

Chapter 3: Art of Simulation Design

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Introduction

Business simulation design is a combination of art and science. Although the science aspects are arguably domain specific this chapter suggests that the art aspects are not. It explores how computerised business simulations parallel the strip cartoon or comic and uses this parallel to explore the art of computerized simulation design.

The chapter explores how the relationship between the comic’s pictures and words parallel the business simulation’s models and interactions with learners. Using this parallel, the chapter shows how it is possible to classify and position simulation models in terms simplicity and stylisation and decisions and results (interactions) in terms of

ambiguity and granularity. Beyond this, the chapter draws a parallel between the comic's panel or frame and the simulation's period and explores the parallel between the comic's transitions between frames and the different ways the simulation progresses period-to-period. Next, the chapter explores the parallel between the cartoon's verbal/visual relationships the simulation's model/interaction relationships. Finally composition, humour/stylisation and indicia are explored.

In summary, the chapter explores the parallel between the strip cartoon or comic and the mathematical equivalent – the business simulation-game and in doing so provides information about the structural design of a simulation to ensure learning.

The Vocabulary of Comics

Scott McCloud (1993) analyses cartoons (comics) in terms of a “Big Triangle” (Figure 3.01).

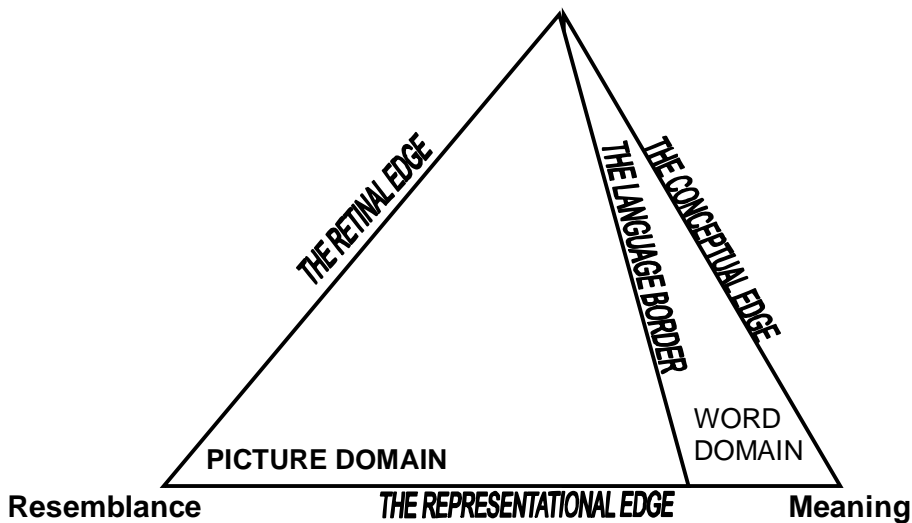


Figure 3.01: Scott McCloud's Big Triangle

At the bottom of the Big triangle is *the Representational Edge*. As you move from left to right across this edge you move between *reality* towards *meaning* where the pictures are *received information* and words are *perceived information* (McCloud 1993). The Big Triangle has two main domains. The area between *the Retinal Edge*, *the Language Border* and *the Representational Edge* is the cartoon picture domain and the area between *the Language Border*, *the Conceptual Edge* and *the Representational Edge* is the cartoon word domain.

For the picture domain McCloud explores abstraction along the horizontal and vertical axes. Horizontally the cartoon picture becomes progressively simpler (iconic abstraction). On the far left, a picture has a photographic quality. But on the far right, it is the simplest line drawing. Vertically, McCloud suggests a non-iconic abstraction where there is a movement away from meaningful representation towards surrealism. In figure 3.02 this is illustrated by the faces - photograph like (bottom left), smiley (bottom right) and the surrealistic face at the top.

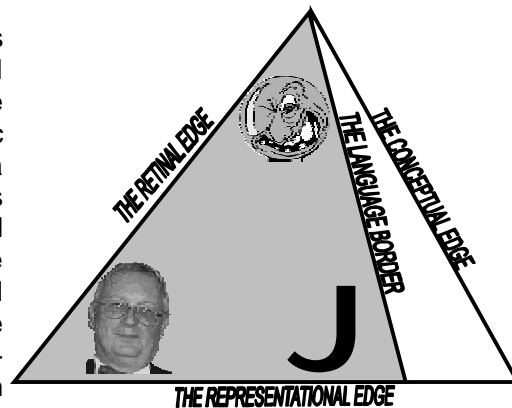


Figure 3.02: The picture domain

Similarly, the Word Domain differentiates between simple, direct words and more elaborate story telling (McCloud 1993).

Mapping Simulations to the Cartoon “Big Triangle”

For the simulations a *Simulation Trapezoid* (Figure 3.03) is envisaged that equate to the graphic cartoon’s *Big Triangle*. Except that here the *Picture Domain* transforms into the *Model Domain* and the *Word Domain* into the *Interaction Domain*.

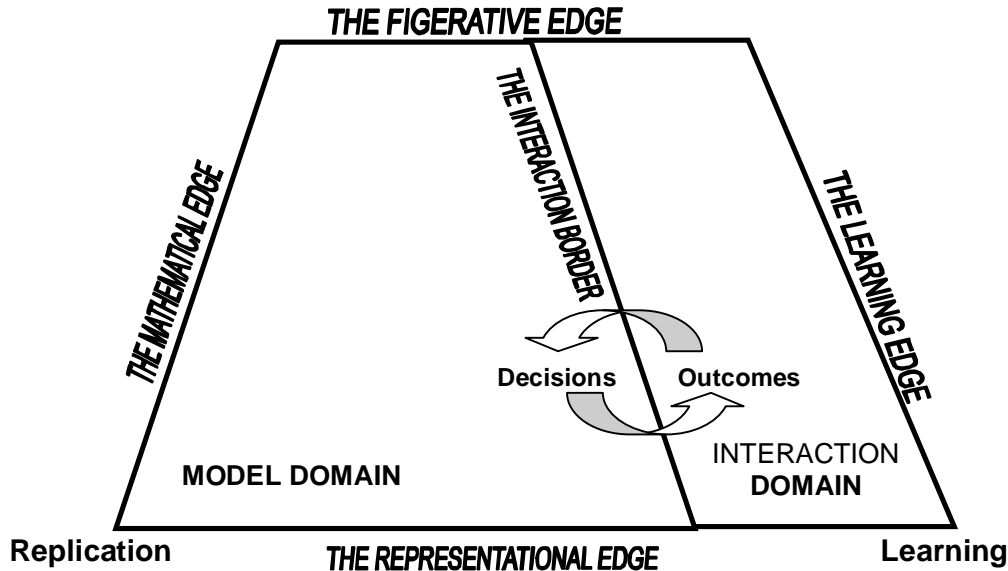


Figure 3.03: The Simulation Trapezoid

The Simulation Trapezoid parallels the Cartoon’s Big Triangle with the *Retinal Edge* transforming into the *Mathematical Edge*, the *Language Border* into the *Interaction Border* and the *Conceptual Edge* into the *Learning Edge*. The *Representational Edge* remains the same but here extends from *Replication* to *Learning* (rather than *Resemblance* to *Meaning*). But, we argue that the simulation trapezoid does not converge to an apex. Rather there is an upper edge - the *Figurative Edge*, where the model is fully metaphorical or emblematical and the interactions are completely unambiguous. The Interaction Domain interacts with the Model Domain with the decisions and the Model Domain interacts with the Interaction Domain with outcomes (business results).

Why Trapezoid? First because, although the Model Domain narrows it does not come to an apex as even a fully metaphorical or emblematical simulation can have a range of complexity. Second, the Interaction Domain is a parallelogram, as the range of options remain the same across the domain as one climbs it.

Model Domain

The model domain consists of the mathematical algorithms, data and parameters that define the pre-planned (computer) process aspects of the simulation. The **Horizontal Complexity Axis** ranges from exact replication (left) to similitude (right) and the **Vertical Stylisation Axis** ranges from no stylisation (bottom) to extensive stylisation (top). Also, the model domain can be seen as having several *aspects* – the scenario aspect, the content (subject) aspect and the calibration aspect.

Scenario Aspect

This defines the extent to which the business situation is stylised and simplified and there are several levels (Figure 3.04). At the bottom, the model attempts to replicate, exactly, an actual business. Above this the model is progressively stylised. First into a replica of a generic industry sector. Then into an imaginary business with invented products and processes and then, perhaps, to the surreal. This aspect expands on the “continuum from industry specific to generic” (Biggs, 1990) to include imaginary and surreal.

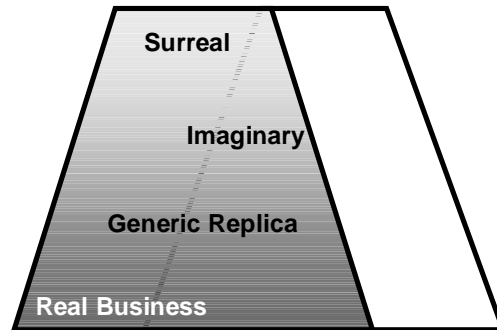


Figure 3.04: Model Scenario Aspect

At the bottom-left is Prospector a complex stage-gate process simulation. Although this models a stage-gate process in detail, it is still stylised and simplified. Higher and towards the right, is Distribution Challenge (generic total enterprise simulation replicating a distribution company). In between, the DISTRAIN simulation is a customized version of Distribution Challenge replicating a specific distribution company. A customisation that was more complex and less stylised and so positioned below and left of Distribution Challenge.

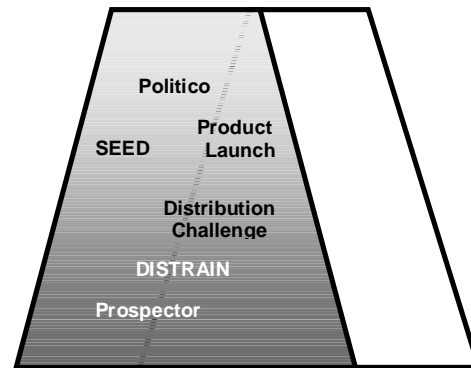


Figure 3.05: Simulations on the Model Domain

Both SEED and Product Launch involve imaginary products. For SEED (a complex entrepreneurial planning simulation) the product is a high-tech *Cuddl-Etoy* and for Product Launch (a concept simulation exploring the Product Life-Cycle) an innovative self-heating soup. The imaginary nature of their products, allow business issues to be explored without the pre-conceptions that might exist and distort learning if actual products had been chosen. At the top of the model domain is Politico, a simulation that *surrealistically* models national politics and where the basic assumption is that political success and power comes from the *timing* of statements about policy and that actual political actions are completely useless (although it has been suggested that it is possible that it is the situation modelled (politics) that is surreal rather than its representation in the simulation).

Content (Subject) Aspect

This defines the extent to which certain issues, processes and concepts are emphasized and included at the expense of others. So, for example, a total enterprise simulation would attempt to provide “an overview of general business management” (Biggs, 1990). In contrast, a functional simulation (Biggs, 1990) would cover a single functional area (such as manufacturing or sales) in depth. Additional simulation types include concept simulations (Leach, et al, 1983), planning simulations (Malik et al, 1997) and process simulations (Hall, 2005).

Calibration Aspect

This defines the extent to which the parameters used by the simulation are exaggerated. This exaggeration is to enhance both cognition (understanding) and affection (feelings). To enhance cognitive understanding, the impacts of decisions on outcomes may need to be amplified to ensure that learners can identify the causal links between decisions and outcomes.

