

Valuance[®]

Decision Analysis for the Management of an Arbitrary Process

Comprehensive Valuance Corporation

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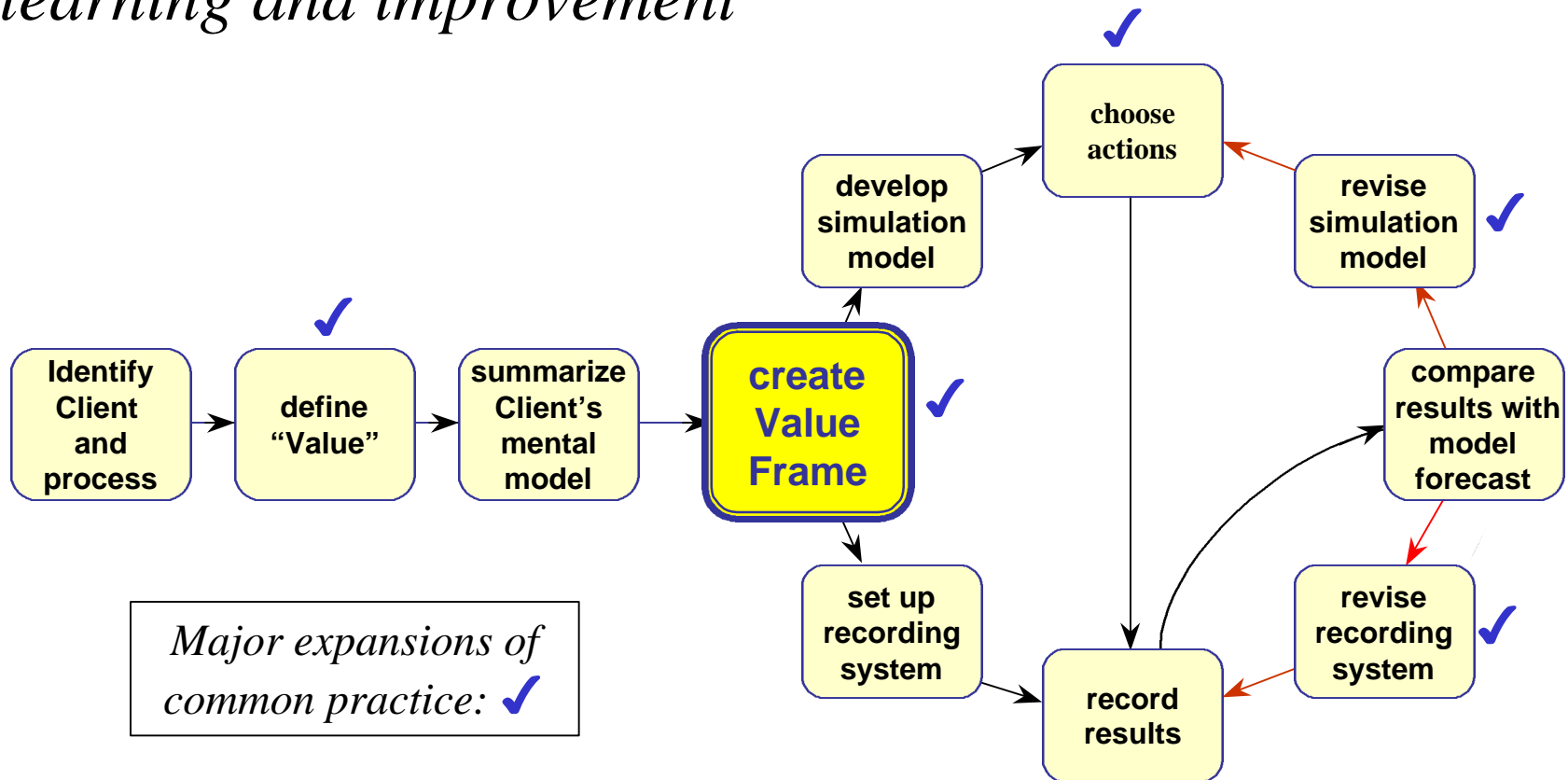
Valuance® is integrated planning and recording for the management of any values in any process

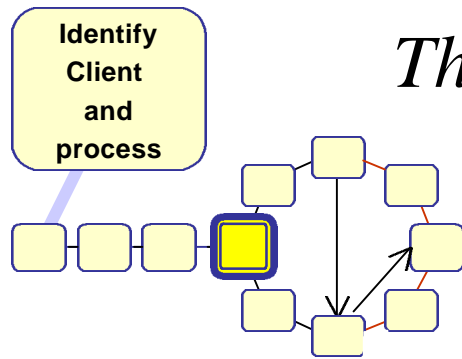
- Application of normative decision theory
 - largely consistent with common practice of Decision Analysis (Stanford school)
 - expanded in several ways, with profound implications
- Value function modeling
 - not limited to value functions that can be summed over time
 - unique approach to time-preference
- Integrates decision making with recording of results
 - enables learning from experience
- Generalizes traditional accounting, replacing its basic principles
- This presentation --
 - outlines the Valuance discipline as applied to a specific example
 - focuses on the points of expansion and their implications

Valuance® can help with any process -- and from any Client's point of view

- Large or small business
- Nonprofit organizations
- Capture and trial of Adolf Eichman
- The process of human existence on earth through the centuries, including human use of natural resources
- The use of shared resources
 - A government as Client
 - An industrial firm as Client
- The growth and education of teenagers
 - The teenager as Client
 - A parent as Client
- Personal health - loosing weight

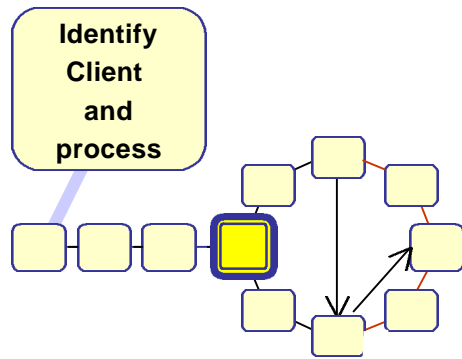
The Valuance® Cycle provides for continuous learning and improvement





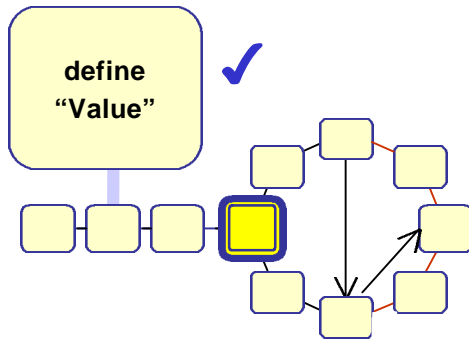
The first step is a form of high-level modeling of the Client in his or her world

