Scientific Management Theory

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The scientific process

1. Observation
2. Hypotheses
3. Prediction
4. Theory
5. Explanation
(perspective)
Scientific Investigation

- Observation/phenomenon
  - Theory A
    - Hypothesis A
    - Data/Testing
      - Revised Theories
Some examples

Some examples from physical science?
(1) The theory of gravity

\[ F = \frac{Gm_1m_2}{r^2} \]
Observation
Observation
(2) Phrenology

Phrenology (颅相学) was introduced by a Austria doctor F.J. Gall in 1796. He believes that the brain can be partitioned into different regions, each controlling for some psychological characteristics, and will correspond to bumps on the skull. One of Gall’s student classified the brain into 37 zones, each representing one psychological mechanism.

Four doctrines

1. That moral and intellectual faculties are innate
2. That their exercise or manifestation depends on organization
3. That the brain is the organ of all the propensities, sentiments and faculties
4. That the brain is composed of many particular organs as there are propensities, sentiments and faculties which differ essentially from each other.
5. That the form of the head or cranium represents the form of the brain, and thus reflects the relative development of the brain organs.
Location of personalities

Fig. 144.
NAMES, NUMBERS, AND LOCATION OF THE ORGANS.

1. Amativeness.
2. Conjugal Love.
3. Parental Love.
4. Friendship.
5. Inhabitiveness.
6. Continuity.
7. Vitaliveness.
8. Combativeness.
10. Alimentiveness.
11. Aggressiveness.
14. Firmness.
15. Conscientiousness.
16. Hope.
17. Spirituality.
18. Veneration.
20. Constructiveness.
22. Sublimity.
23. Initiation.
24. Mirth.
25. Individuality.
26. Form.
27. Size.
28. Weight.
29. Color.
30. Order.
31. Calculation.
32. Locality.
33. Eventuality.
34. Time.
35. Tone.
36. Language.
37. Causality.
38. Compassion.
40. Serenity.
Where is your concentration?

5. CONTINUITY. [or Concentrativeness] -- Ability to chain the thoughts and feelings to one particular subject until it is completed.

Source: http://www.bc.edu/bc_org/avp/cas/sart/phrenology/phrenology_frames.html
Website

For more information about “modern” phrenology:

http://134.184.33.110/phreno/index.html
(3) Our solar system

Geocentric model

Heliocentric model
In 1905, Albert Einstein provided an explanation of the photoelectric effect. He did so by postulating the existence of photons, quanta of light energy with particulate qualities.

In the photoelectric effect, it was observed that shining a light on certain metals would lead to an electric current in a circuit. Presumably, the light was knocking electrons out of the metal, causing them to flow. However, it was also observed that while a dim blue light was enough to cause a current, even the strongest, brightest red light caused no current at all. According to wave theory, the strength or amplitude of a light wave was in proportion to its brightness: a bright light should have been easily strong enough to create a large current. Yet, oddly, this was not so.

Source: http://en.wikipedia.org/wiki/Wave%E2%80%93particle_duality
Einstein explained this conundrum by postulating that the electrons were knocked free of the metal by incident photons, with each photon carrying an amount of energy $E$ that was related to the frequency, $f$ of the light by

$$E = hf,$$

where $h$ is Planck's constant (6.626 x 10^{-34} J seconds). Only photons of a high-enough frequency, (above a certain threshold value) could knock an electron free. For example, photons of blue light had sufficient energy to free an electron from the metal, but photons of red light did not. More intense light above the threshold frequency could release more electrons, but no amount of light below the threshold frequency could release an electron.
(5) Light as particles vs. wave
Interference
Light as waves
Which theory is true?
How do we memorize?

Research question: What is the biological basis of memory? The general theory is that neurons transfer signals received from one to another in order to generate memory. But how do neuron cells do that?

Eric Richard Kandel spent all his life on this question. It is almost impossible to use human neurons for experiments. Instead, Kandel found Aplysia (海蜗牛、海兔) because Aplysia has only 20,000 neuron cells, are large enough to be seen under microscopes and the stimulated state would last for a few hours to a few days.

