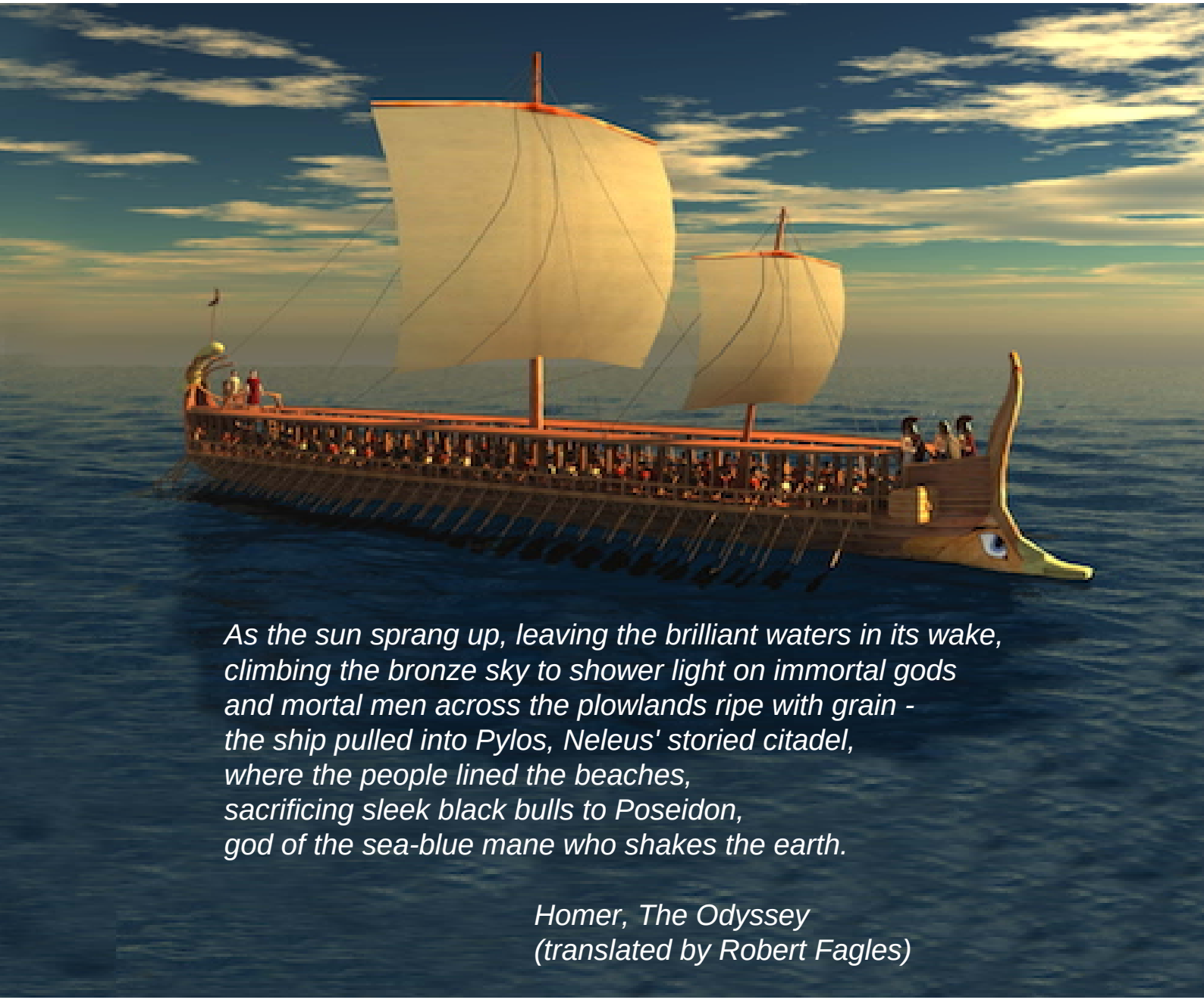
Story in Engineering

What story tells us about human nature
that will make us better engineers

LES CHAMBERS



Good engineers argue the facts

great engineers tell stories

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Les Chambers is an electrical engineer specialising in life-critical control systems. He was among the first engineers to directly control chemical reactions with software. In other projects he has designed smoke extraction systems for underground railway networks and worked in validation of strike jet missile systems. Working as a systems engineering trainer, safety authority and quality manager he developed an interest in story theory as a means of persuading developers and managers to follow the strict disciplines required to deliver safe, high-quality systems. Currently, through his work in developing cloud-based applications for engineering specification, his quest is to fuse web app and story technology to move past the concept of "digital assistant" to that of human empathetic "digital companion".

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Prologue: A *True Story*

Fade in:

INTERNAL: CONFERENCE ROOM

The road tunnel safety system commissioning team is seated, chatting.
Project manager Jack enters and towers over them. His body language indicates that he is bent on oratory and not craving their conversation.
Jack points at the commissioning manager.

Jack: Here is the opening date. Put it in your schedule and work back from there.

Jack moves towards the door.

Les: We're not gonna meet that date Jack. We're not magicians. This is a safety critical system with stringent compliance requirements. We are thirty test cases short of completion. So far I've logged over two hundred major defects. Just the rework and retesting of that lot will take weeks.

Jack makes a waving motion with his hand is if to fend off a fly.
He addresses the issue of the functional safety program.

Jack: Les, I thought we weren't going to do this.

Les stares blankly at Jack.
Jack exits the conference room.

I was struck dumb, incapable of rational thought - just bloody mad. For with that wave Jack had trivialised the entire discipline of functional safety engineering, he had devalued my profession, my career, my vocation, he had disrespected all the people whose hard work was aimed at keeping the public safe - not only on this project but on all projects that have ever been and will come. I had no words, no vocabulary to counter his pronouncement. I watched silent as he left the room. Later he asked for my defect reports. Working through them he downgraded the defect severity levels thus proving that, "Problems? There are no problems."

My inciting incident. This was my "inciting incident" the point in my engineering career where things were thrown out of balance, the point where I realised that my engineering education was not equal to this situation so violently served up by the real world. In my thirty-fourth year of engineering I realised I'd been living a cloistered life focused on quantifiable mathematical fact uninformed by the wisdom of centuries of philosophical thought. This had left me without the insights and the communication skills required to disarm this archetypal hazard: *uninformed-manager-parading-as-expert-crashes-safety-critical-development-schedule*. I just needed to be a better persuader.

> *This was my call to adventure and my quest was to right this imbalance in my engineering education by opening a window into the human condition so conveniently provided by story theory.*

Recognising archetypes. Taking the story perspective, Jack's behaviour is archetypal, a repeating behavioural pattern encountered in engineering projects. From my point of view, he is become an antagonist (a shadow), someone or something that stands in the way of my object of desire. I desire

a safe system delivered through proper engineering process. His desire is to deliver of a piece of freeway infrastructure on a promised date to a given budget. He is responsible for large chunks of other people's money. He has one focus: return on investment. Characters expressing this archetype get violent with obstructions: any thing or any one trailing the scent of cost blow out or deadline overrun. From his point of view I am an antagonist threatening his object of desire and I must be destroyed.

Telling the story. Let's freeze the action right here and introduce a Hollywood script writer. Without doubt he would make me the hero and Jack the antagonist. I fit the mould. Look at me: the archetypal functional safety engineer, with little influence, a bad salesmen, intelligent but full of self doubt (the constant state of the creative), peddling nothing. "Spend this million dollars," I say. "And what do we get for that," they ask. "Trust me," I say. "Nothing bad will befall you." Not a compelling argument! And I'm up against an incredibly powerful antagonist who has everything that I lack: charisma, power, an almost godlike figure at the helm of a half billion dollar project. Jack has the power of (commercial) life and death over all contractors. And this isn't a conference room, it's the innermost cave, and we're at the story's crisis where the hero confronts the antagonist and is almost killed.

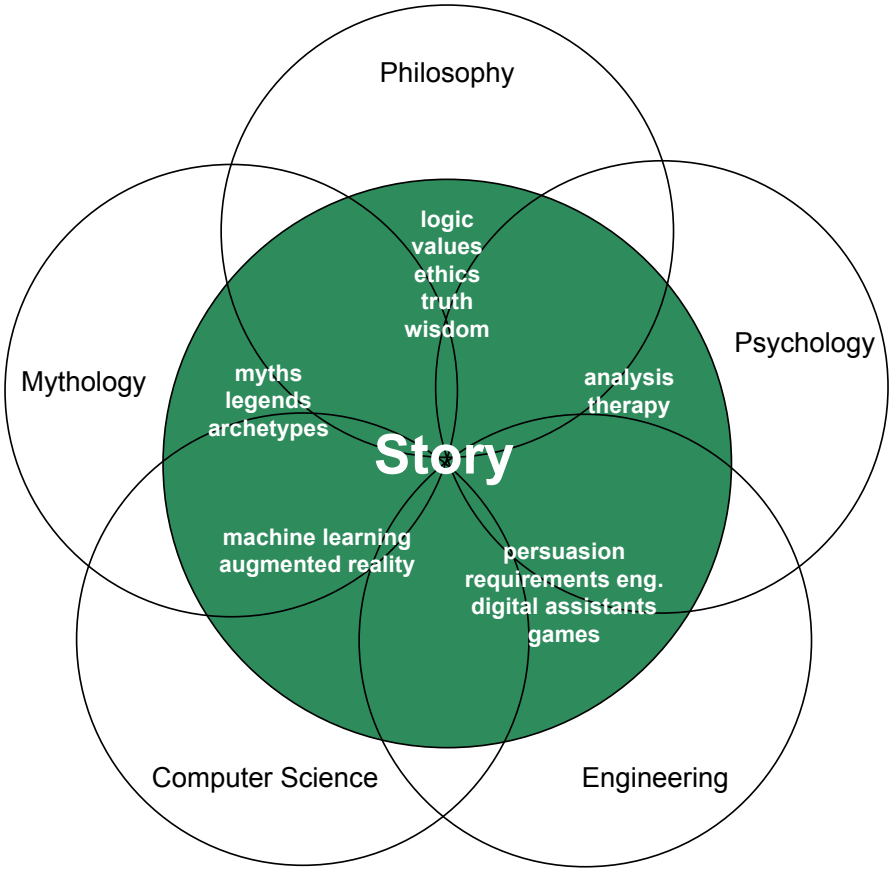
The storyteller's strategy. Now let's flashback to the beginning. What if I were a skilled storyteller? Would I have recognised the Jack archetype and this inevitable crisis? Would story theory have given me more insight into this plot point and informed my strategies for disarming Jack's pathological behaviour? Could I have leveraged the wisdom of human nature captured over thousands of years and encapsulated in myths and legends; wisdom now hidden in plain sight in all our storytelling media.