- The Client is one who actually wants to influence something through action
 - Values are not arbitrary, but are those of the Client
- The process is something--
 - important to the Client
 - viewed as persisting through time



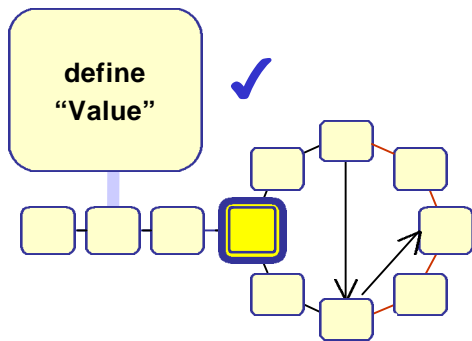
Russell Green revived his dying grain farm in less than ten years

- The Russell Green farm provides our example of a complete Valuance project
- The Russell Green example is -----
 - a small business case with the proprietor as Client
 - a demonstration of how Valuance could be used to better manage the human presence on earth and its use of natural resources
 - a template for any Valuance project
- The example gives a most general approach to
 - multidimensional values
 - time-preference issues



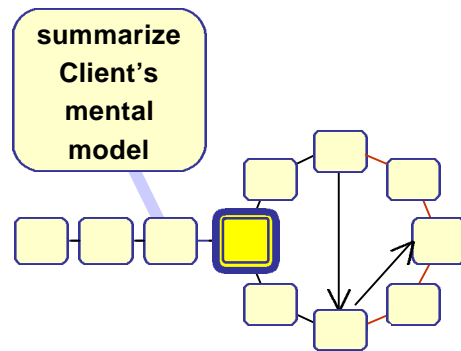
The Valuant helps the Client define “Primary Value” by asking about his or her purpose

- ***What is your purpose*** in managing this farm?
 - *Russell Green*: “to provide a comfortable living for my family, and to leave the farm to my inheritors in better condition than I received it.”
- ***“What do you have to look at*** to determine how well your purpose is being fulfilled?”
 - “I have to look at the state of the land itself, the quality of the soil and the life it supports. I look at the place we live, if it is beautiful and comfortable. I look at how much income we have each month to spend on things we want and need. When those things are all in good shape, then I feel that I am succeeding in my purpose.”
- **Primary Value -- Soil Quality, Human Domain, Family Income**



The Client's resources represent a secondary, but absolutely essential, form of value

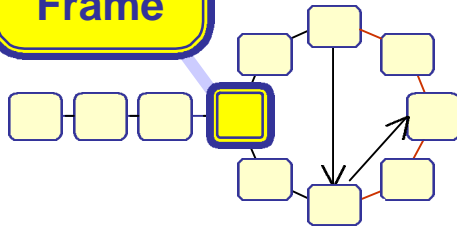
- *“What else do you have to manage to make sure your success will continue into the future?”*
 - “I must also manage my money so that I can continue to operate the farm year after year.”
 - “And there are my experienced farm hands, and of course, some machinery and equipment which have to be maintained.”
- **secondary values:**
 - **money**
 - **staff**
 - **machinery**
 - **equipment**



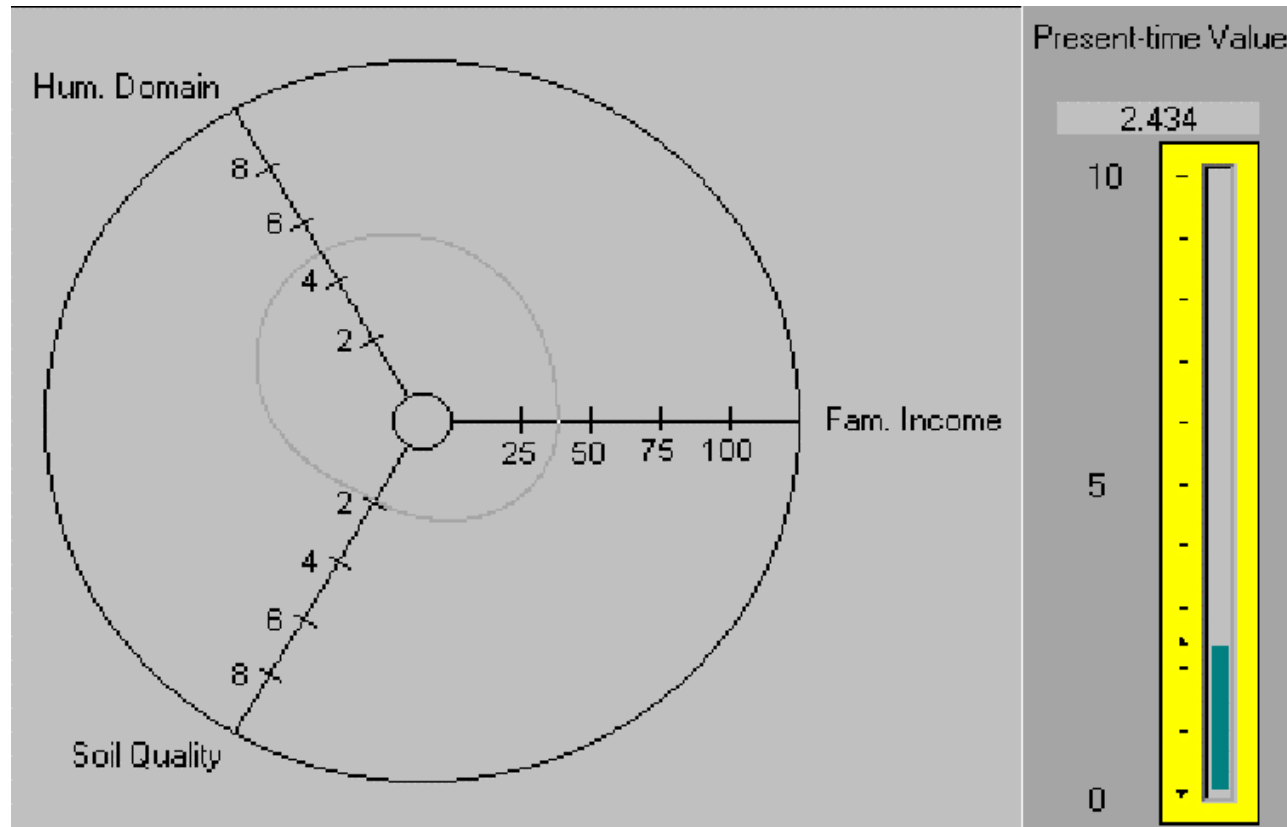
The Client's initial mental model is his or her understanding of the value-building process

