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Unleashing The Voice Of The Product And The Voice Of The Process

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Abstract

In this paper we propose that, our need to create products and services that match the 'voice of the customer' becomes much more achievable when designers allowing the 'voice of the product', the 'voice of the process' and the 'voice of the system' to guide them. The paper explores how TRIZ helps us to systematically map these 'voices' and how, once we have found them generically we can then set about making a systematic transfer into the domain of specific solutions. Several mini-case study examples are used to illustrate the various points raised in the paper.

Introduction

Just about any organisation today recognises the importance of capturing and utilising the 'voice of the customer'. The voice of the customer is the thing that allows organisations to survive in an increasingly fierce global market-place. It is, however, notoriously difficult to capture accurately, and, paradoxically, experience tells us that very often the actual voice of the customer turns out to be considerably different from that assumed by the prevailing market behaviour. It is our proposal in this paper that capturing that voice can be made very much more easy when we also take into the account the voices of the product and process. Very few organisations are aware of the 'voice of the product' and the 'voice of the process'. But, thanks to TRIZ-based research into patterns of discontinuous evolution, both very definitely exist. This paper is about the application of TRIZ trends and the Evolution Potential concept and the way in which both can be applied to systematically identify where products and processes are going to evolve in the future.

The paper takes as its starting assumption a desire on the part of companies and individuals to generate specific 'killer application' solutions to satisfy a stated target market. We are looking, in other words, for 'innovative' solutions as opposed to merely inventive ones. Our definition of 'innovative' thus equates to the precious few inventive solutions that eventually turn out to be sustainably profitable market successes.

A previous paper (Reference 1) has discussed the essential elements that will determine whether a novel product or service turns out to be innovative or not. These elements –

which emerge through an application of the Law Of System Completeness (Reference 2) include comprise:

1) a more ideal product or service ('Tool')
2) an economically viable means of (mass-)production ('Engine')
3) a market demand ('Interface' or 'Object' that the 'Tool' will act on), and
4) a route to market ('Transmission')
5) effective co-ordination of the various elements ('Control')

In order to ensure that we are able to engineer all five of these essential elements to appear as and when we want them, we also need to recognise the existence of both generic and specific solution domains. We might chose to bring the five elements together with the generic/specific divide by configuring a picture like that shown in Figure 1.

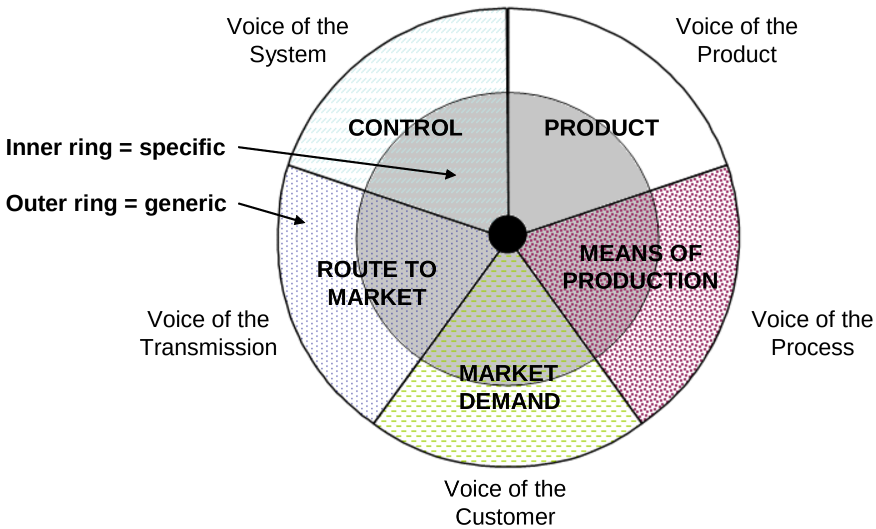

Figure 1: Essential Elements Of The Innovation Story

This figure defines our five 'essential' domains as segments within a series of concentric circles. The outer ring formed from two of these circles defines what we might think of as the 'generic' domain. The next ring in then represents the 'specific', and the small black circle at the centre of the picture then represents what we might think of as the eventual 'answer' to whatever question we started from.