You had to be there. Engineers aren't salesmen. We know what we are doing but struggle to explain ourselves to the unwashed; the general public. They haven't had the benefit of our education and experience, they don't know and frankly, they don't care. But cut 'em some slack, they've never seen a dead body in a work place, they've never had a desk next to a blast wall with a chemical reactor on the other side with potentially explosive reaction kinetics controlled by software that THEY wrote. They've never woken up at 2am in the morning in a cold sweat over an attack vector they hadn't thought of. They've never had their identities stolen. They've never made a mistake that could have, or did, kill someone.

The supernatural world. My point is that safety critical systems engineering is a supernatural world full of complexities, tests and trials, heroes and villains, conflict and catharsis all bound up in an environment of ramping jeopardy. Engineers inhabit that world and grow stronger from their experiences, but when they return to the normal world they can't explain their ordeals to civilians. You had to be there. Without those experiences no amount of logical argument, promising or threatening will move the civilian to receive, understand, remember, believe and most important of all - act. But what if we took a different tack? What if we studied the technology of human nature, engaged with human emotions and learnt how to give people synthetic experiences that closely approximated our ordeals in the supernatural world? Would we shake loose more dollars for proper safety engineering? Would we design better systems? If I knew of concepts such as aesthetic emotion could I have persuaded Jack to delay the tunnel opening?

Fusing technology and art. There is another imperative. With the ever growing availability of cheap computing power and massive datasets, we are witnessing a rapid fusion of technology with the liberal arts. Augmented reality (www.magicleap.com) and the need for emotional engagement with digital assistants/companions requires engineers to have an in-depth knowledge of the human condition, specifically the dynamics of emotional engagement. Pokémon Go has recently demonstrated what empathy for an automaton can achieve. Suddenly we've got couch potatoes covering kilometres per day in search of cute virtual creatures.

Figure 1. Fusing Technology and the Liberal Arts



Companies developing these apps characterise themselves as engineering storytellers. They need people who can weave a narrative with software. For example, Magic Leap's banner reads: "...We are storytellers, rocket scientists, wizards, gurus ... were here to make magic real for you ..." Where will they find these people? The engineering education does not do "emotion", engineers don't write stories. Consequently we are missing the core insights required for robo-social app development - empathy. We don't practice it and we don't know how to kindle it in others. And our teachers and mentors were no better; educated in monasteries isolated from the socialising effect of the company of women, **we were raised by wolves**.

> *Enter story theory, the human user manual evolved over millennia by storytellers. The ultimate application note on human nature and the role it plays through the arc of our individual stories.*

By studying story fundamentals engineers can connect with the human emotional need to identify with the feelings of others. So I say to you:

> *The classical engineering education that worships scientific fact and the truth beyond reason that mathematics provides is still necessary but it is no longer sufficient. We need the studies in empathy that story provides.*

Story for engineers. In this tutorial I make the case that understanding the structures, the dynamics and the energy that makes stories effective can make us better engineers. Overlaying story patterns on your day-to-day activities can help you identify where you've been failing in human communication, persuasion, requirements capture and so on.

> *In the best traditions of improving clarity through model based analysis, story theory provides a systematic process for characterising a situation or stating a problem, thus easing the path to a solution.*

Story patterns help engineers:

1. Increase their powers of persuasion in high-stakes situations
2. Improve their ability to communicate in all formats (presentations and written reports)
3. Analyse threat situations
4. Recognise and disarm the pathological human behaviours before they become a threat to safety and security
5. Better manage their creative process
6. Discover system and software requirements that would otherwise have been missed
7. Design better human interfaces.

All by learning how to tell a rattling good tale.

So, if you're still reading you are embarked. You have crossed the threshold into the supernatural world of Story. The stakes are high, I'm sorry but there is no turning back!

Les Chambers

How to Read these Notes

Each chapter presents an aspect of story theory. Paragraphs tagged with "Engineering function" identify how this theory can inform and improve some aspect of engineering practice. I attempt to separate the chemistry from the alchemy, the astronomy from the astrology and distil insight from the drama; insights that cannot be gained from an engineering education. I have also included more detail on applying story theory to engineering in section *8. Story Application Notes*.

1. Story Persuades

A story:

> Every day, a blind man sat on the pavement in Central Park. He had his hat in front of him, begging for money. A sign read:
>
> *I am blind*
>
> Passers-by ignored him. One day, an advertising man saw his plight. He altered the wording on his sign and the cash started pouring into the hat. What had he done?
>
> He had changed the sign to read:
>
> ***It is spring and** I am blind*.
>
> — Maurice and Charles Saatchi, *Brutal Simplicity of Thought*.

1.1. How?

The Saatchi story is an example of how powerfully persuasive a message can be if it embeds essential facts in the flow of a story. The mere fact of being blind is of little interest but when you add a **protagonist** (the blind man) with a **desire** (to see the flowers of spring) and a **quest** (maybe he needs an operation) with **empathy** ("There but for the grace of God go I.") and **conflict** with an antagonist with seemingly insurmountable odds (blindness) - all implicit in the four words added to the original message - you create a story capable of penetrating the hardest of hearts.

We are wired for Story. Storytellers have known for more than two millennia that human beings are cognitively wired to accept information in the story form. Our brains are naturally driven to make sense of what we see by organising disparate facts into a narrative. A master storyteller can persuade an audience without being "caught at it". But not with just any story. Particular story patterns attract attention, invite engagement, incite belief and even cultivate trust because they tell the truth. They are a metaphor for real life.

The genesis of story theory. The first analysis of story structure is attributed to Aristotle's Poetics (circa 335 BCE). In modern literature anthropologist Joseph Campbell's book *The Hero With A Thousand Faces* is the most influential modern text on the subject. Campbell made writers aware of the ageless patterns in compelling stories. Inevitably filmmakers such as George Lucas (*Star Wars*) recognized the commercial possibilities of Campbell's ideas. Campbell's influence can also be seen in the films of Steven Spielberg, John Borman, Francis Ford Coppola and many others. Christopher Vogler, a script analyst at Disney Studios, made Campbell's ideas more accessible with a seven page memo that ultimately became his book *The Writer's Journey*; now in the bookshelves of all Hollywood scriptwriters. Script writer and story consultant Bob McKee is renowned for his practical insights into successful story design. His books: *Story: Substance, Structure, Style, and the Principles of Screenwriting* and *Dialogue: The Art of Verbal Action for the Page, Stage, and Screen* are also recommended reading. A sampling of McKee's seminar alumni have created *Breaking Bad*, *Game of Thrones*, *Downton Abbey*, *House of Cards*, *Frozen* and *The Wolf of Wall Street*.

Connection to psychology. In his study of personality, Swiss psychologist Carl Jung suggested that humanity is one culture, our stories, fairytales and myths are dreams springing from our collective unconscious. "Myths," he said, "are first and foremost psychic phenomena that reveal the nature of the soul.[1]" According to Jung the collective unconscious holds imprints of our past, archetypes of human experience collected on an evolutionary timescale. Archetypes are triggered by our experiences; they guide and inform our behaviour. Campbell's ideas were therefore distinctly Jungian. He asserted that stories have one structure - the mono myth, and to teach, persuade or create with stories we must apply this pattern. These ideas were practiced to great effect by George Lucas in his *Star Wars* movies. The Jedi Knights had a collective unconscious that they invoked to perform supernatural deeds.

> *... my ally is the Force, and a powerful ally it is. Life creates it, makes it grow. Its energy surrounds us and binds us. Luminous beings are we, not this crude matter. You must feel the Force around you; here, between you, me, the tree, the rock, everywhere, yes.*
>
> — Master Yoda, *Star Wars: The Empire Strikes Back*

The psychological function of story is therefore to access the "luminous being" in your audience. To talk directly to their subconscious when many decisions are made.

A call to adventure. This tutorial explores these patterns, together with various techniques you can apply to producing better outcomes from many engineering tasks, from making a case to defending a position to building systems that better integrate with human nature.