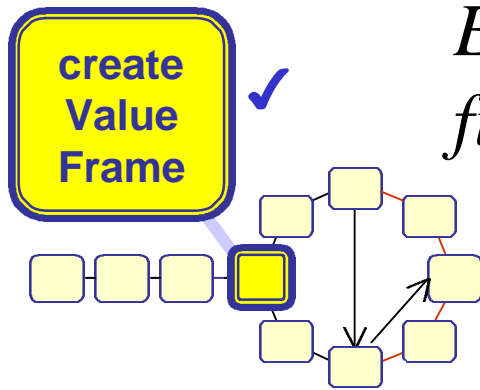
- Operating model
 - “I grow grains, trying to keep the yields up through the use of fertilizers and pesticides. I keep costs down by doing most of the work myself, but I have some experienced and loyal staff. When there is enough money, I invest to improve the home and garden.”
- Recent experience
 - costs increasing
 - profits declining
 - soil becoming depleted
 - no excess for improvements
 - concern about value of legacy for my children
 - disturbed that the land for which I am responsible is in decline

create Value Frame ✓



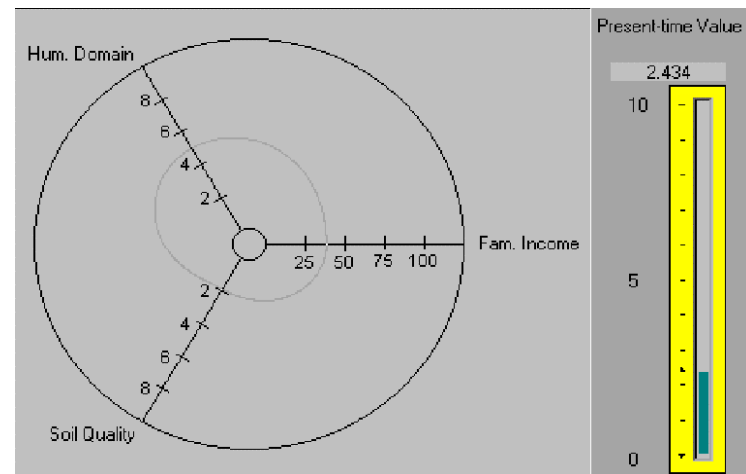
The Present-time Value function assigns a number to each possible configuration of Primary Value

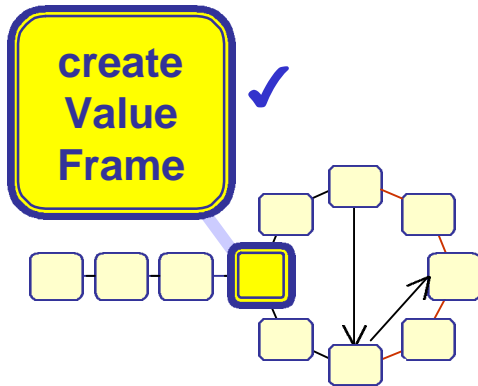




Each argument of the Present-time Value function is a Primary Value, measured in its own natural units

- Soil Quality
 - Assigned index between 0 and 10
- Quality of Human Domain
 - Assigned index between 0 and 10
- Family Income
 - Thousands of dollars per year





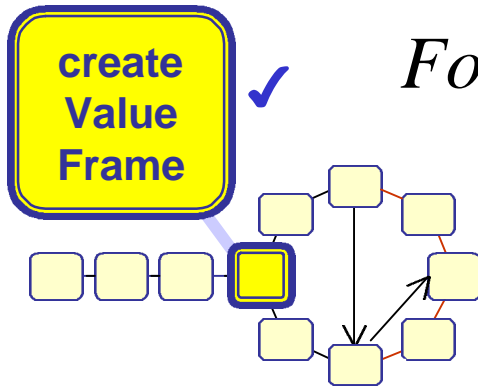
The Value Frame table gives the structure of the recording system and the simulation model

green - Value Frame

Value Frame Table

event group	event type	Soil (location) index 0 - 10	Hum. Domain (undivided) index 0 - 10	Fam. Income (undivided) draw \$/K / year	checking (undivided) balance \$/K
amendments	fertilize				
	compost				
	cover crop				
extractions	produce crops				
domain changes	improve				
assessments	assess soil				
	assess domain				
agricultural capital	invest				
overhead	maintain				
	withdraw				

quality index determined at least annually by assessment



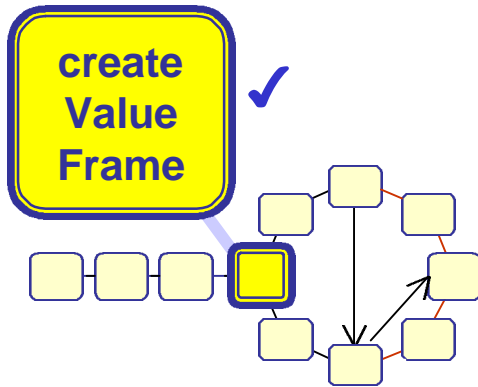
For the recording system, the Value Frame Table defines the “chart of accounts”

		Soil (location) index 0 - 10	Hum. Domain (undivided) index 0 - 10	Fam. Income (undivided) draw \$/K / year	checking (undivided) balance \$/K
event group	event type				
amendments	fertilize				
	compost				
	cover crop				
extractions	produce crops				
domain changes	improve				
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	assess domain				
agricultural capital	invest				
overhead	maintain				
	withdraw				

quality index determined at least annually by assessment

- Value Frame columns
 - value measures
 - name of value
 - value holding set
 - name of measure
 - unit of measure
 - analogous to balance sheet accounts
- Value Frame rows
 - event types
 - analogous to operating statement accounts

- Value Frame cells
 - define events in terms of value changes
 - shaded cell means --
 - that value may be affected by that event
 - effect is by definition, and in the present period
 - unlike accounting *transactions*, an *event* may affect 0, one, or many values

