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# Dynamics of Organizational Change

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## **Abstract**

This paper discusses a model of organizational change as described in the punctuated equilibrium model. The model builds on two previous models in this area, i.e. the one by Frechette and Spital and the one by Sastry. After discussing shortcomings in both these models a new model is presented which is believed to be (a) a more valid representation of Tushman and Romanelli's theory of punctuated organizational change, and (b) an extension of both existing models incorporating new structure not represented so far. The paper discusses the structure of the new model and tests its validity by comparing dynamics from the model with those stated in the theory. Sensitivity analyses are conducted in order to further explore model behavior and find potential inconsistencies and areas for improvement. In a concluding section the limitations of our model are discussed and improvements for the future are proposed.

## **1. Introduction**

In the last decades, many theories have tried to explain the reasons and consequences of organization change. The most prominent of these are the population ecology, adaptation theories, and the punctuated equilibrium model of change. The last one of these is the most detailed one with respect to the causal relationships. It is also a very widely accepted theory. For example, Gersick (1991) tries to show the high applicability of this model for organizational studies by discussing models from six different domains such as groups, history of science, and biological evolution. In the SD literature, Frechette and Spital (1991) and Sastry (1997) have used the punctuated equilibrium model by Tushman and Romanelli (1985) to construct dynamic models of organizational change.

Tushman and Romanelli's punctuated equilibrium model of change emphasizes two types of change: incremental and strategic. During an incremental change period, also called the convergent period, the organization tries to "achieve a greater consistency of internal activities with the strategic orientation". The strategic changes, reorientations, are defined by "simultaneous and discontinuous shifts in the strategic orientation". According to Tushman and Romanelli, "patterns of organizational evolution are characterized by periods of convergence punctuated by reorientations leading to the next convergent period" or "organizations evolve through relatively long convergent periods punctuated by discontinuous or metamorphic changes which lead to the next convergent period".

Even though Tushman and Romanelli make dynamic propositions on what characterizes both incremental and strategic change, in this paper, we'll focus on strategic change because it is the dynamics of the radical change process we are mainly interested in. Incremental change is important in the sense that what happens during the convergent period affects the trigger mechanism behind and success of strategic change. The effect of a convergent period will be represented with exogenous variables for the time being. Future versions of this model will make the convergent period endogenous.

In the next section we will discuss the two previous system dynamics models of organizational change and indicate their most important shortcomings. After spotting these deficiencies, a new model of the punctuated equilibrium theory will be proposed. Next the model will be tested using extensive sensitivity analysis from which a number of conclusions will be derived. The final section of this paper contains a critical discussion of our model, relates conclusions to existing literature and proposes required changes for the future.

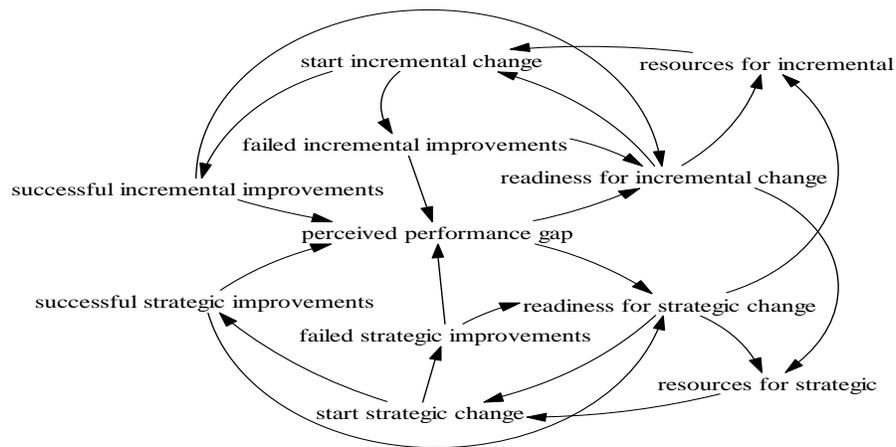
## 2. SD models of punctuated equilibrium model

As stated, there are two SD models of the punctuated equilibrium model. One is by Frechette and Spital (1991) and the other is by Sastry (1997). First, the model of Frechette and Spital (1992) will be explained since it precedes the latter in time.

### 2.1 The model of Frechette and Spital

Frechette and Spital's (1991) objective was "to model the key components of a change system; to describe the relationships between components and to explore policy options...to improve the long run effectiveness of organizational change" (p209) by taking the theory explained in the 1985 paper of Tushman and Romanelli as a basis. They see two important dimensions of change: scope of change and timing of change. Scope of change signifies the difference between incremental and strategic change processes, both of which are modeled explicitly. Timing of change refers to reactive vs. anticipatory change processes. Only the prior one, i.e. change initiated as a response to an event (or series of events) that has occurred, is modeled.

In the model (see figure 2), change is initiated only after 'readiness to change' reaches a certain level. 'Readiness to change' is affected both by perceived performance gap and by the organization's memory with respect to success or failure of previous change experiments. After performing policy experiments to understand the relative importance of perceived performance gap vs. organization's memory on initiating change, Frechette and Spital conclude that performance improvements are sustained in the long run only when there's a balance between the effects of performance and organizational memory (p217).



**Figure 1:** The feedback structure of the model by Frechette and Spital (1991)

The study of Frechette and Spital is an important one because it takes as a basis an accepted theory of organizational change. The explicit distinction between incremental and strategic change is an important step. The simulation experiments shed light on the existing theory of punctuated equilibrium model as well. Even though Tushman and Romanelli mention the effects of performance gap and success/failure of previous changes on inertia ('readiness for change' in the model can be interpreted as inertia), they do not discuss the relative importance of the two. The simulation experiments by

Frechette and Spital show that if one of these is given higher priority than the other for initiating change, change leads to performance crisis.

### *Problems with the model of Frechette and Spital*

The model of Frechette and Spital and the policy experiments they run, show the possibility of modeling the issues around organizational change and using this model for answering various policy questions. Yet the model is lacking some important factors that influence the dynamics of a change process within organizations.

The explicit modeling of the concept of inertia should be included. One may argue that “readiness to change” represents inertia. However, there is a problem with this argument such that in the model, readiness to change applies both to incremental and strategic change whereas inertia only applies to strategic change. Tushman and Romanelli describe inertia as “resistance to all but incremental change” (p. 177). Thus, inertia does not form a constraint for incremental change, but rather it builds up during the period of incremental change.

One of the drivers of change is the performance gap. Performance gap is modeled more or less as an exogenous variable. The only thing that affects performance is the success/failure of change. However, in order to trigger change, performance is given a pulse, rather than having performance get calculated by its determinants. Tushman and Romanelli are very clear about the determinants of performance: internal and external consistency of strategic orientation. We believe that it is important to make performance totally endogenous by explicitly modeling its determinants. Moreover, the only determinant they modeled, i.e. the success/failure of change, does not have a direct effect on the performance gap. As change takes place, the fit of the strategic orientation to the environment gets affected. Consequently, the level of the performance also changes. The explicit modeling of these relationships would yield a more structurally valid model that represents the theory more precisely.

In relation to the previous point, it should also be pointed out that the external stimulus for change is created by giving a pulse to the performance gap. According to Tushman and Romanelli, when a change occurs in the environment, it increases the probability of strategic change for the organization. Thus rather than giving a pulse to performance gap, a change should be created in the environment which leads to change in the external fit of the strategic orientation. This would lead to a decrease in the performance or increase in the performance gap, which might lead to strategic change. It would then also be possible to see the effects of the response time of the organization, i.e. the time between a change in environment and strategic change, on the long-run performance of the organization.

