method of applied science would appear to be being employed, the difference between two (measured) digital experiences may be a great number of site alterations, with each alteration reflecting a hypothesis, with many parties within the business generating hypotheses and requesting changes. If uplift is attained, it will be difficult to determine which design alteration was most effective; but then all the business wants is uplift, not the practice of a purely scientific approach.

To compliment multiple design changes to pages, it is possible to conduct 'split' testing, or AB testing, on page elements such as button designs, labelling, font size, imagery and so forth. In this case, two buttons may be designed, one saying 'Buy now', and another saying 'Join us', and placed in the page in equal measure until a statistical difference in usage is detected. Then, one design may prevail as being more effective, and so testing single hypotheses can also be undertaken. An image of an animal in a bandage may be more effective at driving people to 'buy' pet insurance than an image of a happy customer. If a number of AB tests are bundled together, Multi-Variant Testing takes place. The page 'design specifications' that support the conversion funnel can in this way be tweaked and thereby optimised to meet business goals. The cost of changing the digital channel's user experience needs to be weighed against incremental gains, through better conversion rates.

Earlier, when the conversion funnel was sketched, the claim that web analytics can 'optimise' a web site was touched upon. Web site analytics does appear to support web site optimisation, but optimisation is about more than measuring aggregated and individual click paths. Optimisation has a second component that has been mentioned here, design specifications. Behind the aggregated statistics are designed pages that form the user's experience. To optimise the pages, in line with business targets, design specifications are required, and specifically 'designs for performance'. Designed changes need to attain targets, and address problems that may stop a well motivated prospect getting through the funnel, to a special place; a view of the confirmation page, and their subsequent 'conversion', via the funnel, from a 'Prospect of the business', to a 'Customer of the business'.

The user can at any point leave the funnel simply by clicking away on a bookmark. If the user is to be converted into a business customer in the digital channel, but is confused by what is being viewed during the purchasing journey, such confusion needs to be removed from the design. A specification for a design solution is needed, to compliment the design problems uncovered by the web site analytics. Together, analytics and design specifications support web site optimisation.

3 Vincenti, W.G. 1990. *What Engineers Know and How They Know It.* John Hopkins University Press.

5. Cognitive engineering and design problems

The above picture of commercial design practice takes in many individuals, disciplines and concerns; and so the design process needs guidance, in how to structure the way in which the root design problem of digital channel 'performance' is conceived, and thereby approached in the design process. In this regard, the paper asserts that the sketch provided, of the conversion funnel, can be best understood in terms of a design problem of cognitive engineering. A conception of cognitive engineering as 'design for performance' (Dowell & Long, 1998) will be used to re-express the problem of conversion funnel design, in a manner suitable to the engineering context of 'optimisation' that exists around it, in all but name.

The digital channel to prospective customers is one channel of many, but all channels can be conceived of in terms of Ergonomics, in that all channels will involve to a greater or lesser extent, humans interacting with devices to perform effective work (Dowell & Long, 1989;[4] Long, 1987[5]). Where a business offers common services across multiple channels, the humans in question (prospective customers) interact with functionally equivalent devices to perform the same 'work', such as product purchase. Web sites offer 'electronic form' devices to the user. Direct mail channels offer paper-based form devices, pre-paid envelope devices, and sometimes even pens! Via different channels a common range of products can be purchased. To the prospective customer, the work is the same – generating an order; but with different devices, levels of performance may widely differ. Dowell and Long conceive of performance as having two inseparable components, 'Task Quality' and 'User Costs'. Quality here refers to how well formed the order is, by interacting with the devices that the business offers (via the channel).