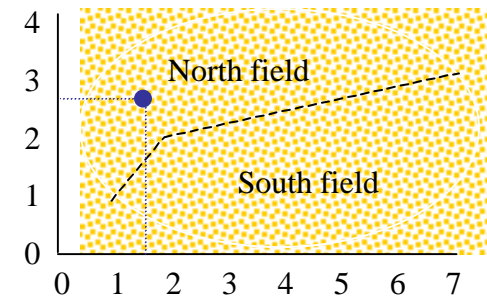


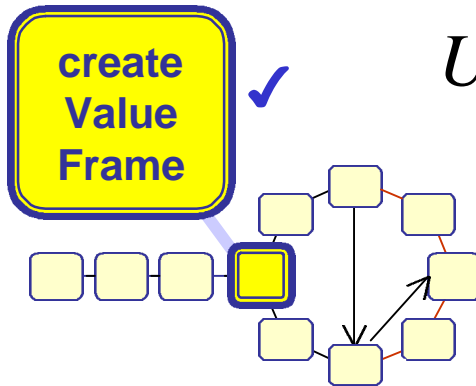
For each value, the “holding set” identifies the fundamental item which holds the value

name of value
holding set
value measure
unit

Soil (location) index 0 - 10	Hum. Domain [undivided] index 0 - 10	Fam. Income [undivided] draw \$K / year	checking [undivided] balance \$K

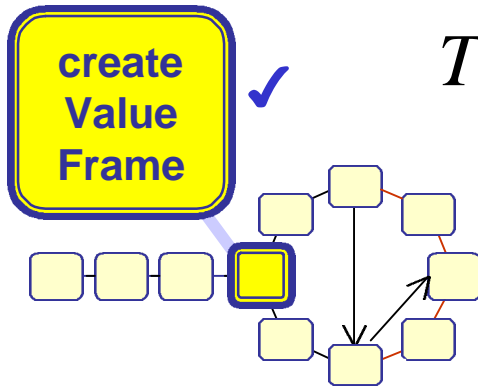
- Soil
 - “location” as physical description (coords. 1.5, 2.7)
 - not interpretive name (North field)
- other values
 - “undivided” means the holding set has only one element





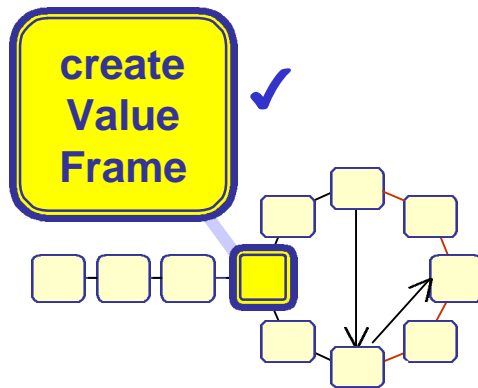
Use of the value-holding set is the key to flexibility, and to the integration of planning and recording

- *Flexibility* means we can anticipate all the questions managers may want to ask, and be prepared to answer them
 - different levels of detail
 - additional categories, or revised categories, for reporting on any variables
- *Integration of planning and recording* means we can accurately answer arbitrary questions about the difference between the projected results and the actual results
- In both areas, the practical issues are about “aggregates formed over categories”



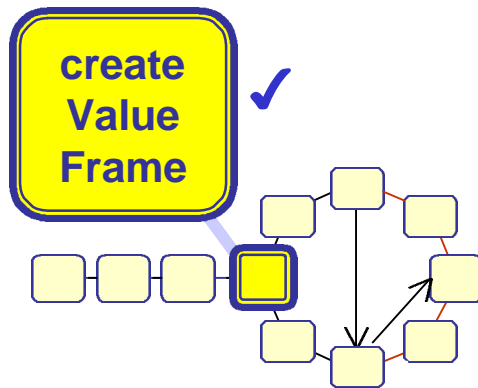
To get flexibility, we need to create structure based on mathematical measure theory

- Each value (Primary or supportive) includes
 - a value-holding set, S
 - one or more “measures” (in the mathematical sense) defined on S
 - these are functions on $\Pi(S)$, the set of subsets of S , not on S , itself
 - one or more real-valued functions on S , called state parameters
 - these define the “state of the system” as in classical dynamic systems theory
 - zero or more functions on S (of any range) called state descriptors
 - conditions placed on the state descriptors define domains of integration for functions on S
- Notice:
 - “aggregation” or “averaging” is mathematical *integration*, even in the simplest cases



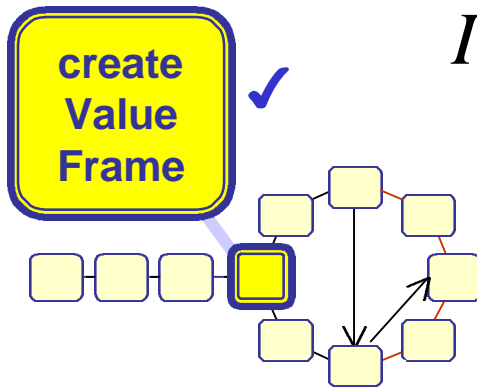
We return to the Russell Green farm example, but with more detail in Russell's "Soil" Value.

- The value-holding set, S , consists of all surface locations on the farm
 - an element of S is specified by two coordinates
 - there are two measures, called “area” and “volume”
 - there are three state parameters: “topsoil depth”; “organic percentage; “quality assessment”
 - there is one state descriptor, the use code, defining what crop is currently planted at each location, or what other use is being made of that location
 - uses include agricultural storage
 - housing for machinery
 - family residence
 - recreation