## *2.2 The model of Sastry*

A significant contribution to modeling the punctuated equilibrium model is the model by Sastry (1997). Her aim was “to examine the completeness, consistency, and parsimony of the causal relationships laid out” (p237) in Tushman and Romanelli’s 1985 paper.

The model (see figures 3 and 4) includes only strategic change and consists of four sectors: strategic orientation, inertia, performance, and pressure to change. Change is initiated as a result of a performance gap, i.e. the difference between the desired performance and the perceived performance. Performance has two drivers: appropriateness and competence. Appropriateness shows whether the strategic orientation of the organization is in alignment with the strategic orientation required. Competence shows the degree of efficiency the organization has in fulfilling its tasks. Competence is determined with the inertia. When the performance gap is high, a change in strategic orientation takes place provided that the organization has enough ability to change. This change has two effects. First, it makes strategic orientation come closer to the required strategic orientation. Second, it decreases the inertia.

As a result of experiments, Sastry found some gaps in Tushman and Romanelli’s theory. One of the gaps she spotted was inappropriate, ongoing reorientation leading to organizational demise: “Once change was initiated, organizations continued to reorient inappropriately beyond the optimal point, eventually resulting in organizational collapse” (p256). To solve this problem, Sastry added a measure of organization-environment fit. Now, the decision makers do not decide to go through change when there is a pressure to change but they use their perceptions of organization-environment fit in deciding whether to change and how much to change the organization’s strategic orientation in

response to given levels of pressure to change. This way the perception of a mismatch between the organization and the environment along with sufficient ability to change and high enough pressure to change affect the organization's change process.

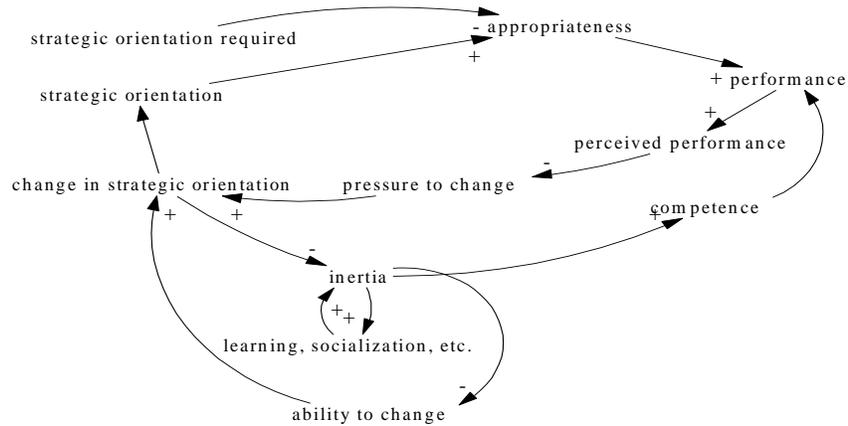


Figure 3: The feedback loop structure of Sastry's model (1997)

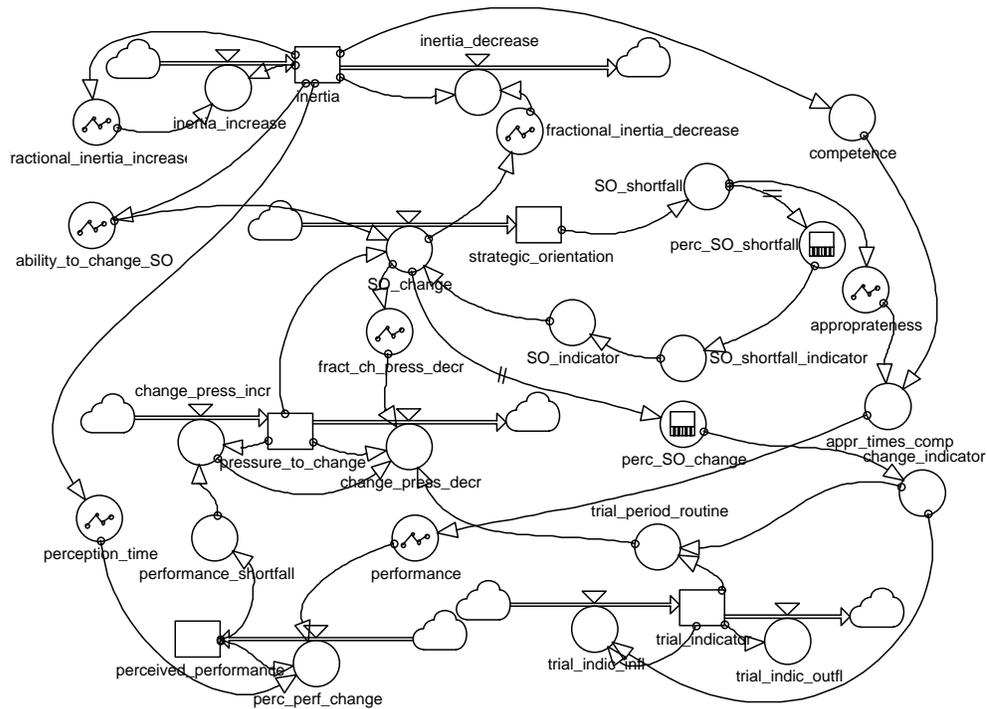


Figure 4: The stock-flow structure of Sastry's model (1997).

The other improvement Sastry added was a trial-period routine: “This routine enforces a waiting period following each reorientation during which executive leadership refrains from making further change”. This routine was required because Sastry realized that during the simulation, organizations got engaged in change efforts too soon right after a previous reorientation and thus the organization did not have any opportunity to rebuild the destroyed competence. With this routine, “by suspending the change process after a given level of organizational change has been undertaken, organizational leaders using a trial-period routine protect the organization from collapse”.

The study of Sastry has important implications in terms of showing the usefulness of simulation for analyzing the dynamic consequences of a theory in a field that is primarily dominated

by verbal theories. However, we believe that the model has some deficiencies, which will be discussed in the next section.

#### *Problems with the model of Sastry*

In Sastry's model, performance is determined by competence and appropriateness. Whereas the appropriateness is correctly determined by the organization-environment fit of the strategic orientation, the cause of competence is not correctly represented. In her model, competence is caused by inertia, "inertia  $\rightarrow$  competence". However, this is not a correct representation since competence is built as a result of processes that also lead to the generation of inertia. According to the theory, in time "interdependent relationships with buyers, suppliers strengthen, commitment to internal participants and external evaluating agents are elaborated into institutionalized patterns of culture, norms, and ideologies". In turn, these "emergent social and structural processes" have two outcomes: (1) inertia, (2) convergence on a strategic orientation through enforcement of rules and norms, which lead to the development of a high degree of competence in executing a strategic orientation. Then, the relationships should be represented as "social and structural processes  $\rightarrow$  inertia" and "social and structural processes  $\rightarrow$  convergence on a strategic orientation  $\rightarrow$  competence" rather than "inertia  $\rightarrow$  competence".

If our understanding is correct then it renders some of Sastry's conclusions ineffective in terms of assessing the theory's capabilities of explaining organizational change. In one of the simulations, Sastry realized that an organization with low inertia (representing a young organization or an organization right after change) gets into a process of "inappropriate and ongoing reorientation leading to organizational demise". The reason is as follows: even though the organization has maximum value for appropriateness, low inertia leads to low competence which is sufficient to generate a low enough performance that causes high pressure to change and eventually the organization reorients. Since every reorientation leads to decrease in inertia, the organization gets trapped in a vicious circle of unnecessary reorientations. However, if the performance is modeled to be a result of internal and external consistencies (neither of which are caused by inertia) then there is still the possibility that an organization with low inertia will not change given that its strategic orientation is both internally and externally consistent.