By stimulating Aplysia with electrodes, Kandel studied how messages were transferred between neurons.
The theory

The findings

- He found a core material responsible for message transmission between axons, the cycle AMP response element binding (CREB) protein.
- By increasing this protein, he was able to increase the memory of fruit fly significantly (reduce learning trials from normally 10 times to only once).
- He also found materials to inhibit CREB and showed that the memory of rats can be significantly reduced.
- Kandel received his Nobel prize award in 2000.
Some examples

Some examples in social science?
(7) Emotional Intelligence

cerebral cortex

Amygdala
How we deal with our emotion
Dealing with our emotion

- Use your emotion
- Know your emotion
- Regulate your emotion
(8) The Theory of intelligence

Hereditary → Inference → Intelligence

Environment
Correlation coefficients for "intelligence" test scores from 52 studies. Some studies reported data for more than one relationship category; some included more than one sample per category, giving a total of 99 groups. Over two-thirds of the correlation coefficients were derived from I.Q.'s, the remainder from special tests (for example, Primary Mental Abilities). Midparent-child correlation was used when available, otherwise mother-child correlation. The vertical lines within each rectangle are the median correlations.

(9) Two factor theory

Charles Spearman’s two-factor theory of intelligence

(10) Attachment theory

Attachment theory is a descriptive and explanatory framework for discussion of interpersonal relationships between human beings, proposed by Prof. John Bowlby in the 50s.\footnote{Note: Bowlby, J. (1958) The nature of the child’s tie to his mother. International Journal of Psycho-Analysis, 39, 350-373.
The experiment

Each test comprised the following stages:

- Mother and child enter the room.
- Mother and child are left alone; child can play with the toys.
- A stranger enters the room; talks to the mother.
- Stranger approaches the child with a toy.
- Mother leaves stranger alone in the room; stranger engages the child with toys.
- Mother returns; child’s response is noted.
- Child is left in the room on its own.
- Stranger returns, tries to engage the child.
- Mother returns; child’s response is noted.
- The stranger leaves.

The observers looked at four particular behaviors:

- Separation anxiety
- The infant’s willingness to explore
- Stranger anxiety
- Reunion behavior.

Source: http://www.teachingexpertise.com/articles/attachment-theory-1116
依附類型

1. Secure attachment（安全依附型）
   一個安全依附型的小孩在陌生情境中，當媽媽在身邊的時候可以自由地探索環境，和陌生人互動，當媽
   媽離開時可能會難過哭泣，當媽媽回來時，小孩會很快地靠近媽媽尋求安撫。安全依附有助社會及情
   緒的發展，嬰兒才能適應與母親分離，致力於探索環境，而發展出自我概念。

2. Anxious-ambivalent（焦慮矛盾型）
   此類型的小孩即使當母親就在身旁時，面對探索和陌生人時依然會感到焦慮。當母親離開時，孩子會非
   常的沮喪；當母親回到身旁時，孩子又變得很矛盾，明明想跟母親保持親近卻充滿憤怒，當母親開始注
   意他時又會想要抵抗。

3. Anxious-avoidant（逃避型）
   此類型的小孩會迴避和忽視母親的存在，在母親離開或回來不表現出情緒。母親在時不去注意；母親離
   去亦顯不出緊張痛苦；母親去而復返非但不表高興，反而生氣；陌生人出現時無特殊反應。孩子不會去
   探索環境不管誰在那裡。小孩面對對待陌生人和母親是一樣的。沒有太多的憤怒，不管誰在這個環境。

4. Disorganized attachment（紊亂型）
   此類型的小孩沒有固定連貫的反應方式。會依據環境的回應來表現抵抗或迴避。小孩經歷過受驚嚇的照
   顧者或令人害怕的照顧者。因為人際互動是不穩定的，所以導致孩子無法有一致性的反應。面對照顧
   者，一般的孩子看到照顧者所理解的自我，如同一面完整的鏡子，而紊亂型依附的孩子看到照顧者所理
   解的自己，如同 從一面破碎的鏡子。

http://zh.wikipedia.org/wiki/%E4%BE%9D%E9%99%84%E7%90%86%E8%AB%96

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The theory

I am ok

You are ok

<table>
<thead>
<tr>
<th>You are ok</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>Secure attachment</td>
<td>Anxious-ambivalent</td>
</tr>
<tr>
<td>No</td>
<td>Anxious-avoidant</td>
<td>Disorganized attachment</td>
</tr>
</tbody>
</table>

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The theory of addiction

Bruce Alexander proposed in the 1970s that “drugs do not cause addiction, and that the apparent addiction to morphine commonly observed in laboratory rats exposed to it is attributable to their living conditions, and not to any addictive property of the drug itself.”