The static and standardised images of a paper-based catalogue may generate more returned products to a business than a web site that offers zooming, panning, and a library of product photographs from different angles. When the order is fulfilled, users of the digital channel may be more likely to be delighted with their purchase, than a user who was unable to determine aspects of the product until closer inspection was possible. The quality of the user's work varies across channels. Associated with work of a given quality are costs to the user. These may be most simply conceived of as time and effort, or may be more refined and make reference to costs of mental and physical human behaviours (e.g. training), plus device costs such as load on a server of posting back information to that server, after every click. In our retail example, the time cost of waiting for the postal delivery of a paper-based order form (back to the business in the direct mail channel) may be removed by using the digital channel's electronic form. Going to a branch to buy the product may involve the prospective customer incurring greater costs (time, effort, financial), but generate the highest quality of work. There again, a lack of stock at a local branch may lead to the work being left undone when this channel is chosen, with other consequent costs to the user, of performing work of zero quality, such as frustration. When looking at digital channel performance, it is therefore helpful to look at performance in these terms, quality of work done at some cost.

4 Dowell, J & Long, J. B. 1989. Towards a conception of an engineering discipline of human factors. *Ergonomics* 32 (11), 1513-1535.

5 Long, J.B. 1987. Cognitive Ergonomics and Human Computer Interaction. In: Warr, P., (Ed.) Psychology at Work. Penguin, Harmondsworth.

In this retail example, the similar work undertaken across different channels may be abstractly conceived of as one whereby 'ownership' of an object or objects, is transferred from the seller to the buyer, along with the physical location or evidence of ownership. A lamp appears in your living room, or a policy number is sent to you in the post. In each case, the prospective customer interacts with devices, provided by the seller, to ensure this work is performed effectively. Dowell & Long call the human interacting with the channel's devices the 'worksystem'. The worksystem incurs costs as its contribution to the expression of work performance.

Worksystem design for the digital channel needs to be similarly conceived. The product browsing experience needs to be simple and informative, the route to the checkout needs to be self evident, and product selection supported by devices such as 'baskets', with clear means of action ('Add to Basket' buttons) and action reversal ('Remove' buttons). A shopping checkout experience that loses 96% of customers that approach it, with something in their basket, thereby becomes a very interesting and commercially valuable design concern. Channel performance needs to be improved, but can that improvement be brought about by increasing the likelihood of higher quality work being done, at a lower cost of time and effort to the worksystem? It is suggested here that this is a helpful way to think about structuring the root design problem of the digital channel, performance. Generating uplift in the digital channel through redesign of web pages is a problem of cognitive engineering.

Dowell and Long's conception of cognitive engineering maps the behaviours of the worksystem, with an abstract place, entitled the 'domain', which is comprised of domain 'objects'. In retail domains, the objects may be modelled in a variety of ways; what is important to the conception is that each behaviour of the worksystem is understood in terms of progressing some desired transformation of a domain object on its way to a final state whereby the work is accomplished. In a retail domain, ownership of a domain object is transferred. One simple model of such a domain may be in terms of transforming 'order' objects from a state of 'empty and unfulfillable' (no object in a shopping basket) through to 'valid and unfulfillable' (something in the shopping basket that can be purchased), and then on through the conversion funnel to a domain object (target) state of 'valid and fulfillable' (all personal, financial, and logistical details known to pay for and deliver the object to the new owner in return for the cash value).

Until 'Terms and Conditions' are accepted for example, a valid order is unfulfillable, as the prospective customer has not yet accepted the 'conditions of business', for scenarios such as theft in transit. Such business logic pervades the digital channel, and yet is not a necessary part of the 'work' carried out by worksystems in a branch or shop, where responsibility for safe transport is undertaken by the consumer once they have left the shop, with a well manufactured bag supplied by the business. The conception of a cognitive engineering design problem therefore ties worksystem behaviour into a view of how that behaviour is transforming the domain object into its target state – accomplishing effective work. Task quality is used to measure the work done in the domain, and so the measurement of worksystem performance has a second element, inseparable from worksystem costs. Costs cannot be truly understood unless we know what work they were incurred 'doing'. Work is done to a 'quality', and in attaining work of that quality, the worksystem incurred costs.