Model Validity

The position in model domain also raises questions about validity. Specifically are simulations located towards the bottom left more valid than simulations located to the right and above? Harvey (1994) states “Comics can be (and too often are) evaluated on purely literary grounds” and argues that this is wrong. This parallels a common assertion that “Management simulations are valid pedagogical tools provided they are complex and realistic” (Miller and Leroux-Demers, 1992). Harvey then continues by suggesting that such an evaluation “ignores the purpose served by the visuals – the story or joke that is being told”. Equally, for simulations a focus on reality and the associated complexity ignores their purpose – learning. With the exception of Politico, as the simulations illustrated in Figure 3.5 have been used widely and successfully on business training courses, it seems reasonable to suggest that simulations like cartoons are valid across most of the model domain.

Simplification

This ensures the simulation focuses on the desired learning needs and results and reduces duration. As such it exactly parallels the cartoon, where only necessary features are depicted allowing the cartoon to fit in a restricted space on the page (Harvey, 1994).

The Product Launch simulation illustrates simplification. Product Launch is designed to explore basic marketing and financial concepts and in particular the product life cycle. This meant that marketing issues (pricing and promotion), financial issues (profitability and cash flow) and operations (demand patterns) all had to be explored as one moved through the life cycle. But, as the simulation was originally designed for use on a sales conference it had to have a very short duration – two hours. So, although the marketing model was complex, the financial model was very simple – customers paid cash, materials were bought for cash, there was no facility to borrow money and assets were not depreciated. In the several hundred runs, this simplification has not caused a problem and learners have been able to link their marketing decisions to the financial outcomes – a vital learning need.

For simulations, in the words attributed to Einstein “make everything as simple as possible, but not simpler” involves a difficult judgement about what to include and what to leave out.

Stylisation

The simulation is stylised to improve both *learning* and *engagement*. Again, this parallels the cartoon where, for example, heads are drawn disproportionately larger than bodies to allow facial expression to be discernable. This *Metonymic Distortion* is because the “face is for the cartoonist the most expressive and important human feature” (Brooks and Pilcher, 2001). For simulations, the “real world” needs to be distorted or stylised to for emphasis.

The stylisation of Prospector’s stage-gate process illustrates how it affects learning. Figure 3.06a shows, for the “real world” stage-gate process, the issues addressed as a series of ovals with significant overlaps and with each “gate” revisiting issues.

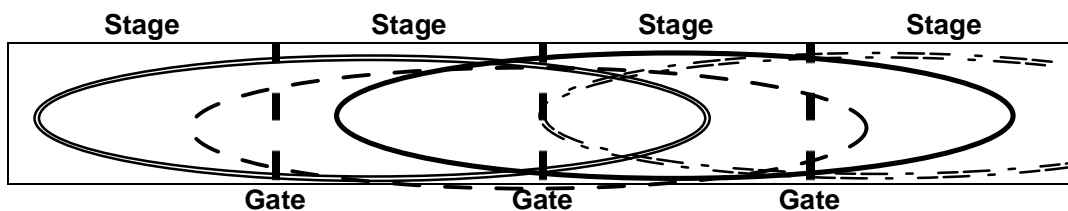


Figure 3.06a: Real world Stage-Gate Process

In contrast, the simulated stage-gate process was stylised (figure 3.06b) so that issues addressed had minimal overlaps and each stage in the process introduced another issue. This focus on separate issues clarified and hence ensured learning. However, the extent

to which stylisation is used to focus is a difficult judgement. Too little stylisation and there is insufficient focus resulting in confused and possibly wrong learning. Too much stylisation and there will be insufficient discussion and deep cognitive processing.

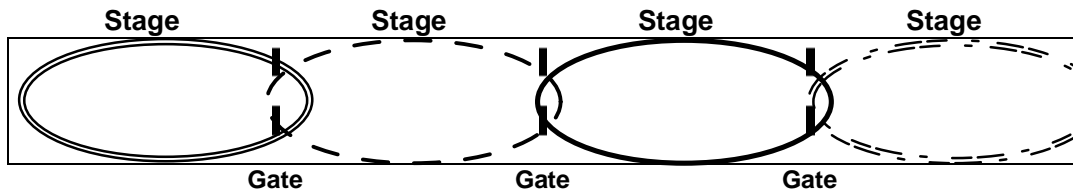


Figure 3.06b: Simulated Stage-Gate Process

Stylisation to improve *engagement* is illustrated by the DISTRAIN simulation. Here the simulation was designed to explore the “real world” issues facing an electrical distributor – a highly competitive industry sector with very, low margins. If exactly replicated by the simulation, this high level of competition and low margins meant that (as in the real world) it was easy for the simulated companies to be loss making and this would be very demotivating. So, the responses to prices and profitability levels were changed slightly so that it was possible to grow sales and profits significantly. Stylisation to improve engagement is also a difficult judgement. Too little stylisation may lead to perceptions of business failure and hence be demotivating. But, equally, if it is too easy to be successful, learners will not be sufficiently challenged and not only will this reduce learning but may be demotivating if they feel their time is being wasted.

Design Implications

Having explored model simplification and stylisation? These seem to be as follows:

- § Learning
- § Engagement
- § Simulation Duration
- § Model Focus

Learning

Stylisation is crucial to learning as it is necessary for the learners to be able to *unravel* the links between their actions (decisions) and the outcomes (results). Additionally, this unravelling is impacted by complexity and a too complex model will hamper learning. But, equally, a too simple model will not cause sufficiently deep cognitive processing.

Engagement

As described in Chapter 4 (Design for Process), role overload (French and Caplan, 1972) leads to disaffection and so appropriate simplification is crucial. Further, if the learners are unable to *unravel* the links between actions and outcomes they will not learn and for adult learners (Knowles et al, 1998) this causes disaffection. So, appropriate stylisation is vital.

Simulation Duration

Simplification and to an extent stylisation reduce the amount of time required for the simulation to deliver learning and this means that simulations to the bottom left of the model domain have much longer durations than simulations to the upper right of the model domain.

Model Focus

As discussed in Chapter 6 (Design for Value) the simulation must only building in the model relationships that directly connect to desired learning.

Interaction Domain

The Interaction Domain defines the cognitive process aspects of the simulation. Just as a cartoon’s words are often more important than the quality of it’s drawing, so too are the interactions, perhaps, more important than the model. It comprises the decisions and outcomes from the simulation - the **decision aspect** and the **outcome aspect**.

The **Vertical Axis** defines the degree of *ambiguity* – from very ambiguous at the bottom to unambiguous at the top. The **Horizontal Axis** defines the *granularity* of the decisions and outcomes. Granularity ranges from complex (on the left) to simple or basic (on the right). One suggests that decisions or outcomes in the bottom left corner (A) require the greatest cognitive processing and those in the top right corner (B) the least.

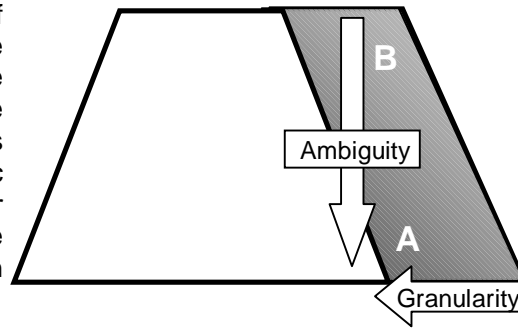


Figure 3.07: Interaction Domain

Decision Aspect
Decision Ambiguity

This defines the extent to which the impact of the decision is uncertain. Thus the outcome from a production decision would be reasonably certain. (Although where there could be a material or capacity shortages it would be more ambiguous). But, the outcome of a price decision would be ambiguous as it would be difficult to forecast the impact on sales demand.

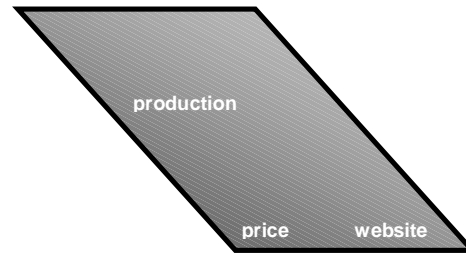


Figure 3.08: Decision Aspect

Scherpereel (2006) categories decisions in terms of three orders (routine deterministic (1) those with probabilistic aspects (2) and complex decisions requiring heuristic solutions (3)) and these can be seen as bands down the decision aspect with progressively increased cognitive processing requirements and this means that important decisions should be positioned at the bottom of the Decision Aspect with the unimportant (but necessary) decisions at the top.

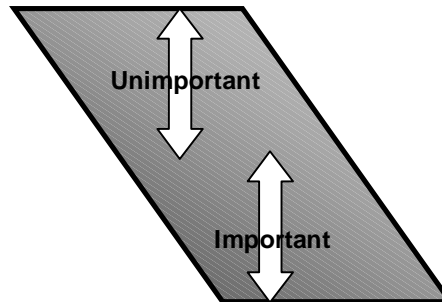


Figure 3.09: Decision Importance

Decision Granularity

This is defined in terms of the range of possible values and the choices possible. Thus, a price decision (Figure 3.8) would have a wide range of possible values. But whether or not to have a web site has have two possible values (Yes or No). Thus the Decision Granularity extends from where any number can be entered to a restricted range of numbers to multiple choices and finally to a binary choice.

Marketing Plan	Plan 1	Plan 2	Plan 3
Market Served			
Launch Month	June	July	May
Number in Range	4	7	2
Sell to Retailers	No	Yes	Yes
Web Site	Yes	No	Yes
Web Price	69.95	0.00	69.95
Retail Outlet Price	0.00	69.95	69.95
Price to Outlets	0.00	29.95	29.95
Advertising Spend	0	70000	50000
Public Relations	None	Launch	Both
Enhanced Web Site	Yes	No	Yes
Point of Sale Display	No	Yes	Yes
Packaging	Plain	Fancy	Fancy

Figure 3.10: SEED Marketing Decisions

Experience suggests that as the time taken to make a decision is reduced as it's granularity is reduced and this is another way to reduce duration. SEED illustrates this (Figure 3.10). Here, except for the price and advertising decisions, all decisions were multiple-choice (ranging from a maximum of twelve choices (Launch Month) to two decisions (the Yes/No choices)). By limiting granularity SEED's duration was reduced from two days to six hours.

Deciding Ambiguity and Granularity

As unambiguous and low granularity decisions (top right) are made in the shortest time and ambiguous and complex granularity decisions are made in the longest time, this provides a way of matching decision granularity and ambiguity to learning importance. Decisions key to learning purpose (Scherpereel's complex decisions requiring heuristic solutions) need to be positioned at the bottom of the Decision Aspect. Decisions that are necessary but subsidiary to learning can be less ambiguous and should be positioned higher in the domain.

An example how a production decision is handled by different simulations illustrates how one can affect ambiguity and the thinking required to make the decision. For Product Launch, the production decision is unambiguous with the amount produced being the same as the amount decided and productive capacity being purchased as needed. For Management Challenge (a generic total enterprise simulation) the production decision is a little more ambiguous as the production decisions across all products are aggregated and compared against productive capacity. If there is insufficient capacity then production is reduce proportionately. Also, it takes one simulated period to increase capacity thus forcing learners to consider their long-term production needs. Operations (a simple manufacturing management simulation) is even more ambiguous. Here besides capacity limitations, production may be limited by raw materials and learners must think about whether they should work overtime or not and take into account a seasonal sales pattern. Even if none of these constraints apply actual production is *randomly* distributed around the production decision. Compared with Product Launch this increase in ambiguity reflects the difference in simulation purpose. Product Launch focuses on marketing and Operations focuses on manufacturing. However, reflecting Operations' short (three hour duration), the production decision is not as ambiguous as it could be as it does not take into account the effect of prolonged overtime on productivity (as is the case for the Management Experience simulation).

Finally, a judgment based on duration constraints needs to be made about the decision's granularity. The degree of granularity is a judgement because the additional processing required by granular decisions is likely to provide an opportunity for reflection and discussion – both necessary for learning. Also, low granular decisions must involve several competing and not obvious options.