What this picture is essentially trying to communicate is the fact that in order to create a successful innovation, it is necessary to consider all of the five essential elements, first in their generic sense, and then in their specific sense. It is our premise here that these five elements plus two domains represent pieces in an innovation jigsaw. The jigsaw analogy is important primarily from the perspective that, as in an actual jigsaw, we want to get to the completed big picture, but it doesn't matter which sequence we put the individual pieces together. If it doesn't stretch the jigsaw analogy too far, we further propose that, as with a jigsaw, it is usually easier to start by assembling the pieces around the edge, and then working towards the centre. It is thus our hypothesis that beginning in the domain of the 'generic' is actually easier than the domain of the specific. More on this idea later.

Continuing with our big picture theme for a little while longer however, our next step is to attribute a 'voice' to each of the elements in our 'innovation big picture'. Hopefully fairly obviously, the 'voice of the customer' corresponds to the 'market demand' slice. The voice of the product or voice of the service then corresponds to our product or service. Next up, our 'means of (mass-)production is represented by a 'voice of the process', our route to market has a ‘voice of the transmission’, and our coordination function is represented by a ‘voice of the (overall) system’.

The final step in defining this map of the world involves the transition from the generic to specific domain. There is much in common here with the classical TRIZ problem solving framework reproduced in Figure 2. What we have, however, added to this model are ‘resources’ and ‘constraints’. It is our proposal that these are the two things that will determine what we specifically can and specifically cannot do in any given situation. The resources that we have specifically available to us, and the constraints that we are specifically bound by will ultimately be the things that will determine which of the various generic ‘voices’ we can actually listen to and act upon.

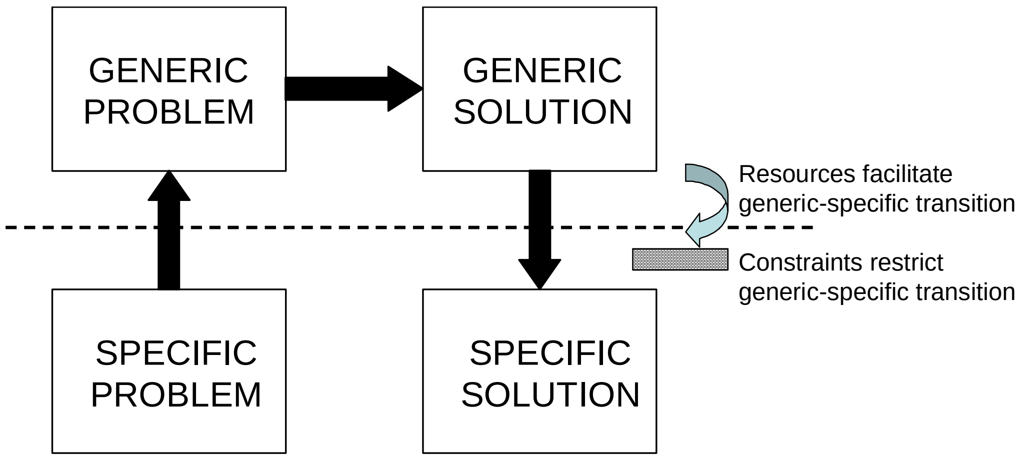

Figure 2: Classical TRIZ Problem Solving Framework And Relationship To Resources And Constraints

Having now defined our new big picture, the remainder of this paper sets about transforming what may appear to be a very abstract concept into something that is applicable in any number of concrete situations. The paper is thus divided into three main sections. In the first section we explore the ‘voice of the product’ and ‘voice of the process’ phenomena through a mini case study example for a simple consumer product. In this section, the aim is to demonstrate the mechanics of generically reproducible strategies for capturing the voices. Also in this section we examine a process for transitioning the generic voice of the product into the specifics of a given innovation opportunity.

In the second section the emphasis shifts to the voice of the system. In this section we examine another short case study, this time from a business as opposed to technical perspective.