The disease model makes two claims:

Claim A: All or most people who use heroin or cocaine beyond a certain minimum amount become addicted.

Claim B: No matter what proportion of the users of heroin and cocaine become addicted, their addiction is caused by exposure to the drug.
Design and results

- The Rat Park is a 200-square-foot housing colony for 16-20 rats with an abundance of food, balls and wheels for play, and private places for mating and giving birth.
- The control group is a 1-square-foot cage for the same number of rats.
- In both groups of rats were given both tap water and water laced with morphine.
- Result: The caged rats used 16 times of water laced with morphine than the rat park group.
Results for addicted rats

- In the second experiment, rats in both groups were given nothing but morphine-laced water for 57 days, until they were physically dependent on the drug.

- But as soon as they had a choice between plain water and morphine-laced water, the animals in Rat Park switched to plain water more often than the caged rats did, voluntarily putting themselves through the discomfort of withdrawal to do so.
(12) Self-consistency Theory

- It argues that all other things being equal, individuals will engage in and find satisfying those behaviors that maximize their sense of cognitive balance or consistency (Korman, 1970).

- According to Korman, people have a need to align their level of performance with their self-evaluation.

- Individuals will be motivated to perform on a task or job in a manner that is consistent with the self-image with which they approach the task or job situation.

(13) Social Identification Theory

Social identity is a theory formed by Henri Tajfel and John Turner to understand the psychological basis of intergroup discrimination. It is composed of four elements:

- **Categorization**: We often put others (and ourselves) into categories. Labeling someone a Muslim, a Turk, a Gimp or a soccer player are ways of saying other things about these people.

- **Identification**: We also associate with certain groups (our ingroups), which serves to bolster our self-esteem.

- **Comparison**: We compare our groups with other groups, seeing a favorable bias toward the group to which we belong.

- **Psychological Distinctiveness**: We desire our identity to be both distinct from and positively compared with other groups.
(14) Social exchange theory
(15) JCM vs. SIP

**Job Characteristics Model**  
Hackman & Oldham (1976)

\[ MPS = \left[ \frac{\text{Variety} + \text{Identity} + \text{Significance}}{3} \right] \times \text{autonomy} \times \text{feedback} \]

MPS \rightarrow \text{Job Satisfaction}

**Social Information Processing Model**  
Salancik & Pfeffer (1978)

\text{Job Satisfaction} \rightarrow \text{Perceived job characteristics}
(16) Why employees want fairness?

Procedural vs. Distributive justice

*Instrumental Model*

*Group Value Model*

Folger & Konovsky (1989)
Escalation of commitment

**Self-justification theory** posits that individuals tend to escalate their commitment to a course of action in order to justify prior behavior.

**Prospect theory** posits that individuals exhibit risk seeking behavior when a problem is framed as a choice between losses.

According to the **Agency theory**, agents are expected to reach decisions that maximize their self-interest at the expense of the principal’s interests.

"the observation that sparked the development of organizational demography was that at the business school at the University of Illinois, assistant professors had a lot of influence in the governing process while at the University of California at Berkeley, they had almost none....... That observation led to a search for relevant literature and other examples of the effects of age and tenure distributions on organizations, and sparked subsequent empirical research on the importance of demographic distribution on organizational process.” (Jeff Pfeffer)
Hypotheses

The *organization’s demography*, defined in terms of length of service (LOS) distribution affects the organization’s:

- performance and adaptation;
- rate and type of administrative succession;
- strategies of control and size of the administrative component;
- distribution of power among cohorts;
- degree of cohort identity and intercohort conflict;
- linkages and transaction patterns with other organizations;
- turnover rate; and
- career opportunities and
- associated training and development needs.