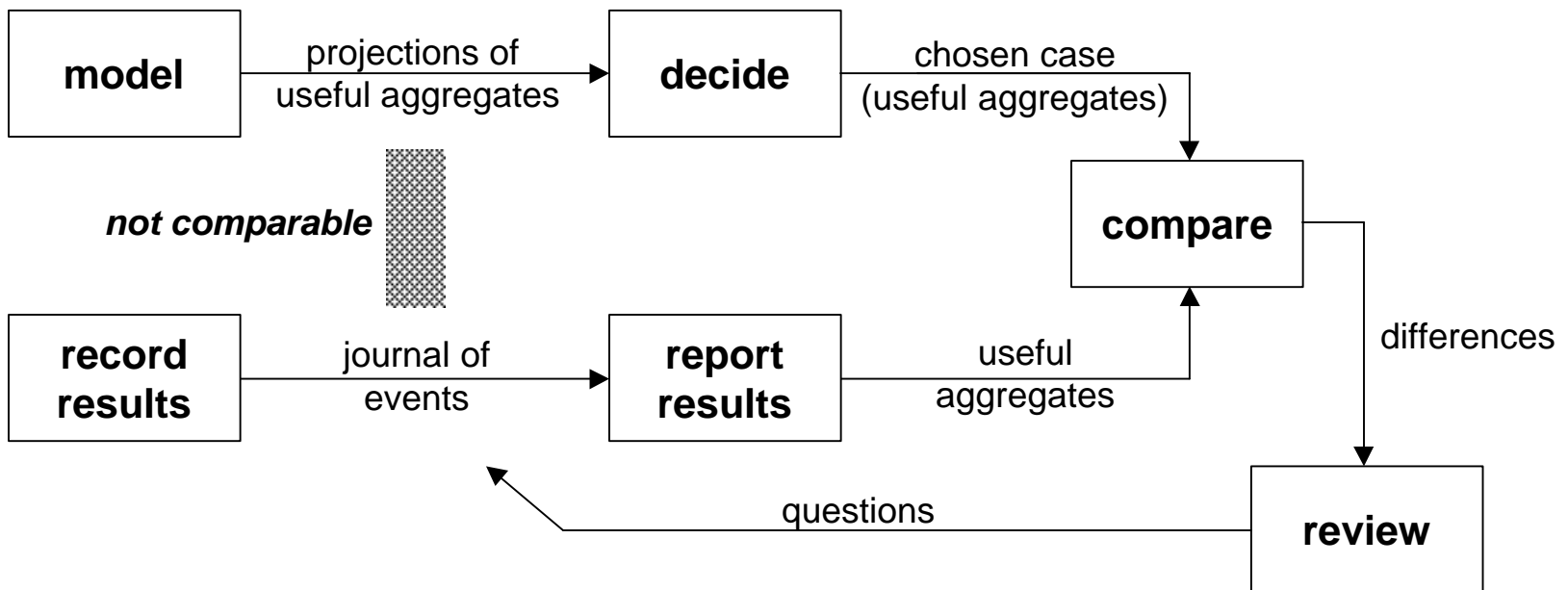


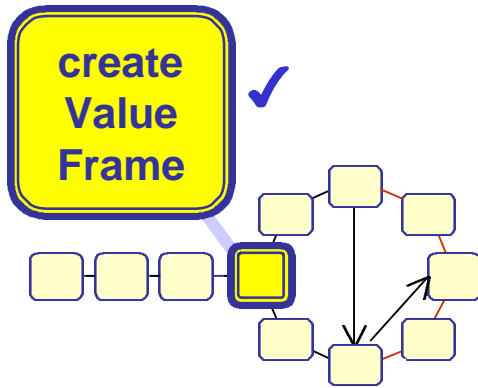
Russell's Present-time Value function includes the Soil state parameters as arguments

- Example -- simple integral of “quality assessment” weighted by area in agricultural use
 - alternates or additional value-functions
 - quality assessment weighted by area over entire property
 - average organic content per unit area
 - immense variety of changes and alternates possible *without any change in the structure* of the model or the recording system
 - why? -- because the fundamental structure is already perfectly general, limited only by the definition of the process

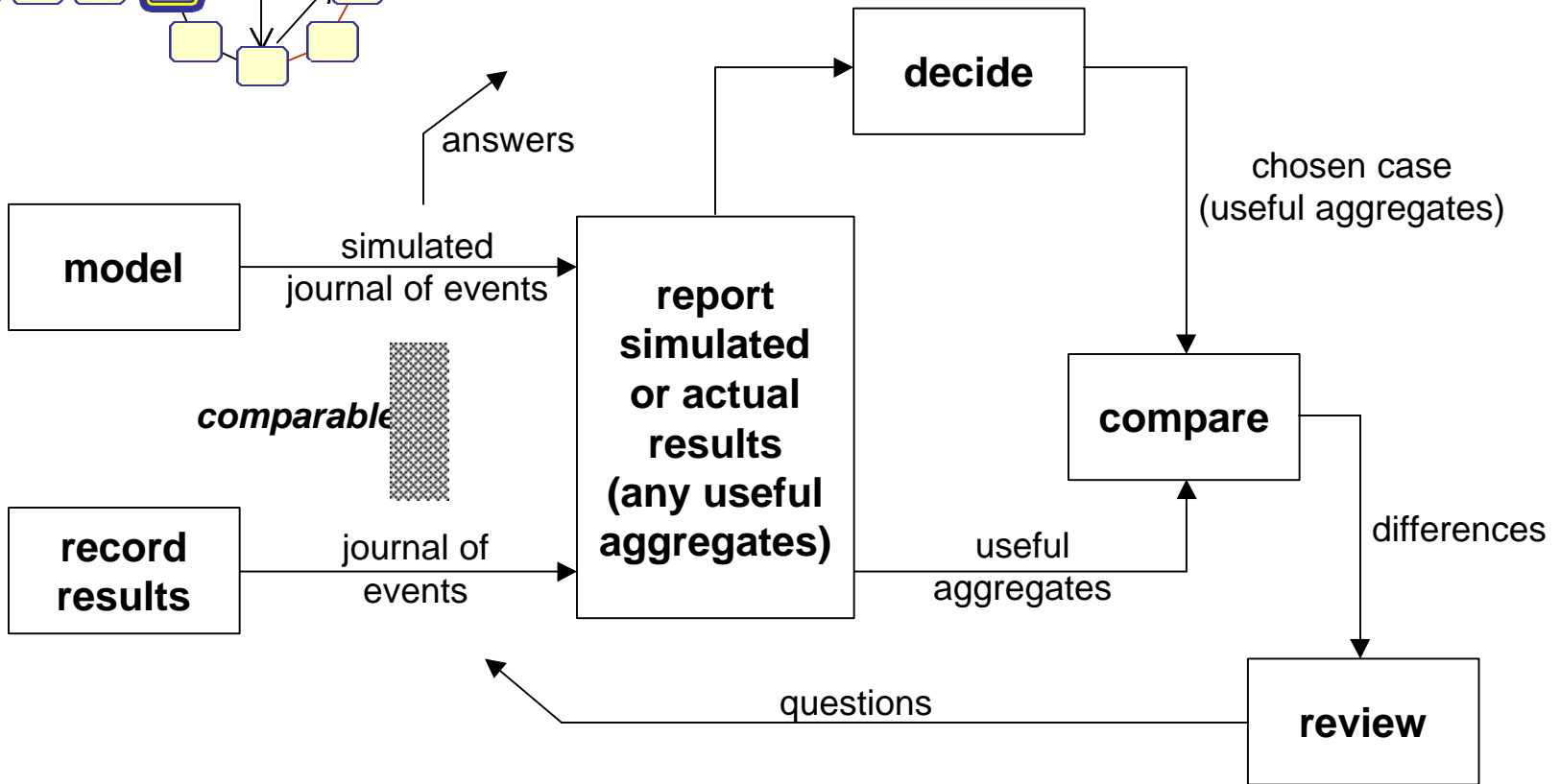


It is common Decision Analysis practice to directly model the aggregates that managers need to see