Finally, in the third section, we attempt to construct an overall picture through another case study example. In this example, we first explore the convergence of the various different voices in the generic realms, and then show the transition from the generic to the specific domain. In so doing, it is our intention to show how all three voices can be made to operate together to create economically attractive ‘wow’ design solutions. Specifically, we show how the voice of the customer and the voice of the product first work together to allow engineers and designers to identify the ‘right’ product solution. We then show how the ‘voice of the process’, ‘voice of the transmission’ and ‘voice of the overall system’ are integrated to create means of transforming the ‘right’ design into practical reality.

The Voice Of The Product

The simple system in question is the golf-tee (Figure 3). Despite being such an apparently simple system, the golf-tee has been the subject of over 400 patents in the last 20 years. Clearly, it appears to be inadequate in performing its function(s) in some way.

Figure 3: Typical Golf Tee

Before considering what any of these inadequacies might be, 'the voice of the product' can be used to help us to see where the golf-tee might evolve in the future. The easiest and most systematic means of hearing this 'voice' is to conduct an Evolution Potential analysis (Reference 3) of a typical current design. By mapping where the current design is on each of the relevant TRIZ trends, we have the opportunity to map all of the trend jumps that the tee has not yet made. Figure 4 plots the current evolutionary state of the tee illustrated in Figure 3. Without going in to the details of each trend, what this figure immediately shows us is that the design is relatively un-evolved, and thus has considerable untapped evolution potential.

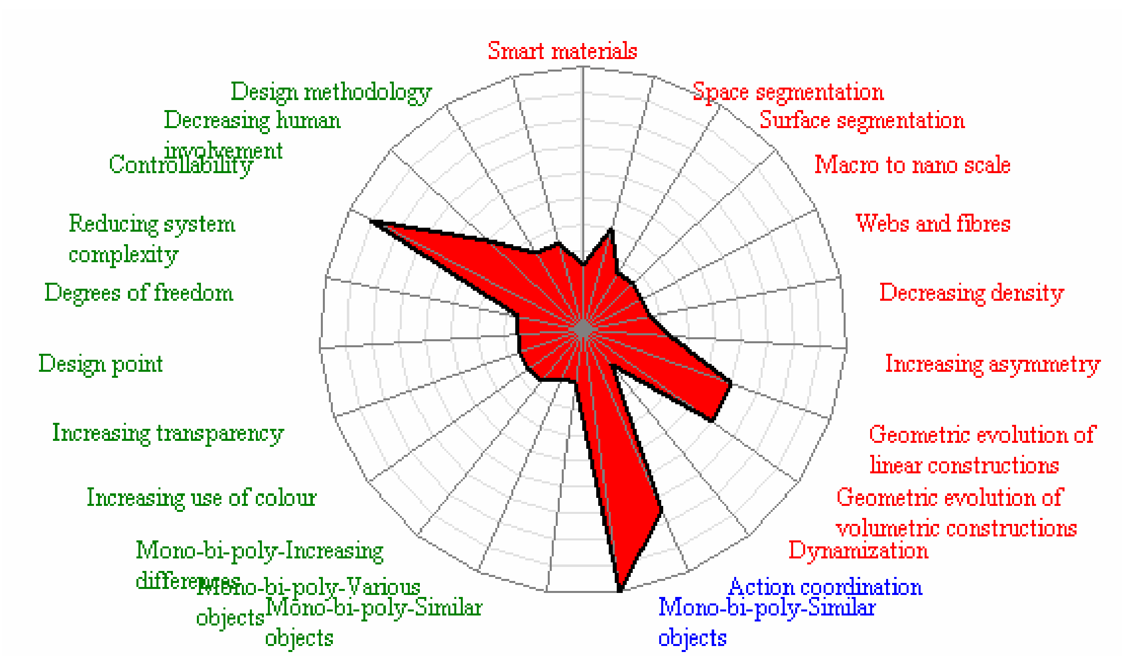

Figure 4: Evolutionary Potential Plot For Typical Golf Tee

Having constructed this plot, it becomes possible to systematically work through each of the trends and to generate ideas on where the tee might evolve. The voice of the Space Segmentation trend, for example will tell us that the tee 'wants' to become hollow, and then multi-hollowed, and then porous. We don't yet know *why* these directions might be useful, simply that this is where the voice of thousands of other products has told us we should be looking.