(19) Upper Echelons theory

“The central idea of upper echelons theory is that executives act on the basis of their highly personalized interpretations of the situations and options they face. That is, executives inject a great deal of themselves – their experiences, personalities, and values – into their behaviors. To the extent those behaviors are of consequences, say in shaping strategy or influencing the actions of others, organizations then become reflections of their top managers.” (p.109)

Empirical evidence

One little study was conducted by DeWitt Dearborn and Herbert Simon (1958). The authors argued that exposure to the goals and reinforcements of a particular functional area will cause managers to attend to certain information in a complex business situation and, in turn, to interpret that information in terms that suit their functional expertise.

To test these ideas, Dearborn and Simon had middle managers from a single company read a 10,000-word business case that presented a large number of facts with virtually no structure or interpretation. The managers were then asked to identify the major problem facing the company. As the researchers expected, the managers tended to gravitate to interpretations that mirrored their functional backgrounds.
(20) Resource Dependence Theory

“the observation that sparked the development of the theory was the varying organizational reactions to the pressure in the later 1960s and early 1970s to end employment discrimination against women and minorities and to, instead, take affirmative action to incorporate these previously excluded groups.”

“The dominant explanation for variation in organizational behavior lodged the causal mechanism in the values and actions of the organizational leaders......but to Salancik and me, an explanation emphasizing the unconstrained choices of individual leaders did not seem correct.”

Resource Dependence Theory

“Because the organization necessarily transacted with external actors in the acquisition of inputs and the disposal of outputs, the interdependence created by and through such tractions was, potentially, a source of power and its obverse, constraint. To the extent that the external environment was highly concentrated so a focal organization had few alternative sources for some necessary input, and to the extent the dependence on the particular resource obtained from a concentrated source was high, the focal organization, would be more constrained and prone to accede to the demands of those powerful external actor.”

Empirical results

- One empirical study used survey data to show how the extent to which Israeli firms depended on the government for sales and for financing affected their expressed companies’ response to affirmative action using a field stimulation methodology in which firms were queried in the guise of getting information to furnish to female MBA graduates.
- For large firms that were dependent on the government but the government was not dependent on them, the correlation between their level of sales to the government and their responsiveness to the inquiry about affirmative action was .84.
- For smaller, less visible firms that controlled the production of items purchased by the government, there was actually a negative relationship between the proportion of sales to the government and the firms’ responsiveness to the inquiry.

Explanation

Why is it so difficult to change organizational culture?

• **Attraction:** People are differentially attracted to careers as a function of their own interests and personality. People search environments that fit by their personality and that people would like to obtain their outcomes by selecting a specific organization.

• **Selection:** Organizations select people who they think are compatible for many different kinds of jobs. In that way organizations end up choosing people who share many common personal attributes, although they may not share common competencies.

• **Attrition:** The opposite side of attraction. When people do not fit an environment they tend to leave it. When people leave the environment a more homogenous group stays than those were initially attracted to the organization.

http://www.tcw.utwente.nl/theorienoverzicht/Levels%20of%20theories/meso/Attraction-Selection-Attrition_Framework(ASA).doc/
The ASA model

Attraction

Selection

Attrition
Twenty-one Examples

- Eistein’s vs. Newton’s view of gravitation
- Phrenology
- Egocentric vs. Heliocentric model
- Photoelectric effect (Quantum theory)
- Light as particle and wave
- Big Bang Theory

- The theory of Emotional Intelligence
- The theory of mental Intelligence
- Two factor theory of intelligence
- Attachment theory
- The theory of addiction

- Self enhancement theory
- Social Identification theory
- Social exchange theory
- Job characteristics model vs. Social Information processing
- Instrumental model vs. Group value model
- Self-justification theory, prospect theory, agency theory
- Organizational demography
- Upper Echelons theory
- Resource dependence theory
- Attraction-Selection-Attrition Model

What is a theory?
What is a theory?

The empirical sciences are systems of theories. ... Theories are nets cast to catch what we call ‘the world’: to rationalize, to explain, and to master it. We endeavor to make the mesh ever finer and finer.