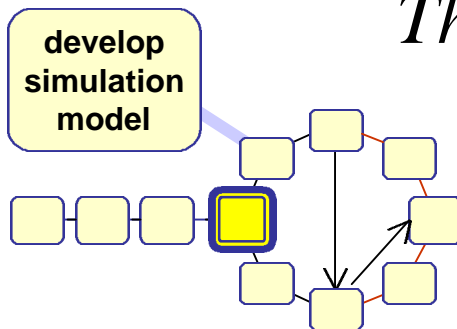




In Valuance[®], we simulate results in the same form as we record them



The formal simulation model is structured from the information in the Value Frame Table



- Model the events
 - by event type and time period
 - how they change the value measures *of the unshaded columns*
 - not necessary to identify decisions yet
- Report on Primary Values at end of each simulated period
 - exactly the same format and level of detail as in recording of actual results

		Soil (location) index 0-10	Hum. Domain (undivided) index 0-10	Farm Income (undivided) draw \$K / year	checking (undivided) balance \$K
event group	event type				
amendments	fertilize				
	compost				
	cover crop				
extractions	produce crops				
domain changes	improve				
assessments	assess soil				
	assess domain				
agricultural capital	invest				
overhead	maintain				
	withdraw				

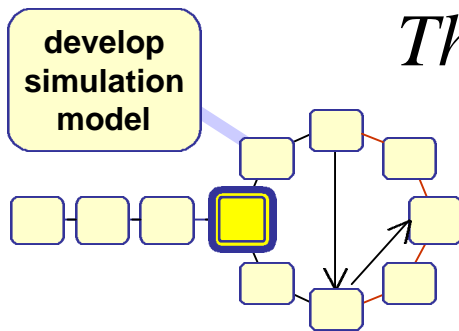
quality index determined at least annually by assessment

Russell Green's commentary on the unshaded cells:

“Fertilizer has easily predicted costs, and it is one of the factors in determining the yield of crops in any year. Another factor in determining yield is the state of the soil, itself. Fertilization also has a depletion effect on the soil, which I can estimate based on my own experience and on available research studies. Composting is a means of directly improving the quality of the soil, even substantially, but it is rather expensive, at least in the early years of use. Later on, it can become much less expensive, as the systems for generating and distributing it are developed on the farm. Cover crops also work like compost for the benefit of soil quality, but more slowly, and at less expense. The economics of the crop production process, including planting, harvesting, and everything in between, is fairly complex. However, we have been working with it for years, and have pretty good data, except for the facts that yields decline as soil quality declines, and that the extraction of crops also depletes the soil.

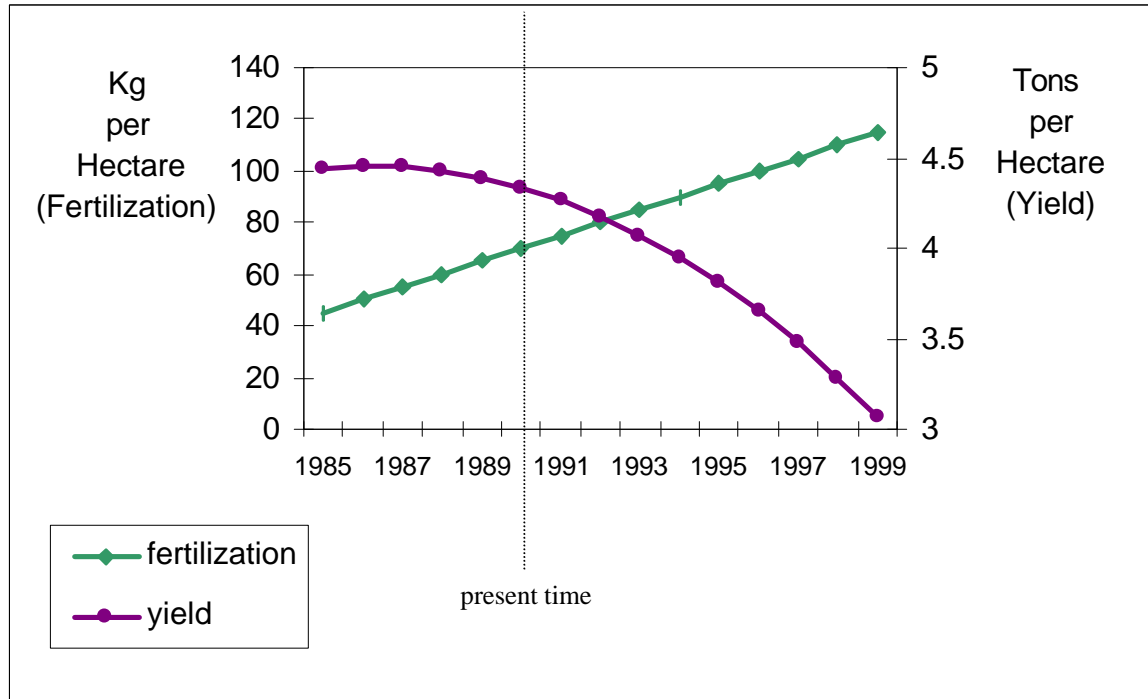
“When we have the spare funds to invest in improvements in the Human domain, we know just what to do.

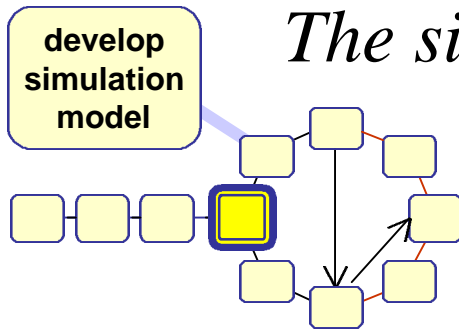
“I will want to order some laboratory tests as part of the soil assessment, and over time, develop a multivariable description of soil quality, including topsoil depth, organic content, and other key measures.”