Should we wish to restrict our creative efforts, however, we might chose to restrict the number of trends in our analysis. The best way to do this is to begin the process of transitioning from the generic to the specific voice. As illustrated in Figure 2, the various resources and constraints available and imposed on us will determine which trends we can and cannot utilize. A good next step involves identifying the constraints that will determine what can and cannot be done in generating the new tee. Some of these constraints might be:-

a) low life cycle cost – ideally the tee should be no more expensive than the best of current systems. The relevant cost factors involve both manufacture and number of uses before the tee is either broken or lost – i.e. there is a 'life-cycle cost' and not just a purchase cost to be considered.
b) ease of use – good tee designs operate in one motion – the golfer places the ball on the tee and places both onto the ground at the same time; the ball generally being used to push onto the tee to drive it into the ground. Adding a second or third action requirement would not be welcomed by the golfer.
c) The tee should not influence –or even be perceived to influence – the trajectory of the ball as it leaves the tee post-impact.
d) Development time should be very short (3 months maximum) given the application and likely market value.

These constraints – assuming we are happy they are legitimate - then allow us to examine each of the trends in order to assess their relevance. Table 1 makes an attempt to do this, based on the above constraints. In the case of this golf tee case study for example, it appears quite clear that the cost constraint is going to limit the use of several trends. We will construct a table like the one shown below in order to identify which trends are going to fit the constraints and what the possible design implications might be:-

Trend	**Likely impact of evolution on tee design**	**Match with Constraints**
Smart Materials	Increased functionality; most likely to help in the hard and soft contradiction.	Very unlikely to be cheap enough to match cost constraint
Space Segmentation	Offers potential in several areas – reduced use of material, increased functionality	Possible concerns over manufacture cost; but such problems have been solved in similar situations elsewhere. Good prospects for this trend.
Surface Segmentation	Definite prospects for increased functionality – attachment to ground, height and storage	No likely cost problems. Good prospect.
Macro-to-Nano	Some possibilities in terms of attachment to ground (?) and influence on ball flight	Very unlikely to match time constraint.
Webs and Fibres		Very unlikely to match cost or time constraints given the state of the art.
Decreasing Density	Possible benefits in terms of bio-degradation and harm to machinery	Several possible low cost materials may be possible. Good prospect.
Asymmetry	Several possibilities.	Smart design should not conflict with constraints. Good prospect.
Geometric Evolution	Several untapped possibilities.	As above.
Dynamisation		Inevitable increase in complexity will not match cost constraint. 'Fluid' or 'field' solutions will not meet time constraint.
Action Co-ordination	'Actions during intervals' is the only remaining unused stage. Requirements are not calling for	

	other functions therefore little point in considering this trend in this case.	
Mono-Bi-Poly (Time)	No advantage in adding more elements identified.	Increased part count inconsistent with cost constraint.
Mono-Bi-Poly (Interface)		As above.
Use of Colour	Considerable untapped potential which may match height and location requirements	Possibilities if cost can be maintained.
Transparency	Unlikely to match specified functional needs.	
Design Point	Possibilities in solving hard/soft contradiction	Must use other trend resources.
Degrees of Freedom		Unlikely to match cost constraint as system will become more complicated.
Reducing Complexity	Little scope as there is already only one component.	No problem.
Controllability		Okay provided the feedback comes from one of the other viable trends – e.g. colour, geometry. No need to consider on its own.
Human Involvement	Fully automatic tee is present in driving ranges…	…does not fit cost constraint imposed here.
Design Methodology	Because tee is seen as a disposable item, very little advantage has been taken of more robust design strategies	May fit with constraints provided design time can be maintained within target.

Table 1: Correlating Generic Trend Directions With Specific Constraints

The consequence of this analysis is that we can draw another radar plot; this time featuring only those trend possibilities that fit the defined constraints. For the constraints in this example, the revised plot will resemble the one reproduced in Figure 5.