1.2. Why Engineers Need Story

> *To exert influence we need to understand human nature.*
> *To build better systems we need to predict the human emotional response.*

Failed persuaders. At the heart of most disasters lie engineers who saw it coming but did not have the persuasive skills to influence preventive action. Bhopal, the world's worst industrial accident, was the subject of several failed management audits before a methyl isocyanate gas release killed more than 2000 people in one night. In the following years the health of more than 500,000 people was adversely affected. In July 1985 American mechanical engineer Roger Boisjoly advised his management of faults in the design of the space shuttle's solid rocket boosters. Six months later, the space shuttle Challenger blew up on launch, killing seven astronauts.

Failure of the engineering education. At the heart of all these failures was a toxic systemic defect: the engineer's inability to communicate and persuade effectively in person and on paper. And the reason this defect is so all pervasive in engineering communities is a lack of instruction in the nature of the human condition. A study of story theory provides a highly accessible window into this essential subject.

High-stakes persuasion. More and more we engineers are called upon to persuade non-technical people on the efficacy of technical approaches that usually cost money and sometimes don't provide any obvious short-term benefit. Examples are, security management and safety management. Failing to persuade can have long-term effects. Children are still being born with birth defects thirty years

[1] C.G. Jung, *The Archetypes and The Collective Unconscious, Volume 9, Part 1*

after the Bhopal incident. Uranium 238 will still be radiating from the Chernobyl nuclear power plant in four billion years.

Influencing with story. Stories are capable of reaching deep into our belief systems and profoundly influencing our behaviour.

> *Be aware that while you're talking your audience is assembling your stated facts into their own personal story.*

If you want to persuade you need to control that narrative by presenting your argument in a digestible format. You achieve this with the story patterns that humans naturally absorb. So, in preparing your next high-stakes presentation where the outcome of a "no" answer could be death or property destruction, what should you consider?

2. A Story Pattern in Brief

Anthropologist, writer and lecturer Joseph Campbell argued that in all the traditional stories of ancient cultures there could be found one underlying identical pattern. He called it the *monomyth* and it went like this:

> *A hero ventures forth from the world of common day into a region of supernatural wonder: fabulous forces are then encountered and a decisive victory is won: the hero comes back from this mysterious adventure with the power to bestow boons on his fellow man*.
>
> — Joseph Campbell

Disney script analyst Christopher Vogler summarised Campbell's epic study of mythology with a twelve-stage story map that became law in Hollywood.

1	We meet a hero in an ordinary world ...
2	who receives a call to adventure ...
3	that the hero initially refuses, but ...
4	with the encouragement of a mentor and due to some inciting incident the hero develops a desire for some elixir and ...
5	crosses a threshold into a supernatural world where ...
6	the hero encounters various tests and trials meeting allies and enemies. The tension slowly builds until, on the trail of the elixir ...
7	the hero approaches an antagonist hold up in an innermost cave ...
8	where the hero endures a supreme ordeal.
9	Taking possession of the elixir ...
10	the hero sets out on the road back to the ordinary world pursued by the antagonist, enduring a final ordeal and spiritual death ...
11	but is resurrected and transformed by the experience.
12	The hero returns to the normal world with the elixir, a boon that heals a malaise of the normal world.

The following pages explore the relevance of this pattern to engineering.

3. Application: *Persuading with Story*

To persuade an audience you first need to get their attention. What motivates people to read what you've written or listen to what you're saying? From minute to minute we are assaulted by attempts at communication. Most are filtered out.

> *From the moment I picked up your book until I laid it down, I was convulsed with laughter.*
> *Some day I intend reading it.*
>
> – Groucho Marx

When you attempt to communicate you are actually saying, "Please listen to me, please understand, please believe in what I'm saying," and maybe even, "please do this ..." Masters of this art transmit their ideas using patterns that we are programmed to receive - story patterns. At the core of all stories is a hero with a burning desire who goes on a quest and, as the story unfolds, the audience is drawn in at a deep emotional level; through their imagination they inhabit your story. With this act of deep focus begins the process of seeing, believing and attitude transformation.

> *Masters of rhetoric know we become that on which we focus.*
> *We inhabit our focus and it shapes us.*

3.1. Engagement: *Inhabiting the Story*

Empathy for the hero. Audiences engage when they become emotionally involved with your protagonist. The emotional triggers are empathy and authenticity. Your audience must know what your hero wants and want her to have it. Empathy can be particularly strong if what the hero wants mirrors your audience's vicarious desires (finding the gold, falling in love, commanding the space vehicle out where none other has gone before ...). The beginning of empathy is conflict where the hero, pursuing her object of desire, is placed in jeopardy and forced to make difficult decisions. "My God, what would I do in that situation!"

Choosing the hero. Your choice of hero is critical. Ask yourself, "Who or what must be the subject of my audience's empathy."If you're delivering a product sales pitch to an end user the hero must be the customer. They could care less about who developed the product, the key issue is, "What's in it for me". Ergo your story must focus on their tests and trials, their crises and climaxes and their ordeals with antagonists. It must present your product as the elixir that will heal their wounded land.

If you're pitching for venture capital (seeking empathy from a banker??) the hero must be you. "We are this brave and brilliant band of tech warriors, surviving on pizza and Jolt Cola, pulling all-nighters, taming hitherto unknown technologies to save the world, and we've almost got it together, we can see the finish line, the deployment to revenue operations, but we've got this final hurdle, we're running out of money. Will our world beating product ever further the cause of humanity? Help us!"

Empathy case study. I once had a long and emotionally deep conversation with the manager of a railway signalling company. It started out as an off-the-cuff chat. He'd come under unrealistic schedule pressure from his client and was looking for ways of managing the situation. As a sidebar I told him how Wendy Darling once asked Peter Pan the way to Neverland. Peter answered, "Follow the second star on the right and on till dawn." Tell them that I joked. I'd struck a chord, he sighed and stared out the window, "I wish I could do that," he said. J. M. Barrie's story of *Peter Pan: The Boy Who Wouldn't Grow Up* had opened a door to his deepest feelings. We talked for two hours

working through some strategies. For people to work together effectively they must first engage emotionally and be honest with each other. Doctor Spock of *Star Trek* called this mind melding.

Authentic speakers tell stories that are true to life. Authenticity encourages belief, or at least encourages us to suspend our disbelief. "Yes," your audience thinks, "Life is like that".

Witness Winston Churchill's famous sentence in praise of the fighter pilots of the Battle of Britain:

> *Never in the field of human conflict*
> *has so much been owed*
> *by so many*
> *to so few.*

This sentence is transparently heartfelt. Churchill composed it in transit to London from RAF Uxbridge (August 1940). He was in a highly emotional state having just spent a morning observing RAF fighter aircraft operations against incoming German bombers in an underground operations bunker. His words are made even more powerful by his use of the tricolon - a rhetorical pattern employing three parallel phrases. We find something complete and satisfying in the group of three. You can get even more emotional impact by carefully choosing the order and adding a twist to the last phrase - the twist is often a surprise. US President Franklin D Roosevelt was another tricolon exponent: "Be sincere, be brief, be seated".

Inauthentic speakers use cliché: *going forward, paradigm shift, low hanging fruit, think outside the box* ... and the like. There is no surprise in a cliché, they are a filler that people ignore - filter out. They have no dramatic function, no emotional impact, therefore no motivation or communication value because they don't ring true. Consider this technocratic sludge:

> *Achieve a user centric portal framework.*
>
> – Second Australian Annual Conference on Government Portals

Be advised that if you say or write the first thing that comes into your head it's probably a cliché. When Churchill's Rolls-Royce left RAF Uxbridge he instructed his staff not to speak. He reflected for some minutes before uttering that sentence. It may have the longevity of some of Shakespeare's best lines because he has engaged us all at a deep emotional level with his poetic truth.

Inauthentic case study. I once attended a presentation by the managing director of a large defence company. There were more than 200 engineers in the room. The MD's objective was to motivate the troops to improve their project management discipline. The result was the exact opposite. The boss opened his mouth and with his first sentence demotivated everyone in the room. "I came here to enthuse about project management," he said. His voice and body language made it clear that this was a superficial going-through-the-motions kind of talk. There was no hero, no sense of strong desire. What was the quest? Where was the conflict with the antagonist? With none of the classic story ingredients his talk lacked authenticity and his attitude transferred to his audience, who switched off immediately.

> *Authenticity and empathy feed off each other when authenticity departs,*
> *empathy dissolves, your audience ceases to feel and you lose them.*

3.6. Understanding: *Informing with Metaphor*

Use strong metaphors to explain ideas and enlist enthusiasm. American poet Robert Frost defined a metaphor as:

> *Metaphor: Describing this in terms of that where this is new and that is familiar.*
>
> — Robert Frost

Frost is responsible for some of English literature's most enduring metaphors, for example:

> *The woods are lovely, dark, and deep,*
> *But I have promises to keep,*
> *And miles to go before I sleep,*
> *And miles to go before I sleep.*
>
> – Robert Frost, *Stopping by Woods on a Snowy Evening*

Legend has it that Frost had been up all night writing the long poem *New Hampshire* and had finally finished when he realized morning had come. He went out to view the sunrise and suddenly got the idea for *Stopping by Woods on a Snowy Evening*. He wrote the poem in just a few minutes and later reflected, "It was as if I'd had a hallucination." Opinions vary on what it means, of course the poet is always silent, probably because he doesn't know himself. The Jungian analyst will tell you that the woods are a symbol of the mother archetype which manifests in our conscious behaviour as a longing for redemption, devotion or feelings of awe - the feelings that drive people of strong religious faith. The woods are therefore a metaphor for the aspirational self, the good in all of us, the strong desire to engage in everything that feeds the soul. But the horseman has responsibilities in the normal world. It will have to wait for now. This is a repeating theme. Witness the prayers of ancient intellectual Augustine (354-431): “Lord, make me chaste (sexually pure) – but not yet!”