Result Aspect

Outcome (Result) Granularity

This defines the extent to which the outcome is refined or processed and their granularity reduced. This is illustrated in Figures 11 and 12. In Figure 3.10, the Balance Sheet (11a) provides raw, unrefined data. But, processing the Balance Sheet with the Income Statement produces a series of Profitably Measures (11b) that are to the right of the raw Balance Sheet data on the Outcome Aspect Domain (figure 3.12). The Profitability Trend (11c) moves further to the right and processing the trend in to graph (11d) moves the result even further to the right. Finally, making comments on the profitability (11e) involves further processing and movement to the right.

Total Equity	???
Total Liabilities	???
Total Fixed Assets	???
Total Current Assets	???

Figure 3.11a: Raw Data

Return on Assets	20%
Return on Equity	15%

Figure 3.11b: Refined Data

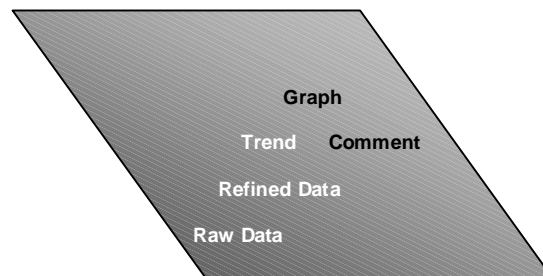


Figure 3.12: Outcome Positioning

Year	1	2	3	4
Return on Assets	20%	18%	9%	11%
Return on Equity	15%	12%	6%	7%

Figure 3.11c: Trend over time

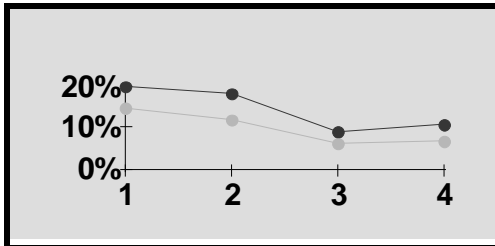


Figure 3.11d: Trend Graph

Accountants feel Return on Assets may be poor
Return on Equity is poor

Figure 3.11e: Comments on Measures

Outcome Ambiguity

This defines the extent to which outcomes are difficult to interpret and require further processing. Figure 3.12 positions the reports shown in Figure 3.11 across the Interaction Domain.

Except for Comments, ambiguity is reduced as outcomes are processed further. But, for Comments, ambiguity is affected by the choice of words. So, words like *feel* and *may* are more ambiguous than words like *are* or *is*. (In 9e the first comment is more ambiguous than the second.)

As it is probable that results must be neither too ambiguous nor too prescriptive, it is inappropriate to have outcomes at the bottom (totally ambiguous) or the top (totally prescriptive).

In a similar position to Comments and with a similar spread of ambiguity there are other output forms – graphics, pictures, sounds, music and animations. For example, with Prospector, the *virtual* customers' responses to negotiation proposals are shown as a series of coloured bars that range from three red bars (totally unacceptable) through yellow (possibly OK) to three green bars (very, very acceptable). Again for Prospector, whenever a company wins a contract, applause is heard. For SEED, when the learners start using the simulation it plays "The Teddy Bears' Picnic" thus emphasizing the fun aspects. (Where the simulation is run with all the teams in a large room, playing music when learners start to make decisions warns the trainer that a team may have spent insufficient time preparing and a lack of music indicates that they are taking too long before making their initial decision.)

Design Implications

Having explored decision and result granularity – their ambiguity and granularity – what are the implications for simulation design and use? These seem to be as follows:

- § Simulation Duration
- § Decision Ambiguity and Purpose
- § Decision Granularity and Duration
- § Result Ambiguity and Granularity
- § Granularity and Ambiguity – the Tutor's perspective

Simulation Duration

As the granularity and ambiguity increases then so too does cognitive processing and the time to do this. Hall and Cox (1994) looked at the number of decisions made but did not take into account decision or result granularity. This increase in cognitive processing means that simulation duration increases on the diagonal (Figure 3.12) as ambiguity and granularity increase.

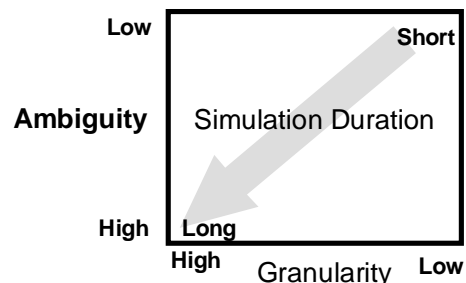


Figure 3.12: Impact on Duration

Decision Ambiguity and Purpose

Because with the more ambiguous decisions it is more difficult to forecast their impact, it is likely to take longer to process them cognitively and this has implications in terms of the choice of the decisions, their granularity and the purpose of the simulation. For the marketing simulation, the key and most ambiguous decisions are price and promotion.

The production decision (as an outcome of the price and promotion decisions) is peripheral and hence relatively unambiguous. Similarly, for a simple production simulation, the most important decision was the amount to produce and the less important decisions were material purchases and shifts. Further, as it was necessary for learners to simulate twelve months (a year), to shorten the time taken to run the simulation its decisions were less ambiguous and less granular than the decisions for the marketing simulation (where it was only necessary to simulate eight periods).

By deciding which decisions are core to the simulation's learning purpose and making these more ambiguous than the other decisions (that are necessary but never the less peripheral to the simulation purpose) helps ensure the most effective use of the learners' time. At the limit, these peripheral decisions can be automated using intelligent software (as was the case with SEED).

Decision Granularity and Duration

An example of how reducing granularity can shorten the simulation was the development of a simulation for a financial appreciation course. The learning need was for learners to understand how management actions across a total enterprise affected its financial performance. A total enterprise simulation existed but lasted a day and a half and would need extra decisions extending it to about two and a half days. But, the client needed a simulation lasting half day. The existing simulation involved highly granular decisions (deciding price, promotion etc.) but the new simulation reduced granularity by making decisions a choice from a series of options each of which affected multiple variables (Figure 3.13).

Financial Options
Option 1 - Raise Domestic Prices
Option 2 - Lower Domestic Prices
Option 3 - Minor Export Activity
Option 4 - Major Export Activity
Option 5 - Launch New Product
Option 6 - Replace Equipment (Buy)
Option 20 - Increase Inventory
Option 21 - Decrease Inventory
Option 22 - Low Payment Discount
Option 23 - High Payment Discount
Option 24 - Change Discounts
Option 25 - Improve Product Quality
Option 26 - Write Off Inventory
Option 27 - Increase Dividend

Figure 3.13: Low Decision Granularity

By reducing granularity (moving from deciding individual values for prices, promotion, production levels, etc. to selecting from a list of options) changed the simulation's duration from two and a half days to half a day.

Result Ambiguity and Granularity

Result ambiguity and granularity depends on the simulation's learning purpose. For example, a simulation to enable learners to understand basic accounting concepts would provide detailed information about incomes, payments, costs, expenditures etc. to allow learners to understand the flows of money. But, a simulation to explore the strategic development and position of a company would not provide such raw data. Rather it would focus on strategic outcomes (growth, profitability, market share, survival risk, etc.)

Result Granularity and Ambiguity – the Tutor's perspective

The needs of the tutor running the simulation are different from those of the learner. He or she is likely to need to explain how results were derived, comprehend the economic background to the results and to assess performance and learning (Hall, 1994). This means that the tutor will need a separate set of reports. Where the need is to explain results, these reports need to be granular (detailed) but where the need is for assessment, the reports must have low granularity and ambiguity.

So, to explain the Cost of Sales (Income Statement), the tutor may need to explain how Cost of Sales is derived (Figure 3.14) and so have access to a report showing the underlying calculations.

Income Statement			Cost of Goods Sold	
Sales Income	12,457	→	Opening Inventory	470
Cost of Goods Sold	8,882		Total Variable Costs	8,000
Gross Profit	3,575		Production Overheads	750
Operating Expenses	2,500	Cost of Goods explanation	Depreciation	382
Operating Income	1,075		Closing Inventory	720
Interest	31		Cost of Goods Sold	8,882
Pre-tax Profit	1,044			
Taxation	522			
Earnings	522			
Dividend	382			
Retained Earnings	140			

Figure 3.14: Reconciling Cost of Goods Sold calculation

But, where the tutor assesses performance, the simulation might present results as unambiguous comments on strengths and weaknesses (Figure 3.16) as this low ambiguity and granularity shortens the amount of cognitive processing required.

Weaknesses for Team 1
Return on Capital is exceptionally low
Company has negative Value Added
Solvency risk is high

Figure 3.15: Team Performance Comments

Thus as for cause and effect the reports for the tutor divide into two (Figure 3.16).

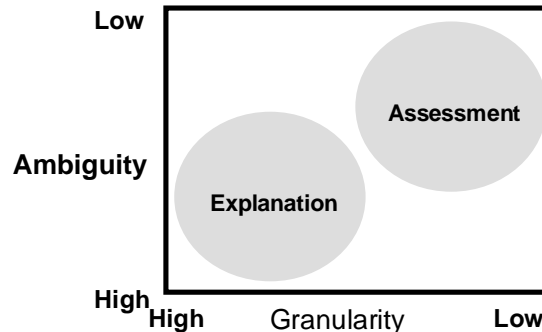


Figure 3.16: Tutor's Reporting Groups

When designing and assessing the design of a simulation, I believe that by considering decision and result ambiguity and granularity simulation designers can make more informed decisions about the types of decisions and results they use.

But not only does the ambiguity/granularity mapping of decisions and results help during simulation design, it can provide a basis for the evaluation of the design values and quality of existing simulations. Specifically, the types of decisions and results may be inappropriate to the simulation's stated purpose. For example, it might be inappropriate for a Total Enterprise Simulation designed to explore business strategy to include decisions about detailed production scheduling and invoice payment.

The suggested links between ambiguity, granularity and duration are intuitive and provide an opportunity for empirical research. Further, mapping the ambiguity and granularity of existing simulation decisions and results may provide insights into their strengths and weaknesses and opportunities for improvement.

The Panel or Frame – the Temporal-Topical System

Just as sequential art (the comic) consists of a series of panels, the simulation consists of a series of periods or stages. Just as the cartoon or comic strip moves from panel-to-panel, the simulation *progresses* from period-to-period or stage-to-stage, generally signifying the passage of time and so Groensteen's *Spacio-Topical System* (space-topic system) is paralleled by the simulation's *Temporal-Topical System* (time-topic system).

For strip cartoons the panel or frame is as important an element as the each frame's content. As a result, Eisner (1985) dedicates a full chapter (and nearly 40% of his book) to frames discussing them in the context of encapsulation, control, creation, container, structural support, narrative device, emotion etc. Likewise, Groensteen (2007) devotes a significant part of his book to the *Spacio-Topical System*. Here he explores both the frame and their arrangement of the strip across the page (*hyperframe*) and *multiframe* (the arrangement of the strip across multiple pages). Groensteen discusses the frame in the context of closure, separation, rhythm, structure, expression and readability. Some of these translate directly to business simulations and some seem not to but *may* provide insights that can be applied to new types of simulation. McCloud devotes less space to frames but discusses them in terms of time describing each as framing "*a single moment in time*" and this parallels the simulation's decision-making cycle where typically a business is moved forward one year, quarter or month at a time.

For simulations, the parallels between the panel and the decision-period exist in terms of encapsulating time, transitions as the comic/simulation progresses and closure/reflection.