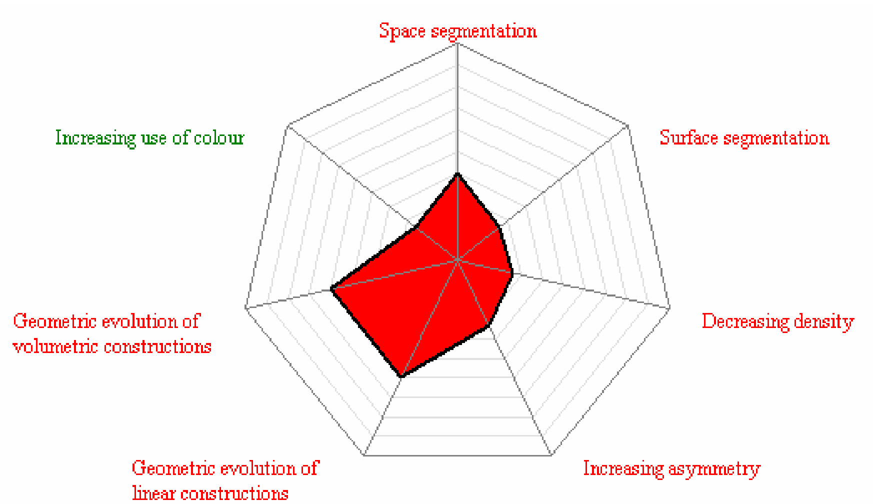

Figure 5: Evolutionary Potential Plot For Golf Tee As Modified By Constraints

This plot now gives us the basis of a ‘voice of the product’ idea generation session in which the ideas generated are likely to be consistent with our stated constraints. Reference 4 presents more details on such ideas for interested readers. Our focus here, however, is more about the mechanics of the innovation process. In order to take the golf-tee story further, it will be necessary to find matches between the ideas generated from the 'voice of the product' and the problems that might emerge through the voice of the customer. Reference 4 again does this specifically for the golf tee. We will reserve our discussion on the matching between 'customer' and 'product' voices to the third section of the paper.

What we have done in this section is explored how the TRIZ trends and Evolution Potential mapping process allows us to hear the voice of the product. We will use exactly the same trends and process steps to map the means of production of the golf tee and examine how the 'voice of the process' will tell us where those manufacture methods are likely to evolve in the future. We have also started to see how constraints allow us to begin the transition from the generic voice domain to the specific. In the next section we will do a similar thing for another segment of the innovation essential elements.

The Voice Of The Transmission (Route To Market)

The voices of the product and process both use the TRIZ technical trends. When we wish to listen to the voices of the route to market and our overall co-ordination of the innovation process, we need to switch to the business versions of the discontinuous evolution trends (Reference 5). Since the manner in which we will utilize the business trends is exactly the same as for the preceding technical trends and the 'voice of the product' analysis, we need not repeat a discussion of the mechanics of the process.

Let us imagine in this case that we are in the pet-food business, and looking to generate ideas as to where the business might evolve in the future. Figure 6 illustrates a hypothetical business Evolution Potential analysis, highlighting the 'Customer Expectation' trend.

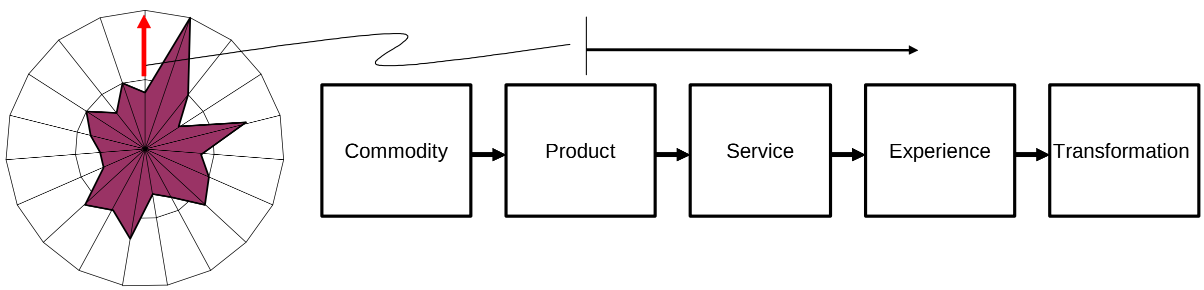

Figure 6: Hypothetical Pet-Food 'Route to Market' Evolution Potential Analysis And 'Customer Expectation' Trend