Open metaphors. It's a fair question, "What's the point of this metaphor if it is not clear what it means?" Well, firstly it is useful because it engages the subconscious and will probably be remembered for centuries, as have many of Shakespeare's lines ("Things bad begun make strong themselves by ill" - Macbeth). Secondly a notion so strongly linked to subconscious desires sparks debate at a passionate emotional level which is useful in creative environments where we start with open questions and look for many answers ("what if's"). This is the process we call "divergent thinking". And we humans are at our most creative when passionate about something.

Engineering function: arguing a case with metaphor. Most of the fifty-five contractors involved with the American Obamacare health care system knew it would fail when put into production, wasting millions of dollars, not to mention the valuable time of fourteen million Americans[3]. If a systems integration test fails it's logical to assume the system as a whole will fail when deployed, right? Yet, under senior management/political instruction, they deployed it anyway! This oft repeated pathological behaviour can be classified as: "Lord, make me chaste – but not yet!" where you know an action is wrong but you do it anyway. Would that an insightful developer had stood before a political master and pointed out that, apart from ignoring commonsense, the project was about to violate 2000-year-old wisdom. It may have given them pause.

[3] Refer www.chambers.com.au/public_resources/case_study/obamacare/saving-obamacare-case-study.pdf

Ultimately, as engineers, we need to converge on solutions but that is step 2. Step 1: divergent thinking with open metaphors, Step two: convergent thinking with closed metaphors.

Closed metaphors are explicit, unambiguous and convey truths that are immediately intuitively obvious. The toilet icon is a good example.
Another example: a technologist recently characterised a denial of service attack as someone parking a truck across your driveway.
Closed metaphors can be used to convey a set of complex ideas with a single phrase.

Consider using metaphors to classify:

1. Attitudes of mind (refer section *8.4. The Serial Killer Fallacy: Unsafe Inductive Reasoning*)
2. Situations and behaviours (refer section *8.5. Deus Ex Machina: Unsafe Schedule Crashing*

Strong metaphors. Taking the Jungian view, strong metaphors channel and mould the images/motifs already present in the collective unconscious - redolent with deep emotion - easing the path from the unconscious to the conscious mind. In expressing a metaphor with Jungian symbolism you are therefore speaking directly to your audience's unconscious, inciting emotions. Take for example the river metaphor.

The river metaphor. Rivers loom large in many famous stories. The story unfolds both emotionally and physically through progress up a river in *Heart of Darkness* (Joseph Conrad), the inspiration for Francis Ford Coppola's movie *Apocalypse Now,* depicting the Vietnam War. The river, as symbol, embodies the flow of life: as Jungian therapy says, the goal-directedness of the psyche, our powerful instinct to move forward and progress our own life's story. In the twenty first century it can be employed to represent the inexorable progress of technology, the insatiable desire for more apps on your mobile phone, the rivers of gold flowing into Google's coffers, the unquenchable desire of a project team to deliver a world beating product and, as a result, the flow of benefits to the cause of humanity. In the movie *Lawrence of Arabia* Auda abu Tayi (Anthony Quinn) expressed a compelling river metaphor in these lines:

> Auda abu Tayi: [to Lawrence] *I carry twenty-three great wounds, all got in battle. Seventy-five men have I killed with my own hands in battle. I scatter, I burn my enemies' tents. I take away their flocks and herds.* ***The Turks pay me a golden treasure, yet I am poor! Because I am a river to my people****!*

Auda abu Tayi could have been modest, offering the throwaway line, "I am a generous leader." But these are not the words of a leader, they would not motivate a tribesman to risk his life in battle. But the idea of generosity wrapped around the emotional charge of the river metaphor certainly would.

Metaphors should surprise and delight your audience, providing sufficient colour to trigger their natural desire to paint pictures in the mind. Just a well chosen word can have an impact even if you have to invent it.

The "explodie" phone. A technology consultant does a cameo on a national radio show. He tells the story:
"I'm strapped into my seat awaiting takeoff. A voice comes over the public address, 'If you have a Samsung Note 7 mobile phone please turn it off. We hear they are EXPLODIE!'. I'm not kidding she actually said that! "

This useful hazard analysis and advice on preventive measures would not have got national prominence had it not been fuelled with the emotional charge of the "EXPLODIE" metaphor - I love it!

3.7.Believing: *Truth in Story*

All belief stems from perceived truth. In order for them to believe, your audience must exit your presentation thinking, "Yeah, life's like that." Your story must be an authentic metaphor for life.

> *Storytelling is the creative demonstration of truth. A story is the living proof of an idea, the conversion of idea to action.*
>
> — Bob McKee, *Story*

The key principle is demonstration. Your story should never explicitly **tell** the truth it must **demonstrate** it through the actions of your protagonist. For example, nowhere in *The Godfather* movie trilogy will you find the words, "... unchecked ambition will lead to your destruction". What you see in the climax of the trilogy is demonstration: Michael Corleone falling off a chair into the dust of a barren courtyard in a far-off land, alone, a broken man - dead.

Stories that feature conflict, failure, death, destruction and, every now and then, the triumph of the human spirit are perceived as true. Stories with no conflict, are lies.

So when presenting your story don't:

1. Insist that nothing could possibly go wrong
2. Have characters that are never put in jeopardy
3. Have unrealistic happy endings
4. Preach to your audience (show don't tell).

Instead:

1. Be upfront about what could go wrong and the plans you have to deal with the crisis
2. Relate stories of past conflicts and how you triumphed.

3.8. Expressing truth: *Controlling Idea*

All compelling stories say something. Through their telling they become exemplars of some undeniable truth. Storytellers call this the "controlling idea". Business synonyms include "core message", "takeaway" and "theme".

Example:

> *First they came for the Socialists,*
>
> *and I did not speak out –*
>
> *because I was not a socialist.*
>
> *Then they came for the trade unionists,*
>
> *and I did not speak out –*
>
> *because I was not a trade unionist.*
>
> *Then they came for the Jews,*
>
> *and I did not speak out –*
>
> *because I was not a Jew.*
>
> *Then they came for me –*
>
> *and there was no one left to speak for me.*
>
> — Martin Niemoller, 1892 - 1984[4]

The controlling idea: "Silence equals complicity when it allows evil to continue" or "What you walk past you endorse".

Your story must have a single strong message. Multiple messages tend to confuse audiences, probably because you're asking them to believe in too much at once. The message is strong if it resonates with your audience. Strong messages last, some of them for thousands of years. For example, separated by 500 years, Shakespeare's *Macbeth* and Francis Ford Copola's *The Godfather* convey exactly the same message wrapped in the emotional charge of a story: Ambition unchecked by moral constraints leads to tragedy.

Structuring the controlling idea. Bob McKee has a mathematical definition of controlling idea:

> Controlling idea = *f*(story-value-transition, cause)

Where "story value[5]" is a quality of human experience and "cause" is the force that triggers a positive or negative change in that value. For example, both Michael Corleone and Macbeth transform from good to evil with the cause being unchecked ambition.

Engineering function. The controlling idea behind Air B&B: Your home can be converted from expense item to income earner by using an international booking system. For further discussion refer section *4.5. Controlling Idea*

[4] Martin Niemoller was a protestant pastor who's political activism against Hitler gained him internment in concentration camps for the final seven years of Nazi rule.)
[5] Refer definition in section *11. Glossary*

as a flash the operator answered, "Unless there was a shut-off valve in the car park. Nothing!" Hazard analysis needs story. I rest my case.

4.5. Controlling Idea

The controlling idea describes a story's fundamental meaning. It expresses the principle that guides story design. For example, in the Dirty Harry movies justice is restored because the cop is more violent than the criminals. Deconstructing this statement we have a transition between two states of fortune – justice/injustice and a reason for the transition.

Engineering function: Controlling idea in system goals. Projecting this idea onto system development we can express a system's fundamental reason for being as follows:

The <*target customer community*> will transition from <*the current state of deprivation*> to <*the new state of fulfilment*> because the system will <*description of service*>.

The iPod's controlling idea. Can we describe in one sentence the vision that created this billion-dollar industry?

The iPod, and its successor the iPhone, grew out of a primal human desire to have music everywhere at all times. Initially developed by the Sony Walkman, public taste for mobile music was left unsated by the music industry's lack of technical literacy. Here the story values where access to mobile music and lack thereof. Steve Jobs' multi billion dollar controlling idea was:

> *The world will gain access to all music everywhere because I will integrate the flow of music from music companies to an Internet store (iTunes) that allows downloads to a simple (and aesthetically pleasing) listening device via the Internet.*

Jobs pursued his controlling idea relentlessly, befriending musicians such as Bob Dylan, negotiating with music companies and driving his design team to produce a simple and aesthetically pleasing iPod. Sony could have had that business but it lacked the desire and the controlling idea.