Panels and Stages – encapsulating time

The width of the cartoon frame (panel) is paralleled, for the simulation with the length of each decision-making period (the time it between receiving results making the next decisions. Just as the width of a cartoon frame adjusts detail and hence pace (Moore, 2007) the duration of a simulation limits the amount of cognitive processing possible (Hall & Cox 1994). In turn this defines the numbers and types of interactions (decisions and outcomes) that can be handled period-by-period. Just as for the cartoon "*each panel should frame only the minimal essentials of a scene – those elements necessary for maximum storytelling effectiveness*" (Harvey 1994) and we replace the word storytelling with learning in this quote, the sentiment applies to simulation.

Relationship to the Experiential Learning cycle

Just as a single comic strip panel addresses part of story, a period or stage in a simulation explores one or more topics and just as the size of a comic strip's panel constrains the detail that it can hold, the duration of a simulation period or stage constrains what can be learnt. But although the comic strip's panel *encapsulates* static contents, the simulation's period or stage *encapsulates* a dynamic, progressive experiential learning process (Figure 3.17)

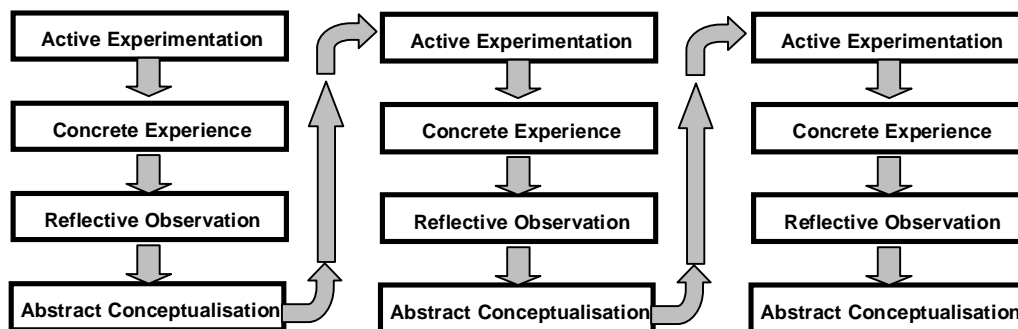


Figure 3.17: Dynamic, Progressive Experiential Learning Process

Space between panels - Reflection Time

Both Eisner (1985) and McCloud (1993) emphasize the importance of the space between panels (the gutter) as a structural element. For simulations, space between decision periods has implications in terms of the necessity for reflection (Gosen & Washbush, 2005; Gosen, 2004) and the need to plan for this and reinforce it. Where the simulation is spread over time this reflection can be at a subconscious level and automatic. But, where the simulation is run as in a single session, reflection time will be conscious and must be designed in and enforced.

For example, at predefined times, the Prospector simulation generates *requests* from a mythical *parent company* (the trainer) to provide information (Figure 3.27). This forces participants away from the Active Experimentation – Concrete Experience phases of the Kolb (1985) cycle to the Reflection and Conceptualisation phases of the cycle and overcome a problem with Direct Use simulations – the Short Circuited Experiential (Hall, 1995b) – where participants become obsessed with experimentation.

Parent Company Reviews	
1.	Search Criteria Review
2.	Pre-evaluation Criteria Review
3.	Tender Criteria Review
4.	Final Offer Review
5.	Tender Price Review
6.	Risk Level Review
7.	Work Budget Review
8.	Workload Review
9.	Cash Flow Review

Figure 3.18: Reflection Triggers

Relationship between frames/periods

Just as a common structure for the strip cartoon (rather than comic book) is three or four frames, a common structure for a simulation is six to eight periods or stages. Although when used in an academic setting this may extend to twelve or more periods.

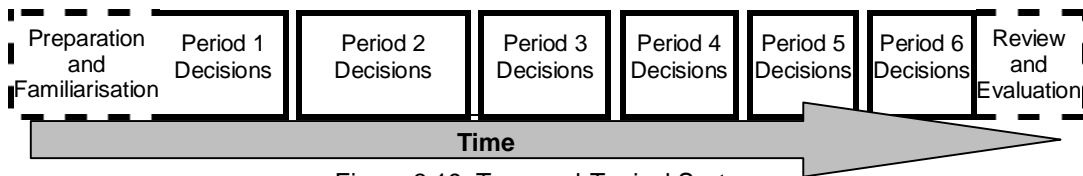


Figure 3.19: Temporal-Topical System

The panels fully or partially surrounded by a solid line indicate the process associated with actually running the simulated business (decision-making). The dotted line panels indicate stages in the simulation where the learners are preparing to run the business and reviewing and evaluating their performance. The width of the decision-making panels can narrow as time passes as learners become familiar with the business they are managing and so make decisions faster.

Transition/Progress over time

McCloud (1993) discusses the comic in terms of the transitions from panel-to-panel and suggests several types of transition that link one panel to the next. In a similar manner, simulations *progress* from period-to-period or stage-to-stage in several ways and these parallel McCloud's transitions (Figure 3.19).

Cartoon	Simulation
Moment to Moment	Economic Progression
Action to Action	Task Progression
Subject to Subject	Issue Progression
Scene to Scene	Business Progression
Aspect to Aspect	Viewpoint Progression
Non-Sequitur	Ad Hoc Progression

Figure 3.19: Types of transitions and progressions

Moment-to-Moment Transition/Economic Progression

The Moment-to-Moment Transition moves a single subject forward over time and is paralleled by Economic Progression that defines how the economic situation changes

independently of the decisions made. For example, with DISTRAIN; the market sectors (Counter, Industrial and Commercial) each had an underlying growth rate and the Commercial sector had a significant seasonal pattern (Figure 3.20).

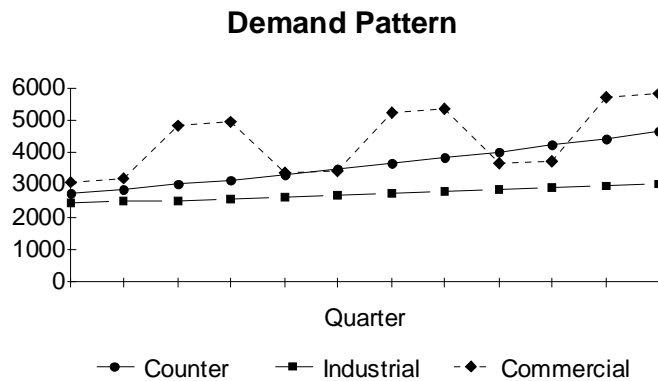
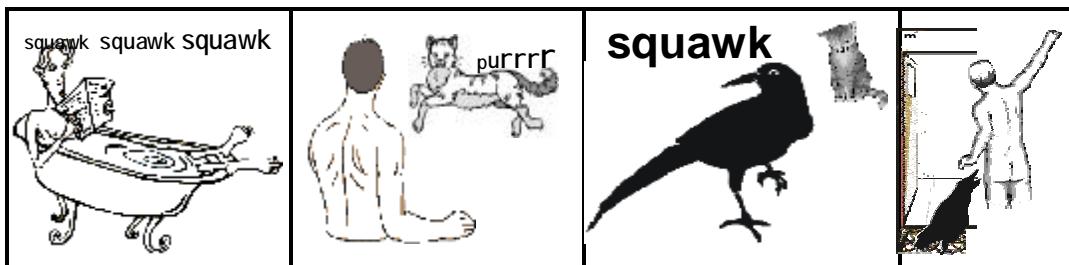


Figure 3.20: Economic Progression

This *economic progression* was stylised in that only one market had a seasonal pattern and all had significantly different growth rates. This was done so each caused different problems and raised different issues.



Cartoon 3.01: Moment-to-Moment Transition

Aspect-to-Aspect Transitions/Viewpoint Progression

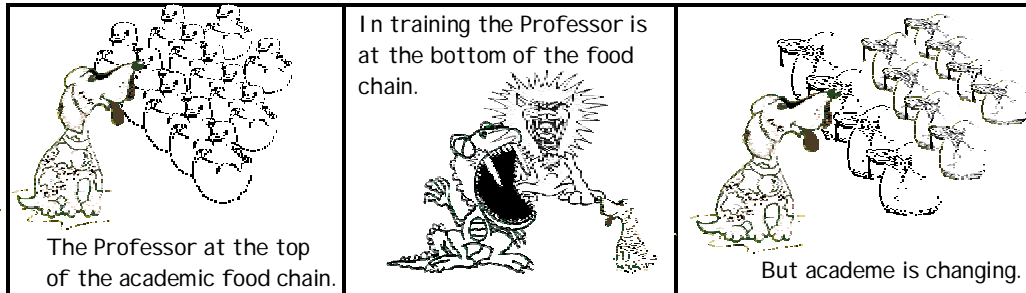
Aspect-to-Aspect Transitions involves looking at a “*place, idea or mood*” from different viewpoints (McCloud, 1993). Viewpoint Progression parallels this by introducing new reports to provide new viewpoints on the business being run and are these new reports designed to promote discussions on specific issues. (This contrasts with Task Progression (described next) where new decisions are introduced and the associated reports are secondary to this.)

For example, Product Launch although the decisions do not change, the reports evolve from a single report to several (Figure 3.21). Where each report introduces new issues associated with the Product Life-Cycle. Again this is an example of stylisation, as in the *real world* all reports would be provided from the beginning.

Product Launch – Viewpoint Progression	
Period	Report
1	Single, basic report showing outcomes for the period
2	Basic report plus comments to stimulate thought
3	As for period 2 plus a report showing decision and result trends
4	As for period 3
5	As for period 4 plus report showing trends in marketing issues
6	As for period 5 plus profitability report and sales graph
7	As for period 6 plus sales forecasting report and income & profit graph

Figure 3.21: Viewpoint Progression

At period 3, providing a table of decision and result trends, encourages learners to start thinking about the longer term (rather than just the current period). At period 5, producing a report showing trends in marketing (price, promotion %, penetration %, market share % and sales demand) encourage the learners to reflect on how their marketing mix decisions are influencing sales. At period 6 the profitability report (showing trends in gross profit %, net profit % and return on investment) encourages discussion about profitability and how actions and the Product Life-Cycle have been affecting these.



Cartoon 3.02: Aspect-to-Aspect Transition

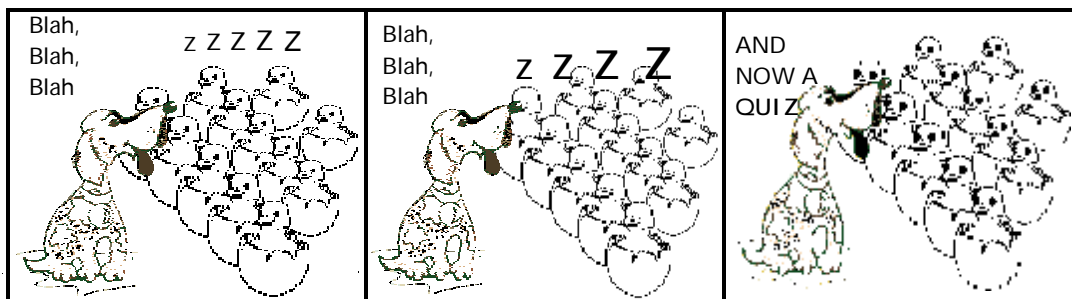
Action-to-Action Transitions/Task Progression

In contrast to Moment to Moment transitions that concentrate on a single subject, Action-to-Action Transitions move between subjects with substantial changes in these from panel to panel. In a similar manner, Task Progression defines how the business decisions evolve as the simulation progresses and so parallels McCloud's Action-to-Action transitions. For SEED (Figure 3.22), the simulation moves from researching the business, to market planning and then to operations and financial planning. Task Progression involves introducing new decisions (and associated reports) as the simulation progresses, with each new decision introducing a new task to discuss and learn about.

This stylisation was necessary as allowing teams to make all decisions from the start resulted in cognitive overload.

SEED – Tasks	
Period	Planning Options
January	Business Research and Policy Advice
February	As January plus Marketing planning decisions
March	As February plus Resource and Working Capital planning decisions
April onward	All decisions

Figure 3.22: Task Progression



Cartoon 3.03: (In)Action-to-Action Transition!