There is also a problem with the representation of strategic orientation. It is modeled as a unidimensional state variable, because "it is the outcome of the accumulation of past decisions on strategic orientation". This variable is modeled as "a continuous expression that represents management's policy of response to pressures to changes" (p250). Then the consistency of the strategic orientation is calculated by the difference between the required and actual strategic orientations. We believe that this way of quantification of strategic orientation is not correct since strategic orientation is not a continuous variable. Let's give a tangible example. Technology is part of strategic orientation. The firm's technology can be, for example, A, B, or C. Let's say it is A and the required strategic orientation is B. What does that mean? How can we quantify these two things and subtract them from each other to find the gap. We believe that what should be operationalized is not the strategic orientation itself but the fit of the strategic orientation. As will be explained later, this is the important aspect of strategic orientation for organizational change.

In the base model, the SO indicator is 1, meaning that the organization does not measure organization-environment fit at all. Simulations with this formulation result in an organization that changes inappropriately and continuously. As a result, Sastry concludes that there is a gap in the theory. She states " I found that decision makers must also measure and respond to organization-environment fit". Thus, she adds a routine that also calculates the organization-environment fit and in the second case, the strategic orientation change is affected not only by high enough pressure to change, but also a perception of mismatch between the organization and the environment. While this finding is true, it already existed in Tushman and Romanelli's theory. In the theory, even though Tushman and Romanelli say that performance pressures are very important in causing change, they also assert that changes in the environment are very important forces for reorientation (p178). And the organizations change in order to achieve a better fit between the existing strategic orientation and the strategic orientation dictated by the environment. Thus, we believe that this particular routine is already a part of Tushman and Romanelli's theory and the simulations without this routine do not show a gap in Tushman and Romanelli's theory.

After having discussed the models constructed by Frechette and Spital and by Sastry we will now turn our attention to our model of organizational change.

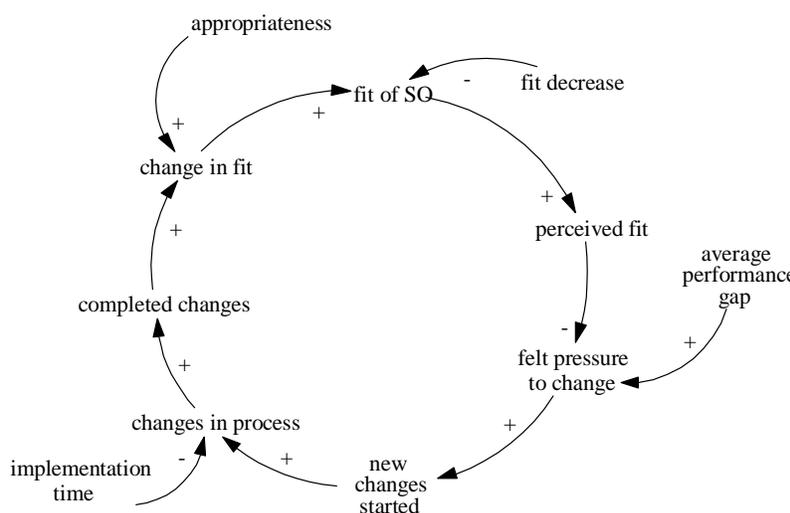
### 3. The new model

The model consists of 3 main parts: (i) the strategic orientation, (ii) the felt pressure to change, its determinants and completed changes, and (iii) appropriateness of the new strategy.

#### 3.1 Strategic orientation

Strategic orientation is defined in terms of “the business the firm is in and how it competes”. It can be described by the set of organizational activities consisting of (1) core beliefs and values, (2) products, markets, technology, and competitive timing, (3) the distribution of power, (4) the organization’s structure, and (5) the nature, type, and pervasiveness of control systems.

Even though, the definition and understanding of strategic orientation is important, what is significant in terms of dynamics is not what the strategic orientation of the firm is but rather its meaning for or its effect on the strategic change process. Although Tushman and Romanelli explain what strategic orientation is, their main focus is on the appropriateness, effectiveness, alignment or fit of the strategic orientation with respect to the external environment. Levinthal (1997, p935) also states that “organizational level adaptation leads organizations to modify their existing form in an attempt to enhance their fitness”. As long as the strategic orientation of the organization fits the one required by the environment, the organization converges around its current strategic orientation. If for some reason (e.g. change in the environment) the strategic orientation turns out to be inappropriate then the organization will change to get a new strategic orientation that would have a better fit.



**Figure 5:** Negative loop describing fit of SO

In the model, this alignment is represented by the variable ‘fit of strategic orientation’(see figure 5). This is a state variable, because it is the accumulation of the effects of past strategic changes and the changes in the environment.

$$fit = fit_0 + \int_{t_0}^t fit \quad \text{and} \quad \frac{dfit}{dt} = fit_{incr} - fit_{decr}$$

Fit of strategic orientation signifies the extent to which there is a fit between the actual strategic orientation of the organization and the one demanded by the environment. The fit gets higher when the

organization goes through a successful strategic change ( $fit_{incr}$ ) and lower when a change in the environment (e.g. a new law, a better technology, a new product) takes place ( $fit_{decr}$ )<sup>1</sup>

If the organization goes through change then the fit of its SO will also change. The change in fit will be effective once the change process is completed. The extent of the effect of change and whether it leads to improvement in fit depends on the amount of change completed and how appropriate the new strategy is.

We will first discuss the completed changes and next the appropriateness of a strategy chosen.

### *3.2 Completed changes*

Completed changes are determined by a felt pressure to change, which is in turn determined by performance as well as inertia. The relationships involved will be discussed below.

#### *3.2.1 Felt pressure to change*

The organization starts new changes if there is a felt pressure to change. If the pressure reaches a value above a particular threshold value, new changes will be initiated. Felt pressure is a state variable since it signifies the cumulative pressure which builds up over time. The pressure increase is determined by (a) the perceived fit (the better the fit the lower the pressure) and (b) the average performance gap (the higher the gap the higher the pressure). Let us discuss each of these two determinants in turn.

Changes in the external environment constitute a motivation for change. Tushman and Romanelli emphasize the effect of changes in product class characteristics (demand, technology, users, and institutional conditions): “As product class conditions change, strategic contingencies faced by the competing firms also change systematically” (p198). If such a change in strategic contingencies would generate a misfit between the organization’s strategic orientation and the competitive conditions, this would be a reason for strategic change. With this reasoning, Tushman and Romanelli propose that the greater the rate of change in environmental conditions, the greater the frequency of reorientations.<sup>2</sup> However, the fact that the fit is low does not mean that the organization will undertake change. Tushman and Romanelli also emphasize that environmental conditions do not directly cause strategic reorientation: “While external conditions may be a reason for a strategic reorientation, perception of inconsistencies is required for its occurrence” (p204). Thus, it is the perception of the executives that guide an organization towards and through a strategic reorientation. This is represented by the variable ‘perceived fit’ in the model. This variable measures the organization-environment fit as perceived by the executives. If the organization perceives its fit to be lower than the fit required by the environment, the pressure to change will accumulate. How well the management team perceives the environment is affected by the organization’s inertia. This will be explained later on.