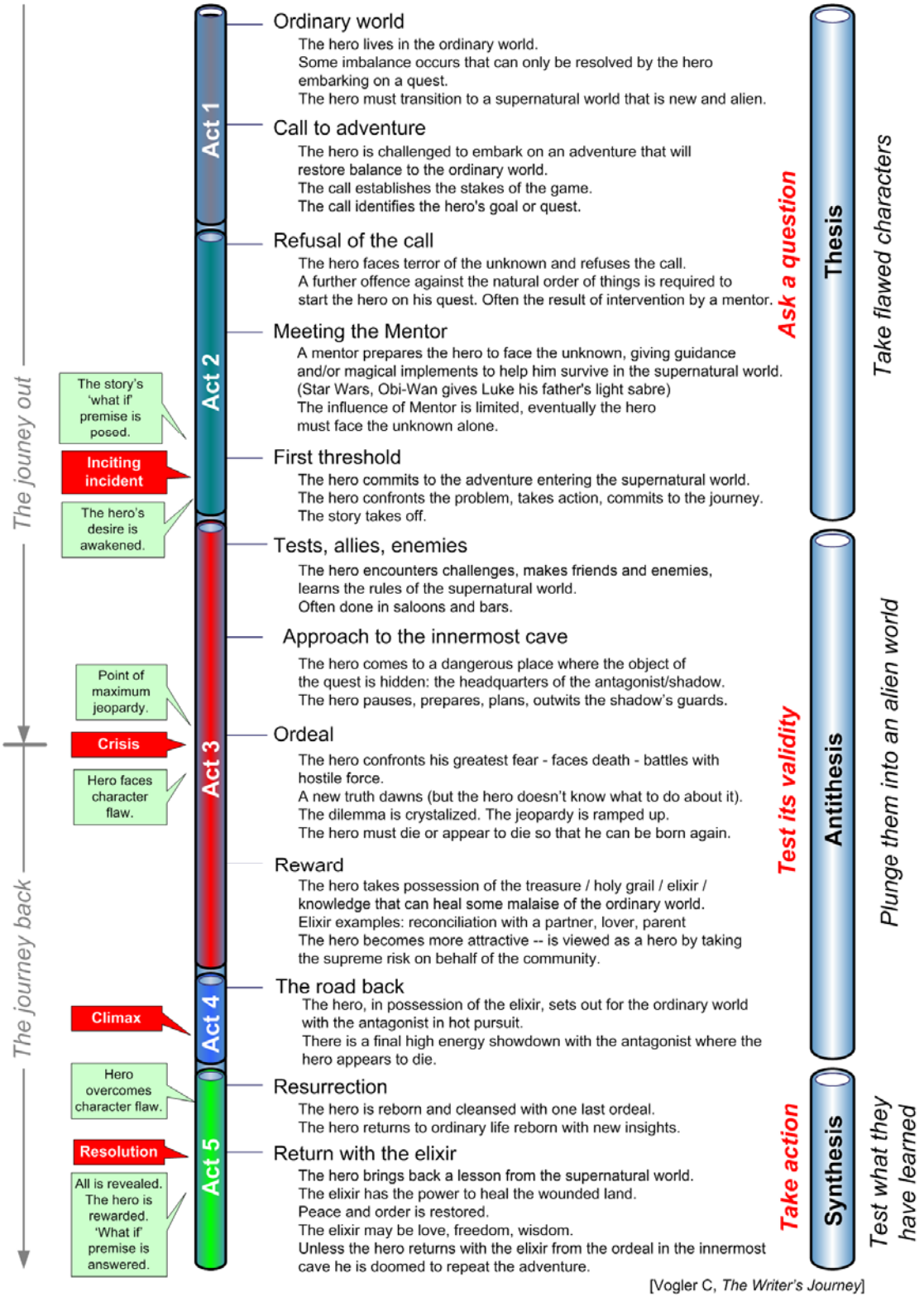
Engineering function: The desire is at the root of all requirements. Desire is a primal human emotion that we often banish from our projects in favour of cold logic – to the detriment of insight. A project's descent into disaster often starts on the first day of requirements capture when the analyst doesn't ask or isn't told what is really important. The premise and controlling idea of the business story are lost in the noise of complex features and technological gadgetry (more at section *8.3. Desire: Writing Requirements*).

As a remedy we can preserve important project objectives through strong controlling ideas wrapped around the emotional charge of the customers primal desire for an elixir.

5.2. Story In Five Acts

We impose order on the massive volume of information that assaults us every day by arranging it in narrative format. We observe, we make a candidate assertion or ask a question (thesis), we test its validity (antithesis) and we take action (synthesis). This is a key driver of the story structure. Here is Christopher Vogler's story pattern in a five act framework.

Figure 2. The Five Act Story Pattern



6. Character Transformation

> *TRUE CHARACTER is revealed in the choices a human being makes under pressure—the greater the pressure, the deeper the revelation, the truer the choice to the character's essential nature.*
>
> — Bob McKee, *Story*

6.1. Character Arc

Character is plot. Stories are driven forward by the actions of their heroes and through these actions the heroes are transformed. All stories are therefore character driven. Their experiences change their attitudes, modes of thinking and habits of mind. In the movie Casablanca, Rick (Humphrey Bogart) starts out as a selfish and cynical lone wolf of a man ("I stick my neck out for no man"). At the climax he performs an unselfish act at great risk to his own safety, helping his ex-girlfriend Ilsa escape to America with another man.

A Few Good Men. In Aaron Sorkin's[15] movie a US Navy defence lawyer, Lt Kaffee (Tom Cruise), sets out to prove that the (fictional) commanding officer of the Guantanamo Bay detention camp, Colonel Jessop (Jack Nicholson) ordered the hazing of a marine private (called "code red") resulting in his death. When we first meet Kaffee he is a smug, superficial, spoilt brat who prefers to plea bargain and has not seen the inside of a courtroom. As the story unfolds it becomes clear that unless he grows up, behaves professionally and faces down Jessop in a courtroom, he will not achieve his object of his desire. In the climactic courtroom scene under extreme pressure - accusing a senior officer of lying can be career destroying in the Marine Corps - he goads Jessop into confessing his crime with an exchange that has gone into the language:

Jessop:	You want answers?
Kaffee:	I think I'm entitled to them!
Jessop:	You want answers?
Kaffee:	I want the truth!
Jessop:	You can't handle the truth!
Jessop:	Son, we live in a world that has walls, and those walls have to be guarded by men with guns ... And my existence, while grotesque and incomprehensible to you, saves lives. ... you want me on that wall, you need me on that wall. ... I have neither the time nor the inclination to explain myself to a man who rises and sleeps under the blanket of the very freedom that I provide, and then questions the manner in which I provide it. ... Either way, I don't give a damn what you think you are entitled to.
Kaffee:	Did you order the Code Red?
Jessop:	I did the job I...
Kaffee:	Did you order the Code Red?
Jessop:	**You're Goddamn right I did!**

Sorkin skilfully builds this compelling story on Kaffee's character transformation, engaging his audience with character transitions from boy to man, immature to mature, indifference to courage, backroom litigator to courtroom warrior.

[15] Aaron Sorkin's script writing credits include: The West Wing, A Few Good Men, The American President, Charlie Wilson's War, The Social Network, Moneyball and Steve Jobs.

Engineering function: personal development. In the technology industries is common for people to actively seek out new experiences that will trigger personal growth. We are a restless bunch of pilgrims. Managers should visualise all their people as heroes on a character arc, a continuous transformation from birth to death.

Character arc is mandatory. The dramatic function of story is to not only reveal the hero's true character but also to chronicle changes in that character for better or for worse in the arc of the story (called character arc). Heroes that don't change are boring because they are not true-to-life. We all change in response to life experiences. I did not enjoy the last Jason Bourne movie. Matt Damon's character at the climax was identical to the Jason Bourne of the inciting incident.

Engineering function: give them experiences. Technologists who are not experiencing change are likely to become bored and depressed and seek alternative employment. All managers should ask themselves, "What 'ordeals' am I providing for my people that will help them grow?"

Distinguishing character from characterisation. Character and characterisation are different concepts. Characterisation is all that can be observed about a person by static examination: age, IQ, sex, speaking style, dress, stated values and attitudes. Characterisation is what can be seen on the surface. Character is what lies beneath. Characterisation is expressed when nothing is at risk. Character is revealed when in jeopardy, under pressure. For example a project manager might extol the virtues of thorough system testing but when a deadline approaches and the prospect of financial loss becomes real, testing might be curtailed.

Engineering function: validate character by crisis. When interviewing job candidates what you observe in the jeopardy-free day-to-day is seldom what you will get in a crisis. So how can we get visibility of true character when no risk is involved and the candidate is willing to say anything we want to hear? Refer application note *8.2. Character Arc: Picking the Dream Team*.

Engineering function: capture requirements by observation not conversation. Requirements engineers should accept what people say at face value but also seek to validate all stated "truths" by observing behaviour, especially under stress. The most useful automation is always created when analysts work in a company's operations, meet the people at the coalface and experiencing first hand the tests and trials that they face. Systems built from pronouncements by subject matter experts in back offices are always at risk of failure.