Subject-to-Subject Transition/Issue Progression

Issue Progression occurs when there is a step change in the issues explored by the simulation and parallels McCloud's Subject-to-Subject Transition This may be done through a change in the environment (as is the case with Product Launch where competitors enter the market about half way through the simulation – causing an increase

in price sensitivity and a reduction in promotion sensitivity). For Prospector, issue progression was more complex (Figure 3.23) and involved moving from stage-to-stage in the acquisition of profitable projects.

Prospector	
Stage	Issues
1	Project Search: deciding a policy for project size, experience, urgency and client type.
2	Pre-qualification: assessing project risk in more detail and deciding best fit.
3	Tendering: determining how to maximize profit while ensuring winning the bid
4	Negotiation: ensuring the best work schedule and cash flow

Figure 3.23: Issue Progression

Issue Progression also involves the stylisation of the real world. Each circle in Figure 3.24 represents a business issue that in the *real world* overlaps, is interwoven and tangled. However, to improve and clarify learning, with simulations we have the opportunity to reduce complexity, overlap and entanglement. Figure 3.25 illustrates how a simulation can be designed to the change importance of issues and new issues introduced as a simulation progresses so as progressively focus on different areas (perhaps to link to a course).

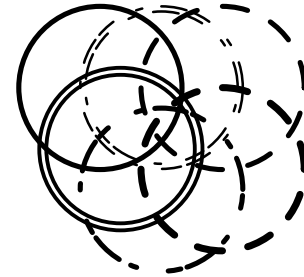


Figure 3.24: Real World Issues

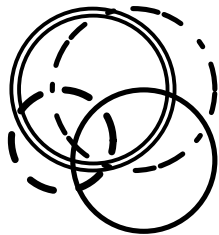


Figure 3.25a: Period 1

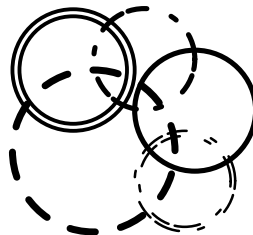


Figure 3.25b: Period 2

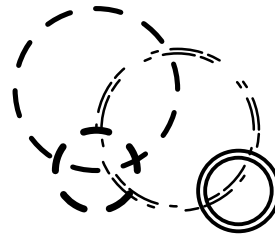
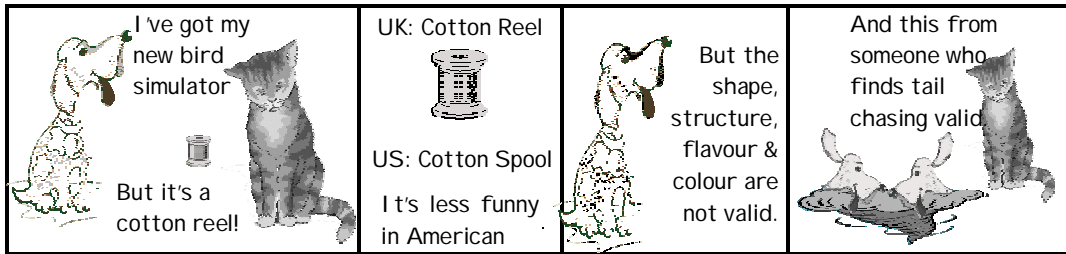


Figure 3.25c: Period 3

Figure 3.25a shows the issues focussed on during the first period of a simulation. Compared to Figure 3.24, the number of issues has been reduced and their relative importance altered. Two issues (the double line and dashed line) are important. One (the solid line) is slightly less important and one issue (the dotted line) of minor importance.

However, in the second period (Figure 3.25b), the dotted line issue has been increased in importance and the three other Period 1 issues have reduced in importance. Also, a new issue has been introduced (double dashed lines). By Period 3 (Figure 3.25c), the dotted line issue that peaked in Period 2 has now shrunk in importance but the issue introduced in Period 2 (double dashed lines) has increased in importance. The double line issue has continued to have reduced importance and the solid line and dashed line issues have disappeared. However, a major new issue (small dotted line) has been introduced. The preliminary introduction a new issue (double dashed line in figures 25b and 25c) in a minor form before introducing it fully latterly, parallels comic strip's Levitz Paradigm (O'Neil, 2001) where for comics a sub-plot is hinted at in a panel before it is introduced fully.

The importance and number of issues change from period-to-period to reduce cognitive load and focus on specific, defined learning objectives. However, to ensure deep cognitive processing and discussion, the issues must still overlap and interact to some extent. This topic is revisited later in the section about Foreground and Background (see Figure 3.41).



Cartoon 3.04: Subject-to-Subject Transition

Scene-to-Scene Transition/Business Progression

Business Progression defines the impact of the decisions on the outcomes period by period and parallels McCloud's Scene-to-Scene Transition that involves significant changes over distances or time. This is illustrated in the Product Launch simulation, where as the market is penetrated customer types evolve (as different types of customers adopt the product (Rogers, 1962). This means that as the customer base is penetrated price sensitivity increases (Figure 3.26)

Penetration-Price Sensitivity Model

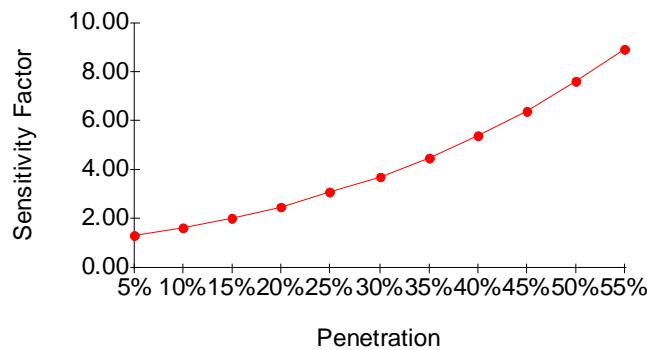
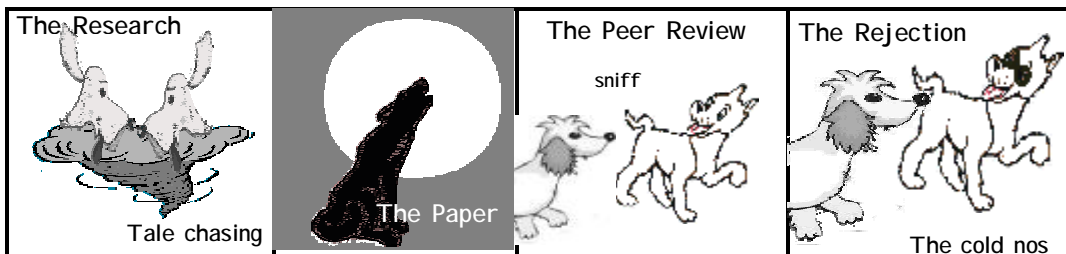


Figure 3.26: Business Progression

Thus this progression defines how the simulation responds dynamically to the decisions made. This is further illustrated by the first version of Product Launch. Here it was felt that customers would respond immediately to price increases but there would be a delay before they reacted to price reductions. Although this delay was realistic it was so ambiguous that it made it impossible for participants to visualise the impact of their price decision. This produced a dynamically unstable result as participants over corrected. Because of this, the delay in the response to price reductions was removed (stylisation of the model to reduce ambiguity).

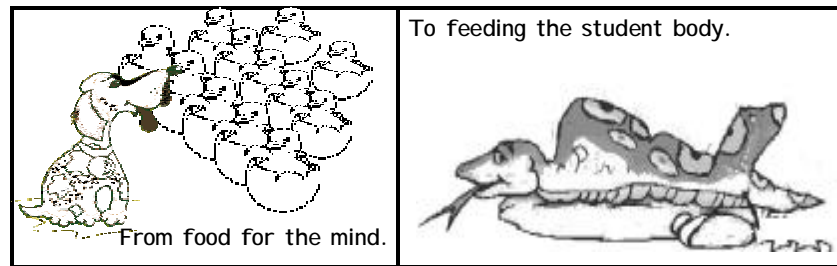


Cartoon 3.05: Scene-to-Scene Transition

Non-Sequitur Transition/Ad Hoc Progression

The Non-Sequitur Transition is where there is no logical relationship between panels and this parallels the introduction of ad hoc changes (Ordway, 1977) or *shocks* (Snyder, 1999) as the simulation progresses. For example, in DISTRAIN it is possible for the

trainer to override the pre-defined growth in sales demand to simulate a disruptive event such as a hurricane.



Cartoon 3.06: Non-Sequitur Transition

Moore (2007) warns about comic transitions that “the problem is to move from one place or one time to another without doing anything violent or clumsy that would disturb the reader’s thread of involvement”. This problem also exists for all the simulation progressions, but is particularly true for ad hoc progressions where an inappropriate shock can cause disaffection (Hall and Cox, 1993). Because of this I embed ad hoc changes only exceptionally. Rather, I provide the capability for the trainer to introduce them proactively. But even so, whether ad hoc changes are embedded in the simulation or introduced proactively, I believe that it is important to give the learners some warning. O’Neil (2001) discusses this for comics in terms of suspense and surprise. Where “*suspense is the state or condition of mental uncertainty or excitement*”. O’Neil continues stating, “*surprise has limited entertainment value*” but “*suspense can keep readers enthralled*”. Consequentially, forewarning of an event provides suspense and forces learners to think about the issues. Introducing changes without warning (surprise) – even though this may be real! – causes disaffection and does not provide learning. Just as the Non-Sequitur Cartoon is made meaningful through the last panel of the earlier Aspect-to-Aspect Cartoon, without this forewarning the Non-Sequitur Cartoon is both baffling and silly – and, for simulations, we do not want the learners to be baffled or feel that the simulation is silly.

Design Considerations

Usually, a simulation consists of a combination of progressions. However, by considering them separately, one can consider different aspects of the desired learning and the extent to which they interact and increase complexity.

The frequency with which I build these transitions into simulations varies (figure 3.27).

Simulation	Frequency
Economic Progression	All simulations
Viewpoint Progression	Most simulations
Issue Progression	Reasonably frequently
Task Progression	Infrequently
Business Progression	Rarely
Ad Hoc Progression	Very rarely

Figure 3.27: Frequency of use of progressions

My frequency of use is dependant on general need, specific learning needs and cost. So I build **economic progression** into all simulations because I believe that it is necessary to the cognitive and affective learning process (see Chapter 4) and, this is despite the fact that it takes considerable time (see Chapter 8). I contrast, I build **viewpoint progression** into most simulations because it is quick and easy to do and provides additional learning opportunities in a managed way. (Managed because it allows me to define when a topic will be introduced and discussed.) I use **issue progressions** reasonably frequently because they allow me to introduce additional learning opportunities at defined times. I use **task progression** infrequently because I have not had many design briefs that

require this for this form of progression, Because building in **business progressions** involves a lot of design effort to ensure that their dynamic response is stable (see Chapter 4), I rarely use them. Because of the cognitive and affective problems with **ad hoc progressions**, I use them very, very rarely.

Relationships: Model and Interactions

The relationship between the comic's words and picture is a vital design element. Eisner (1985) states that *"in sequential art the two functions are irrevocably interwoven"* and later heads a section with the title *"WORDS/ART: INSEPARABLE"*. O'Neil (2001) states, *"To be a comic book, those words and images must work together"*. Just as the relationship is vital for comics, so too for simulations the relationships between model and the interactions are vital as it is this that effects the learners' ability to understand cause and effect and so improve decision-making as the simulation progresses.

For comics, McCloud (2006) explores the balance in depth and suggests several categories of word/picture combinations (Figure 3.28) most of which have parallels for simulations.