Along with misfit of the SO, the second factor which leads to an increase in felt pressure to change is the average performance gap. Tushman and Romanelli consider sustained performance gap as one of the primary causes of change. Moreover, since organizational change involves risk taking, the organization needs a motivation to take this risk (Greve, 1998). The organizational risk taking literature emphasizes the importance of the difference between performance and goals in risk taking (Greve, 1998; March, 1988). Greve (1998, 1999) ties risk taking to organizational change by showing that since core changes are risky, organizational performance relative to goals should be an important determinant of the probability of change. Concordant with this, Tushman and Romanelli state that realized or anticipated performance pressures constitute the basic driving force for organizational reorientation. In the model, this is represented as the performance gap. The organization compares its performance with its goals. The gap between the actual and the desired performance determines the organization’s felt pressure to change. Sustained performance gap will lead to the accumulation of pressure to change. While determining the gap, perceived performance rather than actual performance is used since performance cannot be measured instantly.

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<sup>1</sup> In the model, the change in the environment and the decrease in fit is produced with a pulse function in the fit decrease formula.

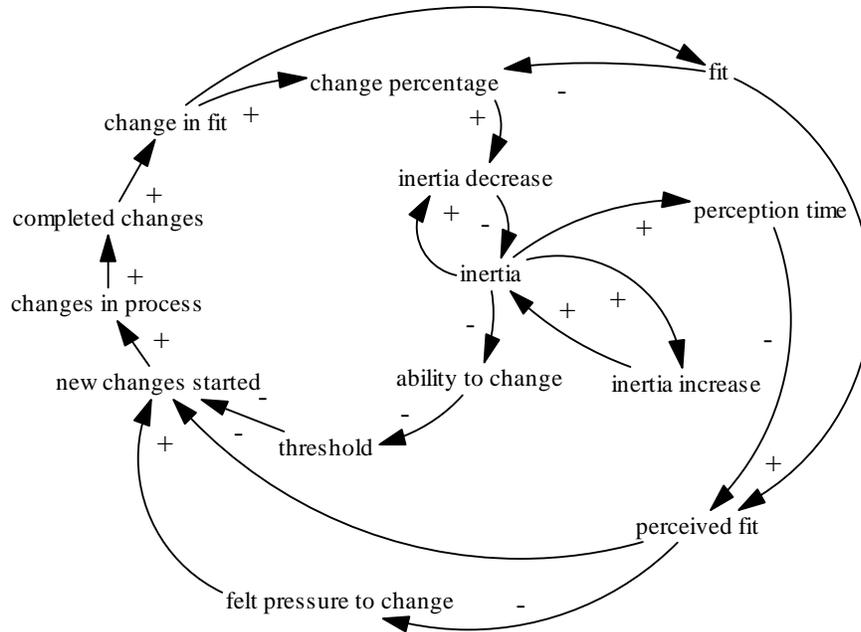
<sup>2</sup> In a frequently changing environment, the organizations should probably have a different attitude towards change.



### 3.2.3 Inertia and ability to change

An important variable that affects whether a change process will start is ‘ability (willingness) to change’. This variable is caused by inertia which is an important construct for the theory. Inertia is a product of the convergent period. It represents “resistance to all but incremental change” (p177). During the convergent period, the organization strives to get competence, increase internal coordination, external accountability, and predictability. Generation of these leads to increased structural and social complexity and interdependence, convergence around a strategic orientation, and resistance to fundamental change. Thus, as the organization converges around a strategic orientation to become more and more competent, inertia is generated (see figure 7). In the model, inertia is represented as a state variable since it accumulates over time as a result of the processes going on in the convergent period and it decreases when a strategic change takes place. Even though Tushman and Romanelli explain the processes that go on during the convergent period, these are not explicitly modeled. We believe that since our main focus is the strategic change, the extensive modeling of all the processes of the convergent period is not necessary. In order to ensure that inertia is a result of the convergent period,  $inertia_{incr}$ , which leads to an increase in inertia, is positive only when no strategic change takes place. As the length of convergent period increases so does inertia. With this representation, it is assumed that every convergent period of same length would lead to the same amount of inertia accumulation regardless of the turbulence and success of the convergent period.

Inertia impedes an organization’s ability: (1) “to reassess environmental opportunities and constraints, and thus to initiate a strategic orientation” (p177), (2) to disrupt relationships and start a strategic change even when the environmental opportunities are reassessed. The latter effect of inertia is ‘ability (willingness) to change’. As the organizational inertia increases (decreases), the organization’s ability to change decreases (increases). Ability to change is given with a decreasing function of inertia. Ability to change is linked to the threshold which forms an obstacle for the organization to start a change process. For an organization to change, the felt pressure to change should be higher than the threshold. If the ability of the organization is high (low) then the threshold is low (high).



**Figure 7:** causal loop structure indicating relationships between inertia and changes

The second effect of inertia is related to the executives’ perception of environment-organization fit, i.e. ‘perceived fit’. Inertial processes affect executive leadership’s decision-making and reduce the probability of organizational responsiveness to environmental discontinuities. During the convergent period, the organization elaborates on certain norms, values, and procedures. As the

organizational activities become more routinized, the volume and diversity of information processed decreases. Moreover, more attention is given to information that supports the status quo. Thus, since inertial forces of convergent periods constraint the perceptions of executives, higher inertia would lead to higher perception time, i.e. late recognition of organization-environment (mis)fit.

### 3.3 Appropriateness of strategy

Together with completed changes, the second factor that affects the amount of fit change is the appropriateness of the strategy chosen<sup>3</sup>. For an organization to change its strategic orientation, the organization must first find a new orientation that it wants to achieve. Of course, this can only happen as a result of searching for information in the environment. In information search for making strategic decisions, there are two crucial things: the amount of information searched and how critically this information is processed. According to the threat-rigidity theory (Staw et. al. 1981), “a threat may result in restriction of information processing, such as narrowing in the field of attention, a simplification in information codes, or a reduction in the number of channels used” (p502). Thus when organizations are under threat, then first of all they consult to fewer sources of information. Second, the new information that comes in is given low value since it cannot be assimilated as easily. Staw et. al. summarizes the effects of threat on organizations as reliance on poor prior knowledge, a reduction in communication complexity, and restriction in the information-processing capacity of the organization.

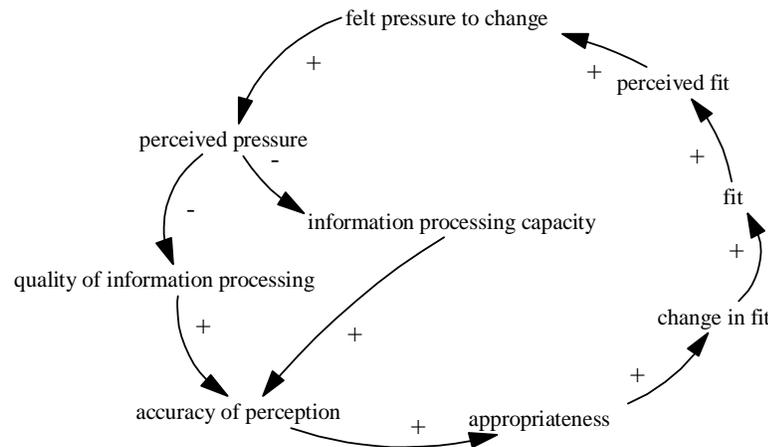


Figure 8: causal loop structure of appropriateness

Since at times of change, the pressure or the threat the organization feels comes from the total amount of pressure the organization feels upon itself, we have linked the amount of information searched and how critically this information is processed to the felt pressure to change. When the organization realizes that it does not fit its environment and that its performance is poor, then the organization will be under much pressure. Since it will want to get out of the unfavorable situation as soon as possible, it will look for less information and process the information less critically in order to find a new strategy<sup>4</sup>.