Mapping character transformation. Character transformation can be mapped using a set of transitions between mental or physical states of human experience (called story values). These transitions can have connotations of negative to positive or positive to negative. In the arc of Kaffee's story there was an overall positive transition from indifferent plea-bargaining lawyer to courageous courtroom lawyer. But along the way there were many negative transitions, from ultra confidence to a feeling of inadequacy. This exchange between Jessop and Kaffee on a visit to Guantanamo Bay expressed the story's inciting incident. Kaffee makes a routine request for some records and Jessop responds by humiliating Kaffee in front of his fellow officers.

Jessop: The Corporal will take you by Personnel on your way back to the flight line and you can have all the transfer orders you want.
Kaffee: [to his colleagues] Let's go.
Jessop: But you have to ask me nicely.

Kaffee: I beg your pardon?
Jessop: You have to ask me nicely. You see, Danny, I can deal with the bullets and the bombs and the blood. I don't want money and I don't want medals. What I do want is for you to stand there in that faggoty white uniform and with your Harvard mouth extend me some fucking courtesy! You gotta ask me nicely.
[a beat, as Kaffee swallows his disbelief]

This incident was the genesis Kaffee's desire for revenge against this arrogant man. A desire that propelled him into the unfamiliar supernatural world of the courtroom. Note that this negative transition of story value does not trigger character change in Kaffee but it does signal that something must be done, motivating Kaffee to embark on a quest that will change him for ever.

Table 1. Tracing character inflection points

The Story Pattern	The Godfather	The Tunnel Project
Inciting incident. A protagonist, suffering some kind of personality flaw determines that **something must be done** to restore balance in the normal world.	Michael wants no part of the family business but loves his father. He returns to the family to look after him. After a second attempt on his father's life he determines that **something must be done.**	The consultant is hired to oversee the functional safety management program to make sure that the new technology will not trigger any safety incidents. The consultant is concerned that he has little agency for influencing the actions of senior management. **Something must be done.**
Crisis. In the context of a crisis the protagonist takes possession of the elixir. **The protagonist is forced to face his character flaw even though he may not understand how to deal with it.**	Michael kills McCluskey and Sollozzo at a meeting in an Italian restaurant. His elixir is the safety of his family. **Michael concludes that remaining an honest man will not solve this problem. He becomes a murderer but does not fully understand the ramifications of his action.**	In a progress review meeting the project manager refutes the importance of the safety management program and downgrades the severity of test results. The consultant realises that the PM is a dangerous man, ignorant of proper systems engineering process and the safety risks involved in not doing things properly. The consultant has no strategy to deal with this. **He realises he has no ability to disarm pathological management behaviour and sets out to find a way.**
Climax: The final ordeal, death and rebirth. Within sight of home the protagonist confronts a final ordeal to secure the elixir. It nearly kills him. **As an outcome of his ordeal the protagonist finds a way to deal with his character flaws and is resurrected as a different person.**	Michael's father Don Corleone sues for peace and secures his safe return home. Don Corleone warns Michael that upon his death their enemies will attempt to kill him. When Don Corleone dies, Michael pre-empts his enemies plans by killing all the New York Mafia Dons and miscellaneous traitors within the Corleone family. **Michael's transition from honest man to Mafia crime boss is complete.**	The deadline arrives and the tunnel is opened with testing incomplete and an extensive list of unresolved defects. The system fails and shuts down the freeway twice, exposing motorists to back-of-queue collisions. The consultant vows to never again tolerate corruption of proper systems engineering process. Next time he will blow the whistle. **The consultant's transition from man-capable-of-compromise to uncompromising-functional-safety-evangelist is complete.**

Story structure forces character change. Stories must be structured to provide pressurised dilemmas that reveal the hero's character flaws and force change (refer Table 1). When Kaffee cross-examines Jessop his initial strategy, to prove Jessop's guilt through logic and circumstantial evidence, is clearly failing. Yet Kaffee knows that Jessop wants to confess. Even though it is technically illegal,

Jessop is proud of the US Marine Corps' highly effective methods for motivating underperforming soldiers. Kaffee also knows that Jessop will confess if he enrages him. But to achieve this he must insult a senior officer and risk being kicked out of the Marine Corps. He is faced with a clear choice do the "smart", indifferent thing and let it go or do the high risk courageous thing and go for it. At the climax his strong desire to bring this arrogant man to justice forces his character transition from indifferent to ethical/incorruptible/courageous.

Character inflection points. Audiences find dramas with protagonists that do not change untruthful because life is not like that. We instinctively know that everyone changes over time, albeit slowly. But there are inflection points, major reversals of fortune, that hurry character transformation along. These points are on display in the case study of section *5.1. The Essence of Story*. These points, traceable to real life situations, are the inciting incident, the crisis and the climax.

6.2. Character Arc in Personal Development

A study of character arc in story development provides us with tips for developing the skills of the people in your organisation.

Character is plot. **Character arc is mandatory.**	Human beings need to move, to grow and to evolve. If your people aren't growing their morale will suffer and you may lose them.
Distinguishing character from characterisation.	Believe nothing you hear. Find truth by observing human beings in motion under stress.
Story structure forces character change. **Character inflection points.**	People only truly develop when they are put in situations that they feel are beyond their capabilities (exposed to unfamiliar supernatural worlds). Your job as manager is to create these narratives, to orchestrate the ordeal death and rebirth.
Mapping character transformation.	When designing the 'ordeals' that will help your people grow, be clear on the required change in character value and the force that will cause it to happen. Growth = f(character-value-transition, cause)

Engineering function: responsibility accelerates personal growth. Five years out of University I was given total responsibility for automating a reactor system on an island in the Hong Kong archipelago. Working alone in a foreign culture and deploying unfamiliar technology this was the most accelerated learning process I have ever experienced. Looking back I can only admire the company that had the courage and foresight to give me that experience.

7. The Cast of Characters

A story's characters provide the dramatic energy that keeps us enthralled. Why? Because characters are not real people, just metaphors for human nature and as Nobel laureate William Faulkner said, "Human nature is the only subject that doesn't date." We find the tragedy of King Leonidas and the 300 Spartans at the battle of Thermopylae (480 BCE) just as fascinating as the adventures of Rick Deckard, the man who "retires" replicants (high-quality robotic replications of human beings) in the movie *Blade Runner* (1982).

Character archetypes. Story theory classifies characters by archetype, a concept developed by psychologist Carl Jung. Jung believed that the unconscious mind has a structure that is shared by all humanity - the collective unconscious - something we were all born with just as surely as we all have arms and legs. Within this unconscious lie instincts and archetypes: universal symbols such as the great mother, the wise old man, the shadow, the tower, water, the tree of life and so on. These are imprints of our past, motifs of human experience collected on an evolutionary timescale. A motif is a recurring pattern of any kind, a frequently occurring situation, a behaviour, a symbol, visual and auditory images of all kinds.

Fusion with psychology. This is where story fuses with the psychotherapeutic practice of analytical psychology which examines the influences these primordial images have on a patient's behaviour. According to Jung the collective unconscious exerts overwhelming influence on the minds of individuals involving virtually every emotion and situation. They can terrify but also heal.

Fusion with neuroscience. Jungian ideas have followers among neuroscientists. They suggest that mental commonalities in humans originate from the subcortical area of the brain: specifically, the thalamus and limbic system. The emotional brain. These structures link the brain to the rest of the nervous system and are said to control vital processes including emotions and long-term memory.

Manifesting archetypes. Archetypes live in our unconscious so they cannot be identified in our outward presentation, but they manifest in our behaviours, images, art, myths, religions and dreams. Personal experiences activate archetypes in the mind giving them conscious meaning, they also covertly organise human experience and memory. This could explain why the same character types keep reappearing in myths and legends, and in modern times, books, movies, television and all other forms of dramatic art. Jung opined that they keep reappearing because they are an accurate model of real life that can be used to analyse and predict human behaviour.

> *Story archetypes inhabit real-life. They are expressed by the people who surround you every day, they interact with you in harmony or conflict and through this conflict you are changed. A study of archetypes will help you relate to others and navigate the arc of your career.*

Jung identified twelve archetypes some of which have informed storytellers for thousands of years - not because they had Jung's insights but through a natural and unconscious process of catharsis where anxieties are relieved by bringing unconscious feelings to the surface. Story telling has long been recognised as excellent therapy post trauma. Warriors returning from battle must be encouraged to tell their stories, it has a purging, cleansing effect.

7.1. Classical Story Archetypes

An understanding of archetypes allows you to recognise behaviour patterns and deal more effectively with people. An individual character may express characteristics of more than one archetype. Archetypes are invariant throughout time and culture. The archetypes that inhabit story theory are:

1. **Hero.** The main protagonist of the story - moves the story forward by his actions - undergoes transformation in the course of the story.
2. **Mentor.** Teaches and protects the hero - inspired by divine wisdom - often pushes the hero across the threshold into the supernatural world. The mentor often gives the hero an instrument to assist him with his quest.
3. **Trickster.** A source of mischief - desire for change - debunks the status quo - is always the sceptic - survives using trickery and deceit as a defence - has great intellect - has secret knowledge - entertains as jester or clown.
4. **Threshold Guardian.** Prevents the unworthy from entering - a minor thug in the pay of the arch villain - holds information of value.
5. **Herald.** Announces the coming of significant change - not to be ignored.
6. **Shape Shifter.** Changes constantly from the hero's point of view - loyalty or sincerity is always in question.
7. **Shadow.** The antagonist/villain expressing the energy of a dark side - bent on destroying the hero - does not undergo transformation in the course of the story - has qualities the hero lacks - must be vanquished to liberate the elixir.