Category	Description
Intersecting	Words and pictures working together in some respects but also contribute independently.
Interdependent	Words and Pictures combine to convey an idea that neither would contribute independently.
Word-Specific	Words provide all you need to know.
Picture-Specific	Pictures provide all you need to know.
Duo-Specific	Both send roughly the same message.
Parallel	Words and Pictures follow seemingly independent paths.
Montage	Words and pictures combined pictorially.

Figure 3.28: Word/Picture Categories (Making Comics 2006)

Intersecting Decisions and Results

This is probably more frequent form of relationship and represents the situation where a result is affected by several decisions, where a decision affects several results or both (Figure 3.29).

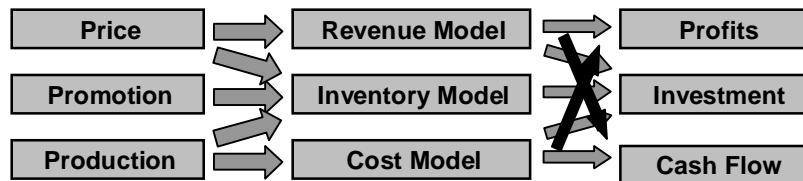
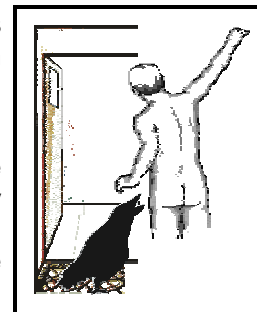


Figure 3.29: Multiple intersections.

Figure 3.29 shows a meta-view of the links between interactions (decisions and outcomes) and the model for the Product Launch simulation. (To the right one is reminded of the intersecting problems of the naked man, the bird and a door onto the street.)

From the design viewpoint one must ensure that there are sufficient intersections for deep cognitive processing but that they are not so complex and ambiguous that they inhibit learning. Because of this it is often useful to break the links down into the simpler combinations that follow.



One can combine this form of interaction with Duo Specific (below) and also build in Tutor Support information that shows to the trainer the impact of individual decisions.

Interdependent Decisions and Results

This is where there is direct link between a single decision through the model to a single result (Figure 3.30).



Figure 3.30: Direct (interdependence)



At the end of the Tendering Stage for Prospector simulation participants must submit a price to the (virtual) customer and based on this single decision the contract is won or lost. The panel to the left indicates the interdependence of *sniffy* academics and dog behaviour (word and picture)!

From the design viewpoint, this structure can be used to force learners to stop and focus on a specific issue or to reduce the ambiguity of less important decisions. But there is a risk that it may be too unambiguous and hence reduce learning.

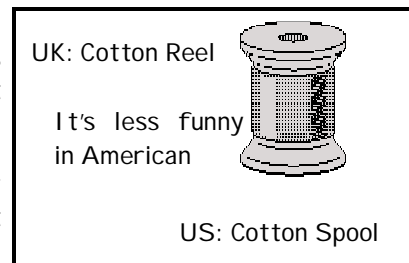
Interaction Specific Decisions and Results

This parallels Word Specific and here the model plays no part in the translation of decisions into outcomes (results) (Figure 3.31).



Figure 3.31: Interaction Specific

The SEED simulation illustrates this where one learning objective was timely market and business research. If the appropriate market research is not performed it is not possible later to plan the business. So, for example, (referring back to Figure 3.19), if market size and price research is not done in January then during the following month (February) it is not possible to plan the market.



However, this market research decision is not processed by the model but is immediately reflected back as information (to be used later by the model). The panel above helps explain the play on words (reel and real) for people who speak American English!

From the design viewpoint, this structure provides a means of defining a sequence of actions and forcing the learners to think about these.

Model Specific Decisions and Results

This parallels Picture Specific where the model drives the results (Figure 3.32) and decisions play no part.



Figure 3.32: Model Specific



At the end of the Product Launch simulation, decisions and results are analysed and compared with prior runs generating a list of strengths and weaknesses. Also, during the simulation, this relationship can be used to generate discussion and reflection (see Prospector simulation, Figure 3.25). (To the left the picture alone conveys the parallel between preparing an academic paper and howling at the moon.)

From the design viewpoint, this structure provides a way of triggering reflective thought or introducing new issues.

Because the Interaction Domain has two aspects (Results and Decisions) there is a second Model Specific situation where the model drives the need for decisions (Figure 3.33)



Figure 3.33: Model Specific

This occurs when the simulation model determines a situation that needs management action and so asks for a decision. For example, in the Beat the Boss simulation, if insufficient raw materials are purchased and there is an inventory shortage, the model then asks the participants whether they wish to make an emergency purchase (at a premium price) or do nothing.

From the design viewpoint, this structure provides a way of introducing problems caused by the current economic and business situation – in other words, it provides a way of introducing crisis based on learners' actions.

Parallel Decisions and Results

This, for simulations, is where the model and outcomes follow seemingly independent paths as the simulation progresses. Thus, for several periods, the response of the model to one set of decisions and the outcomes produced by them are apparently not linked to the other set. But, eventually, they dovetail (figure 3.34), thus emphasising the topic and rewarding long-term consistency and thought.

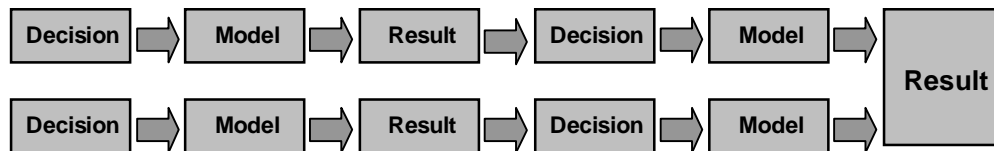
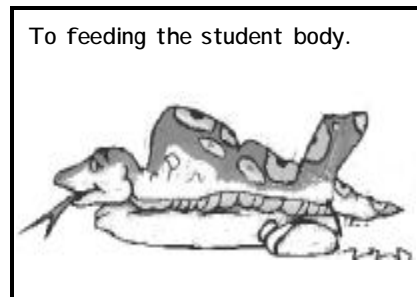


Figure 3.34: Parallel (independent)

This is illustrated in the Product Launch simulation, where over time price and promotion decisions impact the degree to which the market is penetrated. Although this has a short-term effect on profits, capacity need and cash flow, there is a long-term effect on competitive strength. An effect that becomes apparent and important when the (simulated) competition enters the market shortening the Product Life Cycle.



Similarly, the panel above (from Cartoon 3.06) is only fully explicable because of the last panel in Cartoon 3.02.

From the design viewpoint, this structure provides a way of focusing on the long-term impact of decisions where the outcomes and decisions eventually link. Also, linking of the two provides a stimulus to reflection and the review of past actions.

Duo Specific Results

This occurs with simulations when the *same* message is provided in two (or more ways) to emphasize an issue and stimulate discussion (Figure 3.35).

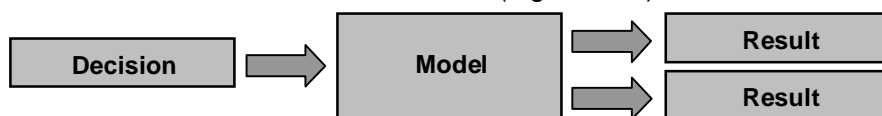
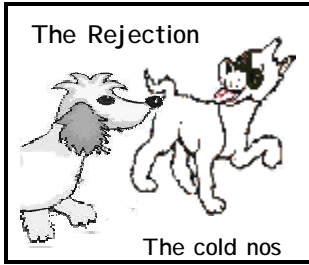


Figure 3.35: Duo specific



For example with the DISTRAIN simulation, participants receive routine information about sales (at cost) and inventories that allows them to consider whether the inventory level is optimum. But, if inventories are well above the optimum to meet sales demand the message “*Accountants feel inventories seem high for*” is generated. (The panel uses the position and temperature of the reviewer’s nose to reinforce the words “*cold nos*”.)

A more complex example is the SMITE Sales Management simulation where sales are impacted in a very complex way (figure 3.36) making it difficult for teams to understand cause and effect.

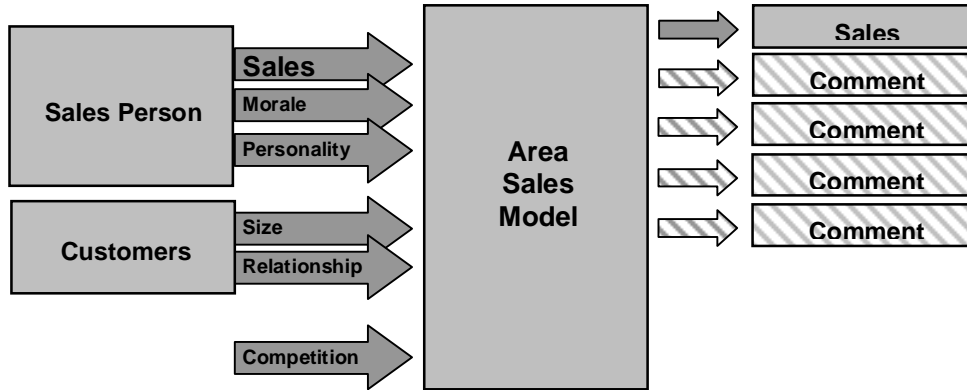


Figure 3.36: Complex Duo specific

With SMITE, every period the sales for every unit is generated and, as appropriate and depending on importance one or more comments produced. However, when designing this I had to balance warning teams of problems against overloading them with too many comments. So you may wish to have logic that prioritises comments and if necessary limits the numbers. Further, it is useful to have comments at two levels. The first where there is a slight problem and the comment is ambiguous and the second where the problem is severe and the comment is unambiguous (for this latter case it may be sensible to word it as though it was from “*head office*”. Finally, it may be useful to *phase* the introduction of the comments.

From the design viewpoint, this structure provides a way of *limiting* the problems facing the learners and forcing them to address a problem that has now become serious. Additionally, it can be used to clarify cause and effect relationships are there are two or more indicators (where there is an Intersecting Relationship).

Montage

The last comic word/picture relationship (**Montage**) occurs when the words take on picture qualities. For simulations, graphics, pictures, sound and music replicate it. For example, impending bankruptcy in the Beat the Boss simulation is indicated by the theme music from Jaws (indicating the threat and, perhaps, the persona of banks). From a design viewpoint, this relationship is perhaps more appropriate to managing the feelings of the learners (affections) rather than their cognitive development.

Design Aspects

Except for very simple simulations, there will be several types of relationship between the model and interactions. When, where and how a type of relationship is used will depend on the required cognitive development and workload. In other words what learning is desired how much time is available for the simulation.

Characters

Heroes and Villains

Just as comics have heroes and villains, a simulation has **opportunities** and **threats**. Just as crafting of both the heroes and villains is vital to comics (O'Neil, 2001), for simulations designing the opportunities and threats are vital. It is these that provide major opportunities for introducing issues and their exploration. For example, I commonly pit growth opportunities (hero) against that threat of bankruptcy (villain). (This was the case with Product Launch where as the sales grew the investment in productive capacity could lead to bankruptcy). But like a comic (or a crime novel) there are both obvious and hidden villains (threats) where it is the concealed threat that requires the greatest thought and from this provides learning. Again, Product Launch provides an example. While avoiding the obvious bankruptcy threat, if participants do not grow sales sufficiently they will not be in a strong enough position to see off the eventual competition.

Flawed Heroes

Most opportunities should be flawed with inappropriate decisions, like Superman's kryptonite leading to disasters. I remember the pilot for INTEX (Industrialising Nation Simulation) where one person recognising the opportunity for growth increased advertising 100 times. Sales grew very substantially, but the extra cost led to a huge, unrecoverable loss – needless to say the person making this decision worked for an advertising agency.