In the next sections, we will discuss the model’s dynamics.

## 4. Model behavior

<sup>3</sup> In this paper “appropriateness” is not used to define the fit of the organization to its environment. Here, we are talking about how appropriate the new strategy chosen by the organization is.

<sup>4</sup> Actually, in the feedback loop, the link between perceived pressure and quality of info processing and between perceived pressure and information processing capacity is not – but rather sometimes – and sometimes +!

Following the theory of Tushman and Romanelli, we have postulated some hypotheses to test our model. For each subsection below, we have formulated an expectation given a certain situation and run the model for the cases of a young and an old organization. The organizations can be distinguished as young and old depending on the initial value of their inertia and internal consistency. A young organization has low inertia and internal consistency whereas an old organization that has not changed for a long time has a high inertia and internal consistency. For each run, we present two graphs. In the first graph, one can see 1) new changes started: the amount of new change the organization starts at each time step, 2) completed changes: the amount of changes that are completed at each time step, 3) changes in process: the total amount of change processes that are still going on, and 4) fit: the fit of the strategic orientation. In the second graph, one can see the 1) threshold to change: the minimum amount of pressure the organization should feel to be able to start change, 2) felt pressure to change: the total amount of pressure the organization feels to change, 3) fit, 4) internal consistency: the measure of how well the organization is functioning internally within its current strategic orientation, and 5) performance: the performance of the organization given the strategic orientation it has and the level of its internal consistency.

#### *4.1 No change in the environment → No change in the organization*

Since Tushman and Romanelli say that reorientations will be associated with changes in the environment and/or sustained low performance, we expect that if no change takes place in the environment then the organization will not change either<sup>5</sup>. Moreover following Tushman and Romanelli's proposition "holding the external environment constant, the longer and less turbulent the convergent period, the more effective the organization" (p195), we expect that the longer the organization does not change, the higher will be the internal consistency and thus the performance.

To test these expectation, we made two runs. The first represents an old organization that has not changed for a long period, i.e. inertia and the internal consistency are at a high value. As seen in graph 1, the organization does not change as expected. Since both performance and fit are high enough the organization has no reason to change.

Then we have made the same run for a young organization or an organization that has just went through change, i.e. inertia and internal consistency are at a low value. It is expected that such an organization should converge on the current strategic orientation and do some incremental changes to increase its internal consistency and performance. In this situation, the positive loop that is responsible for increasing internal consistency will work. As the convergent period gets longer, i.e. as long as a change does not take place, the organization will get better and better in its internal functioning. Increased internal consistency will lead to increased performance. And since the average performance gap will be closing, the felt pressure to change will not accumulate. Thus the organization will not change. Figure 10 shows the increasing internal consistency and performance in the absence of organizational change. Even though at the beginning of the simulation, the felt pressure to change is higher than the threshold, the organization does not change, because it already fits its environment.

If we would make a run with a young organization with a lower fit of strategic orientation than the one demanded by the environment then we will see that this organization changes even in the absence of an environmental change. This behavior does not coincide with the propositions of Tushman and Romanelli. However, they also say that organizations will change as a result of performance pressures. A young organization that does not have perfect fit has performance pressures due to fit problems as well as internal consistency problems. Thus even though such a situation is not explicitly explained by Tushman and Romanelli, it is very likely that such an organization will start changing.

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<sup>5</sup> This is also an equilibrium test. If we start the model at equilibrium, if no disturbance occurs then the system should stay at equilibrium.

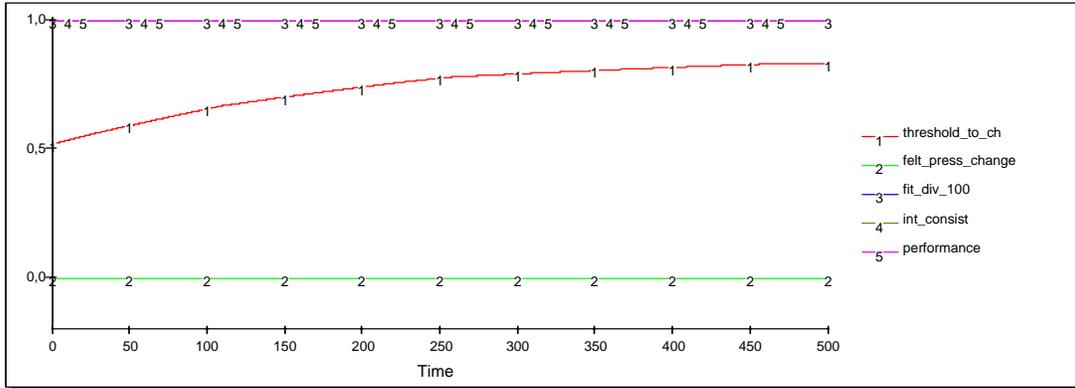
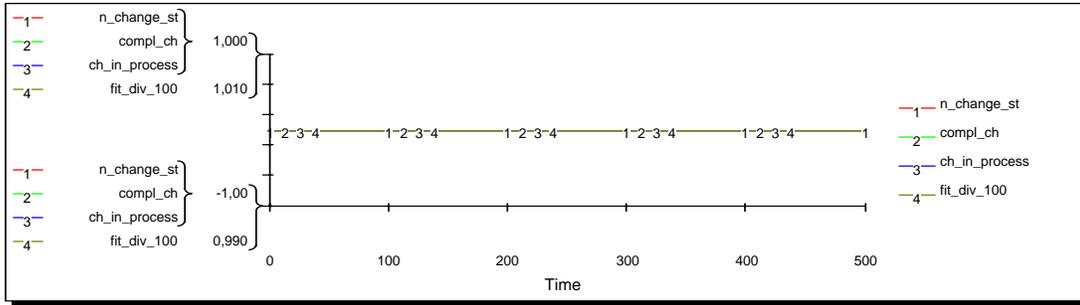