Archetypes can be facets of a person's behaviour. For example the hero may have her own internal shadows. The voice that tells her "You can't do this. You're not good enough."

Engineering function: behaviour analysis. Archetypes are the language of character. They help you classify and understand who a person is and what role they should be playing in your project. Analytical psychologists who follow Carl Jung's models of the human mind use archetypes to explain a persons unconscious thoughts that in turn affect their outward behaviour.

7.2. Hero

Heroes are willing to sacrifice something they value for the benefit of someone else.

> *Train yourself to let go of everything you fear to lose.*
>
> — Master Yoda,
> *Star Wars: The Empire Strikes Back*

In heroic service to their country, air crews of the British Royal Air Force's Bomber Command suffered a 44% death rate in World War II.

In psychological terms the hero is the authentic self that initially separates from the mother and the community as ego, where ego is an identity of our own construction. Over time all heroes struggle and grow emotionally, ultimately integrating all the qualities of other archetypes into a fully integrated self - a process called transcendence.

and mentor who can see future possibilities. When he does deliver great wisdom it's often couched in comedic language.

> *Size matters not. Look at me. Judge me by my size, do you? Hmm? Hmm. And well you should not. For my ally is the Force, and a powerful ally it is. Life creates it, makes it grow. Its energy surrounds us and binds us. Luminous beings are we, not this crude matter. You must feel the Force around you; here, between you, me, the tree, the rock, everywhere, yes. Even between the land and the ship.*
>
> — Yoda, *Star Wars: The Empire Strikes Back*

Engineering function: trickster as creative. If you have a Yoda archetype on your project, dig deeper. Beneath the mischief you may find a creative intellect. Great intelligence is required to inhabit the character of another. Most actors are highly intelligent. Tricksters perform best when given work requiring quick wits and high levels of creativity. Visualising new product features, evaluating new software tools. Don't give them mundane jobs and beware of their penchant for the dark side. All hackers are tricksters.

Engineering function: don't profile on appearances. When working in foreign countries I am always paired with a sidekick to help me navigate local issues. So far they've all been tricksters. On one assignment in Taiwan my sidekick constantly questioned the level of engineering process we forced him to follow (this was a safety critical system). "Why do we have to generate all this paper," he'd complain, over and over again. Then one day a colleague lost his temper, "Mate, it's almost like we've got to reload your brain every morning with this stuff!" The trickster smirked, "Yes, but every night I reset!"

As with all my sidekicks this man became an invaluable asset. We still correspond. Behind the jokes I always find a sharp mind. On my first foreign assignment I made the mistake of inappropriately profiling my trickster is an idiot, when in reality he was just untrained. When I trained him I realised that he was a smarter, better programmer than I. Appearances are always deceiving, better to train them up, give them work and then judge them by what they achieve.

7.8. Shadow/Antagonist

The shadow represents the forces of antagonism, a projection of the dark side of human nature, anything that blocks the hero's way in his quest for his object of desire.

Dramatic function. The shadow creates conflict that brings out the best in a hero. As Aaron Sorkin put it, "somebody's got to want something, somebody's got to be standing in their way of getting it." The shadow puts the heroes life in jeopardy providing the catalyst for character transformation.

Empathy for the shadow. Most shadows do not view themselves as bad people. They might have a wife and children and a mother who loves them. They do evil things because they sincerely believe it's for the best. Stories that engender some empathy for the villain can be incredibly powerful because we find contradictions in a person's character compelling, especially if we can recognise some of their feelings/aspirations/character flaws/behaviours in ourselves.

Table 2. Shadows in fiction and real life

Category	Instance	Example in Fiction	Example in Real Life
Environment/ situation	sinking ship hurricane disease time/distance	**Titanic** A ship hits an iceberg in the north Atlantic and is slowly sinking. There are only enough lifeboats for half the passengers.	**Online Advertising** Online advertising mediums such as Google have taken control of the rivers of gold that once funded print newspapers. They struggle to remain viable.
Institutions	Government corporation political party employer	**Pirates of the Caribbean** The East India Trading Company employs Jack Sparrow as a privateer to eradicate pirates from Caribbean waters so they can dominate Caribbean commerce.	**Government** 55 contractors collaborate to build the Obamacare[17] health care system. There is no effective systems integration. Government officials instruct them to go live even though they know it will fail.
Inner conflict	fear doubt guilt prejudice repression conscience	**Sophie's Choice** On entering a Nazi concentration camp, Sophie is forced to choose which of her children will live, and which will be sent to the gas chamber.	**Conscience** A software engineer is instructed to write software to detect that a vehicle is on an emissions test bed and de-tune the vehicle to produce fraudulent emissions metrics. He struggles with his conscience.
Personal conflict	Arch-villain family manager lover	**Terminator** A cyborg assassin is sent back in time from 2029 to 1984 to kill Sarah Connor (Linda Hamilton), whose son will one day save the world from rogue machines in a post-apocalyptic future.	**Hacker** A website developed by the Australian Bureau of Statistics to conduct the 2016 census was shut down by a denial of service attack. The hackers responsible are as yet unknown.

Macbeth. If all Macbeth did was kill people we would not find him interesting, but Shakespeare gave him a conscience. He suffers anguish before and after each murder. Lady Macbeth is also plagued by guilt imagining she sees blood splatter on her hands.

> *Out, damned spot! out, I say! - One: two: why, then, 'tis time to do't. - Hell is murky! - Fie, my lord, fie! a soldier, and afeard? What need we fear who knows it, when none can call our power to account? - Yet who would have thought the old man to have had so much blood in him?*
>
> — William Shakespeare, *Macbeth, Act 5 Scene 1*

Blade Runner. Roy Batty (Rutger Hauer) is the bleached-blond killer replicant of Ridley Scott's classic sci-fi thriller *Blade Runner*. He is relentless in his quest to have his use-by date extended by his manufacturer Eldon Tyrell (Joe Turkel). When Tyrell refuses he gouges out his eyes before dislocating his skull with his bare hands, he head butts walls and, at the climax, almost destroys replicant terminator Rick Deckard (Harrison Ford). But as his time runs out his parting monologue is pure poetry – it breaks your heart:

[17] For details of the Obamacare Project refer:
www.chambers.com.au/public_resources/case_study/obamacare/saving-obamacare-case-study.pdf

> *I've seen things you people wouldn't believe.*
> *Attack ships on fire off the shoulder of Orion.*
> *I watched C-beams glitter in the dark near the Tannhäuser Gate.*
> *All those moments will be lost in time, like tears...in...rain.*
> *Time to die.*
>
> — Roy Batty (Rutger Hauer), Movie: *Blade Runner*

This passage has gone into the language as the "C-beam Monologue" after its most compelling metaphor. More evidence supporting the utility of strong metaphors in creating long-term memories.

Engineering function: problem definition. To get to a solution you must first have a clear definition of the problem (the antagonist). In complex systems projects we struggle with problem definition. Sometimes we are well aware of them but do not take corrective action (the hero doesn't act - the story is not propelled forward).

> *Story defines a problem as something that stands in the way of our desire. If our desire is righteous we are, ergo, the hero and the opposing force is the antagonist who must be overcome.*

Problem definition at Intel Corp. In his book, *Only the Paranoid Survive,* Andy Grove, former CEO of Intel Corporation, tells the story of the turmoil surrounding Intel's transition from memory chip to processor chip manufacture. Japanese manufacturers were killing Intel in the marketplace with low-cost high-quality memory chips, but the company's top decision-makers found it hard to admit they weren't competitive. Vacating a traditional marketplace is never easy. Grove solved the problem with a narrative. "What if they fired us all tomorrow," he said. "What would our successors do?" The answer was clear, they'd get out of memory chips.

Engineering function: decisive action. Once a hero has identified an antagonist he reviews his action options, selects one and executes. In story, as in real life, this must happen to progress the plot. Plots that do not progress through the actions of the hero get bad ratings. Real-life projects fail.

Engineering function: recognising pathological inaction. The shadow can be a destructive force if not acknowledged and confronted. Inaction against recognised antagonists has been the root cause of many disasters. At Bhopal the shadows were managers who tolerated unsafe operating procedures; at Fukushima the shadow was expressed through inadequate design for a predictable tsunami event; the shadows responsible for 162 deaths when air Asia Flt 8501 (2014) crashed into the Java Sea were managers who tolerated lax maintenance of avionics hardware and did not allocate sufficient budget for pilot training (the pilots failed to recover from a high altitude stall with a disabled autopilot).

Engineering function: getting along. You don't pick your team members and you will never be best friends with all of them. You may actively dislike some of them (antagonists). But as a professional you must maintain good working relationships with all of them. This gets hard if they are rude, unresponsive, dismissive, uncooperative, arrogant, bullying, chronically grumpy ... Diplomats face the worst case. They routinely have to work effectively with people they despise: murdering dictators, corrupt politicians, soulless ideologues representing authoritarian regimes. At some point

everyone has a Lady Macbeth or a Roy Batty on their project (hopefully without the extreme violence). Dealing effectively with a perceived antagonist is a test of empathy. So if you are paired with someone who you can't stand try applying some of these story perspectives:

- **The elixir** in this case is a productive working relationship. Story tells us that elixir is a life and death matter. If you do not possess it your normal world will never be healed. Technologists who can't work effectively with other people have limited career prospects. Further, if you have management aspirations you must possess this elixir. It is therefore a metaphorical life or death issue requiring supernatural effort.
- **Tests and trials.** Fate is testing you. Your predicament is just another ordeal in the supernatural world. Bear in mind that you cannot grow as a human being without tests and trials. You must therefore engage with this problem not ignore it. Heroes act to move the story forward. In this case we are talking about your life's progression, your life's story. It must not remain stagnant.
- **Empathy for the antagonist.** Remember what I said earlier:

  Most shadows do not view themselves as bad people. ...
  They do evil things because they sincerely believe it's for the best.