What is a theory?

“A theory is a systematically related set of statements, including some law-like generalizations, that is empirically testable. The purpose of theory is to increase scientific understanding through a systematized structure capable of both explaining and predicting phenomena.” (p.149)

What is a theory?

Generally speaking, a theory is a statement or set of statements about the relationships among variables. (McBurney, D.H., p.17)

Theory means ... a system of *logically interrelated*, specifically non-contradictory, statements, ideas, and concepts relating to an area of reality, formulated in such a way that *testable hypotheses* can be derived from them. (de Groot, 1969, p.40)
What is a theory?

A complete *theory* should contain four elements

1. **What.** Which factors logically should be considered as part of the explanation of the phenomena? (factor comprehensiveness and parsimony)

2. **How.** How are they related?

3. **Why.** What are the underlying psychological, economic, or social dynamics that justify the selection of factors and the proposed causal relationships?

4. **Who, where, when.** These conditions place limitations on the propositions generated from a theoretical model.

What and How?

One way to demonstrate the value of a proposed change in a list of factors is to identify *how* this change affects the accepted relationships between the variables (i.e., How).

“Just as a list of variables does not constitute a theory, so the addition of a new variable to an existing list should NOT be mistaken as a theoretical contribution.”

“therefore, theoretical insights come from demonstrating *how* the addition of a new variable *significantly alters* our understanding of the phenomena by reorganizing our causal maps.”
What is a theoretical contribution?

A theoretical contribution does not mean that one has to cite some theories in developing one’s arguments.

A total of 11 different theories for three hypotheses.
Theoretical Contribution

From a theoretical viewpoint, what is new in this manuscript which is not in the literature?

H$_1$: Same-sex dyads will result in higher leader-follower relationship

H$_2$: Same-sex dyads will result in higher performance of the follower

H$_3$: Participation in decision making will moderate the similar-sex effect on performance.
Theoretical Contribution

What is new in this manuscript that I learned which is not in the literature?

Contribution: A cross-level study
Theoretical Contribution

Justifications in hypotheses development

- Empirical
- Logical
- Theoretical

A new theoretical perspective
Theoretical Contribution

What is new in this manuscript that I learned which is not in the literature?

Similar-sex dyads → Follower Performance

Social Identification for picking in-group member
Social exchange after selected as in-group member
Theoretical Contribution

What is new in this manuscript that I learned which is not in the literature?

- Similar-sex dyads
- Follower Performance

Similar gender perceived as more capable
Only high performing followers would survive based on the ASA model
Theoretical Contribution

The problem of not having a theoretical perspective

Why justice perceptions?
How about POS?
How about psychological contract?

Why commitment?
How about turnover intention?
How about OCB?
Theoretical Contribution

Why would the author argue for such a relationship?
- Theory
- Perspective
A Slightly Different Perspective

Dispositions

Leader-Member Exchange

Transformational leadership

Justice perception

Organizational Citizenship Behaviors

OCB Before

Promotion Decision

OCB After

What is not a theoretical contribution?

Social Exchange Paradigm

Procedural Justice

POS
Psy Contract
LMX
……

Perceived Insider Status
Perceived Supervisory Support

Organizational Citizenship Behaviors
What is a theoretical contribution?

**Social Exchange Perspective**

- Procedural Justice
- POS
- Psy Contract
- LMX
- ……

Organizational Citizenship Behaviors

**Identification Perspective**

Organizational Identification

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Why?

- It commonly involves borrowing a perspective from other fields, which encourages altering our metaphors and gestalts in ways that challenge the underlying rationales to our views of human nature, group development, organizational transactions, and so forth, generally precipitates a broad reconceptualization of affected theories.

- E.g., Group Value Model
Who, when and where?

• Generally, it is insufficient to point out limitations in current conceptions of a theory’s range of application. ... It is preferable to investigate qualitative changes in the boundaries of a theory, rather than mere quantitative expansions.

• First, proposed improvements addressing only a single element of an existing theory are seldom judged to be sufficient.

• Second, theoretical critiques should marshal compelling evidence.