Figure 9: runs with no change in environment: old organization

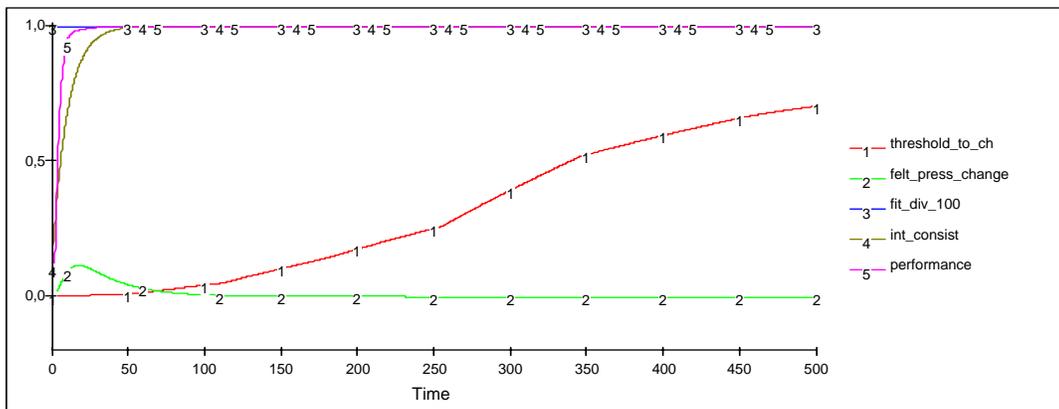
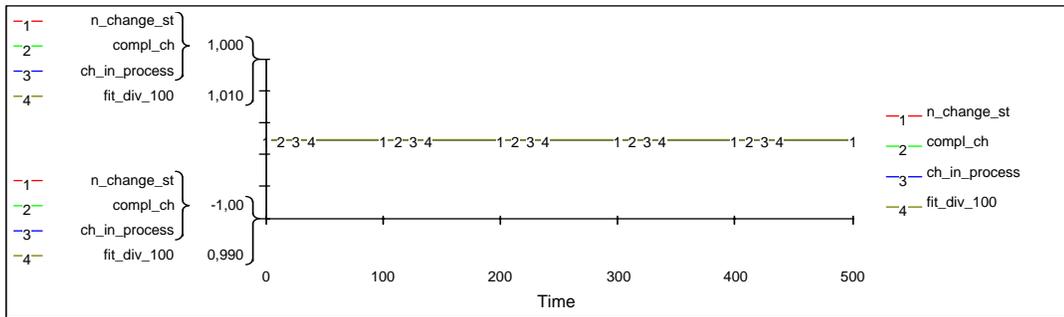
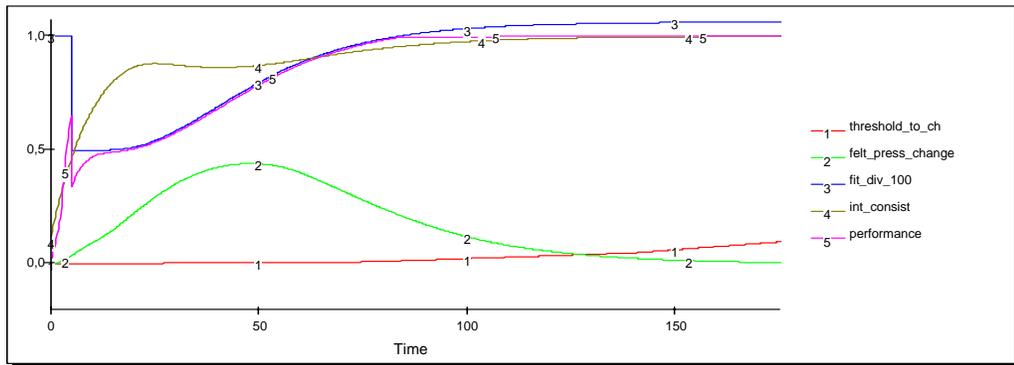
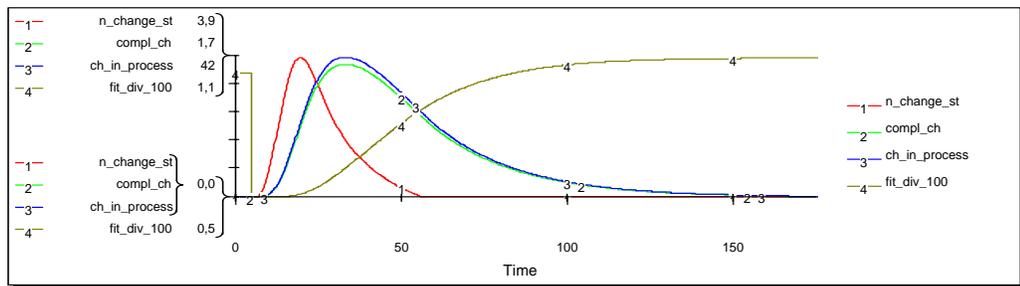


Figure 10: runs with no change in environment: young organization

#### 4.2 Change in the environment → change in the organization

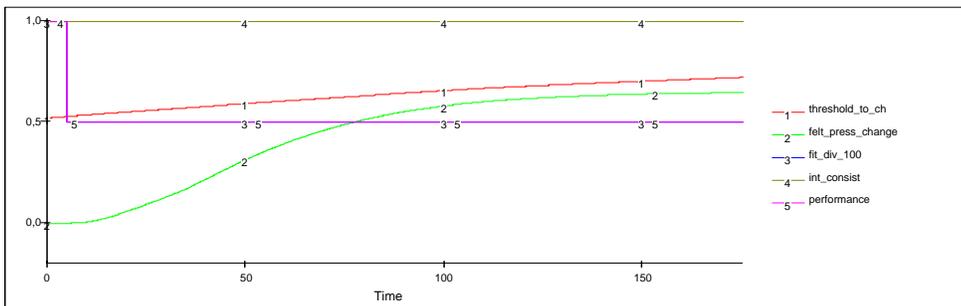
It is an important proposition of the punctuated equilibrium model of change that organizational change is triggered by environmental change (Tushman and Romanelli, Meyer et. al. 1995). We will simulate a one time change in the environment by decreasing the fit with a pulse function. This would mean that a sudden change in the environment such as a new technology or a new product will be launched to decrease the fit of the organization by 50%. Again we made runs for young and old organizations. We are expecting both organizations to change because both the fit and the performance of the organization decreases.

As seen in graph 3, the young organization behaves as expected by going through a change process. At time 5, a change that takes place in the environment causes the fit of the organization to decrease further. This causes a decrease in the performance as well. Since this is a young organization, the inertia is low from the beginning. Thus the organization is apt to the possibility of change with a low threshold to change. Moreover, the low performance from the beginning coupled with a decreased fit causes an immediate increase in the felt pressure to change which stimulates a change in the organization. The change increases the fit and eventually the performance.



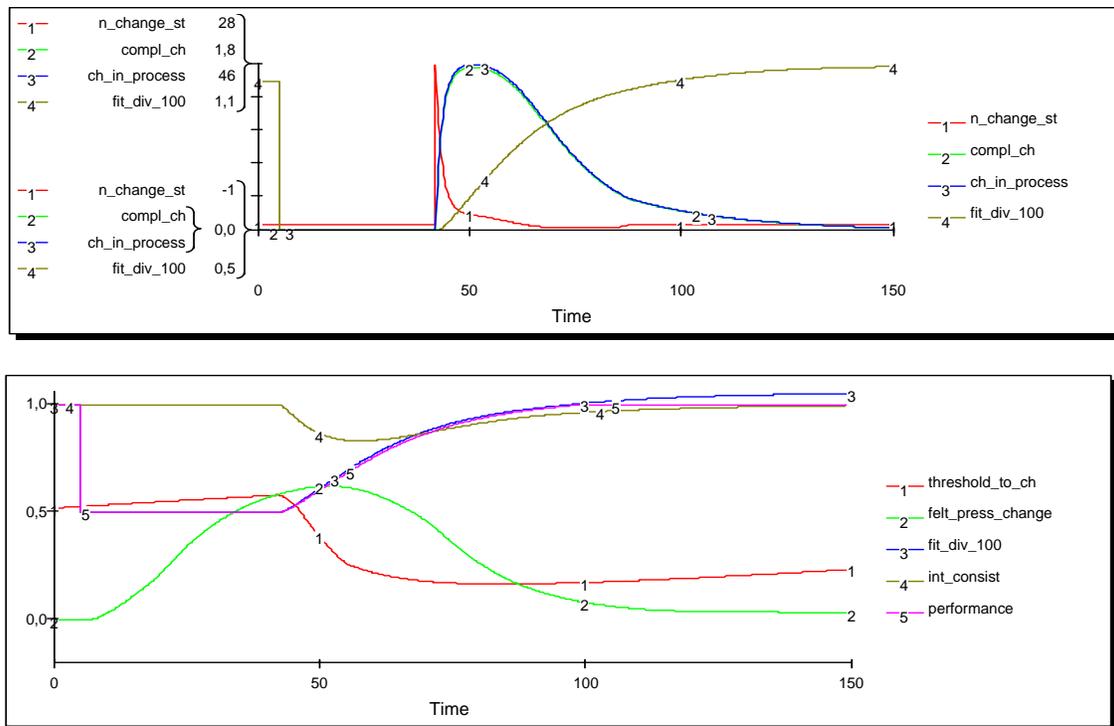
**Figure 11:** decrease of fit (50%) at time 5: young organization

We have made the same kind of run for the old organization. Contrary to our expectation, the old organization does not change (figure 12) and the fit remains at 50 rather than returning to its original value.