Introductions

Also just as most comic heroes are flawed, the business situation facing learners should have initial **strengths** and **weaknesses**. Commonly, I use an initial situation where the business has low profitability but is cash rich – a situation where the low profitability (weakness) is balanced by high cash (strength) (as is the case with the DISTRAIN simulation).

So, when designing a simulation it is vital to consider opportunities and threats and the initial strengths and weaknesses – how these relate to each other, learning objectives, the issues that the introduce and how the simulation must be *stylised* to address these.

Humour and Stylisation

I really, really, really wanted to cite Scott Adams (1999) and then discovered his section on humour (humor). I immediately realised that his six dimensions of humour (below) were paralleled by some aspects of simulation design.

- Cuteness
- Meanness
- Bizarreness
- Recognisability
- Naughtiness
- Cleverness

Cuteness

Arguably, the kitten in Cartoon 3.01 is *cute*. For business simulations this can apply to the scenario, especially where an imaginary business is modelled. For example, for the SEED simulation I used a series of actual Cuddly Toys as props and the simulation's *back-story* included a failed university research project.

Meanness

Arguably, the bird in Cartoon 3.01 is *mean* (at least I felt so at the time). For business simulations we are looking at the degree of challenge and difficulty. Just as in Cartoon 3.01 the *mean bird* was not immediately apparent it is sensible for challenge to creep up on the learners – a concept that is discussed in Chapter 4 as part of managing affection. I remember the final of the National Production Management Game in the late 1970s where all the contestants and I were given a Fountain Pen – mine was inscribed "*Chief*"

Tormentor". Also, in Chapter 4, I suggest that too much emphasis on *fun* may be counter productive as it can be at the expense of learning – in other words, *struggle* is good.

Bizarreness

Arguably, the snake in Cartoon 3.06 is *bizarre*. For business simulations it may be useful if the business scenario is unusual. So for example, the *ultrasonic* cement mixer in the UMIK simulation and the *Chucker Cabs* (the floor to door service) in the Service Launch simulation are arguably bizarre. An element of bizarreness is appropriate for an Imaginary Product.

Recognisability

Arguably, the hatching chick students in Cartoon 3.03 are recognisable as archetypal first year university students. For business simulations the situation and issues must be recognisable, reasonable and relevant but there is still a need for stylisation and simplification. In my experience, just as a kitten can recognise that a cotton reel (spool) replicates a bird, provided the industry structure and issues relate to and are relevant, the simulation need not need to model these in detail.

Naughtiness

Unquestionably, the *sniffy* academic with his *cold nos* is *naughty*. For business simulations we are looking at exaggeration. As described earlier, with DISTRAIN it would not be sensible to closely replicate the distributors' low profit. Rather, I exaggerated the ability to be profitable in the interests of engagement and eliminating disaffection. In general, I find it useful to design the simulation so that learners can perform better than they could in reality – even if this is naughty.

Cleverness

Arguably, the *sniffy* academic with his *cold nos* is *clever*. For business simulations I am looking at cognitive "*traps*" – decisions where the outcome seems obvious unless you think deeply. For example, with Product Launch it is vital for the product to have penetrated the market to a significant extent before competition enters the market. But this involves using all the available cash and hence risking bankruptcy. So a team that *plays it safe* and maintains a *safe* cash balance will do this at the expense of market penetration and profits. So here we are looking at decisions that have both a short and long-term impact and decisions with cross-elasticities.

Composition

For any graphic art form such as the comic strip, a fine art painting or even a photograph, composition is vital. A similar situation exists in the parallel world of the corporate cartoon and this section explores framing, perspective and foreground/background.

Framing

Just as a cartoon picture or fine art painting can frame still life, a person (portrait) or a landscape, simulations can frame a range of business situations (from an individual business activity to replicating a complete company). For simulations and as discussed in Chapter 2 (Types of Simulation) these are at the following levels:

- Activity/Concept Framing
- Functional Framing
- Internal Company Framing
- External Strategic Framing

Activity/Concept Framing

Here the simulation frames a single business activity or concept and other aspects have minimal impact. For example the Product Launch Simulation frames the Product Life Cycle and Prospector frames winning *profitable* contracts.

Functional Framing

Here the simulation frames a single functional area and other functions have no or minimal impact. For example SMITE frames the Sales Management function.

Internal Company Framing

Here the simulation frames the *internal* operation of a complete business with minimal impact from *external* aspects (economy, market change etc). Both Modern Banking and DISTRAIN involve running a complete company but with little concern for the issues associated with their strategic positioning.

External Strategic Framing

Like internal company framing these involve the complete business but the emphasis moves from a focus on the *internal* operation of the business to the *external, strategic* issues. To constrain complexity, the framing of strategy is often at the expense of internal company framing and the internal operation of the business is simplified (and perhaps automated). SEED is an example of such a simulation.

Framing Issues

For example, Product Launch's focus on the Product Life Cycle only requires three decisions (price, promotion and production). Although the price and promotion models are complex, the operational (production) and financial (profit and cash flow) models are simple. Actual production is as decided (and does not involve capacity planning, material purchases etc). Although Product Launch produces a profit statement, this is simple and this does not separate out Gross Profit from Operating Profit etc, there is no depreciation or interest payments. Likewise, Cash Flow just takes into account Cumulative Profit, Fixed Assets and Inventories. It does not take into account payment delays (Accounts Receivable and Payables etc.)

In contrast, SMITE simulation has no operational, product development aspects or financial decisions. Rather the emphasis is on sales territory management, effectiveness, efficiency and staffing. So its decisions focus on human resources (hiring, firing, promotion, coaching and training etc) and staff deployment (area allocation, sales opportunities etc.) Although there are several financial reports, these focus on measuring profits and efficiency and there are no reports showing Assets and Cash Flow.

Modern Banking and DISTRAIN involve running a whole business and so cover marketing, finance, operational in detail. Both cover the *marketing mix* (price, promotion, product and 'place (customer groups), involve managing profits, the Balance Sheet and cash flow (profitability, liquidity, etc.) and operations (forecasting, capacity planning, efficiency, quality, etc.) and how these interact. However, market conditions are stable, funding is simplified, there are minimal product/service changes.

SEED, frames the strategic positioning of a start-up, entrepreneurial business and so covers market choice, deciding distribution and operational structure, how the chosen market is stimulated and organising funding. Based on these *strategic* decisions, the day-to-day operation of the business (scheduling, capacity planning etc.) is done automatically by the simulation model.

I believe that it is inappropriate to mix frames in a simulation. So, for instance, I believe that a simulation designed to explore strategic issues should not involve tactical management decisions and results.

Perspective

A cartoon's perspective parallels the consistency of the simulation in terms of operational, tactical and strategic interactions where operational decisions might be ordering raw materials or changing an individual's working day; tactical decisions might be deciding the current period's price or production level and strategic decisions might be deciding which markets to serve. Here we are looking at the *mix* of decisions made for a single period (Figure 3.37).

Perspective	Example Decisions	Example Results
Operational	Material Purchases, Staff Overtime	Idle time, material shortages
Tactical	Current Price, Short-term Borrowing	Current demand and cash flow
Strategic	Market's Served, Funding Mix	Wealth Creation, Solvency

Figure 3.37: Perspectives - Operational, Tactical and Strategic

So, although for a functional framed simulation it is appropriate to mix these, it would not be appropriate to have operational and (often) tactical interactions in a strategy framed simulation. For example, it was not appropriate for SEED (a strategic planning simulation) to schedule production or decide prices on a month-by-month basis. Rather operational structure was decided and based on this a schedule automatically calculated and price levels were decided relative to general inflation.

Frame/Focus	Perspectives
Activity/Concept	Operational or Tactical or Strategic (but not a mix)
Functional	Operational, Tactical and Strategic
Internal Company	Tactical but with some Strategic or, perhaps, Operational
Strategic	Strategic with, perhaps, Tactical but not Operational

Figure 3.38: Focus/Perspective balance

Figure 3.39 shows how different types of simulation *map* to the *operational, tactical* and *strategic perspectives*. So a Total Enterprise simulation to enable learners to *appreciate* how business works (Appreciation) will have a tactical perspective with some strategic elements (but no operational elements). In contrast, a Strategy Simulation will have a strategic perspective with some tactical elements (but no operational elements). A Tactical Total Enterprise Simulation will have a tactical perspective with some operational aspects. A Totality Simulation, like a Functional simulation will cover all perspectives. Unlike Total Enterprise and Functional Simulations where individual simulations cover several perspectives, individual Concept, Planning and Process Simulations tend to concentrate on a single perspective. (But when looking at a range of Concept, Planning and Process simulations, individual simulations will have different perspectives. For example, one Planning Simulation might focus on the next week's *operation*, another on an annual *tactical* plan and a third on a five-year *strategic* plan.)

Perspective	Total Enterprise			Other		
Operational						
Tactical	Appreciation		Tactical	Totally	Concept	Process
Strategic		Strategy		Functional	Planning	

Figure 3.39: Simulation Type/Perspective balance

Perspective allied with simulation type provides a way of checking to see if the decisions and results are appropriate or inappropriate. In other words, it ensures that the simulation does not waste time by including irrelevant or inappropriate perspectives and does not constrain learning by not including necessary aspects.

Time Scale

Relating to what is framed we also must consider how much time is simulated each decision-period (Figure 3.40).

Perspective	Decision-Period
Operational	Daily, Weekly or Monthly
Tactical	Monthly or Quarterly
Strategic	Quarterly or Yearly

Figure 3.40: Time Scales

DISTRAIN processes time on a quarter-by-quarter basis and Modern Banking on a year-by-year basis. The decision-cycle for Product Launch is not specified and Prospector moves through several stages rather than through several periods.

Also, especially for operational simulations, there may be a primary and secondary time scale and where intermediate results are produced as a period is simulated or that allow for reactive decisions to be made during the decision-period. My TEAMSILL simulation has a primary decision-making cycle of a month but results are provided on a daily basis. My custom Banking Operation Simulation progresses on a week-by-week basis but reactive decisions (such as working overtime or transferring staff between departments) can be made on a day-by-day basis and the operation works on a half-hour step.

Foreground, midground and background, etc

Any graphic design, including comic strips, has a composition element involving the idea of Foreground, Midground & Background. These concepts are equally important for business simulations. Except here we are looking at the issues addressed by the simulation and the relative importance of decision/outcomes sets both for the simulation as a whole (Figure 3.41) and as the simulation progresses (Figure 3.42).

Figure 3.41 shows for the case study simulations key business issues are shown as foreground, midground, background or none (not included) across a business's functional areas (Marketing, Finance, Operations, Human Resources (HR) and Research and Development (R & D)). Additionally, Figure 3.41. shows whether the focus is primarily on the internal operation of company as a whole (Company), on the external strategic issues (Strategy), on a functional area (Function) or on a particular task element (Activity).