• Third, theoretical critiques should propose remedies or alternatives.
What theory is not?

• References are not theory.
• Data are not theory.
• Lists of variables are not theory.
• Diagrams are not theory.
• Predictions are not theory.

Good theory is …

1. Good theory offers novel *insights*.

2. Good theory is *interesting*.

3. Good theory is focused and *cohesive*.

4. Good theory is *grounded in the relevant literature* but offers more than a review/integration of this literature.

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Good theory is …

5. Good theory presents clearly defined constructs and offers clear, thorough, and thoughtful explanations of how and why the constructs in the model are linked.

6. Good theory is testable.

7. Good theory has practical implications.

8. Good theory is well written.

Seven important questions

(1) What’s new?
(2) So what?
(3) Why so?
(4) Well done? (Does the paper reflect seasoned thinking?)
(5) Done well? (Well written or presented?)
(6) Why now? (Is this topic interesting to scholars in this area?)
(7) Who cares? (What % of academic readers are interested?)

Who cares?

One more step forward ......
The aim of science

- The first objective of science is description
- The second objective of science is explanation
- The third objective of science is prediction

What is a theory?
What is a “good” theory?

It depends!

I would define a “good” theory as a theory that:

- can explain a wide range of phenomena
- is simple (parsimonious)
- is supported by empirical evidence
Exchange Theory

Party A

Non-specific return
Unknown time frame

Party B

Economic Exchange

Social Exchange

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A Hypothesis …

According to the social exchange theory, employees who feel that the organization has treated them fairly will reciprocate by contributing to the organization’s well-being. As a result we hypothesize that:

H₁: perceived procedural justice is positively related to OCB.

H₂: perceived distributive justice is positively related to OCB.
The process …

Social Exchange

Procedural Justice ($X_1$)

Distributive Justice ($X_2$)

Organizational Citizenship Behaviors ($y$)

$r_{x_1y} > 0$ and $r_{x_2y} > 0$
What is the theory (Black Box)?
What is a “scientific” theory?

From the viewpoint of *scientific theories*, falsifiability is a criterion of demarcation. “If there is no possible way to determine whether a statement is true then that statement has no meaning whatsoever. For the meaning of a statement is the method of its verification.” (Popper, 2002, p.17).
An example

After lightning, there is always thundering.
The Incompatible Head Size Theory

- In social science a theory *explains what we see* and a theory *predicts what will happen*.
- For example, according to the *Incompatible Head Size Theory*, the head sizes of couples which are similar would have good relationship.

Source: http://depts.washington.edu/pswrite/What%20is%20a%20Theory.pdf
Can this be falsified?

\[ r_{x_1y} > 0 \quad \text{and} \quad r_{x_2y} > 0 \]

Is there a necessary relationship between your proposed theory and your hypotheses?
Mutual exclusiveness

Theory Building Vs. Theory Testing

Theory Building and Theory Testing
Figure 1. A taxonomy of theoretical contributions for empirical articles
Theory building & testing

• The *vertical theory building axis* “captures the degree to which an empirical article clarifies or supplements existing theory or introduces relationship and constructs that serve as the foundations for new theory.

• The *horizontal theory testing axis* “captures the degree to which existing theory is applied in an empirical study as a means of grounding as specific set of a priori hypotheses."
Why do most of our work lie?

- **Builder**
- **Expanders**
- **Qualifiers**
- **Reporters**
- **Testers**

- High theoretical contribution
- Low theoretical contribution

Testing Existing Theory
Trends in articles from 1963 to 2007

Percentage in Category

Publication Year


Expanders
Testers
Builders
Qualifiers
Reporters
Changes needed as perceived by AMJ board members

- Accept more innovative, less formulaic research 17%
- Loosen the theory requirement 10%
- Keep a balanced, broad base of appeal and be open to all 8%
- Increase methodological rigor 6%
- Aim for higher impact; address more socially important issues 5%
- Reduce or eliminate research notes 5%

Papers rated as “Most Interesting”

- Counterintuitive: 57%
- Quality: 57%
- Good Writing: 48%
- New Theory/Finding: 46%
- Practical Implications: 31%
- Impact: 28%

The End