  The first step in developing empathy is to view the shadow as a human being trying to do the right thing. Your shadow may be blissfully unaware that its behaviour is causing you pain. Find a way to address this issue starting your sentence with, "I know you have the best interests of this project at heart but what if we ..."
- **Strength of desire.** Empathy is shared feelings so find a feeling in them that matches your own. Start with their strong desires. They needn't be work-related. For example we all love our children. And when you've found a desire in common make sure they know you are with them.

A small dose of empathy. I achieved this by accident once. An arrogant woman with many years experience with a particular application delighted in humiliating everyone around her, paying out on their contrasting ignorance. She was the classic team killer, a shadow and a threshold guardian. Management was reluctant to fire her because she knew too much. Then she had a baby. When she returned to work, out of politeness, I enquired after her health, "Are you all back together," I said. It's a natural thing a father who has witnessed three births might say. "Yes I'm well, thank you," she replied. Our relationship improved from that day on. The subtext: a shared (highly emotional) experience expresses empathy.

A small dose of empathy might not be the beginning of a deep friendship but it can improve a working relationship. And further, we live in hope that shadows can be redeemed. Did not Arnold Schwarzenegger morph from a killing machine in the movie *Terminator* to a protective mentor in *Terminator Two: Judgement Day*?

Beware "the right man". There is a particularly dangerous class of villain. One who combines charisma with a strong conviction that his pathological behaviour is right. He will stop at nothing believing that the end justifies the means. His charismatic presentation carries whole communities, even countries, on a path to destruction. The classic example is Adolf Hitler who reduced Germany to rubble in twelve years. This is a villain masquerading as a hero.

Engineering function: profiling "the right man" archetype - normalisation of deviance. In systems engineering the promise of career, money, fame or a thrill in the moment drives seemingly rational people to cut corners, delivering too early, under-spending on testing or ignoring plausible risks. We seldom take big risks out of the blue. Risk taking feeds on itself. On Monday, laziness, greed, hubris or pride might cause us to make a small compromise, which eases our path to a larger one on Tuesday. We suffer no penalty and are thus encouraged to repeat the process. And over time we harden our commitment to lower standards. Left unchecked this process often leads to disaster as organisations wither into poor judgement. Anomalies are tolerated, machines are driven outside their design limits, safe operating procedures are watered down. As ever-riskier behaviours are tolerated the high-risk status quo takes on a kind of beauty - action heroes are admired. Corrupted standards go unquestioned and a kind of blindness sets in. The players become so comfortable with deviant behaviour that they consider it more normal than deviant. It is the accepted way we do things around here – "the right way". Most do not see these shadows so bad behaviour is not opposed. Insightful whistleblowers are punished, dissenters are demonised as "non-team players". Then space shuttle Challenger blows up on launch, the Chernobyl nuclear reactor melts down.

In her study of the risks associated with complex technical systems, sociologist Diane Vaughan calls this reality by consensus, “normalization of deviance” and classifies it as a pathological behaviour particularly prevalent in engineering organizations.

In story parlance this is the pattern of the "Right Man Shadow".

8. Story Application Notes

> *When we no longer know what to do we have come to our real work, and when we no longer know which way to go we have begun our real journey. The mind that is not baffled is not employed. The impeded stream is the one that sings.*
>
> — Wendell Berry

8.1. Engineering Function

There have been times in my engineering career when, faced with a difficult situation, I have had absolutely no idea what to do. Without exception all these scenarios involved human conflict. With the benefit of hindsight I strongly believe that, armed with a working knowledge of story theory, I would have been much better prepared to face the dilemmas of the human condition.

The following story application notes overlay story patterns on real-life situations in engineering. They classify human behaviour and suggest solutions. They may help you:

1. Recognise and classify pathological attitudes of mind and external behaviour
2. Devise courses of action to disarm them
3. Invoke productive attitudes of mind when approaching difficult situations
4. Develop insights into why people behave the way they do
5. Recognise what's important and what is trivial and decide when you need to act and when you can safely let a situation slide by.

8.3. Desire: *Writing Requirements*

Strength of desire. To engage an audience a hero's desire must be strong. The hero's quest must be nontrivial. The wages of failure typically include death or eternal damnation. Why else would you embark on an adventure into a supernatural world when you could stay at home and live a comfortable life.

Companies do not embark on system developments without very strong motivation. Large sums of money are involved and in the case of safety critical systems human life can be in jeopardy. To discover the essential requirements of a system the analyst must therefore fully understand the fundamental desires that are driving the customer. A pithy statement of system objectives seldom tells the whole story.

Measuring desire. The strength of desire can be measured by the risks the hero is willing to take in pursuit of the elixir. The authentic hero is willing to die for it. Anything less and the story gets boring. What represents metaphorical death for a corporation? What are they risking for their elixir? In the software industry it's usually money and credibility. On one of my projects the cash burn was $70,000 per day. The insightful engineer measures that desire early as it represents the unifying force that holds an entire project together. Bob McKee calls it "the spine of the story". Requirements calibrated at high desire represent the core benefit of a system. And further, If you're working on a project that is losing its desire, find a way to stoke the fires or bail out.

Analysis of desire yields hidden requirements. As with a human being, a company's decision to act is always motivated by primal emotion. Survival instinct, for example, a desire to colonise, dominate and monetise a marketplace. Analysts can apply story patterns to explore the murky world of these emotions inviting repressed feelings to boil to the surface. We're not asking the customer what she wants we're asking her how she feels. Questions emanating from the story metaphor uncover strong emotions, for amongst these shadows live repressed, unspoken requirements. So immerse yourself in the customer's story, think and feel as your customer thinks and feels, forget about requirements for the moment and think about desire.

Spoken, unspoken and unspeakable. If you ask a user what they want they'll tell you something, which may or may not be accurate, ***this is the spoken***. Using modelling techniques and triangulation (getting multiple perspectives on the same issue) you may discover missing requirements, details they forgot to tell you. Then there are the things they purposely don't tell you, sometimes for political reasons. ***This is the unspoken***. But most obscure of all are the things they can't tell you because they are not consciously aware of them. As with story, heroes know what they want, usually at the inciting incident, but only discover what they really need at the climax. ***This is the unspeakable.*** The climax of a complex systems project is the point of deployment / commissioning / revenue operations. At this plot point epiphanies on the real objectives of a system create rework and are expensive. The quest of the requirements engineer is to avoid climactic discovery at all costs. But how?

Discovery through catharsis. The story literate analyst works step by step through all the conflict, tests and trials the user has experienced in the application domain, especially the high jeopardy

incidents of metaphorical ordeal-death-and-rebirth. The user is encouraged to talk freely about their emotions during the ordeal, giving unconscious feelings and perspectives the opportunity to bubble to the surface. This can bring about expansion of awareness and new insight.

Case Study - Medication Tracking System:

A traditional analyst approaches a Medication Tracking System. She does an interview and documents an objective:

> *The Medication Tracking System shall ensure that all patients receive their correct prescribed drugs.*

The story literate analyst digs deeper, "Tell me some stories about life in the hospital ward. Have there been any incidents, near misses with dispensing medication?" You might get a response like this:

> *Mary Rose was blond, beautiful and three years old. On a Monday she was admitted to our hospital as a precautionary measure with a mild case of flu. On Tuesday she was dead. The autopsy revealed she had been administered an overdose of insulin. She had received the medication intended for the patient in the next bed. The objective of the Medication Tracking System is to make sure this can never happen again.*

Here is an idea wrapped around an emotional charge (aesthetic emotion) – a heartfelt outpouring of desire. It's a story device that engages people and makes them care.

> *Caring is the beginning of empathy and empathy is the beginning of understanding; the first step on the road to accurate requirements.*

In the case of Mary Rose it is logical that patients should get their medication but the image of a dead child will guarantee that the development team will crawl over broken glass to make it happen. The storyteller's requirement statement also tells us much more about our target system:

1. This application is safety-related. Failure can cause harm.
2. The system premise is: what would happen if we use technology to make sure that a patient cannot be administered the wrong medication – ever
3. The controlling idea is: this system will prevent patient death or injury through incorrect medication by <*drug validation strategy*>. The change in story value is: unsafe (patient in jeopardy) to safe
4. The most important attribute of the system is safety integrity. This system must improve patient safety not degrade it.
5. The system must be available 24/7.

A developer reviewing the traditional statement of system objective could easily miss these five derived requirements. This is the power of story.

Recording story as rationale. But that's not the end of it. By adding these five requirements the requirements engineer has taken an emotional outpouring and converted it to clinical, technical requirements. The emotional subtext that brought them into being should not be lost however. This is why these requirements should be tagged with this emotional rationale. This will provide a bullet-proof defence should a cost-cutting antagonist ever attack their reason for being.