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Engineering ‘design problems’ then arise when desired levels of worksystem performance are poorly aligned (do not match) with levels of cost and quality desired by the business (digital channel provider). At such a point, after desired performance is known and expressed, and actual performance known and expressed, and poor alignment is articulated, cognitive engineering design processes can be undertaken, as those processes can be grounded in worksystem performance measurement.

The cognitive engineering design processes that are broadly employed when solving performance-oriented design problems are ‘diagnosis’ and ‘prescription’. The business, at a minimum, will have expectations that a digital channel will generate, across all its ‘valid and fulfillable’ orders, a level of profit. If this level of profit is being attained, but the business has unusually high levels of returned goods, and subsequent re-funds, a place to start diagnosis might be on the ‘browse’ and ‘add to basket’ experience. Are product sizes well displayed? Do prospective customers know what they are adding to the basket? Alternatively, profit may be visible in the value of total order objects that progress from ‘empty and unfulfillable’ to ‘valid and unfulfillable’, but enormous numbers of prospective orders may be abandoned in the Conversion Funnel, maybe at the Terms and Conditions step. Diagnosis in this case may start by looking at the Worksystem at this point in the retail experience.

The cognitive engineering process of diagnosis will draw on as much Business Intelligence data as is available, about worksystem behaviour, to establish a plausible theory about why the performance data indicates a design problem exists. Prescription, then involves specifying a design solution, one that will alter the performance data, bring about ‘uplift’, and align the business’ desired level of performance with actual levels of performance. Cognitive engineering, by separating worksystem from domain, modelling worksystem behaviours as separate from domain object transformations, and measuring worksystem costs alongside work quality, offers digital channel designers a valuable means of structuring how the root design problem of performance is conceived (Dowell & Long,1998).

6. Performance measurement

Dowell & Long’s conception of the cognitive engineering design problem is not alone, in trying to outline basic fundamental components that make up an engineering discipline of ‘cognitive design’. It has however been chosen, because of its emphasis, less on ‘cognitive behaviour’ leading the design process, as much as deficiency in ‘performance’, and then re-specifying the worksystem, and most importantly the human ‘cognitive’ component (that leads to the creation of business ‘customers’), as a means to address a design solution to the problem.

The user’s cognition drives their action, which thereby progresses them through the conversion funnel. A button may be rendered larger, and brighter, to capture a customer’s mental process of ‘attention’, a clear table may support ‘reasoning’ about a choice, and thereby encourage the desired user ‘click’ (behaviour), that will improve performance data towards the business’ desired performance levels, and turn problem into solution (alignment).

By attributing a measurement of cost and quality to an expression of performance, and the concepts of ‘desired’ and ‘actual’ levels of performance to assist in the framing of a ‘design problem’, cognitive engineers have a number of places to start the diagnosis process.

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Firstly, the business needs to be able to express desired performance. This will likely be in aggregate terms, and largely reference task quality, especially the number of occasions the worksystem generated ‘valid and fulfillable’ orders, and the total value of those orders, against some measurement of cost (expense), in supporting the digital channel to the consumer. Performance is also likely to make reference to the missed opportunity in terms of low task quality and high user costs. Orders abandoned in the conversion funnel (‘work’ left undone in the domain), time to progress through the conversion funnel at each step, complaints and customer satisfaction ratings (worksystem costs). It is in measuring actual performance via such criteria that web site analytics, and wider Business Intelligence, provides the cognitive engineer with a valuable toolset for performance measurement and thereby design problem diagnosis.

While the engineering approach relies on the business to express ‘desired performance’, once this is expressed, means are required for measuring the actual performance, and so by: tagging pages across the site; modelling user journeys and paths across the site; measuring the time spent on each page; and comparing this to the value of the basket at each step; measurements of the actual performance of individual prospective customers, can be aggregated into summary statistics. These summary statistics are models of performance that support diagnosis; diagnosis of points in the journey where performance starts to deteriorate, against the performance which is desired.