Focus	Activity	Company	Company	Activity	Strategy	Function
Marketing	Product Launch	Modern Banking	DISTRAIN	Prospector	SEED	SMITE
Price Promotion	Foreground	Foreground	Foreground	Foreground	Foreground	None
Product	None	None	Background	None	Midground	None
'Place (Market)	None	Midground	Midground	Foreground	Foreground	Foreground
Finance	Product Launch	Modern Banking	DISTRAIN	Prospector	SEED	SMITE
Profit & Loss	Midground	Background	Foreground	Foreground	Foreground	Foreground
Assets	Background	Background	Foreground	None	Midground	None
Funding	None	Foreground	None	None	Foreground	None
Cash Flow	Foreground	Foreground	Foreground	Foreground	Foreground	None
Profitability	Background	Background	Foreground	Foreground	Foreground	None
Liquidity	None	Foreground	Foreground	None	Foreground	None
Operations	Product Launch	Modern Banking	DISTRAIN	Prospector	SEED	SMITE
Forecasting	Foreground	Foreground	Foreground	None	None	Foreground
Capacity	Midground	Foreground	Foreground	Background	None	Foreground
Scheduling	None	None	None	Background	None	Foreground
Efficiency	None	Background	Background	None	Midground	Foreground
Quality	None	Midground	Midground	None	None	Foreground
HR	Product Launch	Modern Banking	DISTRAIN	Prospector	SEED	SMITE

Development Capability	None	None	None	None	None	Foreground
Assessment	None	None	None	None	None	Foreground
Motivation	None	Background	None	None	None	Foreground
R & D	Product Launch	Modern Banking	DISTRAIN	Prospector	SEED	SMITE
Product Process	None	None	None	None	Midground	None
	None	Background	None	None	None	None

Figure 3.41: Framing and Foreground/Midground/Background Elements

Like the comic strip, the simulation consists of a series of stages that change the importance of the current decision/outcome/issues. Changes that can be viewed in terms of foreground (where participants should concentrate most effort and spend the most time), background where the decisions/outcomes are least important (and hence warrant the least consideration, effort and time) and midground where the decisions/outcomes fall between the two. Figure 3.42 shows for the Product Launch simulation, how Decisions, Results and Issues move in and out of foreground, mid ground and background.

Period	1	2	3 – 4	5	6+
Decisions					
Foreground	Promotion	Production	Production & Promotion	Price	Promotion
Midground	Price	Promotion	Price	Promotion	Price
Background	Production	Price		Production	Production
Results					
Foreground	Volume	Volume	Volume & Cash	Market Share	Cost
Midground	Cost	Cash	Cost		Volume
Background	Cash	Cost			Cash
Issues					
Foreground	Penetration	Forecast	Cash Flow & Penetration	Competition	Profit
Midground	Forecasting			Pricing	Promotion
Background	Profit				Pricing

Figure 3.42: Product Launch – Decision/Outcome Importance

During period 1, participants use “Test Market” information to help them their first decision and, although they often concentrate on price, the promotion decision is actually more important. This is because with no competition, it is important to become established before competitors enter the market. Price is less important (midground) even though it may be useful to increase it as for a newly launched product customers are likely not to be sensitive to price. Finally, production is in the background as it is relatively easy to forecast once promotion and price have been decided.

However, in the second period, although promotion is still important, production moves to the foreground. This is because the product (a self-heating soup) is a repeat purchase product (which means that sales are both to new customers (affected largely by promotion) and repeat purchases from customers who purchased in the previous period). As a consequence and usually, participants underestimate sales growth and produce too little. Thus the production decision moves into the foreground. Promotion is still important (midground) but the price decision moves into the background.

For period 3 and 4, participants are faced with two conflicting needs – to penetrate the market and not run out of cash. A conflict that occurs because market penetration involves sizeable increases in sales demand and, in turn, this requires greater production and investment in fixed assets. This pushes both the promotion and production decisions into the foreground forcing participants to consider how they interact so there is an optimum balance between demand and capacity ensuring maximum penetration without risking bankruptcy.

At around the fifth period, competition enters the market and this changes the relative importance of price and promotion. Now the promotion of both the participant’s company and the competitors draw customers to the retail outlet where they can compare prices.

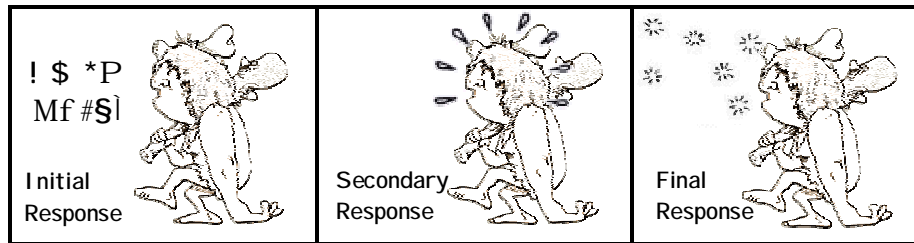
Thus the market moves from being promotion sensitive to being price sensitive. As a result of this price moves into the foreground, promotion into the midground and production the background.

From period six onwards, provided the participants have recognised the change in sensitivities and now that competitors are also promoting, the foreground decision is how the participants can cut promotion to maintain profits as prices erode.

Although discussed in the context of three bands (foreground, midground and background) the positioning of decisions & outcomes is not as simple as there is a continuum between foreground and background. But it does provide a means of linking decisions and results to a particular period's issues (see Issue Progression earlier) and hence to learning needs. Also, this positioning helps one make rational choices about decision and result ambiguity with *foreground* decisions and results being more ambiguous (to ensure deep thought) and *background* decisions and results being the least ambiguous (to make most efficient use of time).

Indicia – Textual Comments

Indicia (emanata, plewds, squeans, briffits, etc.) (Walker, 2000) are those graphic clues to the state of mind and actions of cartoon characters (Cartoon 3.07) where the caveman went from nittle (maladicta), through plewds to squeans.



Cartoon 3.07: Responding to the news of the Mother-in-Law's visit

This gave rise to my asking, “*Can I do the same thing with business simulations*”. I believe that the answer is yes and this is achieved by using *Textual Comments*. Just as Indicia provide graphic clues I believe that textual comments can provide a means to stimulate thought and discussion about:

**staff, supplier and customer perceptions,
strengths and weaknesses,
provide feedback from the *parent company*,
events
progress
future tasks**

Staff, Supplier and Customer Perceptions

These provide *clues* about problems about decisions and results based on feedback from staff, suppliers and customers. Thus, possibly they parallel *plewds* – hard working or very worried (sweat beads around head). As these will be provided directly to the learners they should be ambiguous and this can be due to wording (using words line feel and believe) and source (accountants complaining about high inventory levels and low prices and sales staff complaining about low inventory levels and high prices).

Minor Strengths Year 2 Quarter 2

Sales feel inventory is about right for Industrial

Major Weaknesses Year 2 Quarter 2

Sales feel restricted inventory are limiting sales of Commercial

Minor Weaknesses Year 2 Quarter 2

Accountants feel too much overtime is being worked

Some Staff are complaining about workload

Some Sales feel restricted inventory may limit sales of Counter

Figure 3.43: Examples of Staff Comments

Strengths & Weaknesses

These show where the company is currently strong and/or weak. Here, arguably, strengths parallel *great idea* (light bulb) and weaknesses parallel *bad day* (thunder cloud with rain and lightning). Although, it should be possible for the learners to identify strengths and weaknesses with careful analysis, the maelstrom of work may mean that they are missed and these comments ensure that the issue is not overlooked.

Parent Company Feedback

For most of my simulations I use a corporate structure where the company run by the learners is a subsidiary and, arguably, comments from the top of the company parallel *gawlixes*. (In my experience, comments from my boss were always *gawlixes*). Comments from the parent company can force learners to reflect on issues and the parent company can ask for special reports (as was done Prospector (Figure 3.27)).

Event Feedback

Here the simulation reveals events such as inventory shortages. Thus, arguably, they parallel *emanata* - shock or surprise (straight lines around head) and *squeans* - intoxication (little starbursts or circles). These are particularly useful for operational management simulations where, for example, my TEAMSKILL simulation (a manufacturing function simulation) has an ongoing commentary documenting when machines were set-up and maintained, when they broke down, ran out of materials, when overtime was worked etc. - information that would be very difficult to find from the standard reports.

Progress Feedback

Arguably informing about progress parallel *briffits* (that show movement as clouds of dust behind running figures). For example, the Product Launch simulation comments when the team has reached halfway to its goal of a cumulative profit of a million (unfortunately this is usually too late!).

Future Tasks

Where new decisions and reports are introduced as the simulation progresses, it is useful to build into the simulation reminders about these. Arguably this parallels *lucaffects* (shiny or bright reflection of a four paned window). For example where a decision is to be introduced the following period, the current period's results should refer to this.

Other Clues

Besides using textual comments sounds and pictures can be used as clues. For example, business success could be indicated by applause, a liquidity crisis by the Last Post or Taps, etc. Also, sounds can be used to build anticipation. For example, for my BOSMAN simulation (a complex Banking Operations simulation) the client wished to slow the simulation of a day's passage and while the passage of this time was indicated by a clock ticking. In the Beat the Boss Simulation, the outcome of an advertising campaign was anticipated by a picture of and sounds of a roulette wheel (perhaps reflecting the simulation designer's attitude towards advertising (he was an economist)).

Criticism Style

Again I call on ideas from Scott Adams (1999) where he classifies *critics* into contrarians, sadists, nuts and bastards.

Contrarians

These are “*people who reflexively criticize any idea*” – in the context of simulation such feedback can be used to stimulate discussion and reflection as learners *defend* their position. In particular it can be used for Staff, Supplier and Customer Perceptions and Weakness Comments.

Sadists

These are “*people who enjoy making you suffer*”. Arguably, this is a good and necessary characteristic of a business trainer and simulation designer and as described in Chapter 4 (Design for Process), this involves building in appropriate *challenge* and is appropriate for Parent Company feedback and Progress Feedback.

Nuts

These are “*people who are angry for no reason*” and hence defines the *source* of the comment (accountants, sales people etc.). Here, the learners must unravel the extent of *bias* and appropriate action.

Bastards

These are “*people with valid criticisms*” and hence these are unambiguous comments. Thus unambiguous comments are appropriate for feedback to the trainer, but less so for the learners. For, learners, unambiguous comments should be used for Event Feedback and sparingly for really major weaknesses and problems.

Summary

Just as the cartoon combines words and pictures, the simulation combines a model with interactions and is the mathematical equivalent of the strip cartoon or comic strip.

The simulation trapezoid allows one to make informed artistic judgments about stylisation and simplification (model domain) and the extent of abstraction and granularity (interaction domain). When designing the simulation model there is a need to decide the extent to which the model is a simplified replica – a process that involves deciding what should be included and what is unnecessary. Likewise, there is the need to decide the extent to which the model is stylised. However, just as we have no cognitive problem associated with a cartoon’s simplification and stylisation, one suggests that for business simulations learners will have no cognitive problems with a move away from *reality*. And, just as this helps the cartoon provide engaging insights this helps the business simulation in the same way.

Just as the structure of the cartoon (the panels or frames and their relationships) affect the way the *story* evolves, ensures engagement and provides insights, the simulation’s decision periods build learning, ensure engagement and provide insights.

A key cartooning concept is that the words and art are inseparable (Eisner, 1985) so too it seems that the model/interactions are inseparable for business simulations and a design and discussions of design must consider how these interact and complement each other. This inseparability is important when it comes to judging the quality of a simulation. Like the cartoon, where Eisner (1985) states, “*great artwork is not enough*” an incredibly real simulation model is insufficient.

Equally, just as there are questions associated with the balance between visual and verbal (Harvey 1994) there are questions about the balance between the model and interactions. So, for example, a very intricate model may overwhelm the interaction aspects of the simulation. And, likewise a simplistic model may underwhelm the learner.

By using knowledge from the graphic strip cartoon (comic) domain the, often, tacit aspects of the design of computer business simulations can be exposed and explored.

For example, one might question the extent to which the simulation model can be stylised – is it possible to develop business simulations that deliver learning but where the scenario is surreal? Also, is it possible to use cartoon practice to develop new types of business simulation. So, although this chapter explores the strip cartoon (with incorporating a series of panels or (for the simulation) a series of decision-periods), is it possible to create a simulation that consists of a single set of outcomes and so parallel single panel cartoons (such as the Far Side cartoons)? Or, at the other extreme, is it possible to create a simulation that replicates the graphic novel?

Bellman et al (1957) when describing the design of what is regarded as the first business simulation for business training, suggested that *“Making models, mathematical or otherwise, of complex systems is an art with a small amount of science to guide one.”* And, the author believes that this still true today but, by drawing a parallel to the strip cartoon or comic, it is possible to explore the *Art of Business Simulation design* explicitly.