If we determine that our current pet food is being channeled and sold through primarily supermarket-type retailers as a 'product', then the voice of the Customer Expectation trend should allow us to generate ideas about where this route-to-market business model might evolve in the future. So, for example, looking at the next 'Service' stage of the trend we might generate ideas like:

- 'through-life' care
- portion control
- websites/Q&A
- user forums
- links to insurance

Or, going a step further to the 'Experience' stage:

- remembering the pet's birthday
- diet tips – shifting diet with age

- link to existing associations – WI, book-groups
- home delivery (compare with diaper services)
- health checks/link to vets/'free medical'
- customize food to individual pets
- complementary products – bowls, blankets, etc
- extended care (vacation kennels/catteries)
- factsheets in supermarkets
- reassure the consumer about where the food is coming from

The point here is not so much these pet-food ideas than the fact that we are using the trend as a means of generating ideas for future directions. As with the 'voice of the product' analysis in the preceding section, we will only know which – if any – of these ideas is valid and 'best' when we start matching the various different voices together and transitioning from the generic to the specific. This is what we will attempt in the third and final section of the paper.

Just before heading there, however, it is worth making the point that there are two voices we can capture using the discontinuous business trends. As discussed in Reference 5, it is usual to examine a business two times using the trends; one time focusing on the internal structures of the organization and one time focusing on external relationships. The internally focus Evolution Potential analysis will give us our 'voice of the control', while the externally focused analysis will give us the 'voice of the transmission'.

Converging Voices

Our focus in this final section will be on the Dyson dual-cyclone vacuum cleaner (Reference 6). Neither TRIZ nor this process was used in the creation of this highly successful product, and as such we are merely using it as a means of illustrating the mechanics of the process. This is not intended to be an attempt at 'reverse engineering' what has been done in the past, but rather to highlight how we might use the process ourselves in the future. In so doing, we might be able, however, to identify some of the problems and opportunities that the Dyson cleaner has not yet identified or exploited. We will be able, in other words, to use the process to allow the reader to predict where the Dyson cleaner might evolve next.

Referring back to Figure 1, it will ultimately be necessary to examine all five of the voices, in both generic and specific situations. Given that it doesn't matter which order we do this in, we will randomly chose to start here with the 'voice of the customer'. There are various ways of capturing this, often most difficult, of voices. We could use a formal methodology like QFD, or the Omega-Life-View Tool (Reference 4), or a trend conflict analysis (Reference 1). Whichever route we travel, our end point will be the sort of problem list illustrated in Figure 7 below:

Lack of manoeuvrability
Doesn't clean up to the edge
Hassle of connecting tools
Doesn't pick up everything
Heavy/can't lift up stairs
Changing the bag requires intricate manipulation
Handle chaffs hand
Motor overheats

Brush wears out
Vibration
Expensive to buy
Takes up space in cupboard
Loss of suction
Heavy; can't lift into cupboard
Excessive noise
Lack of feedback

Figure 7: Generic Vacuum-Cleaner 'Voice Of The Customer' Problem List

Shifting to the 'voice of the product' now, we can generate a list of evolution directions based on an Evolution Potential analysis of a conventional vacuum cleaner. Before we do this, however, there is another aspect of this voice that we may wish to consider. This is the part where we utilize a functionally-classified knowledge database. A vacuum cleaner is delivering the main useful function 'separate solid (from gas)'. The function 'move gas' is also closely related to the job to be done by the cleaner. The voice of the function database will thus provide us with a host of ways of delivering these two functions. A function database would very specifically have given us the idea of a dual-cyclone for a vacuum cleaner, since this is a very well established separation method in several other industries. We might chose to conduct an Evolution Potential analysis of this cyclone, and any other separation method that seems interesting. The net result when we have done these analyses will be a list of 'voice of the product' evolution directions as illustrated in Figure 8:

Segmented hose	Segmented bag
Ribbed surfaces	Ribbed surfaces
Nano-turf	Fibrous bag
Lotus Effect coating	Asymmetrical walls
Ball joints	Lotus Effect coating
Bag-less	Damp-proof coating
3-D airflow	Bag-less
Electrostatic	Electrostatic charged bag
Pulsed flow	Active elements
Active filters	Shape-memory
Shape-memory	Self-cleaning
Variable speed	Transparent bag
Replaceable casings	Replace bag feedback
Transparent casing	Cyclone
Replace bag feedback	:
Robotic	etc