Diagnosis may start from pages where performance deteriorated beyond repair, instances where prospective customers were lost from the funnel (and wider site) completely – they ‘exited’ away; or pages where time spent before advancement appeared unusually long, as hesitancy and uncertainty sets in. Web site analytics can provide granular and aggregated data to support the cognitive engineer in diagnosis, and reasoning about why the performance data are as measured, and indicative of the origins of a plausible design problem; the design problem under consideration.

In contrast to scientific hypotheses, that are part of a scientific method to generate scientific knowledge that supports better ‘explanation and prediction’, cognitive engineering needs to develop a set of diagnoses. The diagnoses, when addressed during the cognitive engineering process of ‘prescription’ (developing an interface specification), will improve and align the Worksystem’s performance data so that it better matches the business’ desired level of performance. If uplift is not possible, the digital channel may disappear as a candidate user experience choice for prospective customers, when interacting with the business.

Diagnosis therefore needs to go beyond an approach of applied science, and instead to look at the user’s journey to a point where performance deteriorates, as well as the page where deterioration is most marked. Diagnostic theories need to be generated by the cognitive engineer that draw upon all the models of human mental abilities that support cognitive design (attention, reasoning, vision to name three), to explain the performance (design) problem. The abandonment of a basket at the page before confirmation may have little to do with a problem with the order summary page itself. Quite the opposite is possible when the user’s journey is examined. The order summary page may reveal the true transportation expense of the ‘valid and fulfillable’ order, expenses that if known earlier would have resulted in fewer prospective customers abandoning their order at such a late stage. Diagnoses need to consider the customer’s journey, and the mental events that the pages support, such as ‘true order cost realisation’. Prescriptions will then follow, in the form of design specifications that address the diagnosis and thereby attempt to solve the design problem.

7. The Conversion Funnel design revisited

Business Intelligence for the digital channel is taking many forms, and introducing many new issues around not only consumer privacy, but also around the limits of what can be inferred about consumers from their digital footprints (Baker, 2008).[6] As many interests compete for influence over the user experience through the conversion funnel, a framework is required to structure the design process so that interests are weighted appropriately. The business owns the channel to its prospective customers, and once it has decided on the key objectives for that channel, it will inevitably set performance targets for the channel. Technologies are evolving to subsequently service the business' interest in digital channel performance measurement. It is important to understand the strengths and limitations of the 'glimpse' of customer cognition that statistical models provide, something Guy Debord would call 'the spectacle', and how we design based on these impoverished representations of the consumer's reality (Debord, 1967)[7].

In this paper, Dowell & Long's (1998) conception of the cognitive engineering design problem has been used to bring some order to these competing interests; and better understand what contribution different parties are making to the primary business objective of digital channel performance. Click paths and conversion rates represent aggregations of humans interacting with computers to perform work, and their greatest contribution to the primary business objective is to measure performance, and provide the cognitive engineer with diagnostic inputs, and evidence a re-designed conversion funnel really is the design solution the business is looking for.

To compliment measures of quality and cost, the cognitive engineer needs to tie a digital experience in the digital channel (prospective customers interacting with digital devices), to a domain where work is done, and business targets are attained. This design process will then draw upon models of cognition. Cognitive 'engineering' of a design solution is thereby grounded in performance, at the start (diagnosis) and end (prescription) of each design cycle. It is because this is increasingly how the digital channel is being designed, that Dowell & Long's conception has been chosen. Cognitive engineering in practice, is about designing devices that support cognition, which supports action, which transforms domain objects to accomplish work, of a quality and at a cost. The interests of the cognitive engineer and the business are thereby aligned, by a common interest in channel performance.

End note
Students of cognitive engineering are further directed for reading to the Journal 'Interacting with Computers', Volume 22 (Issue 1), a Special Issue: 'Festschrift for John Long'.

Footnotes
6 Baker, S. 2008. *The Numerati.* Jonathan Cape, London.

7 Debord, G. 2004. *Society of the Spectacle.* Rebel Press.