The simulation model provides forecasts in exactly the same terms as the actual results to come

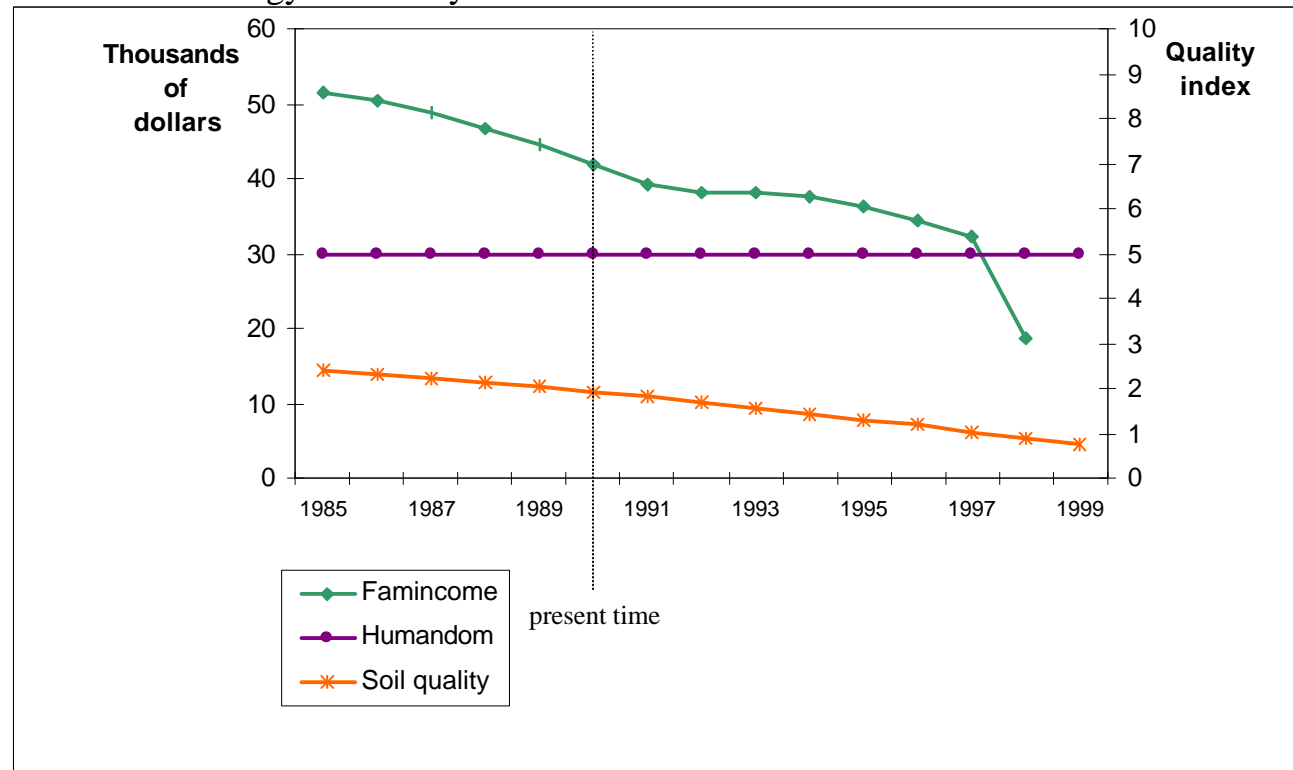
Momentum Strategy -- progress of fertilization and yield

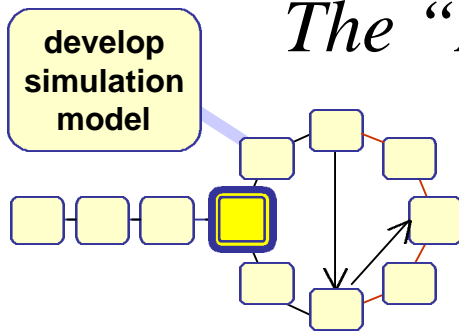




The simulation model confirms Russell Green's suspicion that more trouble lies ahead

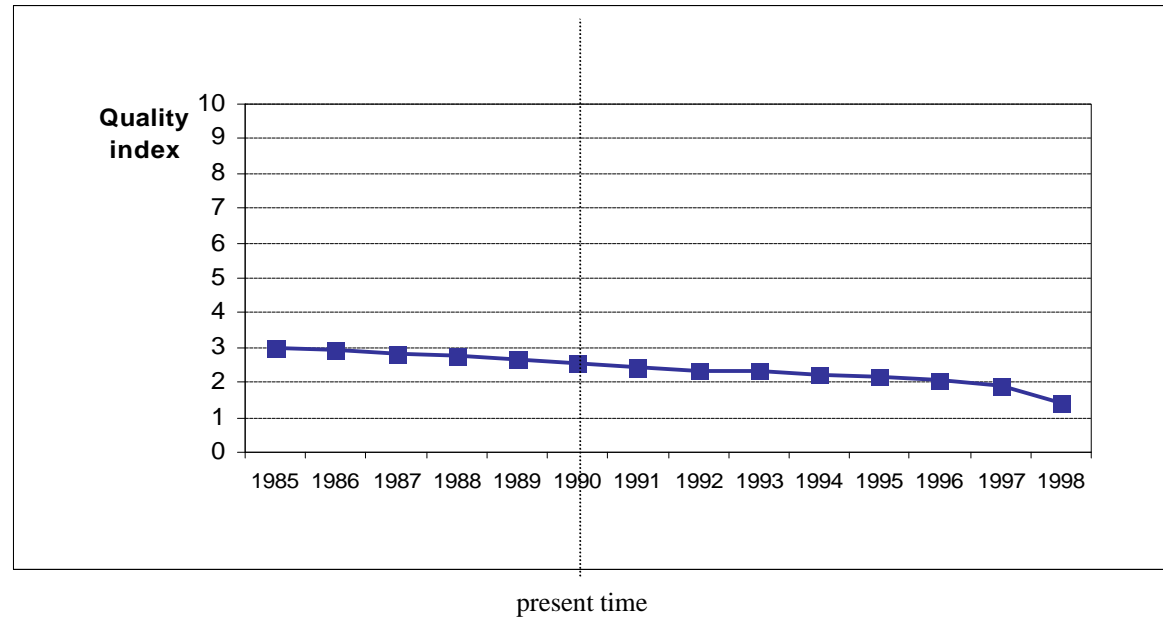
Momentum Strategy -- Primary Values

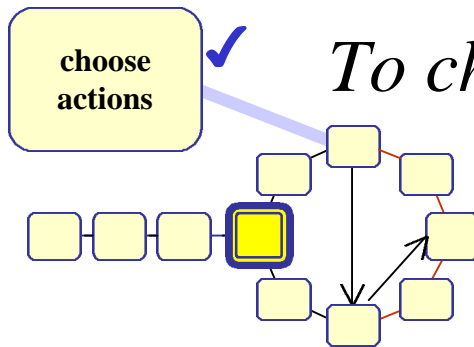




The “Momentum Strategy” would continue the serious decline of the Present-time Value function