**Figure 12:** decrease of fit (50%) at time 5: old organization

The reason is as follows. Before the environmental change happens, the pressure to change is zero. And since an old organization has less ability to change due to high inertia, the threshold that the felt pressure to change has to overcome is high. The low fit and high performance gap never yield enough pressure that will surpass the threshold. This behavior looks strange since this would imply that the old organization would have a sustained gap of 50% in its fit and performance. This ‘invalid’ behavior can be changed by introducing a new piece of structure in the model describing the effects of a sustained gap. In their model, Tushman and Romanelli explicitly state that a sustained performance gap is the basic driver for a change process. So far in the model, this is not taken into consideration. The average performance gap is the only performance component that affects felt pressure to change. In this particular run, the fact that there is a 0,5 average performance gap has a certain level of influence on the felt pressure to change. However, the fact that this organization goes on with such a high performance gap for years and years does not have any influence although sustained low performance would be a drive for organization to take action and change. We have added this structure into the model such that on top of the previous two causes, having a performance shortfall for an extended period of time induces an additional felt pressure to change. When we run the model with this added structure, we see that the organization changes as expected (see figure 13).



**Figure 13:** decrease of fit (50%) at time 5: old organization after the addition of the effects of sustained performance gap on felt pressure to change

In order to check if the improvements we have made in the model change the results of the runs we have made previously, we have remade those runs. The results did not change. The only change was that in case of an environmental change, the young organization starts changing a bit sooner. No graphs have been presented because the old graphs still represent the current behavior.

#### 4.4 Run with a higher inertia level: effect of appropriateness

In the runs of the previous section, for the old organization we had kept the initial inertia at the level of 0,5. One interesting situation comes about when the initial inertia is set at a higher level, e.g. 0,8 (see figure 14). In this situation, since the ability to change gets low, the threshold to change gets very high. This means that it takes quite a long time before the organization feels the felt pressure to change that would exceed the threshold. At the moment the organization feels enough pressure to

change, it is also under too much pressure that this affects the information processing capabilities of the organization negatively, meaning that the organization ends up choosing an inappropriate strategy. As a result of implementing this new strategic orientation, the fit and the performance gets even lower and the organization dies

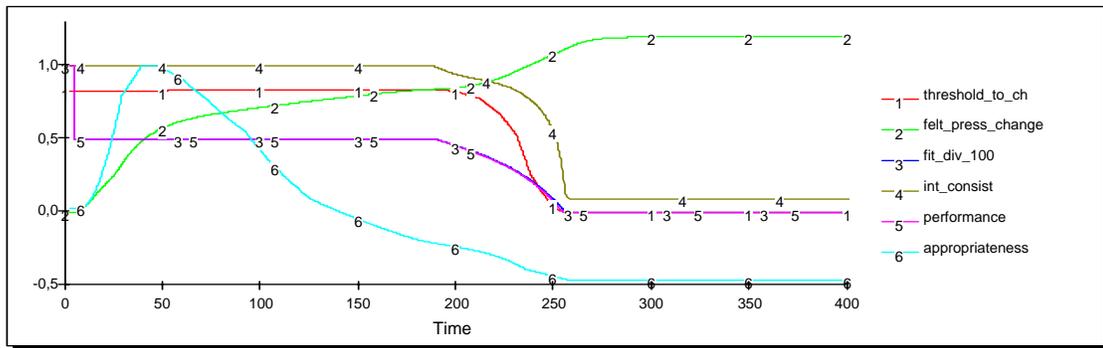
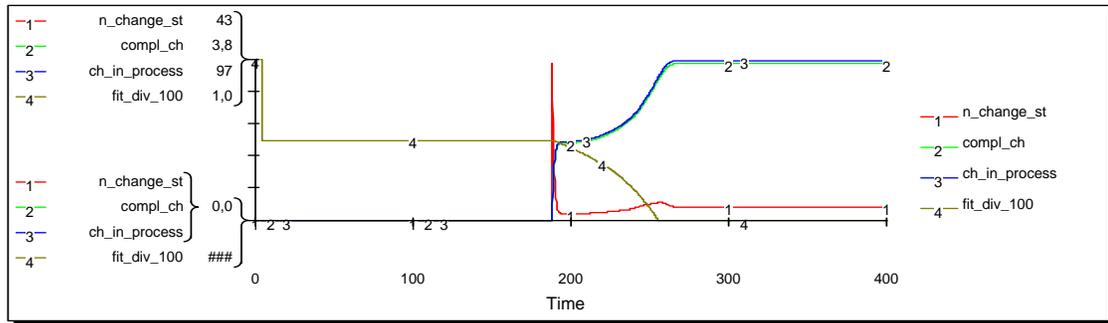


Figure 14: decrease of fit (50%) at time 5: old organization with an initial inertia of 0,8.

#### 4.4 more changes in the environment → more changes in the organization

In order to simulate an environment where sudden changes take place very frequently, we used a pulse function that causes a 50 decrease every 50 weeks. First we made runs for the young organization (figure 15) and then for the old (figure 16). Neither of these organizations can survive in an environment where bursts of change take place at very short intervals. Both of these organizations will die eventually because of being under too much pressure and thus not being able to formulate effective strategies.