Figure 8: Generic Vacuum-Cleaner 'Voice Of The Product' Solution List

As is often the case, when it comes to looking at all five of the voices, there is high risk in trying to innovate along multiple directions (Reference 1). As it happens, looking at Dyson from the outsiders perspective, we see little innovation relating to the 'voice of the process' (i.e. at least when they first launched into production, there were no novel manufacturing process innovations) or the voice of the overall coordination. We do see some innovation in relation to the voice of the route to market, in that Dyson saw that conventional vacuum cleaners were traditionally marketed to women. What Dyson saw without use of the TRIZ trends, the voice of the discontinuous business trends would anyway have suggested to us; that marketing to both sexes will be a likely future evolution direction.

Figure 9 attempts to bring all of these different voices together. At this stage we are very much operating in the 'generic' domain.

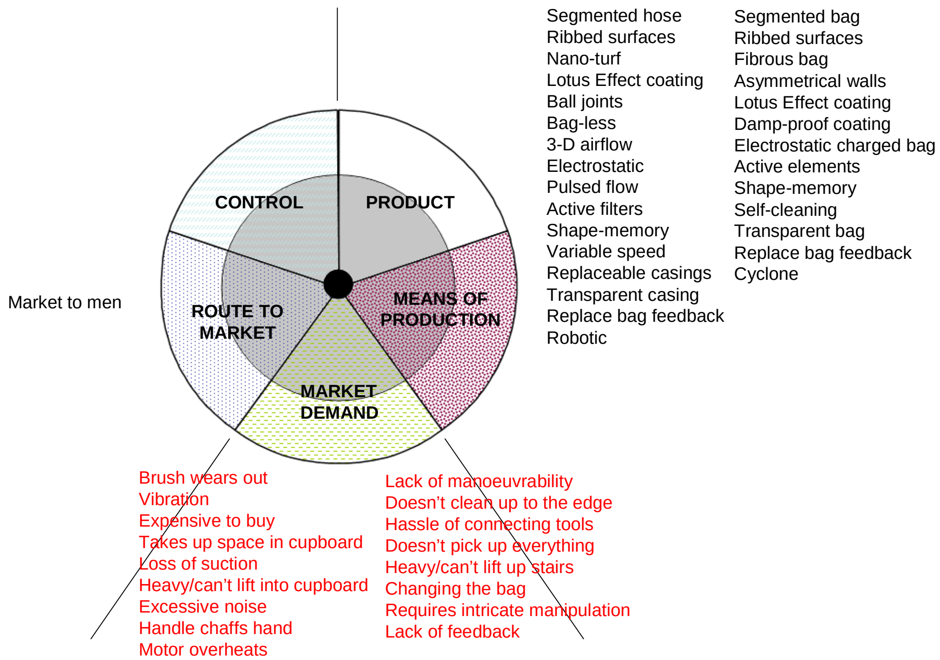

Figure 9: Putting The Voices Together - Generic

As in many new business situations, the main constraint governing the transition from generic ideas about what to do into which ones can actually be used, involved money and time – the target unit cost of the cleaner, and the amount of R&D funding available. Part of Dyson's great skill was in working out which customer problems were more important than others. As far as our process is concerned in this example, with the given resources and constraints, the generic-to-specific transition job involves using the available cost and time eliminate those 'voice of the product' ideas that are outside our scope. We show how this might have worked in the vacuum cleaner case in Figure 10.