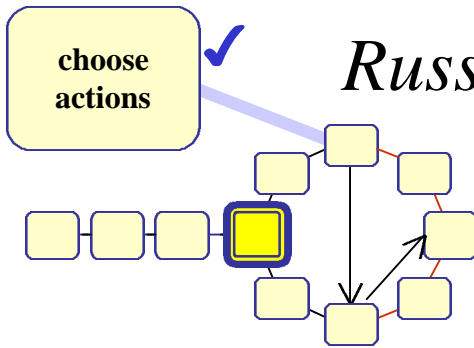
Momentum Strategy -- Present-time Value function



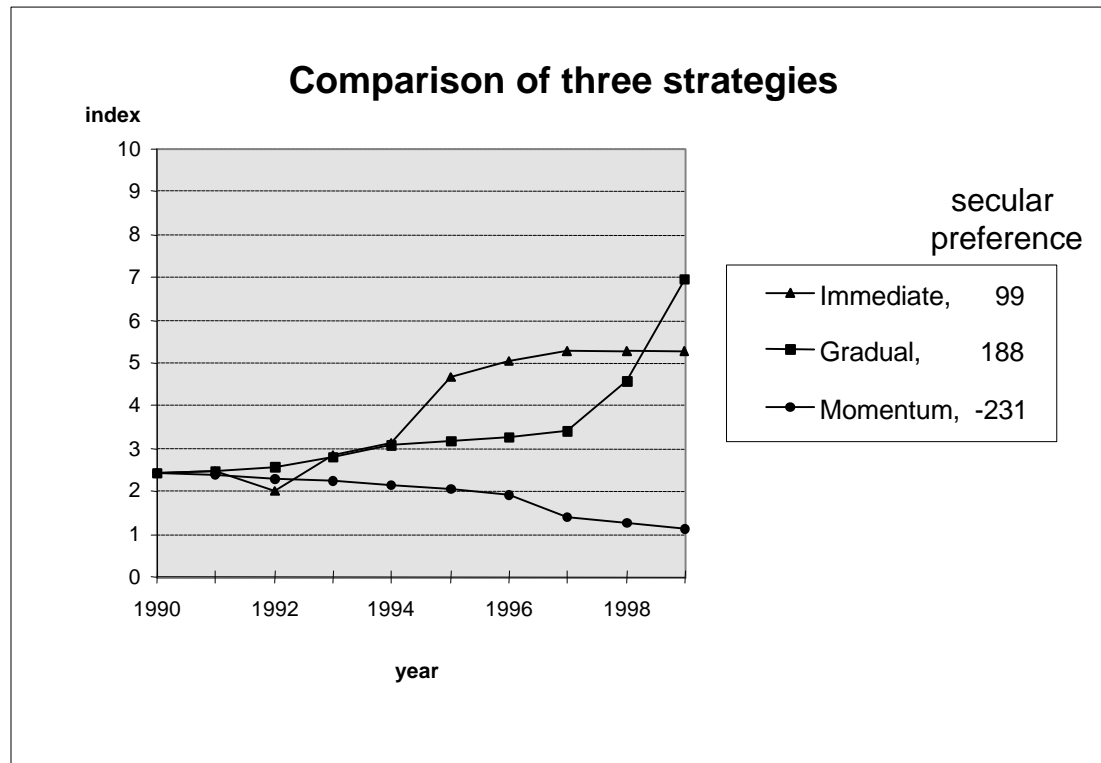


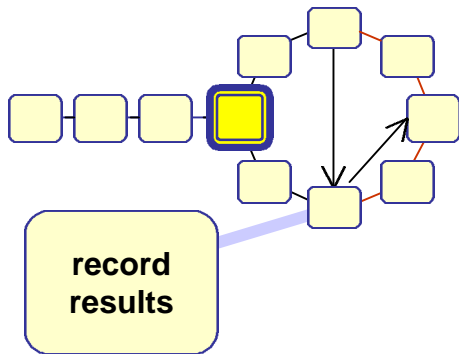
To choose action, Russell needs to consider his preferences relative to the progress of Value through time

- Time-preference is represented by the “secular preference function”
 - real-valued function
 - domain is set of various possible progressions of Value
- *Russell Green*: “In general, I would prefer the pattern in which the overall growth in Present-time Value is highest, but on the other hand, I would regard any dips along the way as very disturbing.”
 - How much does Present-time Value improve through time?
 - How bad does it get along the way?
- Chosen formula: --
 - growth rate over planning period (%), minus an “impairment penalty” calculated from the lowest Value during the planning period
 - the numerical result, for any scenario, is directly meaningful to Russell



Russell compared three alternative strategies, and chose one, based on his secular preference function





The Value Frame Table provides the format for the recording of events

Year Ended 12/31/1998		Soil	Human domain	Family income	cash
Event Group	Event Type	index 0 - 10	index 0 - 10	draw \$/ year	balance \$/K
soil amendments	fertilize				0
	compost				- 13.4
	cover crop				- .4
extractions	produce crops				+119.4
domain changes	improve				0
assessments	assess soil	+ .5			
	assess domain		+ .5		
agricultural capital	invest				- 5.4
overhead	maintain				- .5
	withdraw			+17.2	- 51.8
Totals		+ .5	+ .5	+17.2	+47.9
Projected		+ .8	+ .5	+20.6	+44.5
Difference		- .3	0	- 3.4	+ 3.5

Valuance® expands on common Decision Analysis practice in small but profoundly significant ways (1)

- The Primary Value function is **timeless**
 - After all, any human enjoyment of value must be in the present
 - The Client's assesses Present-time value directly
 - no assumption that it is somehow equivalent to an accumulation
 - Primary value is not “expended” by the act of enjoying it
 - “Resources” are of value only because they enable the creation and maintenance of circumstances for the enjoyment of Present-time, or Primary, Value
- This approach is general enough to include the usual methods as a special case
- This approach permits effective application of Decision Analysis in many areas
 - personal issues not about money
 - major world problems
 - problems with very long time horizons

Valuance® expands on common Decision Analysis practice in small but profoundly significant ways (2)

- The underlying model of the dynamic system is based on mathematical measure theory
 - State variables must be defined on an identified (measurable) set
 - Multiple measures provide the structure for all possible weighting systems
 - Immense flexibility in dealing with categories
 - Modeling the future uses the same framework as recording present events
 - Effective learning is enabled