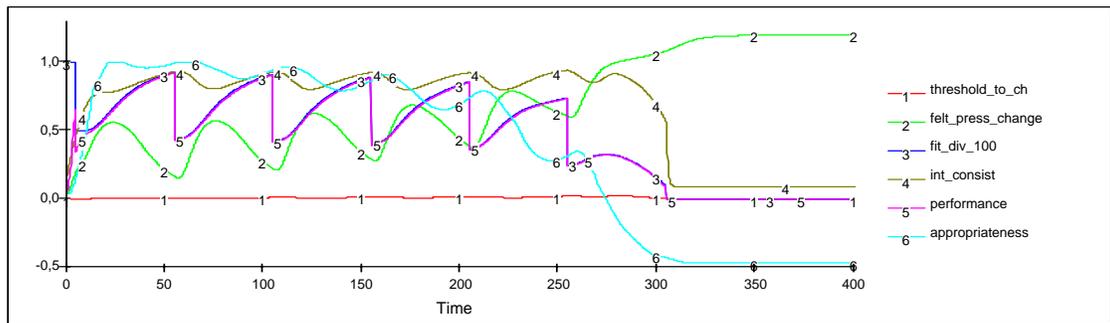
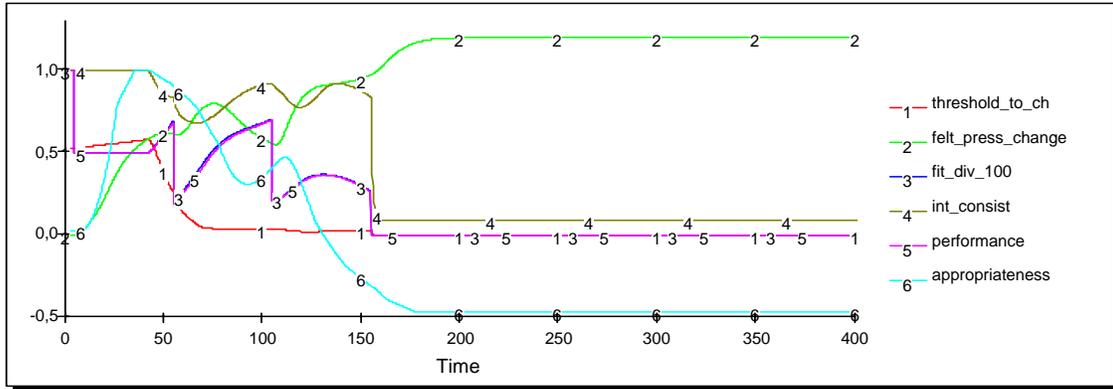
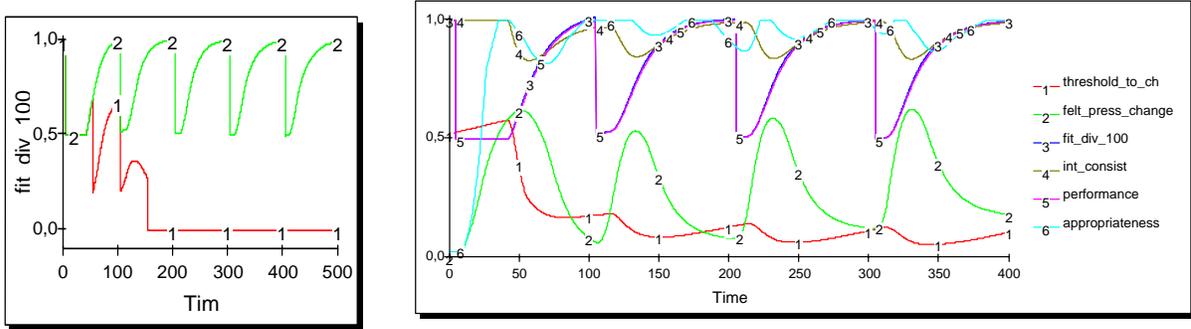


Figure 15: Young organization in a continuously changing environment



**Figure 16:** Old organization in a continuously changing environment

A drastic change in the environment every 50 weeks is of course very frequent. The organization never has the time to relax and build up new routines. It is constantly under pressure. In these circumstances we can imagine that an organization cannot survive. However, if we would decrease the number of pulses, in other words, increase the time intervals between consecutive environmental changes then the organization has time to recover from the previously made changes. In figure 17a, in the first run environmental change takes place once every year and in the second one, once every two years. In the second situation, the organization has time to conclude the previous reorientation before the second environmental change takes place. Thus the fit and performance reach high values before the organization is faced with a new environment change (see figure 17b). High performance and fit also lead to low felt pressure to change. However, in the case of environmental change taking place once every year, since the organization could not finish its change efforts before the new environmental change took place, the fit and performance could never recover. This caused a continuous stimulus on the felt pressure to change. And an ever increasing pressure caused the



organization to choose inferior strategies.

(a)

(b)

**Figure 17:** (a) fit of the old organization as a result of multiple consecutive change processes. run 1: environmental change once every year, run 2: environmental change once every two years (b) the old organization in an environment that changes once every two years.

It is possible that organizations in environments where drastic changes take place frequently develop other routines, change routines, which would enable them to change more easily. Another possibility that might be helping such organization survive can be what Hannan and Freeman (1984) suggest in their theory. According to them most organization fail as a result of their efforts to change. They propose that those organization that end up in a worse situation as a result of reorientation, fall back into their old habits and routines. This at least gives the organizations the chance to survive.

#### 4.5 Differences young vs. old organizations

According to the literature on organizational change, young and old organizations show different behavior patterns. Some of these differences are as follows:

- Young organizations will react to the environmental change faster than the old organizations. When we compare the reaction time of young and old organizations, we see that after an environmental change at time 5, the young organization starts changing immediately at time 6 whereas the old organization waits till time 42.
- High performing organizations have greater losses when changing<sup>6</sup> (Greve 1999) and reorientations in high performing organizations will have negative effects on performance (Meyer et.al. 1995). If we compare graphs 11 (low performing) and 12 (high performing), we see that the high performing organization loses performance and has long period of low performance whereas the young organization always end up with much higher performance than it had started. Moreover, in frequently changing environments, the young organization survives much longer than the old organization.

### 5. Conclusion and discussion

In this paper, we have looked at the theory of Tushman and Romanelli in explaining the way organizations change. The punctuated equilibrium model says that organizations have long periods of stability which are altered by radical changes in the face of an environmental change. We have modeled this strategic change process by using the causal descriptions from Tushman and Romanelli's paper. As our starting point, we also took two previously built SD model of this theory, one by Frechette and Spital and the other by Sastry. Both models were presented and critiqued. Next we described our model of organizational change, in which we have attempted to eliminate some of the drawbacks we have found in the previous models. Moreover, two pieces of additional structure were added. One was related to sustained performance (rather than performance per se) after discovering that an old organization did not change after a significant decrease in fit. The other relates to the appropriateness of a chosen strategy, which depends on the quantity and quality of information being processed. The behavior of the model is largely in line with expectations of the theory and is also able to simulate conditions under which organizations can be put out of business. For instance when inertia level is too high, but also in cases in which the organization is under too much pressure. The latter affects their effectiveness in the way they search for information and the way they process information. This might lead the organization to choose an inferior strategy and in certain cases puts it out of business.

Naturally our model is still far from being complete. Several things discussed in Tushman and Romanelli's theory and in related papers need to be added to future versions of the model. One of these concerns the level of desired performance. At the moment, in the model, desired performance is held fixed. However, Tushman and Romanelli explicitly say that change in power distribution may lead to changes in the performance aspiration levels in the organization. The theories of risk taking also emphasize the importance of changing aspiration levels. March (1988) summarizes these ideas as follows: "Understanding of variable risk preferences will require not only making preferences for risk dependent on a target, but also making the target itself a function of experience" (p232). Greve (1998) mentions social and historical aspiration levels. Social aspiration levels are determined by the performance of similar ones whereas historical aspiration levels are determined by the performance history of the firm itself. Since Tushman and Romanelli restrict themselves to the level of one organization without paying attention to the effect of other organization's behavior, new versions of the model will focus on historical performance. Thus, in the model the desired performance will get updated during the simulation. Initially it is set equal to 1, which is the maximum performance level an organization can reach. March states that the slower adaptation of goals makes action sensitive to

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<sup>6</sup> In our case, an old organization is an organization that has high performance (100 fit, 1 internal consistency) and a young organization means an organization with low performance (100 fit, but low internal consistency)

performance history. Thus, the goal is not updated as a result of instantaneous performance gaps but rather the sustained average performance gap. If there is a sustained performance gap, the organization lowers its required performance. This structure represents the 'drifting goals' archetype in system dynamics. When a persistent performance gap exists the organization takes corrective action (increasing pressures for change) as well as lowering its goals. Thus, in the following versions of the model, desired performance will be variable.

A second improvement concerns the success of change processes. An assumption in Sastry's model seems to be that a change attempt always results with a success. Tushman and Romanelli's theory also does not pay much attention to the success issue. Given the vast number of unsuccessful change attempts in the industry, it would be logical to relax such an assumption and look at the behavior when a change attempt does not result in full success.

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