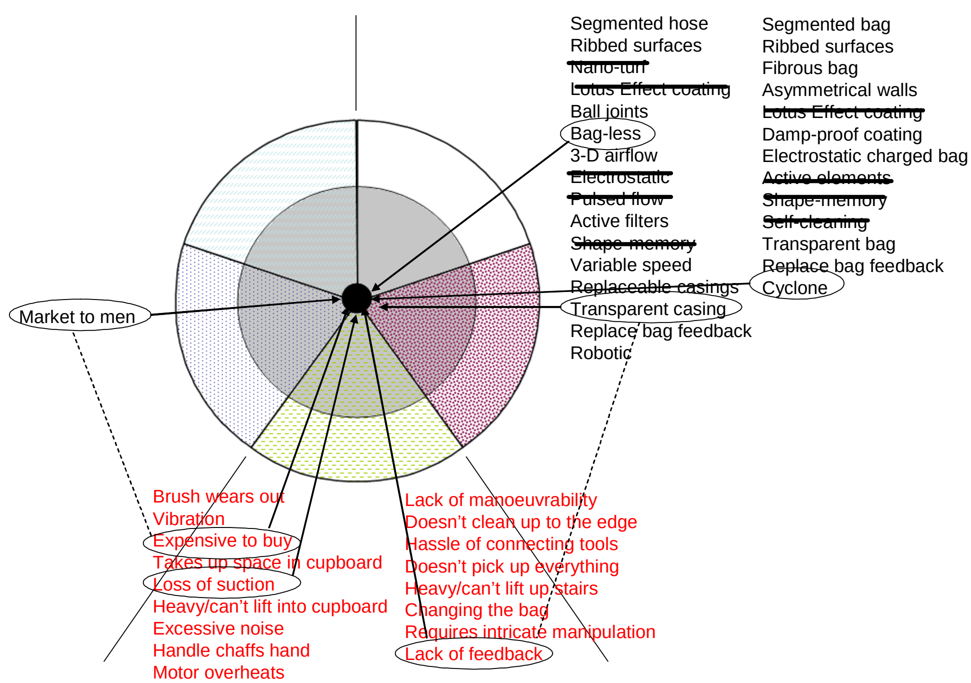

Figure 10: Putting The Voices Together – Generic-To-Specific Transition

Also shown in the Figure is how we set about mapping and connecting the various voices together. What is most important here is that we match the problems identified by the 'voice of the customer' to the solutions suggested by the other four voices. So, to take a pair of simple examples, Dyson observed that conventional machines did not give the user feedback about how much dirt they were picking up, or when the bag was full. This is the 'problem'. The transparent casing suggested by the voice of the product (from the 'Increasing Transparency' trend – Reference 3) then became the 'solution'. Likewise, the main innovation of the Dyson cleaner, we can see how the 'loss of suction' problem was matched to the 'cyclone' solution coming from the voice of the product. The voice of the product, in other words, was trying to tell us that a transparent case and a cyclone were good ideas, but it wasn't until we were able to match it to a voice of the customer problem that we knew why they represented a specific 'solution'.

Most importantly, what Figure 10 is supposed to communicate is the process of bringing together the various different voices, resources and constraints in order to derive 'the answer' to a given innovation situation. This process is still a fuzzy one in many ways, although it is one that is systematically reproducible in any real situation. At the very worst, the innovator will have to examine every combination of problem and solution until a match can be found. Our experience using the process, however, tells us that more often than not, certain problem-solution combinations reveal themselves to be 'obvious'. Having made such connections, of course, it is frequently the case that we will not just pick one solution from our 'voice' lists, but rather that we will seek to combine several – as Dyson did. This is one of the main reasons for forcing ourselves to generate as many generic solutions as we can by listening to the discontinuous trend voices. We can see in this vacuum cleaner situation that our 'voice of the product' analysis has generated a large cluster of good solution directions that have not as yet been adopted by Dyson or his competitors. Should we choose to start matching some of these solutions to other voice of the customer-identified problems, we may find ourselves with a useful next-generation innovation.

Putting It All Together

In this paper we propose that any sustainably successful innovation demands consideration of five essential elements. These five elements relate to the TRIZ Law of System Completeness, namely – Tool, Engine, Transmission, Interface and Control.

Each of these five elements has a 'voice' trying to 'tell us' where that part of the system wants to evolve in the future. Engine and tool (process and product respectively) voices are heard through the technical TRIZ trends. Transmission and Control voices are heard through the discontinuous business trends. Interface voices then come from listening to the customer.

Successful innovation happens when we successfully match solutions generated by the Tool, Engine, Transmission and Control voices to the problems uncovered by the Interface voice.

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